COUNTY OF SUFFOLK

NEW YORK

PUBLIC WORKS SPECIFICATIONS

OF

NOVEMBER 1, 1958

AS AMENDED

BY PART I
March 1977

COUNTY OF SUFFOLK

NEW YORK

DEPARTMENT OF PUBLIC WORKS

R. M. KAMMERER
COMMISSIONER OF PUBLIC WORKS AND
COUNTY SUPERINTENDENT OF HIGHWAYS

BARNEY A. EVANS
CHIEF DEPUTY COMMISSIONER

A. BARTON CASS
CHIEF ENGINEER

PART I

Section I

INFORMATION FOR BIDDERS

OBTAINING AND SUBMITTING PROPOSALS. Persons desiring to make a proposal shall use the proposal blank prepared by the Department for each individual contract. THE SUFFOLK COUNTY PUBLIC WORKS SPECIFICATIONS ADOPTED NOVEMBER 1, 1968 (except as modified on the plans or in the itemized proposal) BY THE SUFFOLK COUNTY DEPARTMENT OF PUBLIC WORKS ARE TO BE CONSIDERED AS AND SHALL FORM A PART OF THE AGREEMENT. The time for which proposals will be received will be found in the published notice calling for proposals. Any proposal received after the hour specified in the published notice shall not be accepted. Detailed plans of the work may be examined at the office of the Suffolk County Department of Public Works, Yaphank Avenue, Yaphank, New York.

PROPOSALS. Each proposal must be submitted on the official form which is furnished by the Department. All blank spaces in the proposal form must be filled in as noted, and no change shall be made in the phraseology of the proposal or in the items mentioned therein.

Proposals that are illegible or that contain any omissions, erasures, alterations, additions, or items not called for in the itemized proposal or that contain irregularities of any kind, may be rejected as informal.

The bidder shall sign in the space provided in the proposal form, with his usual signature. An officer of a corporation or a member of a partnership signing for the bidder, shall place his signature and title after the word "By" under the name of the contractor. The same procedure shall apply to the proposal of a joint venture by two or more bidders; however, if the signature is by an agent or attorney-in-fact for the joint venturers, then the proposal shall be accompanied by four (4) authenticated copies of the evidence of his authority to act on behalf of all of the joint venturers.

The bidder (if a corporate bidder) shall attach a certified copy of a Resolution authorizing the execution of the Non-Collusion Certificate required by Section 103-d of the General Municipal Law.

PREPARATION OF PROPOSAL AND DETERMINATION OF LOW BID. Each proposal shall specify the correct gross sum, in the manner hereafter described, for which the work will be performed according to the plans and specifications and any addenda to the specifications if the same are issued prior to the date of receipt of the proposal, together with a unit price for each of the separate items as called for. The lowest bid shall be determined by the Commissioner on the basis of the gross sum for which the entire work will be performed, arrived at by a correct computation of all the items specified in the proposal therefor at the unit prices in the proposal. The Commissioner of Public Works reserves the right to reject any proposal in which unit bid prices appear, in his judgment, to constitute an unbalanced bid for the work.

Any proposal may be deemed informal which does not contain prices set opposite each of the several items for which there is a quantity exhibited in the itemized proposal or which shall in any manner fail to conform to the conditions of the published notice inviting proposals. The unit prices and gross sum bid shall be indicated in words and figures. In case the amount shown in words and its equivalent in figures do not agree, the written words may, in the discretion of the Commissioner of Public Works, be considered binding. The bidders attention is directed to the fact that he cannot exceed three (3) decimal positions in the cents column under unit bid price.

NO MISUNDERSTANDING. The attention of persons intending to make proposals is specifically called to ARTICLE 3 of the AGREEMENT wherein the bidder agrees that he has examined the contract documents and the site of the work and has fully informed himself from his personal examination of the same regarding the quantities, character, location and other conditions affecting the work to be performed, including the existence of poles, wires, pipes and other facilities and structures of municipal and other public service corporations on, over or under the site, and that he will make no claim against the County of Suffolk by reliance upon any estimates, tests or other representations made by any officer or agent of the County with respect to the work to be performed under the contract. Particular attention is called to special notes and special specifications in the proposal which may contain contract requirements at variance with standard plans and specifications.

The bidders attention is also directed to the fact that in addition to his need to examine the contract documents and the site of work, there may be certain other information which is available for his inspection in the offices of Suffolk County Department of Public Works, Yaphank Road, Yaphank, New York. This other information could include for example, earthwork cross section sheets, earthwork sheets, various subsurface information, special reports, and other pertinent project data. Upon inspection of this material in the offices of Suffolk County Department of Public Works, Yaphank Road, Yaphank, New York, the bidder will be requested to date and sign a form acknowledging and identifying the information made available for his inspection.

SUBSURFACE INFORMATION. Boring logs and other subsurface information made available for the inspection of bidders were obtained with reasonable care and recorded in good faith by the Department. The soil and rock descriptions shown are as determined by a visual inspection of the samples from the various explorations unless otherwise noted. The observed water levels and/or water conditions indicated thereon are as recorded at the time of exploration. These levels and/or conditions may vary considerably, with time, according to the prevailing climate, rainfall and other factors. It is understood that such information was obtained and is intended for County design and estimate purposes only. It is made available to bidders in good faith only that they may have access to identical subsurface information available to the County, and is not intended as a substitute for personal investigations, interpretations and judgment of the bidder.

MODIFICATION OR WITHDRAWAL OF PROPOSAL. Permission will not be given to modify or explain by letter, telegram, telephone or otherwise, any proposal or bid after it has been deposited with the Department. No proposal shall be withdrawn or cancelled before the time designated for opening such proposals publicly except upon such conditions as the Commissioner may deem to be necessary.

Specifically, no proposal shall be withdrawn or cancelled after the time designated for opening such proposals publicly, except to exercise the option as provided herein.

Any bidder or his duly authorized agent who has submitted proposals on more than one project of any one letting may, at his option and upon written request, withdraw any or all of his additional proposals after the person, who opens and reads the bids, has announced that such bidder has submitted the lowest proposal on a project for which bids have last been read. When this option is exercised, the proposals for other projects in the letting will be returned to the bidder unopened. No returned proposals will be considered after the bidder has exercised his privilege to withdraw the same. No proposals will be considered which have not been deposited with the Department prior to the time indicated in the advertisement. Any bidder exercising the privilege of so withdrawing his bid or bids waives all claims that may arise should it be found that his opened proposal is informal or for any other reason is unacceptable to the Department. The Department will open and read proposals in the order in which they are drawn and not in the order in which the projects are advertised.

If the proposal is made by a firm, the name and place of residence of each member of the firm shall be given. If made by a corporation, the names of the president, secretary and treasurer shall be given. If made by a partnership, the names of the partners shall be given.

DEPOSIT. Every proposal must be accompanied by a certified check or bank cashiers check payable to the County of Suffolk, New York, Department of Public Works, for the sum specified in the proposal. The retention and disposition of such certified check or bank cashiers check by the Suffolk County Department of Public Works shall be pursuant to and in conformity with Subdivision No. 2 of Section 38 of the Highway Law as amended.

AWARD OF CONTRACT. Award of contract will be made only to the lowest responsible bidder as will best promote the public interest as provided by Section 103 of the General Municipal Law. The Suffolk County Department of Public Works reserves the right to reject any or all proposals, or pursuant to Section 38 of the Highway Law, to award to other than the low bidder, to waive minor informalities, to advertise for new proposals, or to proceed to do the work otherwise, if, in its opinion, the best interests of the County will thereby be promoted.

If requested by the Suffolk County Department of Public Works, the bidder must present evidence of experience, ability and financial standing, as well as a statement as to plant and equipment.

EXECUTION OF CONTRACT. The person or persons whose proposal is accepted will be required to execute the contract and to comply in all respects with the statutory provisions relating to the contract within ten days of the date of delivery of the contract form by the Commissioner of Public Works. In case of failure or refusal on the part of the bidder to deliver the duly executed contract to the Commissioner of Public Works within the ten day period herein mentioned, the amount of the deposit made will be forfeited and will be paid to the County of Suffolk, New York, Department of Public Works.

The Contractor agrees that he will conduct his operations in compliance with all the laws and regulations of the State of New York and Public Authorities, the County of Suffolk, New York, and the ordinances of any village or town therein and the lawful direction of the officers, agents or representatives of the United States, the State of New York, and the Public Authorities, the County of Suffolk, New York, or of said village or town therein. All costs due to compliance with the above-described laws, regulations, and ordinances shall be included in the prices bid for contract items unless otherwise provided for in the contract.

LAWS, PERMITS AND LICENSES. The Contractor shall observe all Federal, State and Local Laws and regulations. Attention is directed to the regulations of Federal and State Agencies in regard to agricultural insects and diseases. In particular, the Contractor's attention is directed to Federal and State Department of Agriculture regulations for plant pest control which require that equipment operating in infested areas be thoroughly cleaned before moving to non-infested areas. In addition, the Contractor agrees to procure all necessary licenses and permits.

CONTRACT CLAUSES REQUIRED IN PUBLIC WORK. The execution of the Contract by the Contractor binds him to the following specific agreements required by law:

The Contractor specifically agrees, as required by the Labor Law, Section 220 and 220-d as amended, that-

(a) no laborer, workman or mechanic in the employ of the Contractor, sub-contractor or other person doing or contracting to do the whole or any part of the work included in the contract shall be permitted or required to work more than eight hours in any one calendar day or more than five days in any one week, except in the emergencies set forth in the Labor Law;

(b) the wages (including supplements) paid for a legal day's work shall be not less than the prevailing rate of wages (including supplements) as defined by law;

(c) the minimum hourly rate of wage (including supplements) to be paid shall be not less than that stated in the proposal and as shall be designated by the Industrial Commissioner;

(d) the minimum hourly supplements to be paid shall be in accordance with the prevailing practices in the locality where the contract is located and shall be not less than stated in the proposal and as shall be designated by the Industrial Commissioner. Supplements as defined in Section 220 of the Labor Law, as amended, means all remuneration for employment paid in any medium other than cash or reimbursement for expenses, or any payments which are not wages within the meaning of the law, including, but not limited to, health, welfare, non-occupational disability, retirement, vacation benefits, holiday pay and life insurance.

The Labor Law provides that the contract may be forfeited and no sum paid for any work done thereunder on a second conviction for wilfully paying less than-

(a) the stipulated wage scale (including supplements) as provided in the Labor Law Section 220, subdivision 3 as amended, or

(b) the stipulated minimum hourly wage scale (including supplements) as provided in the Labor Law Section 220-d as amended.

The Contractor specifically agrees, as required by the provisions of the Labor Law, Section 220-e, as amended, that-

(a) in the hiring of employees for the performance of work under the contract or any sub-contract hereunder, no contractor, sub-contractor, nor any person acting on behalf of such contractor or sub-contractor, shall by reason of race, creed, color, sex or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates;

(b) no Contractor, Sub-Contractor, nor any person on his behalf shall, in any manner, discriminate or intimidate any employee hired for the performance of work under the contract on account of race, creed, color, sex or national origin;

(c) there may be deducted from the amount payable to the Contractor by the County under the contract a penalty of five dollars for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of the contract; and

(d) the contract may be cancelled or terminated by the County and all monies due or to become due thereunder may be forfeited for a second or any subsequent violation of the terms or conditions of this section of the contract.

The Contractor specifically agrees, as required by the Labor Law, Section 222, as amended, that-

(a) preference in employment shall be given to citizens of the State of New York who have been residents of the State for at least twelve consecutive months immediately prior to the commencement of their new employment;

(b) persons other than citizens of the State of New York or residents of such SMSA (Statistical Metropolitan Sampling Area) may be employed when New York citizens or residents are not available;

(c) the Contractor shall keep a list of his employees stating whether they are citizens of the State of New York, native born citizens or naturalized citizens, and in case of naturalization, the date thereof, and the name of the court in which granted; and

(d) if the Labor Law, Section 220, as amended be not complied with the contract shall be void.

The Contractor specifically agrees, as required by the Labor Law, Section 222-a, as amended that-

(a) if in the construction of the work a harmful dust hazard be created for which appliances or methods for the elimination of harmful dust have been approved by the Board of Standards and Appeals, such appliances of methods shall be installed and maintained and effectively operated by the Contractor.

(b) if the Labor Law, Section 222-a, as amended, is not complied with the contract shall be void.

The Contractor specifically agrees, as required by the General Municipal Law, Section 109, that-

(a) he is prohibited by law from assigning, transferring, conveying, subletting or otherwise disposing of the contract, or of his right, title or interest therein, or his power to execute such contract to any other person, company or corporation, without the previous consent in writing of the Commissioner;

(b) if provision of the law be violated, the Commissioner shall revoke and annul the contract, and the County shall be relieved from any and all liability and obligations thereunder to the person, company or corporation to whom the Contractor shall assign, transfer, convey, sublet or otherwise dispose of the contract, and such transferee shall forfeit and lose all monies theretofore assigned under said contract except so much as may be required to pay his employees.

It is understood between the parties that the agreement is intended to secure the personal service of the Contractor because of his ability and reputation.

The Contractor specifically agrees that the contract shall be deemed executory only to the extent of the monies available, and no liability shall be incurred by the County beyond the monies available for the purpose.

The Contractor specifically agrees, as required by the General Municipal Law, Section 108, that-

(a) he will secure workmen's compensation and keep insured during the life of the contract for the benefit of such employees as are required to be insured by the provisions of Chapter 41 of the Laws of 1914, as amended, known as the Workmen's Compensation Law, and also by the provisions of Article 9 of the Workmen's Compensation Law known as the Disability Benefits Law; and

(b) the contract shall be void and of no effect unless the Contractor complies with this provision.

BLASTING. The Contractor specifically agrees, as required by the Penal Law, Section 1918, as amended, that-

(a) the Contractor or his sub-contractors shall not discharge explosives in the ground unless notice in writing be given 72 hours in advance to the person, corporation or municipality engaged in the distribution of combustible gas in such territory.

(b) in connection with this discharge the Contractor must further ascertain if there are any gas line, within a radius of 200 feet from the point of discharge, which are being maintained by a person, corporation or municipality other than the person, corporation or municipality servicing the territory. If there are, he must also give notice in writing 72 hours in advance to these parties.

(c) after giving these notices, the work must be performed in such manner as to avoid damage to any pipe conveying combustible gas.

(d) the Contractor shall not excavate in any existing street, highway or public place unless notice in writing shall have been given at least 72 hours in advance to the person, corporation or municipality engaged in the distribution of gas in such territory.

(e) in any emergency, if excavation must be performed or explosives must be discharged in order to protect persons from immediate and substantial danger of death or serious personal injury, the 72 hour notice requirements of (a) and (b) are waived, provided notices are given before any such discharge is undertaken.

FORMS. The form of contract and bond, if given, shall be that provided by the Suffolk County Department of Public Works.

LIABILITY INSURANCE. The Contractor shall furnish to the Suffolk County Department of Public Works a certificate or certificates of insurance in form satisfactory to the Department, which certificate shall list the various coverages and shall state that the policies shall not be changed nor cancelled until thirty (30) days' notice has been given to the Department. The kinds and amounts of required insurance are for bodily injury and property damage covering (a) contractor's liability with respect to all work performed by him under the contract, (b) contractor's liability for each sub-contractor, (c) contractor's protective liability insurance for the contractor with respect to all work performed for the contractor by sub-contractors, (d) protective liability insurance for the benefit of the County of Suffolk, New York and the Commissioner of Public Works, and all employees of the Commissioner of Public Works both officially and personally with respect to all operations under the contract, other than operations directly performed by the County or by a Department thereof, but including in such coverage any omissions and supervisory acts of the County, (e) completed operations insurance, and (f) owner's landlords' and tenants' liability insurance in the name of the County of Suffolk, New York and/or the Commissioner of Public Works.

Additional coverage and particular endorsements are required in connection with grade crossing elimination projects.

The Contractor shall not begin work on the contract until all necessary certificates of insurance required herein are on file with the Department at the Suffolk County Department of Public Works, Yaphank Avenue, Yaphank, New York. The Contractor shall not permit any sub-contractor to begin work on the contract until such sub-contractor is officially approved by the Department.

The amount of each type of coverage will be found in the "General Specifications and Conditions of Contract".

AMOUNT OF BOND. If a bond is executed for the faithful performance of the contract, the coverage shall be 100% of the amount of the contract price.

LABOR AND MATERIAL BOND. A separate bond guaranteeing prompt payment of moneys due to all persons supplying the contractor or a sub-contractor with labor and materials employed and used in carrying out the contract shall be executed and delivered to the Commissioner of Public Works. The amount of such bond shall be 100% of the amount of the contract price.

ESTIMATES AND PAYMENTS. In computing amounts in estimates of work done the unit prices bid will be used.

In making up the final estimate the linear measurement made along the axis of the surface of the finished work will be considered the length of the work.

All estimates, including the final, will be made for actual quantities of work performed and materials in place as determined by the measurements of the Engineer, and the resulting quantities involved in any contract shall be accepted as final, conclusive and binding upon the Contractor.

For computation of the quantities of earthwork to be paid for under the various items of the contract, it is agreed that the planimeter shall be considered an instrument of precision, and quantities computed from areas obtained by its use shall be accepted by all parties hereto as accurate. Arithmetical computations, utilizing any type of computing device or machines including electronic computers, shall not be precluded by reference to the planimeter.

FINAL ADDITIONS OR DEDUCTIONS. Upon the completion of the required work as shown in the plans and specifications, should the final estimate of quantities show either an increase or decrease from the approximate estimate of quantities, then such variations will be computed at the unit prices bid and a final agreement will be made respectively adding or deducting this amount from the gross sum bid.

PAYMENTS ON CONTRACT. Payments to the Contractor for work satisfactorily performed will be made monthly upon the percentage basis prescribed by Subdivision 7 Section 38 of the Highway Law. No monthly estimate will be rendered unless the value of the work done equals 5% of the Contract Amount or $1000. whichever is the lesser. Semi-monthly estimates may be rendered provided the value of the work performed in a two week interval is in excess of fifty thousand dollars or if, in the opinion of the Commissioner, it is to the best interests of the County to do so.

The attention of persons intending to make proposals is specifically called to the provisions of Section 70 and 71 of the Lien Law, as amended, and Section 1302-C of the Penal Law, as amended, in relation to funds being received by a Contractor for a public improvement declared to constitute trust funds in the hands of such contractor to be applied first to the payment of certain claims.

No certificate approving or authorizing the first partial payment, or in the event there shall be no first partial payment, then no certificate approving or authorizing any final payment shall be made to a foreign Contractor unless such Contractor furnish satisfactory proof that all taxes due by such Contractor under the provisions of Article 9, 9A, 16 and 16A of the tax law have been paid. The certificate of the State Tax Commission to the effect that all such taxes have been paid shall be conclusive proof of the payment of such taxes.

The term "foreign contractor" as used in the preceding paragraph means, in the case of an individual, a person who is not a resident of this State; and in the case of a partnership, one having one or more partners who is not a resident of this State; and in the case of a corporation, one not organized under the laws of this State.

PARTIAL PAYMENTS. Payment of the actual cost of the materials mentioned in the following list may, upon application by a Contractor and approval thereof by the Chief Engineer, be made to the Contractor prior to the incorporation of any such materials in the work, provided the amount of the partial payment requested for each item is greater than five hundred dollars ($500.00) and the Contractor shall first file with the Department of Public Works a bill or bills of sale showing that the materials have been paid for and that the title to the materials, without encumbrances, is in the name of the Contractor. Such payment may be made when said materials are delivered and are properly stored, provided that the materials upon which such payment is to be made shall be stored at the site of the work or at a place and in a manner approved by the Chief Engineer of the Department of Public Works. No payment shall be made on any materials without documented evidence of the acceptability of such materials filed with the Engineer. Such payment shall not be deemed to be an acceptance of such materials, and the Contractor shall be responsible for and must deliver to the site and properly incorporate in the work only those materials that comply with the specifications.

If the materials are stored on private property, the Contractor shall furnish and file with the County Department of Public Works a release and a waiver covering such materials, which release and waiver shall be executed by the owner of such private property in favor of the County Department of Public Works or its agent.

LIST OF MATERIALS.

Pavement reinforcement mesh
Bar reinforcement
Cables or beams for guide rail
Guide rail fittings
Granite Curb
Steel bearing and sheet piles
Pile Shoes
Miscellaneous metals
Open Steel Floor
Dimension Masonry
Prestressed Units
Aluminum Products
Metal Castings
Concrete Cribbing
Pipe Piles
Railings
Metal Protection Plate for Curbs
Post Tensioned Concrete Girders
Precast Concrete Piles including prestressed piles
Structural Steel (Partial payment not to exceed 75 percent of the actual cost of material may be made for structural steel girders, trusses or beam bridges at any time, provided that the specifications for Structural Steel Measurement and Payment are complied with and approved by the Chief Engineer.)
Structural Steel erected, riveted or welded, but not painted, (allow Contractor's bid price for structural steel in place, minus Thirty Dollars ($30.00) per ton for painting, where painting is included in the unit price for structural steel.)
Steel poles for Lighting or Traffic Signals
Steel Sign Structures and Supports
Sign Face Assemblies
Traffic Signal Assemblies, Controllers, Detectors, and appurtenances
Wire or Cable for electrical and communication purposes
Water Pipe
Transverse Joint Load Transfer Assemblies
Precast Concrete Units
Materials in Short Supply (To be determined in each case by the Chief Engineer)

The Contractor shall pay any and all costs of handling and delivering materials to and from the place of storage to the site of the work, as well as any storage rental.

Payments made shall not exceed 85 percent of the Contractor's bid price for the item, nor shall the quantity allowed exceed the corresponding quantity estimated in the contract.

ENGINEERING CHARGES. When the work embraced in the contract is not completed on or before the date specified therein, engineering and inspection expenses incurred by the County upon the work, including engineering and inspection expenses incurred on the work by railroad companies on contract for railroad eliminations, from the completion date originally fixed in the contract to the final date of completion of the work may be charged to the Contractor and be deducted by the Department from any monies due the Contractor. Consideration of any extra work or order on contract added to the original contract, as well as extenuating circumstances beyond the control of the Contractor, will be given due consideration by the Department before assessing engineering and inspection charges against the Contractor. Such charges will be assessed, however, in cases where the work has been unduly delayed by the Contractor because of unwarranted reasons, inefficient operation. or for any other reason for which the Department determines the Contractor liable.

PART I

Section 2

SAMPLE FORM OF PROPOSAL TITLE SHEET

COUNTY OF SUFFOLK
NEW YORK

DEPARTMENT OF PUBLIC WORKS

COUNTY ROAD PROJECT NO.:
TOWN

ITEMIZED PROPOSAL FOR CONSTRUCTING _____
(Title of Project)

A TOTAL CONTRACT LENGTH OF MILES COUNTY ROAD NO.

TYPE OF CONSTRUCTION:
(Description of Work)

PROJECT NUMBER.....1-65

CAPITAL FUND NUMBER.....5001

DEPOSIT REQUIRED.....$6,000.00

COMPLETION DATE.....January 3, 1977

SAMPLE FORM OF SPECIAL SPECIFICATIONS

Special Specifications and Notes applying to each individual contract will be shown here.

SAMPLE FORM OF LABOR RATES

COUNTY OF SUFFOLK
NEW YORK

DEPARTMENT OF PUBLIC WORKS

COUNTY ROAD NO._____ DATE:_____

PREVAILING RATE CASE NO._____.

The following minimum hourly rates of pay are hereby established in accordance with Federal and State Laws and Regulations.

TOWN_____ PROJECT NO._____

UNSKILLED GRADE (MINIMUM_____ $)

INTERMEDIATE GRADE (MINIMUM_____ $)

SKILLED GRADE (MINIMUM_____ $)

SPECIAL NOTICE

Labor classifications not appearing on this rate sheet can be used only with the consent of the Commissioner of Public Works and then the rate to be paid will be given by the Commissioner of Public Works after consulting with the State Department of Labor.

SAMPLE FORM OF PROPOSAL

ITEMIZED PROPOSAL

To the Suffolk County Department of Public Works:

In submitting this bid the undersigned declares that he is or they are the only person or persons interested in the said bid; that it is made without any connection with any person making another bid for the same contract; that the bid is in all respects fair and without collusion, fraud or mental reservation; and that no official of the County, or any person in the employ of the County is directly or indirectly interested in said bid or in the supplies or work to which it relates, or in any portion of the profits thereof.

The undersigned also hereby declares that he has or they have carefully examined the plans, specifications and form of contract, and that he has or they have personally inspected the actual location of the work together with the local sources of supply, has or have satisfied himself or themselves as to all the quantities and conditions, and understand that in signing this proposal he or they waive all right to plead any misunderstanding regarding the same

The undersigned further understands and agrees that he is or they are to furnish and provide for the respective item price bid all the necessary material, machinery, implements, tools, labor, services, and other items of whatever nature, and to do and perform all the work necessary under the aforesaid conditions, to complete the improvement of the aforementioned project in accordance with the plans and specifications for said improvem at, which plans and specifications it is agreed are a part of this proposal, and to accept in full compensation therefor the amount of the summation of the products of the approximate quantities multiplied by the unit prices bid. This summation will hereinafter be referred to as the gross sum bid.

The undersigned further agrees to accept the aforesaid unit bid prices in compensation for any additions or deductions caused by variation in quantities due to more accurate measurement, or by any changes or alterations in the plans or specifications of the work and for use in the computation of the value of the work performed for monthly estimates.

In case the undersigned, in anticipation of an award of this contract, voluntarily undertakes to commence to perform any of the contract work on the site of the project, he does so entirely at his own risk and without obligation or responsibility on the part of the County unless and until an award of the contract to him is consummated by the delivery to him of a duplicate of the Agreement which has been approved by the Presiding Officer of the Suffolk County Legislature, County of Suffolk, New York, pursuant to Section 126 of the Highway Law, the funds appropriated for the work under the Agreement, encumbered by the County Auditor and a copy of the said Agreement bearing a notice of the said encumbrance filed in the office of the County Treasurer, and he hereby does agree and warrant that, as a prerequisite to the start of any such voluntary work, he accepts, assumes and undertakes all of the provisions of this proposal and of the plans and specifications of the proposed contract, including all of the provisions and responsibilities thereof relative to (1) damage, indemnification and holding the County harmless as set forth in said contract documents, and (2) actually furnishing in advance of any contract operations, the required insurance policies of each and every kind and amount as called for in said contract documents, particularly with relation to workmen's compensation and liability insurance policies as set forth in the related specifications; and he does also agree and warrant that all of such policies will be in force and effect on the date of the start of any of such contract operations, whether or not the contract documents have been executed and filed as aforesaid.

ITEMIZED PROPOSAL

Item No.	Approximate Quantities	Items with unit bid price written in words	Unit bid price Dollars-Cts.	Amount bid Dollars Cts.
1	Necessary	Clearing and grubbing, For..... .....Lump Sum		
2	44,000	Cubic yards, Unclassified excavation, For ....Per cubic yd.		
	ETC.			
Total or gross sum bid written in words			Dollars $.....	Cts. .....

Accompanying this proposal is a certified check or bank cashiers check for $..... in case this proposal shall be accepted by the Suffolk County Department of Public Works, and the undersigned shall fail to execute the contract and in all respects comply with the provisions of Section 38 of the Highway Law, as amended, the moneys represented by such certified check or bank cashiers check shall be regarded as liquidated damages and shall be forfeited and become the property of the County of Suffolk; otherwise to be returned to the depositor in accordance with the provisions of said Section 38 of the Highway Law, as amended.

On acceptance of this proposal for said work the undersigned does or do hereby bind himself or themselves to enter into written contract, within ten days of date of notice of award, with the said Suffolk County Department of Public Works, and to comply in all respects with subdivision 6 of Section 38 of the Highway Law, as amended, in relation to security for the faithful performance of the terms of said contract.

NON-COLLUSIVE BIDDING CERTIFICATION

(REQUIRED BY SECTION 103-d OF THE GENERAL MUNICIPAL LAW)

Section 103-d. Statement of non-collusion in bids and proposals to political subdivisions of the state.

(1) Every bid or proposal hereafter made to a political subdivision of the state or any public department, agency or official thereof where competitive bidding is required by statute, rule, regulation or local law, for work or services performed or to be performed or goods sold or to be sold, shall contain the following statement subscribed by the bidder and affirmed by such bidder as true under the penalties of perjury; Non-collusive bidding certification.

(a) By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of knowledge and belief:

(1) The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;

(2) Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and

(3) No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

(b) A bid shall not be considered for award nor shall any award be made where (a) (1) (2) and (3) above have not been complied with; provided however, that if in any case the bidder cannot make the foregoing certification, the bidder shall so state and shall furnish with the bid a signed statement which sets forth in detail the reasons therefor. Where (a) (1) (2) and (3) above have not been complied with, the bid shall not be considered for award nor shall any award be made unless the head of the purchasing unit of the political subdivision, public department, agency or official thereof to which the bid is made, or his designee, determines that such disclosure was not made for the purpose of restricting competition.

The fact that a bidder (a) has published price lists, rates, or tariffs covering items being procured, (b) has informed prospective customers of proposed or pending publication of new or revised price lists for such items, or (c) has sold the same items to other customers at the same prices being bid, does not constitute, without more, a disclosure within the meaning of sub-paragraph one (a).

(2) Any bid hereafter made to any political subdivision of the state or any public department, agency or official thereof by a corporate bidder for work or services performed or to be performed or goods sold or to be sold, where competitive bidding is required by statute, rule, regulation, or local law, and where such bid contains the certification referred to in subdivision one of this section, shall be deemed to have been authorized by the board of directors of the bidder, and such authorization shall be deemed to include the signing and submission of the bid and the inclusion therein of the certificate as to non-collusion as the act and deed of the corporation.

Date....., 19..... .....
Legal Name of person, firm or corporation

By:.....
Signature (Title)

Please Complete Information Requested Below

The P. O. Address of the Bidder is:

..... Street.

..... City and State.

If a Corporation

Name		Address
.....,	President	.....
.....,	Secretary	.....
.....,	Treasurer	.....

If a Firm

Name	Address
.....	.....
.....	.....
.....	.....

PART I

Section 3

SAMPLE FORM OF AGREEMENT

COUNTY OF SUFFOLK
NEW YORK

DEPARTMENT OF PUBLIC WORKS

AGREEMENT

FOR CONSTRUCTION OR IMPROVEMENT OF.....

THIS AGREEMENT, entered into this.....day of ....., 19..., by THE COUNTY OF SUFFOLK, NEW YORK, hereinafter referred to as "County", acting by and through the Commissioner of Public Works, pursuant to the Highway Law and Chapter 278 of the laws of 1958, and..... a corporation organized and existing under the laws of the State of .....,
a partnership existing of .....,
an individual trading as .....,
of the city of ....., in the State of .....,
hereinafter called the "Contractor".

WITNESSETH, that the County and the Contractor, for the consideration hereinafter named, agree as follows:

ARTICLE 1. WORK TO BE DONE.

The Contractor shall (a) furnish all the materials, appliances, tools and labor of every kind required, and construct and complete in the most substantial and workmanlike manner, the construction, improvement or reconstruction of .....
.....
.....
.....
.....
in the town/towns of .....,
Suffolk County, New York, as shown in the Plans entitled .....
.....
and numbered ....., in accordance with the "Suffolk County Public Works Specifications" of
of the Suffolk County Department of Public Works, which contain the information for bidders; forms of proposal, agreement, and bonds; general specifications and conditions of contract; materials of construction; and Payment Items; and (b) do everything required by the Contract (Contract Documents) as defined herein.

ARTICLE 2. DOCUMENTS FORMING THE CONTRACT. The Contract (and Contract Documents) shall be deemed to include the advertisements for proposals; the Contractor's proposal; the agreement; the "Suffolk County Public Works Specifications" referred to above; the plans; any addenda to specifications if the same are issued prior to the date of receipt of proposal, and all provisions required by law to be inserted in the contract whether actually inserted or not.

ARTICLE 3. EXAMINATION OF DOCUMENTS AND SITE. The Contractor agrees that before making his proposal he carefully examined the contract documents, together with the site of the proposed work, as well as its surrounding territory, and is fully informed regarding all of the conditions affecting the work to be done and labor and materials to be furnished for the completion of this contract, including the existence of poles, wires, pipes and other facilities and structures of municipal and other public service corporations on, over or under the site, and that his information was secured by personal investigation and research and not from the estimates or records of the Department, and that he will make no claim against the County by reason of estimates, tests or representations of any officer or agent of the County.

ARTICLE 4. DATE OF START AND COMPLETION. The Contractor further agrees that he will begin the work herein embraced within ten days of the effective date hereof, unless the consent of the County, in writing, is given to begin at a later date, and that he will prosecute the same so that it shall be entirely completed and performed on or before the ..... day of ....., 19.....

No extension beyond the date of completion fixed by the terms of this contract shall be effective unless in writing signed by the County. Such extension shall be for such time and upon such terms and conditions as shall be fixed by the County, which may include a charge for engineering and inspection expenses actually incurred upon the work, including engineering and inspection expenses incurred upon the work by railroad companies on contracts for grade crossing elimination. Notice of application for such extension shall be filed with the Chief Engineer of the Department of Public Works at least fifteen days prior to the date of completion fixed by the terms of this agreement.

ARTICLE 5. ALTERATIONS AND OMISSIONS. The said work shall be performed in accordance with the true intent and meaning of the contract documents without any further expense of any nature whatsoever to the County other than the consideration named in this agreement.

The County reserves the right, at any time during the progress of the work, to alter the plans or omit any portion of the work as it may deem reasonably necessary for the public interest; making allowances for additions and deductions at the prices named in the proposal, for this work without constituting grounds for any claim by the Contractor for allowance for damages or for loss of anticipated profits, or for any variations between the approximate quantities and the quantities of the work as done.

ARTICLE 6. NO COLLUSION OR FRAUD. The Contractor hereby agrees that the only person or persons interested as principal or principals in the bid or proposal submitted by the Contractor for this contract are named therein, and that no person other than those mentioned therein has any interest in the above-mentioned proposal or in the securing of the award, and that this contract has been secured without any connection with any person or persons other than those named, and that the proposal is in all respects fair and was prepared and the contract was secured without collusion or fraud and that neither any officer nor employee of the Suffolk County Department of Public Works has or shall have a financial interest in the performance of the contract or in the supplies, work or business to which it relates, or in any portion of the profits thereof.

ARTICLE 7. PAYMENT OF ESTIMATES. As the work progresses in accordance with the contract and in a manner that is satisfactory to the County, the County hereby agrees to make payments to the Contractor therefor, based upon the proposal attached hereto and made a part hereof, as follows: The County shall, once in each month and on such days as it may fix, make an estimate of the quantity of work done and of material which has actually been put in place in accordance with the terms and conditions of the contract, during the preceding month, and compute the value thereof and pay to the Contractor the moneys due as provided in sub-division 7 of Section 38 of the Highway Law. No monthly estimate shall be rendered unless the value of the work done equals 5% of the contract amount or $1,000, whichever is the lesser. Semi-monthly estimates may be rendered provided (a) the value of the work performed in two successive weeks is more than $50,000 or (b) the Commissioner of Public Works deems it to be for the best interests of the County to do so.

ARTICLE 8. NO ESTIMATE ON CONTRACTOR'S NON-COMPLIANCE. It is further agreed that so long as any lawful or proper direction concerning the work or material given by the Commissioner of Public Works, or his representative, shall remain uncomplied with, the Contractor shall not be entitled to have any estimate made for the purpose of payment, nor shall any estimate be rendered on account of work done or material furnished until such lawful or proper direction aforesaid has been fully and satisfactorily complied with.

ARTICLE 9. FINAL ACCEPTANCE OF WORK. When in the opinion of the Chief Engineer a Contractor has fully performed the work under the contract, the Chief Engineer shall recommend to the Commissioner of Public Works the acceptance of the work so completed. If the Commissioner accepts the recommendation of the Chief Engineer, he shall thereupon by letter notify the Contractor of such acceptance, and copies of such acceptance shall be sent to other interested parties.

ARTICLE 10. FINAL PAYMENT. After the final acceptance of the work, the Engineer shall prepare a final agreement for the work done from actual measurements and computations relating to the same, and he shall compute the value of such work under and according to the terms of the contract. This agreement shall be certified to as to its correctness by the Engineer. Upon approval of such final agreement by the Chief Engineer, it shall be submitted to the Commissioner for final approval. The right, however, is hereby reserved to the Commissioner to reject the whole or any portion of the final agreement, should the said certificate of the Engineer be found or known to be inconsistent with the terms of the agreement or otherwise improperly given. All certificates upon which partial payments may have been made being merely estimates, shall be subject to correction in the final certificate or agreement.

ARTICLE 11. RIGHT TO SUSPEND WORK AND CANCEL CONTRACT. It is further mutually agreed that if at any time during the prosecution of the work the Commissioner of Public Works shall determine that the work upon the contract is not being performed according to the contract or for the best interests of the County, the execution of the work by the Contractor may be temporarily suspended by the Commissioner of Public Works, who may then proceed with the work under his own direction in such manner as will accord with the contract specifications and be for the best interests of the County; or he may terminate the Contractor's employment under the contract while it is in progress, and thereupon proceed with the work, in affirmance of the contract, by contract negotiated or publicly let, by the use of his own forces, by calling upon the surety to complete the work in accordance with the plans and specifications or by a combination of any such methods; or he may cancel the contract and either readvertise and relet as provided in Section 38 of the Highway Law, or complete the work under his own direction in such manner as will accord with the contract specifications and be for the interests of the County; any excess in the cost of completing the contract beyond the price for which it was originally awarded shall be charged to and paid by the Contractor failing to perform the work or his surety; all in pursuance of the provisions of Section 40 of the Highway Law.

Whenever the County determines to suspend or stop work under the contract, a written notice sent by mail to the Contractor at his address and to the sureties at their respective addresses, shall be sufficient notice of its action in the premises.

ARTICLE 12. DETERMINATION AS TO VARIANCES. In case of any ambiguity in the plans, specifications or maps, or between any of them, the matter must be immediately submitted to the Commissioner, who shall adjust the same, and his decision in relation thereto shall be final conclusive upon the parties.

ARTICLE 13. REMOVAL OF REJECTED WORK AND MATERIAL. The Contractor agrees that all work or material which may be rejected by the County or its representative shall be at once removed from the site of the work by the Contractor at his own expense, and replaced by work or material satisfactory to the County.

ARTICLE 14. SUCCESSORS AND ASSIGNS. The contractor agrees that this contract shall not be assigned, transferred, conveyed, sublet, or otherwise dispose of the same, or of his right, title and interest therein, or his power to execute such contract, or assign all or any portion of the moneys that may be due or become due to the contractor under the terms of this contract.

IN WITNESS WHEREOF, This agreement has been executed by the County of Suffolk, acting by and through the Commissioner of Public Works, and the Contractor has duly executed this agreement on the day and year first above written.

THE COUNTY OF SUFFOLK, STATE OF NEW YORK (L.S.)

By:

Recommended by

.....
Commissioner of Public Works

.....
Chief Engineer, Department of Public Works

.....L.S.
Contractor

(Affix corporate seal of contractor, if a corporation)

By: .....
President

Approved Pursuant to Article 6, Highway Law

.....
Presiding Officer, Suffolk County Legislature

(Acknowledgment by individual contractor)

STATE OF NEW YORK)
) ss.:
County of .....)

On this day of 19 , before me personally came to me known and known to me to be the person described in, and who executed the foregoing instrument, and severally acknowledged that he executed the same.

.....
Notary Public County

(Acknowledgment by co-partnership contractor)

STATE OF NEW YORK)
) ss.:
County of .....)

On this day of 19 , before me personally came and appeared to me known and known to me to be the person who executed the above instrument, who, being duly sworn by me, did for himself depose and say that he is a member of the firm of , consisting of himself and and that he executed the foregoing instrument in the firm name of and that he had authority to sign same, and he did duly acknowledge to me that he executed the same as the act and deed of said firm of , for the uses and purposes mentioned therein.

.....
Notary Public

(Acknowledgment by contractor, if a corporation)

STATE OF NEW YORK)
) ss.:
County of .....)

On this day of 19 , before me personally came , to me known, who being sworn, did depose and say that he resides in , that he is the of the , the corporation described in and which executed the foregoing instrument; that he knew the seal of said corporation; that the seal affixed to said instrument was such corporate seal; that it was so affixed by the order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

.....
Notary Public

PART I

Section 4

SAMPLE FORM OF BONDS

FAITHFUL PERFORMANCE BOND

1. Know all men by these presents, That we (hereinafter called the "Principal")
..... of .....
..... of .....
..... of .....
..... of .....
and .....
of .....
(hereinafter called the "Surety") are held and firmly bound unto the County of Suffolk, New York in the full and just sum of ..... Dollars ($.....) good and lawful money of the United States of America, to the payment of which said sum of money, well and truly to be made and done, the said Principal binds himself, his heirs, executors, administrators or assignees and the said SURETY binds itself, its successors or assigns, jointly and severally, firmly by these presents.

2. Signed, sealed and dated this ..... day of ..... 19.....

3. Whereas, Said Principal has entered into a certain written contract bearing date on the ..... day of ..... 19..... with the County of Suffolk, New York for the (construction or improvement) (maintenance or repair) of that certain portion of public highway known as the .....
in the (Town) (Towns) of .....
..... New York.

Now, Therefore, THE CONDITION OF THIS OBLIGATION IS SUCH that if the said Principal shall well, truly and faithfully perform the work in accordance with the terms of the contract, and with the plans and specifications, and will commence and complete the work within the time prescribed in the contract, on his part to be kept and performed according to the terms and tenor of said contract, and shall protect the said County of Suffolk against, and pay any excess of cost as provided in said contract, and all amount, damages, costs, and judgments which may be recovered against the said County or its officers or agents or which the said County of Suffolk may be called upon to pay any person or corporation by reason of any damages, direct or indirect, arising or growing out of the doing of said work, or from the negligence, non-feasance, misfeasance or malfeasance of any officer, agent or employee of the County, or Department thereof, or suffered or claimed on account of said (construction or improvement) (maintenance or repair) during the time thereof and until the final completion and acceptance of the project, or the manner of doing the same, or the neglect of the said Principal, or his agents, or servants, or the improper performance of the said work by the said Principal, or his agents or servants, or from any other cause, then this obligation shall be null and void, otherwise to remain in full force and virtue.

The surety hereto agrees that in case the said contract is forfeited by the Principal hereto in the manner provided in the contract and the Principal fails to deposit to the credit of the Suffolk County Department of Public Works, the excess cost of completing the work occasioned by the failure of the Contractor, then and in that case the surety will within ten days from the date of notice by the Suffolk County Department of Public Works, of the amount of such excess cost deposit with the said Department such sum of money as the Department certifies to the surety as being the excess above the funds remaining available for this contract, free from all liens and incumbrances in the hands of the County of Suffolk.

And the said SURETY hereby stipulates and agrees that no change, extension, alteration, deduction or addition in or to the terms of the said contract or the plans or specifications accompanying the same, shall in any wise affect the obligation of the said SURETY on his bond.

(Corporate seal of .....L.S.)
principal of .....L.S.) Principal
a corporation .....L.S.)

(Corporate seal of .....L.S.)
surety) .....L.S.) Surety

By:.....

(Acknowledgment by principal, unless it be a corporation.)

STATE OF NEW YORK)
) ss.:
County of)

On this day of 19 , before me personally came to me known to be the person described in and who executed the foregoing instrument and he acknowledge that he executed the same.

.....
(Notary's seal to be attached) Signature of Notary Public

(Acknowledgment by principal, if a corporation.)

STATE OF NEW YORK)
) ss.:
County of)

On this day of 19 , before me personally came to me known, who being by me duly sworn, did depose and say that he resides in that he is the of the the corporation described in and which executed the foregoing instrument; that he knew the seal of said corporation; that the seal affixed to said instrument was such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

Sworn to before me this day of 19 .

.....
..... Signature of party making affidavit
(Notary Public)
(Notary's seal to be attached)

(Acknowledgment by Surety Company)

STATE OF NEW YORK)
) ss.:
County of)

On this day of 19 , before me personally came to me known, who being by me duly sworn, did depose and say that he resides in that he is the of the the corporation described in and which executed the foregoing instrument; that he knew the seal of said corporation; that the seal affixed to said instrument was such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

Sworn to before me this day of 19 .

.....
..... Signature of party making affidavit
(Notary Public)
(Notary's seal to be attached)

(The Surety Company must append statement of its financial condition and a copy of the resolution authorizing the execution of Bonds by officers of the Company).

SAMPLE FORM OF LABOR AND MATERIAL BOND

Know all men by these presents, That we (hereinafter called the "Principal")

.....of.....

and.....

of.....(hereinafter called the "Surety")

a corporation created and existing under the laws of the State of ..... are held and firmly bound unto the County of Suffolk, (hereinafter called the "County", in the full and just sum of ..... Dollars ($.....) good and lawful money of the United States of America. for the payment of which said sum of money, well and truly to be made and done, the said Principal binds themselves (himself, itself), their (his, its) heirs, executors and administraters, successors and assigns, and the said Surety binds itself, its successors and assigns jointly and severally, firmly by these presents;

Signed, sealed and dated this.....day of.....19....., A.D.

Whereas, said Principal has entered into a certain written contract, bearing date on the

.....day of....., 19..... with the COUNTY OF SUFFOLK, NEW YORK

for the.....

.....

.....

..... and

Whereas, in accordance with certain provisions of the said contract a bond is required guaranteeing prompt payment of monies due to all persons supplying the contractor or a subcontractor with labor and materials employed and used in carrying out the contract, which bond shall insure to the benefit of the persons supplying such labor and materials.

Now, Therefore, THE CONDITION OF THE FOREGOING OBLIGATION IS SUCH, that if the said Principal shall promptly pay all monies due to all persons supplying the contractor or subcontractor with labor and materials employed and used in carrying out the contract, then this obligation shall be null and void, otherwise, to remain in full force and virtue.

IN TESTIMONY WHEREOF, the said Principal has hereunto set his (their, its) hand and seal and the said Surety has caused this instrument to be signed by its .... and its ....., and its corporate seal to be hereunto affixed, the day and year first above written.

Signed, sealed and delivered
in the presence of

.....(L.S.)

.....(L.S.)
Principal

.....
Company

SEAL

of .....

By .....
(Title of Officer)

Attest.....
Surety

(Acknowledgment by principal,
unless it be a corporation.)

STATE OF NEW YORK)
) ss.:
County of)

On this day of , 19 , before me personally came , to me known and known to me to be the person described in and who executed the foregoing instrument, and acknowledged that he executed the same.

.....
Notary Public County

(Acknowledgment by principal
if a corporation.)

STATE OF NEW YORK)
) ss.:
County of)

On this day of , 19 , before me personally came , to me known, who being by me duly sworn, did depose and say that he resides in ; and that he is the of the , the corporation described in and which executed the foregoing instrument; that he knew the seal of said corporation; that the seal affixed to said instrument was such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that he signed his name thereto by like order.

.....
Notary Public County

(Acknowledgment by Surety Company)

STATE OF NEW YORK)
) ss.:
County of)

On this day of , 19 , before me personally came , to me known, who being by me duly sworn, did depose and say that he resides in , that he is the of , the corporation described in and which executed the within instrument; that he knows the seal of said corporation; and that the seal affixed to said instrument is such corporate seal; that it was so affixed by the order of the Board of Directors of said corporation, and that he signed his name thereto by like order; and that the liabilities of said company do not exceed its assets as ascertained in the manner provided by the laws of the State of New York; and the said further said that he is acquainted with and knows him to be the of said company; that the signature of the said subscribed to the within instrument is in the genuine handwriting of the said and was subscribed thereto by like order of the Board of Directors, and in the presence of him the said .

.....
Notary Public County

THE FOREGOING CONTRACT, PERFORMANCE BOND AND LABOR AND MATERIALS BOND ARE APPROVED AS TO FORM AND MANNER OF EXECUTION.

.....
COUNTY ATTORNEY

STATE AND LOCAL SALES TAX EXEMPTION. The Contractor's attention is directed to the changes made in Section 1115 of the Tax Law by Chapters 513 and 514 of the Laws of 1974. In connection with capital improvement contracts entered into on or after September 1, 1974, all tangible personal property which will become an integral component of a structure, building or real property of the State, or any of its political subdivisions, is exempt from State and local retail sales tax and compensating use tax.

Section 5
GENERAL SPECIFICATIONS AND CONDITIONS OF CONTRACT

DEFINITIONS

Wherever the following words and expressions are used in these specifications or accompanying documents, it is understood that they have the meanings defined below.

A.A.S.H.T.O. American Association of State Highway and Transportation Officials.

A.C.I. American Concrete Institute.

A.I.S.C. American Institute of Steel Construction.

A.I.S.I. American Iron and Steel Institute.

A.R.E.A. American Railway Engineering Association.

A.S.A. American Standards Association.

A.S.C.E. American Society of Civil Engineers.

A.S.T.M. American Society for Testing and Materials.

A.S.M.E. American Society of Mechanical Engineers.

A.W.S. American Welding Society.

A.O.A.C. Association of Official Agricultural Chemists.

S.P.N. "Standardized Plant Names" prepared by the American Joint Committee on Horticulatural Nomenclature and in effect on the date of advertisement of bids.

ADDENDA. Supplemental additions, deletions, and modifications to the provisions of the specifications which are in effect on the date of advertisement for receipt of bids.

AMENDMENT. A formal alteration by addition, deletion or modification of a proposed contract issued subsequent to the initiation of the sale of proposals and prior to the opening of bids.

AWARD. The decision of the department to accept the proposal of the lwest responsible bidder for the work, subject to the execution and approval of a satisfactory contract therefor and bond to secure the performance thereof, and to such other conditions as may be specified or otherwise required by law.

BID DEPOSIT. The security furnished by the bidder with his proposal for a project as guaranty he will enter into a contract for the work if his proposal is accepted.

BIDDER. An individual, firm or corporation formally submitting a proposal for the work contemplated acting directly or through a duly authorized representative.

BRIDGE. The term "bridge" shall apply to any structure whether single or multiple span construction with a clear span in excess of 20 feet when measurement is made horizontally along the center line of roadway from face to face of abutments or sidewalls immediately below the copings or fillets; or, if there are no copings or fillets, at points six inches below the bridge seats or immediately under the top slab, in the case of frame structures. In the case of arches, the span shall be measured from spring line to spring line. All measurements shall include the widths of intervening piers or division walls, as well as the width of copings or fillets.

CHIEF ENGINEER. The Chief Engineer of the Suffolk County Department of Public Works who is in charge of all engineering and construction and who supervises the performance of the contract.

COMMISSIONER. The County Commissioner of Public Works, County of Suffolk, New York, who is also the County Superintendent of Highways.

CONTRACT AGREEMENT. The agreement covering the performance of the work and the furnishing of labor and materials in the construction of the work in conformance with the requirements of the contract documents.

CONTRACT DOCUMENTS. The contract documents shall include the advertisement for proposals, the contractor's proposal; the agreement; the Suffolk County Public Works Specifications; the plans; any addenda to specifications and all provisions required by law to be inserted in the contract whether actually inserted or not.

CONTRACTOR. The individual, firm or corporation undertaking the execution of the work under the terms of the contract and acting directly or through his, their, or its agents or employees.

COUNTY. Suffolk County, New York, represented by the County Department of Public Works through the County Commissioner of Public Works.

CULVERT. The term "culvert" shall apply to any structure whether of single or multiple span construction with an interior width of 20 feet or less when measurement is made horizontally along the center line of roadway from face to face of abutments or sidewalls immediately below the copings or fillets; or, if there are no copings or fillets, at points six inches below the bridge seats or immediately under the top slab in the case of frame structures. In the case of arches, the span shall be measured from spring line to spring line. All measurements shall include the widths of intervening piers or division walls, as well as the widths of copings or fillets.

DEPARTMENT. The Suffolk County Department of Public Works,--a word commonly used to mean the Commissioner of Public Works or his authorized representative.

DEPUTY COMMISSIONER. The Deputy Commissioner of Public Works, County of Suffolk, New York.

DIVISION. A Division of the Suffolk County Department of Public Works.

EMPLOYEE. Any person working on the project mentioned in the contract of which these specifications are a part, and who is under the direction or control, or receives compensation from the Contractor or Subcontractor.

EQUIPMENT. All machinery and equipment, together with the necessary supplies for upkeep and maintenance, and also tools and apparatus necessary for the proper construction and acceptable completion of the work.

FINAL ESTIMATE. Certification or Estimate of the Engineer submitted to the Commissioner upon completion of the contract, stating from actual measurements the whole amount of work done by the Contractor and also the value of such work under and according to the terms of the contract.

HANDBOOK OF PROCEDURES AND FORMS. Directives and standards for construction contract record keeping to be followed by Resident Engineer.

HIGHWAY. The whole strip of land bounded by the right-of-way lines.

INSPECTOR. The Department representative detailed by the Engineer, Resident Engineer, or Resident Inspector to supervise or inspect methods and materials relating to work both on or off the site of contract.

LABORATORY. The Suffolk County Department of Public Works testing laboratory; the testing laboratory of the Suffolk County Department of Public Works in Yaphank, New York, or a laboratory especially designated by the Commissioner for testing the materials to be used under the contract.

LAYING LENGTH OF PIPE. Linear feet (laying length) of pipe shall be measured by multiplying the number of whole units by the nominal length of each unit and adding thereto the length of any fractional units incorporated in the work. The nominal length of a unit or fractional unit shall be inside measured length from butt end to butt end exclusive of the bell or the groove on the female end.

MATERIAL. Any approved material acceptable to the Commissioner and conforming to the requirements of the specifications.

ORDER ON CONTRACT. Written order issued by the Commissioner covering contingencies, extra work, deductions, increases or decreases and additions, alterations or omissions to the plans or specifications.

PARTIAL OR MONTHLY ESTIMATES. Payments to the Contractor for work satisfactorily performed, made on percentage basis prescribed by subdivision 7 section 38 of the Highway Law.

PLANS. The official contract drawings and applicable standard sheets, which show the location, character, dimensions and details of the work to be performed.

PROJECT. The construction work to be performed under one or more construction contracts to complete an undertaking.

PROPOSAL. The offer of the bidder for the work, when executed and submitted on the prescribed form.

PROPOSAL FORM. The approved form on which the department requires formal bids to be prepared and submitted for the work.

RESIDENT ENGINEER (referred to as the Engineer). The Professional Engineer, representing the County Department of Public Works having direct supervision of the execution of the Contract under the direction of the Chief Engineer.

RESIDENT INSPECTOR. The inspector, representing the County Department of Public Works having the same authority and duties specified for the Resident Engineer.

ROAD SECTION. That portion of a highway included between the top of the slope in cut and the bottom of slope in fill.

ROADWAY. That portion of the highway included between the outside edges of the shoulders.

SHOULDER. The portion of the roadway contiguous with the traveled way for accomodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

SITE. The specific area adjacent to and including the area upon which construction work is to be performed. Generally, such area may be considered as defined by the right-of-way or property made available to the contractor for construction operations.

SOIL AMENDMENT. Materials such as sand, clay, gravel and organic materials used for incorporating with soils to affect the soil structure or organic content, exclusive of the use of lime and fertilizers.

SPECIAL NOTES. Special directions, provisions, or requirements peculiar to the project under consideration.

SPECIFICATIONS. The body of directions, requirements, etc. contained in this present volume together with all documents of any description and agreements made (or to be made), pertaining to the methods (or manner) or performing the work or to the quantities and quality as shown by the test records of accepted materials to be furnished under this contract. Specifications shall also include the Instructions to Bidders; Forms of Proposal; Agreement and Bonds; General Specifications and Conditions of Contract; Materials of Construction; Roadside Development; Itemized Specifications.

STATE. When used, means the State of New York, represented by the State Department of Transportation through the Commissioner of Transportation.

STRUCTURES. Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes endwalls, buildings, sewers, service pipes, underdrains, foundation drains and other features which may be encountered in the work and not otherwise classed herein.

SUBCONTRACTOR. Any individual, firm or corporation to whom the contractor, with the written consent of the Department, sublets any part of the contract.

SURETY. The corporate body bound with and for the contractor, for the full and complete performance of the contract, and for the payment of all debts, pertaining to the work.

TESTS. Methods adopted by the Commissioner to ascertain the quality, character and acceptability of materials and processes utilized in performing the contract.

TON. Short ton of 2,000 pounds.

WORK. Work shall be understood to mean the furnishing of all labor, materials, equipment, and other incidentals necessary or convenient to the successful completion of the project and the carrying out of all the duties and obligations imposed by the contract.

WORK DAY. A calendar day, exclusive of Sundays and State recognized legal holidays, on which weather and other conditions not under the control of the contractor, will permit construction operations to proceed for the major part of the day on the principal item or items of work which would normally be in progress at that time.

SPECIFICATIONS AND CONDITIONS

WORK REQUIRED. Under the contract the Contractor shall be required to do all work enumerated under the different items of the contract and in addition to this shall be required to protect all adjoining property and existing highway facilities within the Right of Way and to repair or replace any such properties or facilities damaged or destroyed by him or his employees through the construction operations, both within and adjacent to the Right of Way.

The Contractor's attention is directed to the fact that during the life of this contract the owners and operators of Public Utilities may make changes in their facilities. These changes may be made by the Utility employees or by contract within the limit or adjacent to this contract and may be both temporary and permanent.

The Contractor shall be responsible for the coordination of the work of his various Sub-Contractors. Their respective operation shall be arranged and conducted so that delays will be avoided. Where the work of the Contractor, or Sub-Contractors, overlaps or dovetails with that of other Contractors, materials shall be delivered and operations conducted so as to carry on the work continuously in an efficient and workmanlike manner. Delays or oversights on the part of the Contractor or Sub-Contractors or Utility owners in getting any or all of their work done in the proper way thereby requiring the cutting, removing and replacing of work already in place, shall not be the basis for a claim of extra compensation. Such work will be performed at the cost and expense of the offending Contractor, Sub-Contractor or Utility owners.

Immediately upon award of the contract the Contractor shall furnish in writing to the Chief Engineer the sources of supply, types of all items and kinds of materials which he proposes to use in the work. No change shall be made in the sources of supply or kinds of materials or in the type of any item except upon written approval by the Chief Engineer.

As soon as the contract is awarded the Contractor shall notify the Chief Engineer of the name and address of the fabricator of all structural steel. This notification shall list the specific shop or shops in which the steel will be fabricated.

START AND PROGRESS OF WORK. After filing the necessary certificates of insurance with the Department as aforesaid and before starting the work the Contractor shall submit to the Chief Engineer an outline of his proposed methods and manner of executing the work including sequences of operation and a time schedule of performing the same. Such outline may be utilized to facilitate the County's inspection and coordination of construction activities only, and shall not be construed to modify or amend the Agreement, or the date of completion therein.

When requested by the Chief Engineer, the Contractor shall furnish weekly work schedules indicating number of personnel, kind of equipment and location and nature of the work to be performed.

DATE OF COMPLETION AND CLOSING. All work to be performed under the Contract shall be completed within the time stated in the Agreement for the project or within such extended time for completion as may be granted by the Commissioner.

Whenever the Commissioner shall deem it necessary that any portion or certain portions of the work shall be progressed in any particular manner or that any such portion or portions of the work shall be completed pursuant to a certain sequence or schedule and before the date of completion of the entire contract, the Contractor shall punctually comply with the related instructions, dates and periods of time.

The extent of the Contractor's compliance with the provisions under this heading will be considered as relevant in any future determination of an award to him as the lowest responsible bidder for any project under the supervision of the Department.

If, during the progress of the work, it should become necessary, because of lateness of the season, to stop the work, then the Contractor shall open proper draining ditches, erect temporary structures where necessary, prepare the project so that there will be a minimum interference with traffic, set up and maintain a competent organization, as directed by the Engineer, to keep the contract in first class condition for traffic, and take every precaution to prevent any damage or unreasonable deterioration of the work during the time it is closed.

FAILURE TO COMPLETE ON TIME. For each Calendar day that any work shall remain uncompleted after the contract date specified for the completion of the work provided for in the Contract, the sum specified in the Contract will be deducted from any money due the Contractor, not as a penalty but as liquidated damages; provided however that due account shall be taken of any adjustment of the Contract time for Completion of the Work as provided for elsewhere in the Specification.

Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion or after the date to which the time for completion may have been extended, will in no way operate as a waiver on the part of the County or any of its rights under the Contract.

The Commissioner may waive such portions of the liquidated damages as may accrue if he deems the work is in such condition as to be safe and convenient for use by the traveling public.

The assessing of liquidated damages shall be in addition to Engineering Charges as provided for in Part 1, Section 1, of the Specifications as amended by pertinent Addenda.

In the event the delivery of any material in short supply is delayed substantially beyond the normal delivery time which results in delaying the completion of the contract, the contract will be extended without the assessment of engineering charges or liquidated damages. The Contractor shall, however, demonstrate to the Commissioner of the Department of Public Works that he has made every reasonable effort to obtain such material and complete the contract.

CONTRACTOR TO GIVE PERSONAL ATTENTION. The Contractor shall give his constant personal attention to the work while it is in progress or he shall place it in charge of a competent and reliable English-speaking superintendent, who shall have authority to act for the Contractor and who shall be acceptable to the Engineer. The Contractor shall, at all times, employ labor and equipment which shall be sufficient to prosecute the several classes of work to full completion in the manner and time specified. All workmen must have sufficient skill and experience to properly perform the work assigned them. All workmen engaged on special or skilled work shall have had sufficient experience in such work to properly and satisfactorily perform it and operate the equipment involved. Any person employed by the Contractor whom the Engineer may deem incompetent or unfit to perform the work shall be at once discharged, and shall not be again employed. In case of a disagreement with the Contractor regarding the discharge of such employees, the matter may be reviewed by the Commissioner.

SAFETY REQUIREMENTS. The Contractor shall perform all work on this contract in a workmanlike manner with due regard to the safety of the employees and of the public.

The Contractor shall comply with provisions of Industrial Code Rule No. 23, as amended; issued by the State of New York Department of Labor, Board of Standards and Appeals, regarding the safety and protection of persons employed in construction and demolition work, and all work relative thereto shall be performed by the Contractor under the direction and supervision of the Department of Public Works.

The Contractor shall completely enclose, by safety wire fences, all potentially hazardous locations in accordance with Industrial Code Rule 23 and OSHA (Occupational Safety and Health Act). Fencing shall be not less than five (5) feet in height, mounted on steel angles, wood or other satisfactory means of support spaced at intervals of not more than ten (10) feet. Fabric shall be .083" diameter (No. 14 B.W.G.) iron wire both directions of an electrically welded rectangular mesh, with openings no greater than two (2) inches wide by four (4) inches high. Warning signs reading "DANGER" - "KEEP OUT" shall be mounted on the fence as required by the Engineer in charge but at no more than one hundred (100) foot intervals. Signs shall be 16" x 24" with five (5) inch black letters on a white background. Safety wire fencing shall be furnished, erected, relocated, maintained, and removed, as required.

ORDERS TO FOREMAN. Whenever the Contractor or his superintendent is not present on any part of the work where it may be desired to give directions, orders will be given by the Engineer or his representative and shall be received and obeyed by the Foreman who may have charge of the particular work in reference to which the orders are given. All foremen shall be English-speaking.

AUTHORITY OF INSPECTORS. Duly authorized inspectors who shall perform their duties under the direction of the Engineer will be assigned to the work or each part thereof. The Contractor shall execute his work in the presence of an inspector and during the working hours of the day unless specifically directed otherwise, and shall afford every facility for inspecting the materials and work at all times. The presence of the inspector shall in no wise lessen the responsibility of the Contractor. In case any dispute arises between the Contractor and the inspector as to materials furnished or the manner of performing the work, the inspector shall have authority to reject materials or suspend the work until the question at issue can be referred to and decided by the Engineer. The inspector is not authorized to revoke, alter, enlarge, relax, or release any requirements of these specifications, nor to approve or accept any portion of the work, nor to issue instructions contrary to the drawings and specifications.

AUTHORITY OF THE RESIDENT ENGINEER. The Resident Engineer is the representative of the Department of Public Works at the site, and, subject to review by the Chief Engineer, shall have the power, in the first instance to inspect, supervise and control the performance of the work. He shall not, however, have the power to issue a change order or an extra work order, and the performance of such work by the Contractor on the order of the Resident Engineer without first obtaining a written order on contract therefor from the Commissioner or from the Chief Engineer for the Commissioner shall constitute a waiver of any right to extra compensation therefor. The Contractor is warned that the Resident Engineer has no power to change the terms and provisions of this Contract in any respect.

AUTHORITY OF THE CHIEF ENGINEER. Subject to review by the Commissioner of Public Works the Chief Engineer shall in all cases determine the amount of quantity of the several kinds of work and the quality of materials which are to be paid for under this contract; he shall determine all questions in relation to the work and the construction thereof, and in all cases decide every question which may arise relative to the performance of the work covered by this contract on the part of the Contractor. Any doubt as to the meaning of these specifications and drawings, or any obscurity as to the wording of them, will be explained by the Chief Engineer and all directions and explanations requisite or necessary to complete, explain or to make definite any of the provisions of these specifications and drawings and give them due effect, will be given by the Chief Engineer, in writing.

The foregoing enumeration shall not imply any limitation upon the power of the Chief Engineer, for it is the intent of this contract that all of the work shall generally by subject to his determination, direction and approval, except where the determination, direction or approval of the Commissioner is expressly called for herein or required by State or Local Law.

STAKEOUT. The Contractor shall furnish, free of charge, all stakes, templates standard subgrade testers, straight edges, approved paint and marking devices, and such temporary structures as may be necessary for marking and maintaining points and lines for the work, and is to give the Engineer such facilities, labor and materials for giving the lines and points as he may require.

Unless otherwise provided in the proposal, the Contractor will be initially given line and grade throughout the entire length of the contract by properly marked offset or reference stakes placed by the Engineer. He shall carefully preserve all such stakes and marks. The Contractor shall keep the Engineer informed a reasonable time in advance of the time and place he intends to do work, so that line and grade may be furnished and necessary measurements made for records and payment. The Contractor shall brush-out survey lines as directed by the Engineer, in advance of all survey work in order to permit accurate and unimpeded work by the survey parties.

When the work is ready for fine grading, the Engineer will set accurate grade on stakes or pins located in the roadway, furnished and driven by the Contractor. These pins shall be carefully preserved by the Contractor.

All property lines and survey monuments which may be disturbed during construction shall be properly tied to fixed points before being disturbed, and properly re-set by the Contractor upon the completion of the work as directed by the Engineer.

CLOSING OF HIGHWAY. The legal closing of a highway to public travel in the manner provided by Section 104 of the Highway Law will be done by the Commissioner of Public Works when he deems such closing necessary. All highways are not so closed during highway construction operations.

When a highway is legally closed and public travel diverted therefrom, adequate warning, danger and direction signs and lights shall be erected and maintained by the Contractor to properly protect and direct public travel by day and by night. Suitable barricades shall also be erected at the ends of such closed sections of highways and large signs displayed indicating such closure. All signs, barricades and other traffic control devices used shall conform to the New York State Manual of Uniform Traffic Control Devices.

CONSTRUCTION EQUIPMENT. It is the intent of these specifications to permit the use of the most efficient equipment that is consistent with conditions at the time of use. It is however anticipated that seasonal or weather conditions combined with the nature of the terrain will often require the use of lighter and smaller equipment than might be used under optimum conditions.

Construction equipment having a gross single axle load in excess of 22,400 pounds or a gross tandem axle load in excess of 36,000 pounds shall not be operated on or across any segment of pavement or structure which is to be retained as part of the ultimate highway section without specific authorization in writing by the Engineer. This authorization shall indicate specifically the limits within which such equipment with over-legal axle loads shall operate, the frequency of such loads and any other limiting factors consistent with conditions.

If the Engineer determines that the use of heavy equipment on portions of the road section other than pavement, on any part or all of a contract, is having or will result in detrimental effects on the finished highway he will so notify the Contractor in writing and shall indicate the maximum weight and/or axle load for any equipment that may be used for any specific operation or location.

WINTER EARTHWORK OPERATIONS. Earthwork construction operations requiring compaction shall not be performed from November 1 to April 1 except with the written permission of, and under such special conditions and restrictions as may be imposed by the Chief Engineer.

OPENING HIGHWAY TO TRAFFIC PRIOR TO ACCEPTANCE. When directed, in writing by the Chief Engineer, the Contractor shall open to traffic any portion of new pavement and/or structures before final acceptance of the contract. Traffic, on these portions of highway so opened to travel by the Chief Engineer, shall be maintained and protected in accordance with all the provisions of the Maintenance and Protection of Traffic items in the contract.

Should the Contractor be dilatory in completing certain features of the work on the portion of the highway directed to be opened, the Chief Engineer may order all or a portion of the said highway open to traffic; and in this event the Contractor shall not be relieved of his liability and responsibility during the period the work is so opened prior to final acceptance.

These provisions apply not only to the reconstruction of existing highways, but also to work on new locations where traffic is not maintained during construction.

PRESERVATION OF PROPERTY. It is the intent of this specification that the Contractor protect and preserve all public and private property including all existing vegetation, existing landscape features and monuments within, along and adjacent to the highway right of way. The Contractor shall use every precaution necessary and perform the work as specified, in a manner approved by the Engineer, to prevent damage, injury, pollution or destruction; shall protect all trees and other woody plants which are to remain; shall take special care to protect the natural vegetation and surroundings including all natural drainageways, ponds, lakes, swamps, woods and fields; shall store materials in such a manner as to prevent leaching which would be injurious to soils and to plants; shall select a suitable location and supervise fire, when burning is permitted, to avoid spreading and to avoid scorching vegetation: shall repair all injuries to woody plants which are to remain by approved horticultural methods; and shall specify the compacted soil and regrade as directed to restore the property to a natural condition.

The Contractor shall also use suitable precaution necessary to prevent damage to pipes, conduits and other underground structures, and protect carefully from disturbance or damage all land monuments and property marks until an authorized agent has witnessed or otherwise referenced their location and shall not remove them until directed.

Where the soil over the root area of trees to be preserved has been compacted, it shall be restored by proper cultivation as directed by the Engineer to a condition to permit the entrance of water and the proper aeration of roots.

ARCHAEOLOGICAL SALVAGE. It is the National policy to have preserved for public use historical and prehistorical sites, buildings, and objects of National significance for the benefit of the people of the United States. Indian ruins come within this policy.

Whenever, during the course of construction, historical ruins or objects are encountered, such objects will not be destroyed or moved. Work will be re-scheduled to avoid disturbing such areas and the Engineer in Charge of the project will be notified immediately.

The Engineer will, thru proper channels, notify the Chief Engineer who will arrange to have an immediate inspection of the site made by the State Education Department.

In the event that the objects are to be removed or salvaged, agreements between the Commissioner and the Contractor will be made to cover the cost of any extra work. Such work will be limited to that performed within the road section, and at any location used as a source of approved borrow material. (This does not include commercial sources from which material is purchased.)

CLEANING UP. All work shall be neatly cleaned up upon completion according to the Engineer's directions, and be left in a neat and orderly condition.

Any salvaged material not specified to be disposed of otherwise, shall become the property of the Contractor and removed from the site.

STOPPING WORK. The Engineer may stop by written order any work or any part of the work under the contract if the methods or conditions are such that unsatisfactory work might result, or if improper materials or workmanship is being used.

REMOVAL OF UNSATISFACTORY WORK. Wherever or whenever the Chief Engineer shall consider it necessary to remove any portion of the work executed under this contract for inspection or for any other purpose, no payment shall be made for such removal or for replacement of the work to satisfactory condition in case such inspection shows that the work was not constructed in accordance with the terms of the contract; nor shall payment be made for the removal or replacement of any work which may itself be satisfactory, but the removal of which is necessary for the replacement of unsatisfactory work.

But if such inspection shows that the work was constructed in accordance with the terms of the contract, payment shall be made for the removal and replacement at fair and reasonable prices for the work performed under an order on contract.

The above paragraph shall not apply to concrete foundation for pavement or cement concrete pavement, rejected as a result of core tests. Pavements so rejected shall be removed and replaced at the expense of the Contractor.

All work shall be in a first-class and satisfactory condition at the time of the acceptance of the contract.

REJECTION. Any material which is rejected because of failure to meet the required tests or that has been damaged so as to cause rejection shall be immediately removed from the site of the work.

IDENTIFICATION PLATES. Identification plates will be furnished by the Department without cost to the Contractor. These identification plates shall be installed by the Contractor on bridges and culverts at locations indicated on the plans or as directed by the Engineer. The cost of such installation shall be included in the unit prices bid for the various items of the contract.

No permanent plates or markers other than those approved by the Chief Engineer will be permitted on any structure.

PATENTED DEVICES, MATERIAL AND PROCESSES. It is mutually understood and agreed that the contract prices are to include all royalties and costs arising from patents, trademarks, and copyrights in any way involved in the work. Whenever the Contractor is required or desires to use any design, device, material or process covered by letters, patent or copyright, the Contractor shall indemnify and save harmless the County from any and all claims for infringement by reason of the use of any such patented design, device, material or process, to be performed under the contract, and shall indemnify the said County for any costs, expenses and damages which it may be obliged to pay, by reason of any such infringement, at any time during the prosecution or after the completion of the work.

EQUIVALENTS. The requirements for apparatus, articles, or materials shall be specified, if feasible, in generic terms which afford competition for equivalent products or items. When no generic specification can be found or devised, a minimum of at least three, if available, known acceptable trade names or proprietary products shall be provided for the Contractor's benefit and to afford the desired competition. The Commissioner shall be the sole judge of the qualifications of the offerings and will determine all questions regarding the conformance of any offer with the specifications.

METHODS AND EQUIPMENT. Where particular methods or equipment are specifically required in these specifications, the Contractor may apply in writing to the Chief Engineer to use alternate methods and equipment to provide the same results. Such alternates may be used only upon the written approval of the Chief Engineer. When, in the opinion of the Chief Engineer, satisfactory results are not being obtained using the Contractor's alternate methods and equipment, the methods and/or equipment shall be immediately modified to produce satisfactory results.

DAMAGE. All damage, direct or indirect, of whatever nature resulting from the performance of the work or resulting to the work during its progress from whatever cause, including omissions and supervisory acts of the County, shall be borne and sustained by the Contractor, and all work shall be solely at his risk until it has been finally inspected and accepted by the County, except that:

(a) Payment shall be made to the Contractor for the repair or replacement of the following completed permanent elements of the highway, for which the Contractor is responsible, that may be damaged by public traffic other than the Contractor's:

Guide Rail, Guide Posts, Bridge Railings, Median Barrier, Curbs, Permanent Barricades, Fencing, Light Poles and Appurtenances, Delineators, Signs and Sign Structures, and Traffic Signal Equipment.

Work for which there is a bid item will be paid for at the unit price for that item. Work for which there is no bid item will be paid for at an agreed price or by means of force account. Payment will not be made for repair or replacement in any way connected with untimely failure of any portion of the highway under public traffic, and the determination regarding this matter shall be made by the Chief Engineer, taking into consideration the normal life and the amount of normal wear of the element involved. This provision does not relieve the Contractor of the responsibility of maintenance and protection of traffic for the contract or of the responsibility of having a wholly complete and acceptable job at the time of final inspection and acceptance of the entire contract. Payment for such damage shall be made only after the Contractor has demonstrated to the satisfaction of the Chief Engineer that he has made every reasonable effort to collect the costs from the person or persons responsible for the damage.

(b) The Contractor shall not be responsible for damages resulting from faulty designs as shown by the plans and specifications nor the damages resulting from willful acts of Department officials or employees and nothing in this paragraph or in this contract shall create or give to third parties any claim or right of action against the Contractor or the County beyond such as may legally exist irrespective of this paragraph or contract.

(c) In the event that damage to the work in progress is caused by a flood, drought, tidal wave, fire, hurricane, earthquake, windstorm or other storm, landslide or other catastrophe which constitutes an "Occurrence", as hereinafter defined, and to the extent that such damage has been determined by the Department to be beyond that which may be anticipated from heavy storms, and also to the extent that such damage is not reimbursable by insurance carried by the Contractor, the Contractor may apply in writing to the Commissioner for the Department of Public Works to pay or participate in the cost of repairing the damage to the work from such cause or, in lieu thereof, and at the sole discretion of the Department, terminate the contract and relieve the Contractor of further obligation to perform the work, subject to the following:

(1) Occurrence. "Occurrence" shall include only those floods, droughts, tidal waves, fires, hurricanes, earthquakes, windstorms or other storms, landslides or other catastrophes when such occurrences or conditions and effects have been proclaimed a disaster or state of emergency by the President of the United States and the Governor.

(2) Application by Contractor. The Contractor's written request for the County to pay or participate in the cost of rebuilding, repairing, restoring or otherwise remedying such damage that has been determined by the Department of Public Works to be beyond that which may be anticipated from heavy storms to the work caused by the occurrence shall be submitted to and approved by the Commissioner before performing any work other than emergency work, including emergency work necessary to provide for passage of public traffic.

The Contractor shall indemnify and save harmless the County from suits, actions, damages and costs of every name and description resulting from the work under his contract during its prosecution and until the acceptance thereof, and the County may retain such monies from the amount due the Contractor as may be necessary to satisfy any claim for damages recovered against the County. The Contractor's obligations under this paragraph shall not be deemed waived by the failure of the County to retain the whole or any part of such monies due the Contractor, nor shall such obligation be deemed limited or discharged by the enumeration or procurement of any insurance for liability for damages imposed by law upon the Contractor, Sub-Contractor or the County.

Such obligation does not extend to those suits, actions, damages and costs of every name which arise out of the sole negligence of the County, its agents or employees relative to the construction, alteration, repair or maintenance of a building structure, appurtenances and appliances including moving, demolition and excavating connected therewith.

For information on construction equipment and maximum allowable loads, reference is made to "Construction Equipment" in this section.

OTHER CONTRACTS. The County reserves the right to let other contracts in connection with this work.

The Contractor's attention is specifically directed to the fact that because of the work on other contracts within and adjacent to the limits of this contract he may not have exclusive occupancy of the territory within or adjacent to limits of the contract.

The Contractor will be required to cooperate with other Contractors and the owners of the various utilities and to coordinate and arrange the sequence of his work to conform with the progressive operations of the work already under contract and to be put under contract. Cooperation and adjustments with the Contractors already engaged and to be engaged upon the site is essential to properly coordinate the construction efforts of all Contractors, Utility owners, and Sub-Contractors engaged in the work within and adjacent to the construction area of this contract.

In case of interference between the operations of the Utility owners and different Contractors, the Chief Engineer will be the sole judge of the rights of each Contractor and the sequence of work necessary to expedite the completion of the entire project, and in all cases his decision shall be accepted as final.

In the event that utility facility adjustments are to be made by utility owner's forces in connection with and during the life of the Contract, the Contractor will be required to cooperate with the owners of the various utilities and to coordinate and arrange the sequence of his work to conform with the progressive operations of the utility owner's work underway or to be put underway.

EXTENSION OF TIME. Delays in availability of any part of the site or any delays due to interference between the several Contractors and the Utility owners shall be compensated for by the Commissioner of Public Works solely through granting an extension of time in which to complete the work of the contract without Engineering charges. The Contractor in submitting his bid hereby agrees that he shall have no claim against the County of Suffolk for any damage due to such delays or interference other than extended time in which to complete the work.

The Contractor agrees that he has included in his unit price bid for the various items of the contract the additional cost of doing the work under this contract caused by not having a clear site for the work and interference by other Contractors and necessary utility work and being required to open certain sections of pavement to traffic before the entire work is completed.

INTERPRETATION OF PLANS. In case of any difference in the interpretation of the plans, specifications or maps, or between them, the matter must be immediately submitted to the Commissioner of Public Works, who shall adjust the same, and his decision in relation thereto shall be final and conclusive.

ACCURACY OF PLANS AND SPECIFICATIONS. The detail plans and specifications for the contract have been prepared with care and are intended to show as clearly as is practicable the work required to be done. The Contractor shall take no advantage of any apparent error or omission in the plans or specifications. In the event the Contractor discovers an error or omission in the plans or specifications, he shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the plans and specifications. Work under all items in the contract must be carried out to meet these field conditions to the satisfaction of the Engineer and in accordance with his instructions and the contract specifications.

SANITARY CODE. The Contractor shall comply with the provisions of the State Sanitary Code relating to camps and obtain from the local health officers permits for the construction, maintenance and operation of labor camps, if used.

INSURANCE. The Contractor shall procure and maintain at his own expense and without expense to the County, until final acceptance by the County of the work covered by the contract, insurance for liability for damages imposed by law, of the kinds and in the amounts hereinafter provided, in insurance companies authorized to do such business in the State covering all operations under the contract whether performed by him or by Sub-Contractors. Before commencing the work the Contractor shall furnish to the Commissioner a certificate or certificates of insurance in form satisfactory to the Commissioner showing that he has complied with this paragraph, which certificate or certificates shall provide that the policies shall not be changed or cancelled until thirty (30) days written notice has been given to the Commissioner.

The types and limits of insurance are as follows:

NOTE: The Contractor's attention is directed to the insurance limits required for the performance of work under this contract and that these limits of coverage ARE NOT to be amended by deductible clauses of any nature without the expressed written consent of the County Department of Public Works.

(a) WORKMEN'S COMPENSATION INSURANCE. A policy covering the obligations of the Contractor in accordance with the provisions of Chapter 41 of the Laws of 1914, as amended, known as the Workmen's Compensation Law, covering all operations under the contract, whether performed by him or by his Sub-Contractor, and also under Article 9 of the Workmen's Compensation Law, known as the Disability Benefits Law (Chapter 600 of the Laws of 1949) and amendments thereto. The contract shall be void and of no effect unless the person or corporation making or executing same shall secure compensation and disability benefits coverage for the benefit of, and keep insured during the life of said contract, such employees in compliance with the provisions of the Workmen's Compensation Law, (General Municipal Law, Section 108).

(b) LIABILITY AND PROPERTY DAMAGE INSURANCE. Unless otherwise specifically required by special specifications, each policy with limits of not less than:

Highways and other Projects of the County Department of Public Works Contracts

Bodily Injury Liability		Property Damage Liability	
Each Person	Each Occurrence	Each Occurrence	Aggregate
$500,000	$1,000,000	$500,000	$1,000,000

Projects Affecting Railroad Rights-of-Way Including Structures and Facilities Thereon

Bodily Injury Liability		Property Damage Liability	
Each Person	Each Occurrence	Each Occurrence	Aggregate
$2,000,000	$2,000,000	$2,000,000	$2,000,000

for all damages arising during the policy period, shall be furnished in the types specified, viz.:

(1) Contractor's Liability Insurance issued to and covering the liability for damages imposed by law upon the CONTRACTOR with respect to all work performed by him under the agreement;

(2) Contractor's Liability Insurance issued to and covering the liability for damages imposed by law upon EACH SUB-CONTRACTOR with respect to all work performed by said Sub-Contractor under the agreement;

(3) Contractor's Protective Liability Insurance issued to and covering the liability for damages imposed by law upon the Contractor with respect to all work under the agreement performed for the Contractor by Sub-Contractors;

(4) Protective Liability Insurance issued to and covering the liability for damages imposed by law upon the County of Suffolk and the Commissioner of Public Works and all employees of the Commissioner of Public Works both officially and personally, with respect to all operations under the agreement by the Contractor or by his Sub-Contractors, including omissions and supervisory acts of the County;

(5) Completed Operations' Liability Insurance issued to and covering the liability for damages imposed by law upon the Contractor and each Sub-Contractor arising, between the date of final cessation of the work and the date of final acceptance thereof, out of that part of the work performed by each;

(6) Owners', Landlords' and Tenants' Liability Insurance issued to and covering the liability for damages imposed by law upon the County of Suffolk and the Commissioner of Public Works and all employees of the Commissioner of Public Works both officially and personally, with respect to temporarily opening to vehicular traffic any portion of the County road under the agreement, until the construction or reconstruction pursuant to the agreement has been accepted by the County;

(7) Whenever the operations of a Contractor are on the right-of-way of a railroad, including structures and facilities thereon, the railroad (unless the Special Specifications provide otherwise) will procure a railroad protective liability insurance policy or policies pursuant to a separate agreement between the railroad and the County relating to such operations. Such insurance shall afford coverage equivalent to the following, except as may be otherwise specially required:

(a) The policy shall cover the liability imposed upon the insured (railroad) by law for damages, including damages for care and loss of services, because of bodily injury, sickness or disease, including death at any time resulting therefrom, sustained by any person or persons, and damages because of injury to or destruction of property, including the loss of use thereof, caused by accident and arising out of any acts or omissions of the following in the performance of any operations under the contract for the designated projects:

(I) The Contractor and his Sub-Contractor;

(II) Flagmen, watchmen and other protective employees of the insured, except those specified in (III) and (IV) below, specifically loaned or assigned by the insured to the work performed by the Contractor or his Sub-Contractor, provided the cost of services of such employees is specifically to be borne by the Contractor or Sub-Contractor or by a governmental authority;

(III) Supervisory employees of the insured while performing services at the job site with respect to the operations of the Contractor or his Sub-Contractors;

(IV) Employees of the insured while operating, attached to or engaged on, at the job site, work trains or other railroad equipment exclusively assigned to the Contractor or his Sub-Contractor by the insured;

provided, however, that a proximate cause of the accident is any act or omission of any individual included in (I), (II), (III) or (IV) above.

(b) The policy shall also cover the liability imposed upon the insured by law for damages, including damages for care and loss of services, because of bodily injury, sickness or disease, including death at any time resulting therefrom, caused by accident and sustained at the job site by any employee of the Contractor or his Sub-Contractors.

(c) The terms "Contractor" and Sub-Contractor" as used in (a) and (b) above do not include the named insured.

(d) The coverage shall be subject to the following exclusions:

(I) Any obligation for which the insured or any carrier as his insurer may be held liable under any workmen's or unemployment compensation, disability benefits or similar laws. The Federal Employer's Liability Act, U.S. Code (1946) title 45, Sections 51-60 shall not for the purpose of this insurance be deemed to be any similar law.

(II) Any liability assumed by the insured under any contract or agreement other than contracts of carriage as a common carrier as used herein shall not include those between the insured and the Contractor or his Sub-Contractors.

(III) Any liability arising out of accidents occurring after operations have been completed or abandoned at the place of occurrence thereof, other than accidents caused by the existence of tools, uninstalled equipment and abandoned or unused materials, but operations shall not be deemed incomplete because improperly or defectively performed or because further operations may be required pursuant to a service or maintenance contract. This exclusion does not apply until the County notifies the insured of acceptance of the project.

(IV) Injury to or destruction of property owned by the insured.

(e) Each policy shall provide that it shall not be changed or cancelled until thirty (30) days written notice has been given to the railroad and to the Commissioner of Public Works.

BONDS. The Contractor shall procure and deliver to the County and maintain at his own expense and without expense to the County until final acceptance by the County of the work covered by this contract:

(a) FAITHFUL PERFORMANCE BOND. A bond in the form prescribed by the Commissioner with sufficient sureties, approved by the said Commissioner that the Contractor will perform the work in accordance with the terms of the contract and with the plans and specifications, and that he will commence and complete the work within the time prescribed in the contract, and that he will provide against direct or indirect damages that shall be suffered or claimed on account of such construction or improvement during the time thereof, and until the highway is accepted;

(b) LABOR AND MATERIAL BOND. A bond guaranteeing prompt payment of monies due all persons supplyint the Contractor or a Sub-Contractor with labor and materials employed and used in carrying out the contract, which bond shall inure to the benefit of the persons supplying such labor and materials

WORK AFFECTING RAILROADS.

(a) SUPERVISION: All work on any project affecting the Railroad Company's property, right-of-way facilities, incuding temporary track detour, shall be carried out under the joint supervision of the Department of Public Works and the Railroad Company in a manner satisfactory to both these agencies.

(b) RAILROAD APPROVAL: The Contractor shall obtain the written approval of the Chief Engineer of the railroad company or companies affected in respect to the details and methods to be employed in constructing any structures, track detours, falsework, removal of structures, allowable track clearances, and any or all other details that may in any manner affect the operation or maintenance of any or all railroad facilities. Equipment used for the erection, or removal, of structures over railroad facilities, shall have a minimum lifting capacity of one hundred-fifty percent (150%) of the liftweight (Operational capacity limited to sixty-six and two-thirds percent (66-2/3%) of the tipping load). The requirement that written approval shall be obtained from the Chief Engineer of the railroad company, shall be complied with before the Contractor begins actual construction work. The Contractor shall include in his unit prices bid for this work all the costs of these requirements including any expense occasioned by delay or interruption of his work by reason of the operation or maintenance of the railroad facilities. Approval by the Chief Engineer of the railroad company or companies affected does not absolve the Contractor from any liability resulting from his contractual operations.

(c) RAILROAD CLEARANCES: No temporary bridge, falsework, staging or obstructions shall be erected over the track or tracks where the vertical underclearance is less than 22' over top of rail until the existing bridge warnings have been relocated or new or temporary bridge warnings are installed by the railroad company affected and are in service.

The Contractor shall so conduct his work and handle his equipment that no part of any material or equipment shall foul an operated track or wire lines without written permission of the Chief Engineer of the railroad company. When the Contractor desires to foul an operated track he must give the Chief Engineer of the railroad company at least eight (8) days notice, in writing, of his intentions so that proper protection can be arranged for. An operated track is fouled when any object is brought closer than eight (8) feet from the center line of the track unless it is lower than the top of the rail. Absolute minimum temporary underclearance above top of high rail shall be indicated on the plan or in the proposal. Cranes, shovels and any other equipment shall be considered to be fouling track when located in such a position that failure of same with or without load brings the equipment within the fouling limit. A power line wire is fouled when any object is brought to a point less than six (6) feet therefrom.

(d) RAILROAD EMPLOYEES: When, in the opinion of the Chief Engineer of the Railroad Company the Contractor's normal operations in progressing his contract are such that an operated track is or might be fouled or railroad traffic endangered, the Railroad Company will employ protective labor, when found necessary for railroad operations. When an item for Railroad Protection is included in the contract, the Contractor shall pay for such services.

All services for protective labor and similar protective service occasioned by the operation of the Contractor, except as noted in the preceding paragraph, shall be at the sole expense of the Contractor and the Contractor shall include all such costs in his unit bid prices for such protection.

The Contractor shall, at his own expense, carry compensation and other insurance for protective labor furnished by the Railroad Company.

It is agreed that the furnishing of any protective labor shall not relieve the Contractor from any liability of payment for any damage caused by his operations.

(e) FOUNDATIONS: Foundations may be extended or lowered if deemed necessary by the Chief Engineer of the Suffolk County Department of Public Works, and the Chief Engineer of the railroad company only if such change is ordered by the Chief Engineer of the County Department of Public Works. Any and all increases in quantities caused by changes of this character will be paid for at the unit prices bid for the respective items involved.

(f) CONTRACTOR'S PRIVATE GRADE CROSSING: If the Contractor elects, and the railroad company approves, to have installed for his own use, a private grade crossing at the site of the work, he shall make a formal request to the railroad company for such a crossing. After he has entered into an agreement with the railroad company pertaining to the size and type of crossing, the payment of the cost for installing and removing the crossing, the obtaining of the necessary insurance for the protection of the railroad company, and the agreement as to the required protection to railroad traffic when the crossing is in use, the railroad company will install and remove the temporary crossing at the sole expense of the Contractor.

(g) SIDETRACK FACILITIES: When sidetrack facilities are required by the Contractor, he shall at his sole cost and expense, make the necessary arrangements for the use of existing sidings, tracks not in service or the construction of new sidings. He shall, at his sole cost and expense, restore any and all existing sidings and tracks used for sidetrack facilities to the condition existing prior to its or their use by the Contractor. The construction, location and use of all sidetrack facilities are to be subject to the approval of the Chief Engineer of the railroad company. It shall be understood that the railroad company may move the Contractor's cars, placed on existing sidings, at any time, to permit the placing of cars for said railroad company's business.

When any turnouts from the main tracks are approved by the railroad company such turnouts will be furnished, installed and removed by the railroad company at the expense of the Contractor. Any signal work and derails necessary for sidetrack facilities will be furnished, installed and removed by the railroad company at the Contractor's expense.

When available from railroad stock, the railroad company will furnish on the request of the Contractor, at its current prices plus its usual overhead for labor and materials, such materials as may be required for the restoring of existing sidings used for sidetrack facilities and for the construction of additional sidetracks.

(h) USE OF EXPLOSIVES: Blasting shall be conducted in such a manner as not to endanger the public or obstruct highways or endanger facilities or operation of the railroad. The Contractor shall furnish, while blasting, at his own expense, watchmen and other protection necessary to protect the public and railroad.

The Contractor's attention is directed to Section 1 Information for Bidders regarding "Blasting".

(i) RAILROAD USE OF COMPLETED WORK: The Contractor agrees that the railroad company may, prior to the completion of the work to be performed under contract and the acceptance thereof, enter upon and use any portion of said work without any compensation whatever to the Contractor for such use, and without any compensation or payment whatever to the Contractor for any delay in the work caused by such use. The taking possession and use shall not be deemed an acceptance of the work so taken and used or any part thereof.

(j) PROTECTION OF RAILROAD SERVICE AND FACILITIES: The Contractor shall take special care and vigilance to avoid injury to the trains, tracks or other facilities of the railroad company and shall conduct his work so as not to interfere with the movement of trains or other operations of the railroad company. Whenever work may affect the safety or movement of trains, the method of doing the work shall first be submitted to the Chief Engineer of the railroad company for his approval, and no work affecting such safety or movement of trains shall be commenced or prosecuted until written approval of the Chief Engineer of the railroad is received. It is understood that the approval of the Chief Engineer of the railroad will not release the Contractor from any responsibility for any damages to the railroad company caused by the acts of the Contractor or his employees and Sub-Contractors.

If, during the carrying out of the work covered by this contract, the trains, tracks or other facilities of the railroad company are endangered, the Contractor shall immediately do such work as directed by the Engineer to restore safety and, upon failure of the Contractor to carry out such orders immediately, the railroad company may, with the approval of the Engineer, take whatever steps are necessary to restore safe conditions. The cost and expense to the railroad company of restoring safe conditions or of any damage to the railroad company's trains, tracks or other facilities caused by the Contractor's operations shall, when approved by the Engineer, be considered a charge against the Contractor and shall be paid for by him, or upon his failure or refusal to pay such charge within a reasonable time after the railroad company submits the bill to him, the amount thereof may be deducted from any monies due or that may become due to him under his contract, and any such sum so deducted may be paid to the railroad company after an audit by the County of the items of such cost and expense.

(k) COORDINATION OF WORK: The Contractor shall be responsible for the coordination of the work of his various Sub-Contractors. The Contractor shall coordinate with the railroad company in carrying out railroad force account work. When the work of the Contractor or Sub-Contractor dovetails with the railroad force account work, the materials shall be delivered and the operations conducted so as to carry on the work continuously in an efficient and workmanlike order. Delays or oversight on the part of the Contractor or Sub-Contractors in getting any or all of their work done in the proper way, thereby causing cutting, removing and replacing of work already in place shall not be the basis for a claim for extra compensation.

(l) RAILROAD EQUIPMENT: It is agreed that if the Contractor elects to use work trains or any railroad equipment which operate on the tracks of the railroad company, the operation of such trains and equipment is subject to any requirements determined upon by the Chief Engineer of the railroad company. It is understood that the cost of the services of any railroad employees required by the railroad company to operate such trains or equipment is to be paid by the Contractor. This shall include the cost of necessary flagmen.

(m) OPERATION OF RAILROAD: The Contractor shall make every possible effort to reduce to a minimum the length of time that a Railroad Company will have to operate over any track detour, and to this end he shall continue full operation throughout the winter months, if directed by the Chief Engineer of the Suffolk County Department of Public Works, on any and all work necessary to permit the Railroad Company to restore its tracks in their permanent location as quickly as possible.

The Contractor shall conduct his work so that schedule speed can be maintained by the Railroad at all times.

(n) TELEPHONE, TELEGRAPH AND SIGNALS: The cost of all changes in telegraph, telephone and signal lines made necessary to clear the site for the structures, shall be charged to the project. The cost of all changes in telegraph, telephone and signal lines made for the convenience of the Contractor shall be paid for by the Contractor as part of his construction costs.

DISPUTED WORK. If the Contractor is of the opinion that any work ordered by the Engineer to be done as contract work is extra work and not contract work, or that any order of the Engineer violates the provisions of the contract, he shall promptly notify the Engineer of his contentions thereto and then progress the work as subsequently required and ordered. In the meantime, the Contractor, if he considers the issue unresolved, shall promptly notify the Chief Engineer in writing of his position relative to the dispute. If the Chief Engineer does not resolve the dispute to the satisfaction of the Contractor, the latter shall promptly notify the Commissioner, in writing with copies to the Engineer and the Chief Engineer, of his contentions relative to the dispute, indicating the substance of previous communication on the issue with the Engineer and the Chief Engineer and his rebuttal of their previous findings. The Commissioner shall make a finding thereon and notify the Contractor of same in writing. During the progress of such disputed work the Contractor and Engineer shall keep daily records of all labor, material and equipment used in connection with such work and the cost thereof.

If the Commissioner determines that the work in question is contract work, and not extra work, or that the order complained of is proper, he shall direct the Contractor to proceed, and the Contractor must promptly comply. The Contractor's right to file a claim for extra compensation or damages will not be affected in any way in complying with the above directions of the Commissioner, provided the Contractor shall furnish the Engineer with the signed records above referred to.

If the Commissioner determines that such work is extra work, not contract work, or that the order complained of is not proper, then the Commissioner shall have prepared, if necessary, an Order on Contract covering such work as soon after the determination is made as is practical.

Adjustments of contract items or the addition of new items to the contract necessitated by such determination may be made up until the time the final estimate is submitted for payment provided that all the requirements of "Disputed Work" and "Contingencies, Extra Work, Deductions" are complied with.

In the event the Contractor fails to furnish force account reports, such failure shall constitute a waiver of any claim for payment for disputed work other than for payment at contract unit prices for the work performed.

CONTINGENCIES, EXTRA WORK, DEDUCTIONS. At any time during the progress of the work the County may alter the plans, omit any portion of the work, increase or decrease the estimated quantities of work, and order extra work as hereinafter provided, without constituting grounds for any claim by the Contractor for damages or for loss of anticipated profits or for any variations between the estimated quantities and the quantities of work as done.

Whenever the Commissioner of Public Works determines that from any unforseen cause the terms of any contract should be altered to provide for changes, contingencies of extra work, he may issue an order on contract therefor to the Contractor sho shall forthwith proceed with the performance of the work and the furnishing of the materials and equipment necessary for its accomplishment in accordance with the pertinent specifications. No such extra work shall be commenced or undertaken until the Commissioner of Public Works has issued an order on contract.

No instructions, either written or verbal, shall be construed as an order for changes unless it be in the form of an Order on Contract bearing the signed approval of the Commissioner.

When such order on contract provides for similar items of work or materials which increase or decrease the itemized quantity provided for in the primary contract, the price to be paid therefor shall not exceed the unit bid price in the primary contract for such items.

Agreed prices for new items of work or materials may be incorporated in the order on contract as the Commissioner may deem them to be just and fair and beneficial to the County. These prices will be used in computing the final estimate. Agreed prices must be supported by a complete price analysis in the order on contract.

Where there are no applicable unit prices for extra work ordered pursuant to this specification and agreed prices cannot be readily established or substantiated, the Contractor shall be paid the actual and reasonable cost of:

(1) Necessary materials (including transportation to the site). Material used, if acquired by direct purchase, must be covered by receipted bills or acceptable invoices. All prices on used material incorporated in either temporary or permanent work shall be billed at a fair value, less than the original cost when new. A reasonable salvage credit shall be given for all salvagable material recovered. Salvage value of substantial material recovered must be determined jointly by the Contractor and the Resident Engineer; plus

(2) Necessary direct labor charges. Each class of labor shall be billed separately, preferably at actual payroll rates. Average rates based on different classes of labor, will not be accepted; plus

(3) Payments required to be made to labor organizations under existing labor agreements; plus

(4) Sales taxes, if any, required to be paid on materials incorporated into the work under the order on contract; plus

(5) Equipment and plant rentals, other than small tools, as follows:

The maximum hourly rates used shall be those listed in the current "Equipment Rental Rate Schedule" established by the New York State Commissioner of Transportation pursuant to Section 117 of the Highway Law. The "Equipment Rental Rate Schedule" establishes a maximum hourly rental rate together with the rate to be paid for supplies for each piece of equipment or plant. The composite rate for each piece of equipment or plant includes the rental of the equipment or plant, the cost of supplies, compensation for taxes on supplies, the cost of operators, taxes and profit and is computed as follows:

To the rate established for a particular piece of equipment, add the rate for supplies increased by 50% to compensate for taxes; add the prevailing rate for operators as established by the New York State Department of Labor; and to the sum of these three items add 30% for miscellaneous taxes and profit.

Equipment to be used by the Contractor shall be specifically described and be of suitable size and suitable capacity required for the work to be performed. In the event the Contractor elects to use equipment of a higher rental value than that suitable for the work, payment will be made at the rate applicable to the suitable equipment. The equipment actually used and the suitable equipment paid for will be recorded as part of the record for force account work. The Engineer shall determine the suitability of the equipment. If there is a differential in the rate of pay of the operator of oversize or higher rate equipment the rate paid for the operator will likewise be that for the suitable equipment.

It is mutually understood that the hourly rate thus established includes all costs incidental to equipment and plant rentals including cost of moving to and from the site.

It is further mutually understood that only equipment in first class condition will be eligible to receive the maximum allowable rate. All other equipment shall receive a rate commensurate with its condition.

In the event that a rate is not established in the "Equipment Rental Rate Schedule" for a particular piece of equipment or plant, the County Commissioner of Public Works shall obtain from the State Commissioner of Transportation a rate for that piece of equipment or plant that is consistent with its cost and use for payment to the Contractor.

(6) Twenty percent (20%) of the total of material and direct labor only as compensation for profit and overhead. If any of the work is performed by a Sub-Contractor, the Contractor shall be paid the actual and reasonable cost of such sub-contracted work computed as outlined above or on such other basis as might be approved by the Commissioner, plus an additional allowance of five percent (5%) of materials and direct labor to cover the Contractor's profit, superintendence, administration, insurance and other overhead. The cost of transportation of materials shall be excluded when computing the above described charges for profit and overhead.

Overhead may be defined to include the following items:

(a) Premium on bond;

(b) Premium on insurance required by the County other than Workmen's Compensation Insurance, public liability and property damage insurance, unemployment insurance, Federal old-age benefits, other payroll taxes and such reasonable charges that are paid by the Contractor pursuant to written agreement with his employee;

(c) All salary and expenses of executive officers, supervising officers or supervising employees;

(d) All clerical or stenographic employees;

(e) All charges for minor equipment, such as small tools, including shovels, picks, axes, saws, bars, sledges, lanterns, jacks, cables, pails, wrenches, etc. and other miscellaneous supplies and services;

(f) All drafting room accessories such as paper, tracing cloth, blue printing, etc.

Payment for force account work will be made on the basis of the following reports:

1. The Contractor will deliver to the Resident Engineer daily summary of force account work done on the contract. This summary on 8-1/2" x 11" paper will be delivered to the Resident Engineer not later than closing time on the day following that for which the work is reported.

The summary shall contain:

(a) A list of materials used indicating the amount and nature of each material. The cost (if known) should also be included. This must be later documented by proper receipts.
(b) A list of equipment used indicating the number of hours used and the kind, type and size of equipment.
(c) A list of personnel by name, including the hours and labor classification at which they were used on the force account work.
(d) A statement of the work accomplished by force account for that day.
(e) This summary will be dated and signed by the Contractor's authorized representative and the Resident Engineer.
(f) The contract number and other identification as well as the name of the Contractor shall appear on the statement.
(g) The Resident Engineer will make any notations, remarks or comments on this form that may assist in final payment.

2. Within 5 calendar days after the end of each pay period the Contractor shall deliver to the Resident Engineer a FORCE ACCOUNT SUMMARY OF LABOR used on the work which shall include the name, rate of pay, fringe benefits and/or other items as shown on the actual payroll.

3. On completion of the specific force account work the Contractor shall, within 10 calendar days, deliver to the Resident Engineer a FORCE ACCOUNT SUMMATION wherein all materials, equipment and labor charges are shown and totaled together with such other expenditures as are concerned with the Force Account item. This summation shall be dated and signed by the Contractor's authorized representative and the Resident Engineer.

CONTRACTOR'S COST RECORDS. The Contractor shall maintain records of all payrolls and of the details that comprise his total cost pursuant to any of the provisions under the subject heading, Contingencies, Extra Work, Deductions, and he shall, at any time within 3 years following the date of acceptance of the project, make such records available, upon request therefor, to the Department for review and audit, if deemed necessary by the Commissioner. In case all or a part of such records are not made so available, the Contractor understands and agrees that any items not supported by reason of such unavailability of the records shall be disallowed, or if payment thereof has already been made, the Contractor shall, upon demand in writing by the Commissioner, refund to the Department the amount so disallowed.

FINAL AGREEMENT. The final agreement will not be completed until all work required under the contract has been satisfactorily completed, all claims presented and all accounts for extra work and materials have been rendered, considered, and, if agreed to, made a part of such final agreement. Work remaining to be accomplished under an uncompleted work agreement, shall be considered as completed work for the purpose of the final agreement.

FINAL ESTIMATE. The Commissioner will approve a final estimate for final payment based on the final agreement as prepared and approved by the Chief Engineer, less previous payments and any and all deductions authorized to be made by the Commissioner under the contract. Payment pursuant to such final estimate less any deductions authorized to be made by the County Treasurer under the contract shall constitute the final payment and shall be made by the County Treasurer.

ACCEPTANCE OF FINAL PAYMENT. The acceptance by the Contractor, or by anyone claiming by or through him, of the final payment shall constitute and operate as a release to the County from any and all claims of any liability to the Contractor for anything theretofore done or furnished for or relating to or arising out of the work done thereunder, and for any prior act, neglect, or default on the part of the County or any of its officers, agents, or employees, unless the Contractor serves a detailed and verified statement of claim upon the Department of Public Works not later than 40 days after the mailing of such final payment. Such statement shall specify the items and details upon which the claim will be based and any such claim shall be limited to such items. Should the Contractor refuse to accept the final payment as tendered by the County Treasurer, it shall constitute a waiver of any right to interest thereon.

RESTORATION OF DISTURBED AREAS OUTSIDE THE RIGHT-OF-WAY. It is the intent of this specification that all areas outside the right-of-way, except as noted in the following text, disturbed, used by, or serving as a source of material for the Contractor be restored to a pleasing and acceptable condition as specified and as satisfactory to the Engineer.

The Contractor shall obtain the written approval of the Engineer for the use of any specific area before any work in such area is begun, except as noted in the following text. Where deemed necessary by the Engineer, the Contractor shall submit, as part of the request for approval, a grading plan showing the proposed final grading of the area. Approval shall not be given if in the opinion of the Engineer, the area is not suited to acceptable restoration or if serious or permanent ecological damage is foreseeable. This specification applies to areas such as, but not limited to, borrow pits or areas, spoil or waste areas, haul roads, storage areas, batching areas, equipment storage areas, shop areas and all similar areas. This does not apply to areas which have been or are being used by the Contractor as his established and permanent headquarters and equipment pool sites or to commercial gravel pits, commercial quarries, public disposal areas and all similar areas.

In general, the restoration shall include the removal of all equipment and parts, junk, rubbish, excess materials and debris of all kind; clean-up as required, grading as shown if a grading plan has been prepared; or graded so as to blend into the surrounding ground forms to the satisfaction of the Engineer; scarification of storage yards, batching sites, haul roads, etc. to the depth determined by the Engineer as necessary to support vegetation; the removal and re-grading of temporary roads or areas as required by the Engineer; the repair or removal of damaged trees and the fertilizing, seeding and mulching of the areas as provided for in the contract or as directed by the Engineer. Grading the slopes of excavated areas to a stable condition, but in no case shall earth cut faces be left steeper than one (1) vertical on one and one-half (1.5) horizontal. All rock cut slopes shall be scaled to remove any loose or unstable rock. Areas within sight of the finished highway or any other highway will require particular attention insofar as the above features are concerned. It is the intent to have all such areas present a pleasing appearance to travelers on any highway.

Where borrow pits result in the formation of ponds or low areas intermittently filled with water the Contractor shall furnish the Engineer with a copy of his agreement with the landowner permitting the use of such areas. If such an area is within sight of any highway, the Chief Engineer's written approval must be obtained prior to the removal of any borrow from such a location. If such approval is not granted, material for use on the contract or for any other state contract may not be removed from the area. In the event the Contractor removes material from such an area without the written approval of the Chief Engineer, payment will not be made for any item of work in which the material has been used. Grading plans may be required for such areas and due consideration given to the appearance of the areas if they are visible from any highway.

All of this restoration shall be accomplished prior to acceptance of the contract except that work of restoring Contractor's work areas (storage, batching, equipment, shop areas, etc.) may be done after the official acceptance of the contract but must be completed prior to the final release of retained funds.

Since the extent of such areas and the use and treatment during construction is within the discretion of the Contractor, within the limitations and requirements outlined, no payment will be made for any labor, material or equipment necessary for the restoration of these areas. The cost of the work shall be included in the amount bid for other items of work. Any work done shall, in general, be in accordance with the Department's specifications for similar items of work and/or as specified by the Engineer.

In the event the Contractor carries on any operation on the above referenced areas without written approval of the Engineer, no payment will be made for any item in the contract involved in any way with any operation on the unapproved area.

RESTORATION OF DISTURBED AREAS WITHIN THE RIGHT-OF-WAY. It is the intent of this specification that all areas within the right-of-way beyond the limits of construction (including a reasonable work area at top of cut and toe of slope as determined by the Engineer) which the Contractor is permitted to use be restored to a pleasing and acceptable condition as specified and as satisfactory to the Engineer. Where a pay item for seeding is not included in the Contract, disturbed earth areas within the work limits shall be graded in a manner approved by the Engineer and seeded as specified for Item 123A "Seeding on Special Areas". The cost of this work shall be included in the prices bid for the various items in the Contract and no separate payment shall be made therefor.

The Contractor shall obtain the written permission of the Engineer before beginning the use of any area within the right-of-way, except as noted in the preceding paragraph. Where deemed necessary by the Engineer, the Contractor shall submit, as part of the request for approval, a grading plan showing the proposed final grading of the area. If in the opinion of the Engineer, the area is not adaptable to acceptable restoration or if serious or permanent ecological damage is foreseeable, approval shall not be given. This specification applies to areas such as, but not limited to, borrow pits or areas, spoil or waste areas, haul roads, storage areas, batching areas, water points, equipment storage areas, shop areas and all similar areas.

In general, the restoration shall include the removal of all equipment and parts, junk, rubbish, excess materials and debris of all kind; clean up as required, grading as shown if a grading plan has been prepared or graded so as to blend into the surrounding ground forms to the satisfaction of the Engineer; scarification of storage yards, batching sites, haul roads, etc. to the depth of the compaction as determined by the Engineer; the removal of pavement or granular surfacing from temporary roads or areas as required by the Engineer; the repair or removal of damaged trees and the fertilizing, seeding and mulching of the areas as provided for in the contract or as directed by the Engineer. Areas within sight of the finished highway or any other highway will require particular attention insofar as the above features are concerned. It is the intent to have all such areas present a pleasing appearance to travelers on any highway.

All of this restoration shall be accomplished prior to acceptance of the contract except that work of restoring Contractor's work areas (storage, batching, equipment, shop areas, etc.) may be done after the official acceptance of the contract but must be completed prior to the final release of the retained funds.

No payment will be made for any labor, material or equipment necessary for the restoration of disturbed areas which extend beyond the limits of the contract. The cost of such work shall be included in the price bid for the various items of the contract. All work shall be in accordance with the Department's specifications for similar items of work and/or as specified by the Engineer.

CONFORMITY WITH PLANS AND SPECIFICATIONS. All work performed and all materials furnished shall be in reasonably close conformity with the lines, grades, cross sections, dimensions and material requirements, including tolerances, shown on the plans or indicated in the specifications.

Plan dimensions and contract specification values are to be considered as the target value to be strived for and complied with as the design value from which any deviations are allowed. It is the intent of the specifications that the materials and workmanship shall be uniform in character and shall conform as nearly and as realistically as possible to the prescribed target value or to the middle portion of the tolerance range. The purpose of the tolerance range is to accommodate occasional minor variations from the median zone that are unavoidable for practical reasons. When a maximum or minimum value is specified, the production and processing of the material and the performance of the work shall be so controlled that material or work will not be preponderately of borderline quality or dimension.

In the event the Engineer finds the materials or the finished product in which the materials are used not within reasonably close conformity with the plans and specifications but that reasonably acceptable work has been produced, he shall then make a determination if the work shall be accepted and remain in place. In this event, the Engineer will document the basis of acceptance by contract modification which will provide for an appropriate adjustment in the contract price for such work or materials as he deems necessary to conform to his determination based on engineering judgment.

In the event the Engineer finds the materials or the finished product in which the materials are used or the work performed are not in reasonable close conformity with the plans and specifications and have resulted in an inferior or unsatisfactory product, the work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor.

All traffic control devices (signs, signals, markings and devices placed by the authority of a public body or official having jurisdiction for the purpose of regulating, warning or guiding traffic) shall be in conformity with the revision of the New York State Manual of Uniform Traffic Control Devices which is current on the date of advertisement for bids.

PROJECT RECORDS. The Resident Engineer on each construction contract is required to keep his project records in accordance with Departmental construction record keeping procedures established by the Chief Engineer and in usage at the time the project is started. Any changes or additions made by subsequent revisions to those procedures shall be incorporated in the said project procedures and records as directed in writing by the Chief Engineer. The Contractor is invited to review these record keeping procedures with the Resident Engineer if he so desires. In certain instances such as in force account work, requests for approval of Sub-Contractors, approvals of sources of materials and the like, the Contractor shall furnish the appropriate data and information required on forms prepared for his use by the Department which he may obtain from the Resident Engineer.

SOIL EROSION, STREAM CONSERVATION AND WATER AND AIR POLLUTION ABATEMENT. The Contractor shall schedule and conduct his operations to minimize erosion of soils and to prevent silting and muddying of streams, rivers, irrigation systems, impoundments (Lakes, reservoirs, etc.) and lands adjacent to or affected by work within the right-of-way. Construction of drainage facilities and performance of other contract work which will contribute to the control of erosion and sedimentation shall be carried out in conjunction with earthwork operations or as soon thereafter as practicable. The area of bare soil exposed at any one time by construction operations shall be kept to a minimum.

Whenever the Contractor's operations, carried out in accordance with the approved schedule, result in a situation where temporary erosion control measures not shown on the plans, must be taken and these measures are approved or ordered by the Engineer, the Contractor shall be paid for these temporary measures. This work shall be delineated in Item 900 and payment will be made in accordance with the provisions of Item 900, "Temporary Soil Erosion and Water Pollution Control."

In carrying out erosion control measures, the Contractor will be guided by, but not limited to, the following controls:

1. When borrow material is obtained from other than commercially operated sources, erosion of the borrow site shall be so controlled both during and after completion of the work that erosion will be minimized and sediment will not enter streams or other bodies of water. Waste or disposal areas and construction roads shall be located and constructed in a manner that will keep sediment from entering streams.

2. Frequent fording of live streams will not be permitted; therefore, temporary bridges or other structures shall be used wherever an appreciable number of stream crossings are necessary. Unless otherwise approved in writing by the Engineer, mechanized equipment shall not be operated in live streams.

3. When work areas or gravel pits are located in or adjacent to live streams, such areas shall be separated from the main stream by a dike or other barrier to keep sediment from entering a flowing stream. Care shall be taken during the construction and removal of such barriers to minimize the muddying of a stream.

4. All waterways shall be cleared as soon as practicable of falsework, piling, debris or other obstructions placed during construction operations and not a part of the finished work.

5. Water from aggregate washing or other operations containing sediment shall be treated by filtration, a settling basin or other means sufficient to reduce the sediment content to not more than that of the stream into which it is discharged.

6. Pollutants such as fuels, lubricants, bitumens, raw sewage and other harmful materials shall not be discharged into or near rivers, streams and impoundments or into natural or man-made channels leading thereto. Wash water or waste from concrete mixing operations shall not be allowed to enter live streams.

7. All applicable regulations of fish and wildlife agencies and statutes relating to the prevention and abatement of pollution shall be complied with in the performance of the contract. If the Contractor uses water from a stream, he shall construct any intake or temporary dam requirement to protect and maintain water rights and to sustain fish life downstream.

Any material generated by any activity for the development, modification and construction of any transportation facility SHALL NOT be burned on or off the contract site. This shall include but not be limited to land clearing material and demolition material. Such material shall hereinafter be referred to as disposable material in the clearing and grubbing specifications.

When it becomes necessary the Engineer will inform the Contractor of unsatisfactory construction procedures and operations insofar as erosion control, water and air pollution are concerned. If the unsatisfactory construction procedures and operations are not corrected promptly, the Engineer may suspend the performance of other construction until the unsatisfactory condition has been corrected.

SUBLETTING OR ASSIGNING THE CONTRACT. The Contractor shall perform with his own organization contract work amounting to not less than 50 percent of the original total contract price, except that any items designated by the County as 'Specialty Items' may be performed by sub-contract and the amount of any such 'Specialty Items' so performed may be deducted from the original total contract price before computing the amount of work required to be performed by the Contractor with his own organization.

(a) 'His own organization' shall be construed to include only workmen employed and paid directly by the Contractor and equipment owned or rented by him, with or without operators.

(b) 'Specialty Items' shall be construed to be limited to work that requires specialized knowledge, craftsmanship or equipment not ordinarily available in contracting organizations qualified to bid on the contract as a whole and in general are to be limited to minor components of the overall contract.

SALVAGE OF MARKETABLE TIMBER. In the interest of conservation, every effort will be made to salvage marketable timber produced as a result of clearing operations, provided the amount of timber is great enough to make the hauling practical. In general, marketable timber is construed to mean logs 8' to 16' in length, plus appropriate trimming allowance, having a diameter inside the bark, at the small end, of approximately 10".

Unmarketable species are not to be considered.

In the event that the Contractor is not successful in salvaging this timber, he shall advise the Engineer, in writing, of his effort to salvage and indicate the reason why the timber could not be salvaged.

Notwithstanding any other provisions in the proposal, marketable logs may be stored in a safe manner and in a safe location to give the Contractor a reasonable time to dispose of marketable timber.

STANDARDS FOR SAFETY AND HEALTH - EXPLOSIVES. Nothing in the following shall relieve the Contractor of the sole responsibility for any and all damage caused by his operations.

DRILLING AND BLASTING. A project meeting relative to the method, manner and procedure of blasting operations shall be held at the site with the Engineer, the Contractor and representatives of all interested agencies including a Departmental Engineer Geologist, prior to the commencement of drilling and blasting operations.

Whenever explosives are used, they shall be of such character and strength and in such amounts as is permitted by the State and local laws and ordinances and all respective agencies having jurisdiction over them. In special cases the right is reserved the Engineer and those agencies to specify the maximum size of the charges.

Blasting shall be done only at such time as the Engineer and those agencies shall approve and under such restrictions as they may impose.

The Contractor shall employ only experienced supervisors and workmen in the handling, loading and firing of the explosives.

The Contractor's attention is directed to the requirements of Industrial Code Rule 39 of the State of New York, Department of Labor, Board of Standards and Appeals, and the applicable Sections of the Labor Law which, together with the conditions indicated herein, shall provide for the possession, handling, storage and transportation of all explosives used at the site.

EXPLOSIVES IN DEMOLITION. Demolition work, subject to the jurisdiction of Industrial Code Rule 23, shall not be performed by the use of explosives unless a specific variation for such use is granted by the New York State Board of Standards and Appeals.

PART II

Section 6

MATERIALS OF CONSTRUCTION

GENERAL REQUIREMENTS. All materials used in the work shall meet the requirements described in this PART unless the same are altered by specific requirements under any itemized specification or by notes shown upon the plans, or in the proposal.

It shall be the responsibility of the Contractor to advise the Engineer of the sources of proposed materials sufficiently in advance of their use so that proper tests may be made.

All materials proposed to be used in construction shall be subject to due examination and testing prior to acceptance. Specific sampling and testing requirements are described elsewhere in this PART and in the specifications but may be altered by notes shown upon the plans or in the proposal. Where testing methods are not described in the specifications, details of test methods may be obtained by application to the Chief Engineer. Materials shall be tested by the County Laboratory or by any agent authorized by the County for that purpose. When materials are to be tested, samples will be taken by the Engineer, inspector or other agent of the county authorized for that purpose and submitted in accordance with the Department's instructions to its employees. The cost of all samples and any other expense attendant to furnishing samples shall be included in the unit prices bid for the various items of the contract. Unless otherwise directed by the Department no materials shall be used until the Engineer in charge of the contract has received written notification of acceptance of that material, and such material shall be used only so long as the quality remains equal to that of the accepted sample. The initial acceptance of a material shall in no way preclude further examination and testing of a material at any time the Engineer suspects that the material is no longer properly represented by the accepted sample. The acceptance at any time of any material shall not bar its future rejection if it is subsequently found to be defective in quality or uniformity.

Contractors shall furnish companies from whom they purchase materials which are inspected at manufacturing plants, with the Item Number, the contract number, and the destination for each shipment of material so ordered. If any part of the contract is sublet, the sub-contractor shall also conform to the foregoing requirements.

Any material which has been plant inspected and accepted by this Department for any Department contract shall not be shipped to other work unless authorized by the Department.

Material which has been rejected on the results of Laboratory tests will not be resampled or retested unless otherwise directed by the Department. Rejected materials shall be removed immediately from the site of the work by the Contractor at his expense unless otherwise directed by the Engineer. No rejected materials, the defects of which have been subsequently corrected, shall be used until written notification of the acceptance of the material has been received by the Engineer.

Materials shall be so stored as to insure the preservation of their quality and fitness for the work. Stored materials even though accepted before storage shall be inspected prior to their use in the work and shall meet the requirements of the contract at the time of their use.

Weight shall be used in all cases for percentage determination unless otherwise specified.

Railroad cars, barges and other containers used for the transportation of materials shall be clean when any materials are deposited therein.

Whenever any specifications or methods of test are stipulated in these specifications the same shall mean that the latest specifications or methods of test, given by the serial designation mentioned or bulletins referred to, shall apply.

Where plant inspection is not maintained, the method and procedure for sampling, inspecting and reporting shall conform to that established by the Department.

The U.S. Standard Screen Sieves meeting A.S.T.M. Designation E 11 shall be used on all materials requiring gradation tests.

Approved Steel Manufacturing Processes

Steel may be manufactured by the processes listed in these material specifications, the payment items and referenced specifications such as ASTM and AASHO, except that Acid-Bessimer Steel will not be accepted for any item.

M 1 PORTLAND CEMENT

SCOPE: This Specification covers four types of Portland Cement and four types of air-entraining Portland Cement as follows:

Type 1—For use in general concrete construction where low heat of hydration is not required and where no sulphate action is anticipated.

Type 1A—Same as Type 1 above except that an air entraining admixture has been inter-ground with the clinker.

Type 2—For use in general concrete construction.

Type 2A—Same as Type 2 above except that an air entraining admixture has been inter-ground with the clinker.

Type 3—For use when high early strength is required.

Type 3A—Same as Type 3 above except that an air entraining admixture has been inter-ground with the clinker.

Type 6—For use in white concrete or white mortar.

Type 6A—Same as Type 6 above except that an air entraining admixture has been inter-ground with the clinker.

Types of cement to be used will be as shown in the plans or Specifications for each contract.

GENERAL REQUIREMENTS: The gypsum shall be added to the clinker by means of an approved automatic mechanical device.

At the option of the manufacturer, additions to non-air entraining cements of those commercial products known as "grinding aids" will be permitted as provided for by ASTM Designation C 150. The manufacturer shall declare the commercial name of the product used and the amount thereof in writing to the Laboratory.

Portland cement of each type shall conform to the respective chemical and physical requirements prescribed in Tables 1 and 2.

Air Entraining Agents for Types 1A, 2A, 3A and 6A Cements

Class 1, Darex AEA
Class 2, N-Tair
Class 3, Airalon
Class 4, Other approved materials

The manufacturer may use any one of the first three classes of air entraining agents unless otherwise shown in the Plans or Specifications. The manufacturer shall inform the Laboratory of the type of air entraining agent used and, from tests that he performs, furnish data in regard to the air content of the cement mortar (AASHO T 137).

The manufacturer must obtain the approval of the Chief Engineer for any agent proposed upon Class 4. The air-entraining agent shall be added uniformly to the clinker by means of an approved automatic device.

SAMPLING AND INSPECTION. Portland Cement and clinker shall be sampled at the mill by a representative of the Department or as otherwise directed by the Department. Test samples of cement and clinker shall represent amounts to be determined by the Laboratory.

Every facility shall be provided the Laboratory for sampling and inspection at the manufacturing mill, storage facilities, and the site of the work, as may be directed by the Laboratory.

Cement shall be sampled prior to its entering the storage silo by means of an approved automatic device. The automatic sampling device shall be so constructed as to obtain continuous samples from across the full mill stream to the silo and deliver such samples into a sealed container of a type and size approved by the Laboratory.

Clinkers shall be sampled in a manner and in an amount as directed by the Laboratory. The clinker shall not be subjected to any grinding operation previous to sampling.

All samples shall be under the sole control of the Inspector from the time they are removed by him from the sealed sample containers to the time they are shipped by him to the Laboratory.

TESTING. The samples of cement will be subjected at the Laboratory to tests of chemical and physical properties in accordance with test methods similar to those specified by AASHO. The details of these tests as well as the details of tests of clinker soundness may be obtained upon application to the Laboratory.

The cement may be rejected if it fails to meet any of the requirements of these specifications. Cement not satisfactory in the 7 day strength tests may be held awaiting the results of 28 day strength tests before acceptance or rejection. Upon application by the manufacturer, 3 day strength tests may be performed. The cement will be accepted if such tests show strengths in excess of 90% of the required 7 day strength. The Department, however, reserves the right to reject any cement that fails to meet the requirements of the 28 day tests, even though it had been previously accepted on the 7 day tests or 3 day tests.

At least 8 days from the time of sampling shall be allowed for the completion of the 3 day test. At least 12 days from the time of sampling shall be allowed for the completion of the 7 day test and at least 35 days shall be allowed for completion of the 28 day test.

STORAGE. The cement shall be stored in an approved weather-tight silo or bin. Facilities shall be provided for maintaining such silos or bins under Department seal control as directed by the Laboratory.

All silos or bins shall be completely empty and clean before sampled cement is deposited therein. Cement offered for Department acceptance should be stored in silos approved by the Department as to efficiency of loading of the type of bulk transport anticipated.

Cement remaining in bulk storage at the mill, prior to shipment, for a period greater than one year after completion of tests shall be resampled and retested before shipment. However, accepted cement which has been in bulk storage at mills more than two years from the time of original acceptance shall not be used. No accepted cement stored by the Contractor over the winter shall be used until re-tested by the Laboratory.

SHIPMENT. All shipments shall be made from accepted lots only and shall be accomplished under inspection and seal controls as directed by the Laboratory.

Bulk cement may be shipped by truck, R. R. cement hopper cars, R. R. air activated container cars, and barges. The compartments of all such conveyances shall be completely empty and clean before any accepted cement is loaded therein. The condition of all such conveyances shall be subject to the approval of the Department and facilities shall be provided for the application of Department seal control to all such conveyances.

Accepted cement may be shipped in paper bags which conform to industry standards and which have the brand name, type of cement, and the name of the manufacturer plainly marked thereon. In addition, a rubber stamp impression denoting "NYS Lot #____" shall be affixed to each bag as directed by the Laboratory. When cement is shipped in bulk this information shall be shown on shipping notices accompanying the shipment.

A bag shall contain 94 pounds net. A barrel shall be considered as weighing 376 pounds net. One bag of cement shall be considered as containing one cubic foot.

The temperature of cement at the time of shipment from an accepted silo shall not exceed 170 degrees Farenheit. When directed by the Laboratory, shipments shall be made from the oldest accepted lots first.

To permit scheduling of inspection the supplier shall furnish the Inspector with advance notic of all shipments and complete shipment information as directed by the Laboratory.

TABLE 1 – CHEMICAL REQUIREMENTS

		Types 1 & 1A	Types 2 & 2A	Types 3 & 3A	Types 6 & 6A•
Loss on ignition	Max. % Wt.	3.0	3.0	3.0	3.0
Silico (SiO_2)	Min. % Wt.	#	21.0	#	#
Lime (CaO)	Max. % Wt.	#	65.0	#	#
Alumina (Al_2O_3)	Max. % Wt.	#	6.0	#	#
Iron Oxide (Fe_2O_3)	Min. % Wt.	#	3.0	#	#
	Max. % Wt.	#	5.0	#	#
Magnesia (MgO)	Max. % Wt.	4.0	4.0	5.0	5.0
Sulp. Anhy. (SO_3)	Max. % Wt.	2.5	2.5	3.0	2.5
Insol. Residue	Max. % Wt.	0.50	0.50	0.75	0.75
Al-iron oxide ratio Al_2O_3/Fe_2O_3	Max.	#	1.5	#	#
Tricalcium Aluminate••	Max. % Wt.	#	#	8	#

No Requirements.

• Color shall be white.

•• The percentage of tricalcium aluminate shall be calculated from the chemical analysis as follows:

Tricalcium aluminate = (2.65 x percent Al_2O_3) – (1.69 x percent Fe_2O_3)

M2 NATURAL CEMENT

GENERAL. Natural Cement (Type N) shall be a finely pulverized product prepared from the calcination of a Natural Cement rock which is burned at sufficient temperature to drive off the carbonic acid gas and still produce a material that is not fused. Beef tallow shall be uniformly added by a mechanical device to the material just previous to grinding in an amount of not more than 0.1% nor less than 0.05% by weight. Natural cement shall be produced from mines containing only uniform, original rock deposits and no admixtures shall be added to the cement except as herein specified.

CHEMICAL PROPERTIES. A Chemical Oxide Analysis of the finished cement shall show lime (CaO) not to exceed 50% and Magnesia (MgO) not less than 15% nor more than 2[illegible]%. Ignition loss shall not exceed 10%.

When the natural cement is tested in accordance with the Hydration Test method, it shall not liberate more than 2.5% CaO on the basis of 1 gm. cement sample in 7 days, and not more than 3.0% CaO in 28 days.

PHYSICAL PROPERTIES. Fineness—Residue on the Number 200 mesh sieve shall not exceed 12%. Soundness—A pat of neat cement, about 3 inches in diameter, 1/2 inch thick at the center, tapering to a thin edge, shall be kept in moist air for a period of 24 hours.

The pat shall then be placed in an atmosphere of steam at a temperature between 98° and 100° C. upon a suitable support one inch above boiling water for five hours and show no signs of distortion, cracking, checking or disintegration upon removal from the steam test-box.

Time of Setting—The cement shall not develop its initial set in less than 10 minutes as determined by the Vicat Needle. The final set shall be attained within 10 hours.

TENSILE STRENGTH. The average tensile strength in pounds per sq. in. of not less than three neat cement specimens shall be equal to or higher than the following:

Age of Specimen	Storage of Briquettes	Tensile Strength lbs. per sq. in.
7 days	1 day in moist air 6 days in water	125
28 days	1 day in moist air 27 days in water	200

Natural cement may be accepted on the basis of the 7-day test provided previous 7-and 28-day strength tests have been satisfactory on cements from the same mill.

SAMPLING, TESTING AND INSPECTION. All provisions under M1 Portland Cement: Sampling, Testing and Inspection except those provisions referring to "Clinker" shall be deemed effective under this specification.

The samples of natural cement will be subjected to chemical and physical tests substantially in accordance with the latest test methods of the AASHO. The details of these tests as well as the details of the hydration test may be obtained upon application to the Laboratory.

REJECTION. The cement may be rejected if it fails to meet any of the requirements of these specifications.

Cement failing to meet the 7-day requirements may be held awaiting the results of the 28-day test before rejection.

STORAGE. The cement shall be stored in such a manner as to permit easy access for proper inspection and identification of each shipment, and in approved weather-tight silos or bins which will protect the cement from dampness. All cement shall be silo or bin-tested.

No accepted cement stored by the Contractor over the winter shall be used until re-tested by the Laboratory. All accepted cement held in storage more than one year at mill or plant, silos or bins, shall be re-sampled and re-tested before use. However, accepted cement which has been in storage at mills, in silos or bins more than two years from the time of original sampling shall not be used.

All provisions under PORTLAND CEMENT—General Requirements, that are applicable to this material, shall be deemed effective under this specification.

PACKAGING AND MARKING. The natural cement shall be delivered in bulk or suitable paper bags of an approved type with the brand and name of the manufacturer plainly marked thereon. When the cement is delivered in bulk this information shall be shown on the shipping notice accompanying the shipment. Bulk natural cement shall be batched in accordance with the method given in Section 7. A bag shall contain 80 pounds net. A barrel shall contain 320 pounds net. One bag of cement shall be considered as containing one cubic foot.

TABLE 2—PHYSICAL REQUIREMENTS

	Type 1	Type 1A	Type 2	Type 2A	Type 3	Type 3A	Type 6**	Type 6A**
Autoclave clinker Test, max. per cent loss	•	•	•	•	‡	‡	‡	‡
Fineness, specific surface, cm²/gm Turbidimeter Test	1750—2000	1750—2000	1750—2000	1750—2000	‡	‡	1600 min.	1600 min.
Time of Setting (alternate methods) *****								
Vicat Test								
Initial set, minutes min.	45	45	45	45	45	45	45	45
Final set, hrs. max.	10	10	10	10	10	10	10	10
Gilmore Test								
Initial set, minutes min.	60	60	60	60	60	60	60	60
Final set, hrs. max.	10	10	10	10	10	10	10	10
Soundness								
Autoclave expansion, max. percent	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Tensile strength p.s.i. (minimum)								
1 day in moist air	‡	‡	‡	‡	275	‡	‡	‡
1 day in moist air, 2 days in water	•••	•••	•••	•••	375	‡	•••	•••
1 day in moist air, 6 days in water	300	275	300	275	****	‡	275	250
1 day in moist air, 27 days in water	375	350	375	350	‡	‡	350	325
Compressive strength p.s.i. (minimum)								
1 day in moist air	‡	‡	‡	‡	1700	1300	‡	‡
1 day in moist air, 2 days in water	•••	•••	•••	•••	3000	2500	•••	•••
1 day in moist air, 6 days in water	2100	1500	1800	1400	****	****	2100	1500
1 day in moist air, 27 days in water	3500	2800	3500	2300	‡	‡	3500	2800
Air Content								
Air content of mortar prepared and tested in accordance with AASHO Method T 137, percent by volume	12 max.	19±3	12 max.	19±3	12 max.	19±3	12 max.	19±3

‡ No Requirement.

• This test may be made by the Department to gauge the general characteristics of the clinker and the uniformity of clinker production.

** Color shall be white.

*** Upon application by the manufacturer, three day strength tests may be performed. Such strengths shall be in excess of 90% of the required 7 day strength.

**** The strength at 7 days shall be higher than at 3 days.

***** In case of non-agreement of results of Vicat and Gilmore tests, the results of the Vicat test shall govern.

M2RH RAPID HARDENING HYDRAULIC CEMENT

GENERAL. The material shall be a hydraulic type cement, which, when mixed with water, will harden rapidly to produce a permanent anchoring bond. It shall contain neither Portland Cement, ferrous metals, nor rust promoting agents.

The materials shall require no more than 48 fl. oz. of water to 10 pounds of cement to achieve a pourable consistency and no more than 38 fl. oz. of water to produce a plastic consistency.

LINEAR MOVEMENT. The compound when prepared in either of the consistencies above shall show no shrinkage on setting, but may exhibit a slight expansion of not more than .002 inches per lineal inch.

COMPRESSION STRENGTH. Two inch cubes cast from this material shall have the following minimum compression strengths:

At age 1 hour	4500 psi
At age 24 hours	5000 psi

TESTING. The contractor shall obtain approval of any Rapid Hardening Cement proposed for use on any project from the Chief Engineer.

M3 FINE AGGREGATES

GENERAL REQUIREMENTS. All samples of fine aggregates are to be secured and sent to the Laboratory by a representative of the Department.

All approved operating sources shall be sampled when:

a. The latest test for a source is two (2) years old
b. A change in the character of processed fine aggregate occurs
c. The location of the source of raw material is shifted or a change in the character of raw material occurs
d. Considered necessary by the Department.

Non-approved or rejected operating sources, equipped with adequate and proper processing facilities, may be sampled upon favorable recommendation by the Engineer in charge of the Department Laboratory and Materials Testing with the approval of the Chief Engineer. Approval action on such sources may be conditioned on the results obtained by periodic sampling and testing as prescribed by the Department.

Proposed unopened sources of material may be sampled upon the favorable recommendation of the Engineer in charge of the Laboratory and Materials Testing with the approval of the Chief Engineer. The results of tests on such samples shall be for information only and shall be interpreted as indicative of the potential fitness of the sources. Action in regard to acceptance or rejection of a source will be taken only after processing facilities have been established, inspected and approved.

Materials meeting test requirements shall be rejected if, in the opinion of the Department, service records indicate that they are unsound or otherwise unsatisfactory.

All sources of fine aggregate shall be thoroughly stripped of all inferior and objectionable material before processing operations are started and shall be kept stripped far enough from the working face to insure against undesirable material becoming mixed with the output.

FINE AGGREGATE DETAILS. Fine aggregate shall consist of sand, stone screenings (except limestone screenings), iron ore tailings, artificial sand which is prepared from an accepted source of dolomite rock and contains not less than 30% of Magnesium Carbonate or a mixture of these, which shall conform to the gradation requirements shown below and shall consist of grains or particles of hard durable rocks, the surfaces of which are not coated with any injurious materials. Any fine aggregate may be rejected if, in the opinion of the Department, it contains sufficient deleterious or unsound material to be harmful.

Fine aggregate when dry shall conform to the following gradation requirements:

Sieve	Percent Passing by Weight	Sieve	Percent Passing by Weight
3/8 in.	100	No. 30	25-60
No. 4	90 - 100	No. 50	10-30
No. 8	75 - 100	No. 100	1-10
No. 16	50 - 85	No. 200 (Wet)	0-3

Fine aggregates shall be classified into types a, b, c and d. Each of the types shall meet the requirements set forth in the following table unless accepted by the Chief Engineer on the basis of service records, petrographic examination, geological studies and/or quarry reports.

TYPE OF FINE AGGREGATE

	By weight	Types a	b	c	d
Rational analysis					
Kaolin	Max. %	6	8	•	•
Quartz and feldspar	Min. %	85	75	•	•
Soundness					
10 cycle sodium sulphate	Max. % loss	6	7	8	10
5 cycle magnesium sulphate	Max. % loss	15	18	22	•

• No requirement.

If fine aggregate is found unsatisfactory when examined for organic impurities, it shall be rejected unless it passes the mortar strength tests for tension and compression prescribed by the Laboratory. Fine aggregates so tested shall achieve a tensile or compressive strength at least one hundred per cent of that developed by the Standard Ottawa Sand Mortar.

TEST METHODS. The details of all tests and test methods for fine aggregates may be obtained by communicating with the Department Laboratory.

M3A MORTAR SAND

The requirements for Fine Aggregates under M3, Types a, b, or c shall apply except as herein modified.

When dry, one hundred percent shall pass a No. 8 sieve, fifteen to forty percent shall pass a No. 50 sieve and five to ten percent shall pass a No. 100 sieve.

Compressive strength of the 1:3 mortar shall be at least eighty-five percent of the Standard Ottawa Sand Mortar Compressive Strength.

M3B GROUT SAND

Grout sand shall consist of clean, hard, durable, uncoated stone particles, free from lumps of clay and all deleterious substances.

The requirements for Fine Aggregates under M3, Types a, b, or c shall apply except as herein modified.

Grout sand shall be of such a size that, when dry, 100 percent shall pass a No. 16 sieve, and not over 10 per cent by weight shall pass a No. 100 sieve.

Compressive strength of the 1:3 mortar shall be at least seventy-five percent of the Standard Ottawa Sand Mortar Compressive Strength.

Sand may be rejected for this class if it contains more than six percent by volume of loam and silt.

M3C WHITE FINE AGGREGATE

The specifications for M3 fine aggregate shall apply except as herein modified:

The Rational Analysis shall show not less than 90% Quartz plus Feldspar.

It shall be of a color approved by the Chief Engineer. The locations of sources of supply that have been tested and accepted insofar as rational analysis and color is concerned can be furnished by the Laboratory.

M3D CUSHION SAND

Cushion sand shall consist of clean, hard, durable, uncoated stone particles, free from lumps of clay and all deleterious substances.

Cusion sand shall be so graded, that, when dry, 100 per cent shall pass a 1/4 inch square opening sieve, not more than 35 per cent by weight shall pass a No. 50 sieve, and not more than 10 per cent by weight shall pass a No. 100 sieve.

Sand may be rejected for this class if it contains more than 10 per cent by volume of loam and silt.

M3E MINERAL FILLER

Mineral filler for bituminous mixes shall consist of limestone dust, portland cement, diatomaceous earth, flyash, or other approved material and shall be free from foreign or other objectionable material. It shall be dry and free from lumps and when tested by means of Laboratory sieves the mineral filler shall meet the following gradation requirements:

	Percent
Passing No. 30 mesh sieve	100
Passing No. 80 mesh sieve	85 min.
Passing No. 200 mesh sieve	65 to 100

M4 COARSE AGGREGATES

NOTE: Throughout these specifications where the term "Broken Stone" or "Broken Slag" is used it is to be interpreted as being synonymous with the term "Crushed Stone" or "Crushed Slag".

GENERAL REQUIREMENTS. All samples of coarse aggregates are to be secured and sent to the Laboratory by a representative of the Department.

All approved operating sources shall be sampled when:

a. The latest test for a source is two (2) years old
b. A change in the character of processed coarse aggregate occurs
c. The location of the source of raw material is shifted or a change in the character of raw material occurs
d. Considered necessary by the Department.

Non-approved or rejected operating sources, equipped with adequate and proper processing facilities, may be sampled upon favorable recommendation by the Engineer in charge of the Department Laboratory and Materials Testing with the approval of the Chief Engineer. Approval action on such sources may be conditioned on the results obtained by periodic sampling and testing as prescribed by the Department.

Proposed unopened sources of material may be sampled upon the favorable recommendation of the Engineer in charge of the Laboratory and Materials Testing with the approval of the Chief Engineer. The results of tests on such samples shall be for information only and shall be interpreted as indicative of the potential fitness of the sources. Action in regard to acceptance or rejection of a source will be taken only after processing facilities have been established, inspected and approved.

Materials meeting test requirements may be rejected if, in the opinion of the Department, service records indicate that they are unsound or otherwise unsatisfactory.

If undesirable material is furnished from acceptable sources of supply through faulty operation or any other cause whatsoever, the source of supply and any objectionable material therefrom may be rejected by the Chief Engineer.

All sources of coarse aggregates shall be thoroughly stripped of all inferior and objectionable material before operations are started and shall be kept stripped far enough from the working face to insure against undesirable material becoming mixed with the output.

COARSE AGGREGATE DETAILS. Coarse aggregates shall consist of well graded, uniformly mixed broken stone, crushed gravel, screened gravel, or broken slag, and shall meet the requirements given for these materials. However, screened gravel shall not be used except as indicated in Part II, Section 7.

If deliveries of coarse aggregate show segregation of sizes, material shall be mixed to the specificed gradation before using.

Coarse aggregates shall contain not more than 30% of particles that are flat or elongated to the degree of 3:1 and shall contain not more than 10% of particles that are flat or elongated to the degree of 5:1. The method of measurement of flatness or elongation shall be as defined by ASTM C-125. The sizes to be used for this determination shall be as directed by the Laboratory in accordance with the intended usage of the aggregate.

The amount of deleterious substances contained in any primary size of crushed stone or crushed or screened gravel coarse aggregates shall not exceed the following percentage by weight:

Material passing the No. 200 sieve	1.0 per cent
Shale or other lightweight materials	1.0 per cent•
Coal or Lignite	1.0 per cent
Clay Balls or Lumps	0.2 per cent
Other Deleterious Substances	1.0 per cent

• This requirement may be waived if service records and/or abrasion and soundness tests indicate to the Department that the aggregate is satisfactory.

Coarse aggregates containing more than the above specified amounts of deleterious substances, to be accepted by the Department, shall be washed or otherwise processed until such specifications are satisfied.

Run of bank gravel shall not be permitted for concrete aggregates.

Sizes of Stone, Gravel and Slag

The sizes of all stone, gravel or slag furnished locally or commercially and used under these specifications shall conform to the gradation requirements for the various sizes tabulated as follows:

PERCENTAGE BY WEIGHT PASSING THE FOLLOWING SQUARE OPENINGS·

Primary Sizes	4"	3"	2 1/2"	2"	1 1/2"	1"	1/2"	1/4"	1/8"	No. 80 Sieve
Screenings•	.....	.....	.....	.....	.....	.....	100	90–100	.....	.....
1B....	.....	.....	.....	.....	.....	.....	.....	100	90–100	0–15
1A....	.....	.....	.....	.....	.....	.....	100	90–100	0–15	.....
1.....	.....	.....	.....	.....	.....	100	90–100	0–15	.....	.....
2.....	.....	.....	.....	.....	100	90–100	0–15	.....	.....	.....
3.....	.....	.....	100	90–100	35–70	0–15	.....	.....	.....	.....
4A....	.....	100	90–100	.....	0–20	.....	.....	.....	.....	.....
4.....	100	90–100	.....	0–15	.....	.....	.....	.....	.....	.....
5.....	90–100	0–15	.....	.....	.....	.....	.....	.....	.....	.....

• Screenings shall include all of the fine material passing a 1/4" screen.

All crushing plants installed on the work shall be fitted with tailing chutes so that no stone will reach the bins other than that which passes through the proper screens.

All stone, gravel or slag must be of the required sizes when placed in the work, and breaking up of stone, gravel or slag by hammers or otherwise will not be permitted.

CRUSHED STONE

Crushed stone shall consist of clean, durable, sharp angled fragments of rock (including iron ore tailings) of uniform quality throughout. Gravel hardheads retained on a four inch scalping screen and then crushed will be acceptable as crushed stone provided such crushed hardheads shall meet the gradation requirements, and the requirements for the type of stone specified in the contract or proposal.

Crushed stone used as coarse aggregate for cement concrete items shall be obtained from sources conforming to the regulations of the Department as to sampling and testing methods and procedures and Quarry Reports.

Crushed stone as a coarse aggregate shall be classified under three types—A, B, and C. Each type shall meet the requirements of the following table unless accepted by the Chief Engineer on the basis of service records, petrographic examination, geological studies and/or quarry reports.

Crushed stone for use as an aggregate in wearing courses of Bituminous pavements shall be of trap or other acceptable igneous rock.

	Type		
	A	B	C
Deval abrasion test			
Per cent loss max. by weight	4.0	5.7	6.5
Magnesium sulphate soundness test			
Per cent loss at 10 cycles max. by weight	1.0	10.0	12.0
*Freezing and thawing test			
Per cent loss at 25 cycles max. by weight	3.0	3.0	

*This requirement effective only on aggregate used in portland cement concrete where surfaces are exposed.

CRUSHED GRAVEL

Crushed gravel shall consist of clean, sound, tough, hard gravel, free from coatings and shall be thoroughly washed. Crushed gravel shall contain at least 75 per cent of fractured particles in each primary size and shall meet the gradation requirements for crushed stone. A fractured particle shall be defined as one which has at least one fractured face and in which the total area of face fracture exceeds 25% of the maximum cross sectional area of the particle.

In making the abrasion test and the soundness test uncrushed particles shall be used.

Gravel as a coarse aggregate shall be classified under three types—A, B, and C. Each type shall meet the requirements of the following table unless accepted by the Chief Engineer on the basis of service records, petrographic examination, geological studies and/or quarry reports.

	Type		
	A	B	C
Deval abrasion test			
Per cent loss max. by weight	5.0	10.0	12.0
Magnesium sulphate soundness test			
Per cent loss at 10 cycles max. by weight	15.0	15.0	25.0
*Freezing and thawing test			
Per cent loss at 25 cycles max. by weight	10.0	10.0	....

*This requirement effective only on aggregate used in portland cement concrete where surfaces are exposed.

SCREENED GRAVEL

Screened gravel shall consist of clean, sound, tough, hard stone free from coatings and shall be thoroughly washed.

Screened gravel may consist of all uncrushed particles or of crushed particles up to 75 per cent of the total in each primary size. In making the abrasion test and the soundness test uncrushed particles shall be used. The methods of testing screened gravel coarse aggregate shall be the same as the methods of testing Crushed Gravel.

Screened gravel shall be classified under three types—A, B, and C. Each type shall meet the limit specified for abrasion, magnesium sulfate soundness and freezing and thawing tests in accordance with the requirements for crushed gravel unless accepted by the Chief Engineer on the basis of service records, petrographic examination, geological studies and/or quarry reports.

CRUSHED SLAG

Crushed slag shall be air-cooled blast furnace slag, hard and durable, composed of angular fragments reasonably uniform in density and quality, free from injurious amounts of sulphur, and reasonably free from thin, elongated or glassy pieces, dirt or other objectionable matter. Crushed slag shall contain not more than 3% metallic ore by weight. All slag must be obtained from approved sources.

The dry rodded weight of crushed slag shall not be less than seventy pounds per cubic foot.

The crushed slag shall meet gradation requirements as shown in the table under "Sizes of Stone, Gravel and Slag".

Crushed slag shall meet the requirements of tests as follows:

Los Angeles Abrasion: 40% max. loss
Magnesium Sulphate Soundness: 6% max. loss at 10 cycles

TEST METHODS. The details of all tests and test methods for coarse aggregates may be obtained by communicating with the Laboratory.

M5 BITUMINOUS MATERIALS

Asphalts and Tars

GENERAL REQUIREMENTS. The Bituminous Material furnished shall be of approved quality and shall meet the requirements shown under its respective item in the following tables for the kind of material furnished.

Where more than one grade of material is called for under any item, the Chief Engineer may specify the grade required at the time of use.

Each delivery vehicle or distributor used to incorporate the bitumen into the work shall be equipped with a sampling valve except those vehicles delivering to bituminous mixing plants as described in Part II, Section 8, of these specifications. The type of valve and its location shall be approved by the Chief Engineer. When samples are taken through sampling valves in accordance with Department instructions, they shall be considered to be representative of all material in the vehicle at the start of application.

Silicone additive will be permitted in paving asphalts. Silicone may be introduced into the asphalt at the refinery or at the mixing plant storage tank. Asphalt treated with silicone shall conform to the specifications for untreated asphalt.

Bituminous Material, wasted through careless handling, or Bituminous Material that has been rendered unfit for use by overheating or by long continued heating, or bituminous emulsions which have separated because of freezing or mishandling will not be paid for. For purposes of measurement, a gallon shall be a volume of 231 cubic inches, and measurement shall be based on the volume of the Bituminous Material at a temperature of 60 degrees Fahrenheit. Information as to Specific Gravity at 60 degrees Fahrenheit shall be included with each shipment of bituminous material to a plant or project.

The method to be used for volume corrections for petroleum products shall be the Standard Abridged Volume Correction Tables for Petroleum Oils, A.S.T.M. Designation D1250.

The coefficient of expansion at 60 degrees Fahrenheit for asphalt emulsions shall be 0.00025.

ANTI-STRIPPING ADDITIVE. When required on the plans or in the proposal an additive shall be added to the bituminous material which will cause the bituminous material to coat and adhere more effectively to wet and unheated aggregates.

The additive shall have no deleterious effect upon the bituminous material and shall be completely miscible in all types of bituminous materials.

Anti-stripping additives shall be added only at the refinery except as ordered by the Chief Engineer and shall be blended thoroughly throughout the bituminous material.

Bituminous material containing an anti-stripping additive shall conform to the specifications for untreated material. In addition, it shall be required to show not less than 95% area coated when subjected to a stone coating test at the Laboratory. Details of this test may be obtained upon application to the Laboratory.

The following tables give the detail requirements for each kind of Bituminous Material. The tables shown are as follows:

Table I—Paving Asphalt Items 64, 64P & 65
Asphalt Filler Items 71 & 71B
Subsealing Asphalt Item 71C
Table II—Asphalt Emulsions, Items 70, 70B, 70C & 70M
Table III—Cationic Asphalt Emulsions, Items 66B & 66D
Table IV—Rapid Curing Asphalt Cutbacks, Items 69, 69R, 69C, 69MA & 69MB
Table V—Medium Curing Liquid Asphalts, Items 67B, 67C, 67D, 67DX, 67E, 67F & 67G

SEASONAL AND WEATHER LIMITATIONS. The placing of items that include M5 Bituminous Materials shall be subject to the same seasonal and weather limitations indicated for Section 8—Bituminous Concrete of the Suffolk County Public Works Specifications.

TABLE I.—ASPHALTS

Type	Paving asphalts			Asphalt filler			Subsealing Asphalt
Item No.	64	64P	65	71	71B		71C
Grade	85–100	100–120	60–70	50–60	A	B	15–30
Water	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Homogeneous	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sp. Gr. @ 77°F. (1)							
Pen. @ 77°F. 100 g. 5 sec.	85–100	100–120	60–70	50–60	30–45	30–45	15–30
Pen. @ 39.2°F. 200 g. 60 sec.	—	—	—	—	—	—	note (4)
Pen. Ratio (39.2°F./ 77°F. × 100)	30.0+	30.0+	30.0+	55–70	60–75	60–75	—
% Loss @ 325°F. max. (2)	1.0	1.0	1.0	1.0	1.0	1.0	0.5
% Pen. of Res. min.	60.0	60.0	60.0	60.0	60.0	60.0	70.0
% Sol. in CCl_4 min. (3)	99.5	99.5	99.5	99.5	99.5	99.5	99.5
Flash Point, °F. min.	347	347	347	392	392	392	475
Duct. @ 77°F. min.	60	60	60	10	4	4	2
Soft. Pt. °F. (B&R)	—	—	—	140–167	160–180	180–200	180 min.
Typical Uses	Hot and Cold Laid Plant Mix	Pen. Constr.	Hot Plant Mix	Joints and Cracks	*Brick Filler,* Light Traffic	Heavy Traffic	Subsealing

(1) The Sp. Gr. limits apply only to Petroleum Asphalts.
(2) 1.0% limit for Pet. Asphalts; 3.0% for Fluxed Nat. Asph.
(3) 99.5+Pet. Asph., 95.0+Bermudez; 81.0+Cuban; 66.0+Trinidad.
(4) Pen. @ 32°F., 200 g. 60 sec.=10+; Pen. @ 115°F., 50 g., 5 sec=60−; shall not foam @ 400°F.

TABLE II.—ASPHALT EMULSIONS

Suppliers of asphalt emulsion shall submit on request a sample of the emulsion, taken by an Inspector of the Department, from a factory lot of material of not less than 20,000 gallons. The samples so submitted shall meet the requirements of the following specifications:

Item Number	70B	70B	70M†	70†	70C	70MS†
Grade	—	C*	A	—	—	—
Material Designation	RS-1	RS-2	MS-1	MS-3	—	SS-1
Water %	40-45	30-40	32-37	30-35	50-55	40-45
Asphalt %	55	60	63	65	45-50	55
Homogeneous	Yes	Yes	Yes	Yes	Yes	Yes
Sp. Gr. @ 77°F. min.						
Ash—% Max.	2.0	2.0	2.0	2.0	2.0	2.0
Furol Vis. @ 77°F.	20-100	—	Satisfactory	—	Satisfactory	20-100
Furol Vis. @ 122°F.	—	100-400	—	100-500	—	—
Settlement, 7 Days, max.	3.0	3.0	3.0	—	3.0	3.0
Cement Mixing	—	—	—	—	—	2.0
Screen Test, % max.	0.1	0.1	0.1	0.1	0.1	0.1
Demulsibility, N/50 (35) min.	60	60	—	—	—	—
Demulsibility, N/10 (50)	—	—	—	—	5-45	—
Asphalt Base for Emulsions: Sp. Gr. @ 77°F.						
Pen. @ 77°F. 100 g., 5 Sec.	100-250	100-250	100-250	100-250	100-250	100-250
Sol. in CCl_4 % min.	97.5	97.5	97.5	97.5	97.5	97.5
Ductility @ 77°F., min.	60	60	60	60	60	60
Flash Point, °F. min.	347	347	347	347	347	347
Pen. of Distl. Res. @ 77°F.	100–250	100–250	100–250	100–250	100–250	100–250
Oil in Distillate, % by Vol. Based on Total Emulsion	0-2.0	0-2.0	0-10.0	5-11	0-2.0	0-10.0
Typical Use	Surface Treat. Penetration Spray Patch	Surface Treat.	Road Mix Base or Shoulder Stabilization	Patching Plant Mix Traveling Plant Mix	Curing Concrete	Granular Material Stabilization

* Requires heat application.

† Bituminous material paid for as Item 70, Item 70MS or Item 70M shall be required to pass the stone coating test prescribed by the Laboratory.

Any material accepted at the time of shipment, which should prove to be defective after date of delivery will not be accepted or paid for by the Department and will remain the property of the Contractor.

TABLE III—CATIONIC ASPHALT EMULSIONS

Suppliers of cationic asphalt emulsion shall submit on request a sample of the emulsion, taken by an Inspector of the Department, from a factory lot of material of not less than 20,000 gallons. The samples so submitted shall meet the requirements of the following specifications:

ITEM NUMBER	66B	66D
MATERIAL DESIGNATION	RS-3K	MS-3K
Asphalt %	65 min.	60-70
Homogeneous	Yes	Yes
Sp. gr. at 77°F. min.		
Ash % max.	2.0	2.0
Furol Vis. at 77°F.	—	—
Furol Vis. at 122°F.	100-400	50-500
Settlement, 7 Days max.	3.0	3.0
Screen Test, % max.	0.1	0.1
Partical Charge	Positive	Positive
ph max.	6.5	6.5
Stone Coating		*
Asphalt Base for Emulsions: Sp. gr. at 77°F.		
Pen. at 77°F. 100 g., 5 sec.	100-250	100-250
Pen. Ratio: (39.2°F./77°F.×100) (min.)	30	30
Sol. in CCl_4 % min.	97.5	97.5
Ductility at 77°F. min.	60	60
Flash Point °F. min.	347	347
Pen. of Distl. Res. at 77°F.	100-250	100-250
Oil in Distillate, % by Volume Based on Total Emulsion	0-5.0	2.0-15.0
Typical Use	Surface Treat.	Patching Plant Mix Traveling Plant Mix

* Tested as required in accordance with Laboratory procedures.

Any material accepted at the time of shipment, which should prove to be defective after date of delivery will not be accepted or paid for by the Department and will remain the property of the Contractor.

TABLE IV.—RAPID CURING ASPHALT CUTBACKS

Item Number	69C	69	69MA	69MB	69R
Grade	RC-30	RC-70	RC-250	RC-800	RC-3000
Water, Max. (%)	0.2	0.2	0.2	0.2	0.2
Kinematic Viscosity @ 140°F, Centistokes, (1)	30–60	70–140	250–500	800–1600	3000–6000
Distillation: % total distillate to 680°F., by Vol.					
to 374°F. Min.	15	10	—	—	—
to 437°F. Min.	55	50	35	15	—
to 500°F. Min.	75	70	60	45	25
to 600°F. Min.	90	85	80	75	70
Residue from distillation to 680°F. % Volume by difference min.	50	55	65	75	80
Tests on Residue:					
Pen. 77°F., 100 g., 5 sec.	80–120	80–120	80–120	80–120	80–120
Pen. Ratio: (39.2°F./77°F. × 100), Min.	30	30	30	30	30
Ductility, 5 cm./min., @ 77°F., cm., Min.	100	100	100	100	100
% Sol. in CCl_4 Min. (2)	99.5	99.5	99.5	99.5	99.5

(1) Viscosity test, Alternate Method
Grade 30 — Furol Viscosity @ 77°F — 75 to 150 sec.
Grade 70 — Furol Viscosity @ 122°F — 60 to 120 sec.
Grade 250 — Furol Viscosity @ 140°F — 125 to 250 sec.
Grade 800 — Furol Viscosity @ 180°F — 100 to 200 sec.
Grade 3000 — Furol Viscosity @ 180°F — 300 to 600 sec.
In case of non-agreement of results of Kinematic and Furol Viscosity tests, the results of the Kinematic Viscosity test shall govern.
(2) 99.5%+ for petroleum products; 90.0%+ for blended Native Asphalts.

TABLE V.—MEDIUM CURING LIQUID ASPHALT

Item Number	67B	67C	67D	67E & 67F	67G
Grade	MC-30	MC-70	MC-250 (4)	MC-800	MC-3000
Water, Max. (%)	0.2	0.2	0.2	0.2	0.2
Flash Point, Open °F., min.	100	100	150	150	150
Kinematic Viscosity @ 140°F, Centistokes, (1)	30–60	70–140	250–500	800–1600	3000–6000
Distillation: % total distillate to 680°F. by Vol.					
to 437°F. Max.	25	20	0–10	—	—
to 500°F. Max.	40–70	20–60	15–55	35	15
to 600°F.	75–93	65–90	60–87	45–80	15–75
Residue from distillation to 680°F. % Volume by difference, min.	50	55	67	75	80
Tests on Residue:					
Pen. 77°F., 100 g., 5 sec.	120–300	120–250	120–250	120–250	120–250
Ductility, 5 cm/min., @ 77°F., cm., Min. (2)	100	100	100	100	100
% Sol., in CCl_4 min. (3)	99.5	99.5	99.5	99.5	99.5

(1) Viscosity test, Alternate Method
Grade 30 — Furol Viscosity @ 77°F — 75 to 150 sec.
Grade 70 — Furol Viscosity @ 122°F — 60 to 120 sec.
Grade 250 — Furol Viscosity @ 140°F — 125 to 250 sec.
Grade 800 — Furol Viscosity @ 180°F — 100 to 200 sec.
Grade 3000 — Furol Viscosity @ 180°F — 300 to 600 sec.
In case of non-agreement of results of Kinematic and Furol Viscosity tests, the results of the Kinematic Viscosity test shall govern.
(2) If penetration of residue is more than 200 and its ductility at 77°F is less than 100 cm., the material will be accepted if its ductility at 60°F is more than 100 cm.
(3) 99.5%+for petroleum products; 90.0%+for blended Natural Asphalts.
(4) The material for shoulder stabilization shall be paid for as Item 67DX and shall contain a satisfactory anti-stripping agent.

M5P POWERED ASPHALT

The powdered asphalt shall be produced from a hard asphalt conforming to the following requirements:

1. It must be homogeneous and free from water.

2. Solubility in carbon tetrachloride (CCl_4) not less than 99%.

3. Penetration at 77°F., 100 gr., 5 sec., not more than 3.

4. Penetration at 115°F., 110 gr., 5 sec., not more than 10.

5. Softening point (R & B) 240°F. to 280°F.

Before delivery to the mixing site, the hard asphalt shall be reduced to powder in an impact mill. As used, not less than 50% by weight shall pass a #80 sieve, and not less than 95% by weight shall pass a #20 sieve.

M6 STRUCTURAL STEEL

GENERAL. Unless otherwise specified, all structural steel shall conform to the requirements of A.S.T.M. Designation A36.

HIGH STRENGTH STEEL. When high strength steel is required, steel conforming to the requirements of A.S.T.M. Designation A440, A441 or Modified A441 shall be furnished as specified in the Contract Documents.

MODIFIED A441 STEEL. Modified A441 Steel shall be furnished in thickness greater than 3/4 inch up to and including 4 inches maximum.

When Modified A441 Steel is called for in the Contract Documents the steel furnished shall conform to the requirements of A.S.T.M. Designation A441 except as modified in this section.

Revise Table I as follows:

	Ladle Analysis	Check Analysis
Carbon %	0.10 to 0.19	0.08 to 0.21
Manganese %	0.90 to 1.25	0.85 to 1.30
Phosphorous, max. %	0.04	0.05
Sulfur, max. %	0.05	0.063
Silicon %	0.15 to 0.30	0.13 to 0.32
Copper %	0.25 to 0.40	0.23 to 0.43
Vanadium, min. %	0.02	0.01
Chromium %	0.40 to 0.65	0.36 to 0.69

Revise the tensile strength and yield point requirements in Table II for plate thickness up to and including 4 inches and all structural shapes to read—

Tensile strength, min., psi 70,000
Yield point, min., psi 50,000

Impact Properties. Charpy V-Notch impact tests shall be performed on the steel as described in paragraph 23 of A.S.T.M. Designation A370. Impact specimens shall not be aged at temperatures higher than 90°F.

Specimens shall be taken midway between the center of the steel section and the surface of the plate or shape. The specimens shall be taken parallel to the longitudinal centerline of the piece and the base of the V-Notch shall be pendicular to the plate or shape surface.

One impact test shall be made from the thickest material furnished in each lot. A lot, for purposes of impact testing, shall consist of 50 tons or fraction thereof of finished material from a single heat which is the same grade, condition, type of product (plate, bar, wide-flange, I, H, angle, etc.) and which is within one of the following thickness classifications:

1. Differing not more than 3/8 inch in thickness when the least thickness of the lot does not exceed 2 inches.

2. Differing not more than 1 inch in thickness when the least thickness in the lot exceeds 2 inches.

The governing thickness for wide-flange, I, H and T sections shall be the average thickness of the flange.

Test specimens for shapes shall be taken at a point one-third the distance from the outer edge of the flange or leg to the web or heel of the section.

The results of the above described impact tests shall be reported on the certified test reports required by these specifications. Impact test data will be used for information only. However, impact test data indicating test energies less than 15 ft. lbs. at 40°F. will be cause for the County to consider discontinuing further use of the type of steel tested.

Alternate Steels. Weldable steel that meets the above specifications except for chemical composition may be used if approved by the Chief Engineer.

Approval will be based upon the results of mechanical and impact tests submitted by the manufacturer and weldability under structural conditions of the type of steel proposed to be furnished. For the type of steel to be acceptable the impact data shall indicate that longitudinal Charpy V-Notch values of at least 15 foot-pounds at 40°F. are obtained from the steel in the plate thickness and shape sizes to be furnished.

STEEL TO BE WELDED. Steel conforming to the requirements of A.S.T.M. Designation A36, A441, or Modified A441 shall be used where structural connections are to be made by welding. Steel conforming to the requirements of A.S.T.M. Designation A242 may be welded provided the alloy furnished is of a weldable quality. A.S.T.M. A242 steel shall not be used unless it is required for corrosion resistance.

CORROSION RESISTANT STEEL. When steel conforming to the requirements of A.S.T.M. Designation A242 is specified, the steel furnished shall have a corrosion resistance of from 4 to 6 times that of plain carbon steel.

HIGH STRENGTH BOLTS. High strength bolts including suitable nuts and plain hardened washers shall, unless otherwise specified, conform to the requirements of A.S.T.M. Designation A325.

SAMPLING, TESTING AND INSPECTION. A certified copy of the results of the chemical analysis and physical tests required by the specifications shall be furnished for all steel. These data shall be given to the shop inspector for submittal to the Chief Engineer with his final inspection report.

When steel is furnished under an item which does not require shop inspection, these data shall be submitted to the Resident Engineer.

A manufacturer's certification that products conform to A.S.T.M. or other specification requirements will be interpreted to mean that the manufacturer has tested the product as required by such specifications and has found both materials and workmanship to conform to the specified requirements. Workmanship for the purpose of this specification shall include dimensional accuracy, surface finish, temper and any other physical property which will be affected by manufacturing procedures.

The certified test data furnished for High Strength Bolts, Nuts and Washers shall be the results of physical and chemical tests performed on the material supplied. These "additional tests" shall be performed at the frequency described in A.S.T.M. Designation A325.

M6A STEEL CASTINGS

GENERAL. Steel castings shall conform to the requirements of A.S.T.M. Designation A-27. Unless otherwise specified all steel castings shall be Grade 65-35, full annealed.

FRACTURE. Test specimens shall show a fracture having a silky or fine granular structure throughout.

STRUCTURAL DEFECTS. Steel castings shall be true to pattern in form and dimensions, without sharp, unfilleted angles or corners, and shall be free from pouring faults, sponginess, cracks, blow holes and other defects in positions affecting their strength and value for the service intended.

Blow holes appearing upon finished castings shall be so located that a straight line laid in any direction will not cut a total length of cavity greater than one inch in any one foot, nor shall any single blow hole exceed one inch in any dimension or have an area greater than one-half square inch. Blow holes shall not have a depth injuriously affecting the strength of the casting. Minor defects which do not impair the strength may, with the approval of the Inspector, be welded by an approved process. The defects shall be removed to solid metal by chipping, drilling or other satisfactory methods and, after welding, the castings shall be reannealed, if required by the Inspector. Castings which have been welded without the Inspector's permission will be rejected.

Large castings, if required by the Engineer, shall be suspended and hammered all over. No cracks, flaws or other defects shall appear after treatment.

M6E ELASTOMERIC BRIDGE BEARINGS

GENERAL. Elastomeric bearings shall be either integral bearings composed entirely of elastomeric material, Type I, or bearings composed of multiple layers of elastomeric material separated by steel sheets, Type II. Each Type I bearing shall be cast as a unit in a mold under pressure and heat. A bearing which has been cut from a larger piece of material or which is obtained by bonding smaller pieces of material together shall not be acceptable as a Type I bearing. A Type II bearing shall be cast as a unit in a mold under pressure and heat and the steel sheets separating the elastomeric layers shall be completely bonded to the elastomeric material on all surfaces. When required and indicated on the plans, any load bearing steel plate shall be factory bonded to the elastomeric bearing.

MATERIALS. All materials shall be new unused material with no reclaimed material incorporated in the finished bearing.

Elastomeric Material. The elastomeric compound used in the construction of these bearings shall contain only neoprene as the raw polymer. The physical properties of the cured elastomeric compound shall be determined by using samples taken and prepared from the actual bearings. The physical properties so determined shall comply with ASTM Designation D-2000 Line Call-Out 2BC, 525, A14, B14, C12, K21, with the following modifications:

C12 ASTM D1149

Ozone – 100 pphm in air by volume – 20% strain
temperature
100± 2°F – mounting procedure A ASTM D518
100 hours – – – –no cracks

K21 ASTM D429

Method B lb. per inc., min. – – – 40

Specimen rubber thickness shall not exceed 3/8"

Steel Sheets and Bonded Load Bearing Plates. The Bonded Load Bearing Plates shall conform to the requirements of the contract. All steel under this item shall meet the requirements for "Sampling, Testing and Inspection" as given under Part II, Section 6, M6 Structural Steel. Bonded Load Bearing Plates which will not be subjected to field welding shall be painted with three coats of paint. Load Bearing Plates which will be field welded shall be protected from rusting from the time of manufacture until after the plate can be field painted, after welding, by a coating of boiled linseed oil. All painting shall be done in accordance with the specifications for Painting of Metal Structures as listed in Section 8a except that sealing, sampling, and testing will not be required for the primer applied at the manufacturing site. The internal Steel Sheets shall be Rolled Mild Steel.

Performance Characteristics. Both Type I and Type II bearings shall conform to the following requirements:

1. Compression Strain of the Elastomeric Bridge Bearings shall not exceed 5% of the effective rubber thickness at a compressive stress of 500 psi nor 7% at a compressive stress of 800 psi. The bearing and ambient temperatures shall be 75± 10°F at the time of testing.

2. The bearing shall be conditioned at a temperature of -20± 1°F for 96 ± 1 hours. At the end of this conditioning period the bearing shall be subjected to a compressive stress of 500 psi and a shearing force applied so that the bearing exhibits a shear strain of 25%. The shear strain shall be based on the effective rubber thickness. The shearing force required to produce 25% shear strain when divided by the plan area of the bearing shall not exceed 50 psi. The shearing force shall be measured 15 minutes after 25% shear strain has been achieved. The total time lapse between removal of the bearing from the -20°f environment and the measurement of the shearing force shall not exceed 30 minutes. The bearing shall be insulated from any heat conducting surface of the testing apparatus by sheet asbestos, or any other suitable material having a thermal conductivity of less than 0.1 B. T. U./ (hr.)(sq.ft.)(°F.ft.). During the removal of the bearing from the -20°F environment and positioning for testing, the bearing shall be completely covered with a minimum 2" thick insulating blanket and during the test procedure, the exposed sides of the bearing shall be enclosed with this insulating blanket. This insulating blanket shall be any suitable material having a thermal conductivity of less than 0.04 B. T. U./(hr.)(sq.ft.)(°f/ft.).

3. Bearings, Type II only, which have a plan area exceeding 650 square inches shall be subjected to a compressive stress of 3000 psi. The deflection shall be recorded at compressive stresses of 500, 800, 1000, 1500, 2000, 2500, and 3000 psi. The bearing and ambient temperatures shall be 75± 10°F at the time of testing. While under stress, the bearing shall be visually checked for evidence of poor bonding of the internal steel sheets and the elastomeric compound. Lack of

bonding shall be indicated by the lack of surface constraint at the edges of the internal steel sheets. If this effect exceeds 5% of the total edge periphery of the steel sheets for the bearing or any single steel sheet, the bearing shall be rejected.

NOTE: All compressive stresses in 1, 2, and 3 above are based on the plan area.

Fabrication Details.

1. The elastomeric laminae dimension shall not vary to the extent that the shape factor changes more than ±0.5.

2. There shall be a minimum of 1/8 inch edge seal, integral with the bearing, over all internal plates.

3. There shall be a minimum of 1/4 inch elastomeric bedding surface on both top and bottom of the bearing. When a bonded load plate is required, there shall be a minimum of 1/4 inch elastomeric material between the bonded load plate and the internal steel sheet.

4. There shall be a continuous sealing rib along the edges of both top and bottom of the bearing. This rib shall be 3/16" wide x 1/8" deep with a tolerance on each dimension of -0, +1/16". A sealing rib shall not be required on the top surface where a bonded load plate is required.

5. The tolerances for the bearing shall be as shown below.

Bearing Dimensions (Inches)	Type of Dimension (Plus or Minus)	
	Fixed	Closure
0 - .499	.010	.015
.500 - .999	.010	.018
1.000 - 1.999	.015	.020
2.000 - 2.999	.020	.025
3.000 - 3.999	.025	.030
4.000 - 4.999	.030	.035
5.000 - 7.999	.035	.050

NOTES: 1. For bearing dimensions 8.000 inches and over, multiply by .0050.

2. Fixed dimension tolerances apply individually to each fixed dimension by its own size.

3. Closure dimension tolerances are determined by the largest closure and this single tolerance is used for all other closure dimensions.

4. These fabrication details are abstracted from the RMA Quality Standards Handbook (Second Edition) of the Rubber Manufacturers Association, 444 Madison Avenue, New York, New York.

The finish of the mold used to produce these bearings shall conform to good machine shop practice. The mold flash shall be removed by tear or hand trimming. Every Type II bearing with a load bearing steel plate bonded to it shall have stamped in the steel on a side visible after erection, the project number and individual bearing number. Type I bearings and Type II bearings without a load plate shall have the same information applied to a visible side in a manner approved by the Chief Engineer.

Sampling Procedure.

GENERAL. Bearings with a plan area of less than 650 square inches shall be tested for performance characteristics by a laboratory designated by the Department. Such designated laboratory may be the New York State Bureau of Engineering Materials in Albany, New York. The Contractor, in determining the cost in connection with the required testing, shall assume that the testing will be done in Albany, New York. Should the designated laboratory be other than the New York State Bureau of Engineering Materials and to which transportation charges are greater than to Albany, the Contractor will be reimbursed by the County for the difference in cost.

Bearings which have a plan area greater than 650 square inches shall be tested for performance characteristics by a laboratory approved by the Chief Engineer. The Contractor shall assume the responsibility and any cost of transportation and testing. Two copies of all test results and the original data shall be forwarded to the Chief Engineer.

The Contractor shall provide the Chief Engineer with written notification 30 days prior to the start of bearing production. This notification shall include the contract number, quantity and size bearings being produced, the manufacturer, manufacturer's location, the name of the manufacturer's representative who will coordinate with the Department and the name and location of testing laboratory approved by the Chief Engineer when the contract includes bearings which have a plan area greater than 650 square inches. The Department's representative will choose, at random, the required number of bearings at the manufacturing site to fulfill the requirements of the following sampling schedule. Bearings shall be available for testing a minimum of 30 days prior to need for placement in the contract.

The Department may elect to choose and sample bearings from the project site instead of the manufacturing site. The Contractor shall be notified of this intent in writing prior to the completion of bearing production.

Sampling. Bearings with less than 650 square inches plan area:

TEST	SAMPLE REQUIRED	DISPOSITION
Compression Strain	1 per every 5 required for project per size, min. of 2 bearings	Returned to Contractor
Cold Temperature Shear	1 set per every 50 required for project per size, min. of 1 set (1 set equals 2 bearings)•	Returned to Contractor
Physical Properties of Elastomeric Material	1 per project per size	Returned to Contractor

•Bearing samples used for compression strain testing shall be utilized for cold temperature shear testing.

Bearings with a plan area greater than 650 square inches:

TEST	SAMPLE REQUIRED	DISPOSITION
Compression Strain	100% of project quantity	Return to Contractor
Cold Temperature	2 sets of bearings per size, min. (1 set equals 2 bearings)•	Return to Contractor
Compression Strain (3000 psi), Type II	100% of project quantity	Return to Contractor
Physical Properties of Elastomeric Material	1 per project per size	Return to Contractor••

• Bearing samples used for compression strain testing shall be utilized for cold temperature shear testing.

•• At the time of testing, a 12" x 6" x 1/4" slab of elastomeric compound shall be removed from the lower load bearing surface of bearing and forwarded to the Department for testing. Bearings in this category shall be repaired by a method approved by the Chief Engineer.

Shop Drawings. The Contractor shall submit detailed shop drawings, in conformity with contract requirements for Item 29, for approval prior to any fabrication.

M6F GALVANIZED FENCE FABRIC

Fence Fabric shall conform to the Specifications for Zinc-Coated Steel Chain-Link Fence Fabric A.S.T.M. Designation A392 except as herein modified.

For 2" Mesh galvanizing shall be done by the hot-dip process and only after weaving. Zinc Coating shall be Class II, 2.0 oz. of zinc per sq. ft. min. of uncoated wire surface. The fabric shall be woven in the "Chain Link" pattern in a 2 inch mesh of No. 9 gauge wire.

For 1" Mesh galvanizing shall be done by the electroylic method before weaving. Zinc Coating shall be Class II, 2.0 oz. of zinc per sq. ft. min of uncoated wire surface. The fabric shall be woven in the "Chain Link" pattern in a 1 inch mesh of No. 9 gauge wire.

The wire constituting the fabric, for both mesh sizes, shall meet a minimum tensile load of 1285 pounds.

The 1285 pound limit is formulated on minimum diameter 9 gauge wire with an 80,000 psi tensile strength.

Samples shall be taken as directed by the Department.

M6G RIGHT-OF-WAY FENCING

Right-of-way fencing shall conform to the requirements of specifications for Zinc-coated (Galvanized) Iron or Steel Farm-Field and Railroad Right-of-way Wire Fencing, A.S.T.M. Designation A 116. The design of fencing shall be design 8047-6-9. No. 9 gauge wire with class 3 coating shall be used throughout.

Samples shall be taken as directed by the Department.

M7A ALUMINUM CASTINGS

Aluminum castings shall conform to the requirements of ASTM specifications as shown in the following table, and as modified herein and by the plans and specifications.

	ASTM		
Al. Assoc. Alloy & Temper	Alloy & Temper	Spec.	Product
43-F	S5A-F	B108	Permanent Mold Castings
43-F	S5A-F	B26	Sand Castings
A356 (modified)•	SG70B (modified)•	B108	Permanent Mold Castings
356-T6	SG70A-T6	B26	Sand Castings
356-F	SG70A-F	B26	Sand Castings
360	SG100-B	B85	Die Castings

• Where this material is required, castings shall be solution treated and aged to produce the following mechanical properties:

Ultimate Strength	25,000 psi. min.	
Yield Strength	18,000 psi. min.	(a)
Elongation	6 per cent min.	(b)

(a) Yield strength shall be at 0.2 per cent offset and need not be determined unless ordered by the Chief Engineer.

(b) Gauge length for measurement of elongation shall be four times the diameter of the specimen.

WORKMANSHIP. The castings shall be of uniform quality and condition, free from cracks, blowholes, porous places, hard spots, or shrinkage defects which affect the suitability of the castings for their intended use. Before inspection the castings shall be smooth and clean.

HEAT TREATMENT. Castings shall be heat treated in such a manner as to produce material which will conform to the properties specified herein with the approved uniformity.

SAMPLING, TESTING AND INSPECTION. Unless otherwise required by the plans or specifications, inspection at the foundry will not be provided by the Department. When foundry inspection is not provided, three certified copies of the records of the chemical analysis and physical tests, performed in accordance with the Specifications, shall be furnished to the Department as follows:

When shop inspection is provided, the contractor shall furnish the inspector with the certified test data. When no shop inspection is provided 2 copies of the certified test data shall be submitted to the Engineer and one copy shall be furnished to the Laboratory.

Samples of any aluminum castings may be taken by the Engineer subsequent to the delivery of the material to the site of the work in quantities to be determined by the Department.

BRIDGE RAILING. Castings to be used as bridge railing components will be inspected at the place of fabrication by an authorized representative of the Department.

Castings to be used as bridge railing posts shall be produced under radiographic control. This shall consist of radiographic examination of castings until proper foundry technique, which will produce castings consistently free from harmful internal defects, is established for each mold. Production castings shall be examined as necessary to insure maintenance of satisfactory quality.

Tension test specimens shall be machined from integrally cast test coupons extending sufficiently from one side of the base of the posts to obtain a 0.350 inch diameter test specimen as defined in "Methods of Tension Testing of Metallic Materials" ASTM Designation E8, with the exception that the radii at the ends of the reduced section shall not be less than 1/2 inch.

The method of test and determination of tensile properties shall be in accordance with ASTM Method E8.

A minimum of one per cent of the posts in any lot, but not less than one, shall be sampled for tensile testing. For the purpose of sampling, a lot shall consist of not more than 1,000 lbs. of clean castings when produced from a batch-type furnace charged with one heat of ingot of known analysis or not more than 2,000 lbs. of clean castings when produced from one continuous furnace in not more than 8 consecutive hours.

If the results of any tensile test do not conform to the requirements prescribed, two additional tests shall be taken from the same group of castings, and the average of the three tests must meet the requirements.

M7B WROUGHT ALUMINUM

Wrought aluminun shall conform to the requirements of ASTM specifications as shown in the table and as modified herein and by the plans and specifications.

Each piece shall be marked with the manufacturer's name or trade mark and with alloy and temper designations in the manner described in the pertinent ASTM specifications.

When a clad material is specified, it shall be clad both sides unless specified otherwise.

SAMPLING, TESTING, AND INSPECTION. Unless otherwise required by the plans or specifications, inspection at the place of manufacture will not be provided by the Department. When inspection is not provided during the manufacture of wrought products, three certified copies of the records of the chemical analysis and physical tests, performed in accordance with the specifications, shall be furnished to the Department as follows:

When shop inspection is provided, the Contractor shall furnish the inspector with the certified test data. When no shop inspection is provided 2 copies of the certified test data shall be submitted to the Engineer and one copy shall be furnished to the Laboratory.

Alloy & Temper	ASTM Spec.	Product
1100-O	B209	Sheet and Plate
1100-H18	B211	Wire
2024-T4	B209	Sheet and Plate
2024-T4	B211	Bars and Rods
3003-H14	B209	Sheet and Plate
4043	B285	Welding Rods & Bare Electrodes
5052-H38	B211	Wire
5154	B285	Welding Rods & Bare Electrodes
6061-T6	B209	Sheet and Plate
6061-T94•	B211	Wire
6062-T6	B211	Bars and Rods
"	B308	Structurals, Rolled or Extruded
"	B221	Extruded Bars, Rods & Shapes
"	B210	Drawn Seamless Tube
"	B235	Extruded Tube
"	B241	Pipe
6063-T832	B210	Drawn Seamless Tube
6063-T5	B221	Extruded Bars, Rods & Shapes
6063-T6	B241	Pipe
6063-T6	B209	Sheet and Plate
6063-T6	B221	Extruded Bars, Rods & Shapes
7075-T6	B209	Sheet and Plate
Alclad 2024-T3	B209	Sheet and Plate
Alclad 2024-T42	B209	Sheet and Plate
Alclad 6061-T6	B209	Sheet and Plate

• When this temper is required by the plans or specifications, it shall be defined as that temper which will produce mechanical properties in the wire after weaving as follows:

Min. ultimate tensile strength: 54,000 psi.
Min. tensile yield strength: 47,000 psi.

Samples of any wrought aluminun products may be taken by the Engineer subsequent to delivery of the material to the site of the work in quantities to be determined by the Department.

BRIDGE RAILING. Wrought aluminun to be used as components of bridge railing will be subject to shop inspection by an authorized representative of the Department.

M8 IRON CASTINGS

GENERAL. Iron castings shall conform to the requirements of A.S.T.M. Designation A-48 Class No. 30 unless otherwise specified.

STRUCTURAL DEFECTS. Iron castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes and other defects in positions affecting their strength and value for the service intended.

Castings shall be boldly filleted at angles and the arrises shall be sharp and perfect.

Castings having blow holes plugged or filled with putty or cement of any kind will be rejected.

M9 STEEL FORGINGS

Steel forgings shall conform to the requirements of A.S.T.M. Designation A235, Class C 1. All forgings shall be annealed prior to being machined.

M10 WROUGHT IRON BARS

Wrought Iron Bars shall conform to the requirements of A.S.T.M. Designation A-207.

M11 WROUGHT IRON PLATES

Wrought Iron Plates shall conform to the requirements of A.S.T.M. Designation A-42.

M12 WROUGHT IRON PIPE

Wrought Iron Pipe shall conform to the requirements of A.S.T.M. Designation A72. All Wrought Iron Pipe shall be marked in raised letters with trade name or manufacturer's name.

M13 MALLEABLE IRON CASTINGS

GENERAL. Malleable Iron Castings shall conform to the requirements of A.S.T.M. Designation A47. The Grade shall be Grade 32510 unless Grade 35018 is required by the plans or specifications.

STRUCTURAL DEFECTS. Castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes and other defects in positions affecting their strength and value for the service intended.

The casting shall be boldly filleted at angles and the arrises shall be sharp and perfect. The surfaces shall have a workmanlike finish.

GALVANIZING. When galvanizing is required, it shall be in accordance with M19-Type II. Particular care shall be exercised so as not to embrittle malleable castings when galvanizing. All galvanized castings shall meet specification requirements after galvanizing.

M14 PIPE AND RECTANGULAR TUBING FOR RAILINGS

All pipe shall be welded or seamless pipe meeting the requirements of one of the following: (a) A.S.T.M. Designation A53 with a copper content of not less than 0.2% and a phosphorous content of not more than 0.1%. (b) A.S.T.M. Designation A72. (c) Copper molybdenum iron or pure iron meeting the base metal specifications of the A.A.S.H.O. M36, and in addition, meeting the physical properties and tests given in the A.S.T.M. specifications Designation A72. The hydrostatic tests called for in the above specifications will not be required.

All rectangular tubing shall be shaped and welded to conform to the details shown on the plans and the material shall meet the requirements of the A.S.T.M. specifications A242, except that the minimum tensile strength may be 65,000 lbs. per sq. in. and the minimum yield point may be 45,000 lbs. per sq. in.

All fittings shall be malleable iron castings.

M14R GALVANIZED BEAM GUIDE RAIL

SCOPE. This specification covers requirements for beams, posts, and sections and accessory hardware for galvanized beam guide rail.

BEAMS AND TERMINAL SECTIONS. Fabrication. Beams and terminal sections shall be fabricated as shown on the plans. When beams and terminal sections are galvanized by the hot-dip method in accordance with M19 Type I, they shall be blanked to the proper shape, fabricated and ready for assembly before galvanizing. No punching, drilling, cutting or welding will be permitted after galvanizing. Bolt holes in the beam at the post bolt and elsewhere as necessary shall be enlarged or slotted to permit expansion and contraction and to facilitate erection. The beams shall be straight unless otherwise required by the plans or specifications and of uniform section. The edges shall be rolled to eliminate sharp edges.

MATERIALS. Beams and terminal sections shall be made from 12 gage or heavier sheet. Beams, terminal sections, SL and SH posts shall be rolled from new billet open hearth, electric furnace or basic oxygen steel. All connections or splices shall be made with flat, round-headed galvanized bolts and galvanized nuts conforming to ASTM Designation A307 and as shown on the plans.

STRENGTH. The minimum yield point and elongation of steel used in the manufacture of beam and terminal sections shall be 50,000 psi and 12% in 2" gage length respectively.

GALVANIZING. Beams and terminal sections shall be galvanized in accordance with M19, Type I. Bolts, nuts and washers shall be galvanized in accordance with M19, Type II.

As an alternative to M19, Type I (ASTM-123) galvanizing, beam guide rail and terminal sections may be galvanized by a process or system of continuous galvanizing substantially in conformance with ASTM:A525 except the minimum check limits for the weight of coating as determined by the triple spot and single spot tests shall be 4.0 and 3.0 ounces per square foot respectively (total amount both sides of sheet).

All the requirements for beams and terminal sections as stated herein (M14R) shall apply to this continuous galvanizing method except sampling, shop inspection and test procedures shall be as directed by the Laboratory.

POSTS. The posts shall be as detailed on the Standard Structure Sheet for guide railing and mall barrier.

SL Posts shall conform to ASTM A 245, Grade C., galvanized in accordance with M19, Type I.

SH Posts shall conform to ASTM A36 galvanized in accordance with M19, Type I.

WF and I Beam Posts shall conform to ASTM A36 galvanized in accordance with M19, Type I.

R.R. Rail posts shall be at least 60 pound new Railroad T-rails or re-rolled rails. Relayer rail posts shall weigh not less than 118 pounds per post after cleaning.

R.R. Rail posts shall be cleaned free from dirt, oil, grease, corrosion, etc., by means of sand blasting or other approved methods after fabrication and shall be painted prior to shipment to the site of the work with one coat of zinc chromate primer in accordance with M18K and one coat of stain resistant white paint in accordance with M18E. After placement of posts and prior to attachment of railing, the exposed portion shall be painted one more coat of stain-resistant white paint in accordance with M18E.

R.R. Rail posts shall be straight and free from physical defects, such as broken lower flanges, excessive corrosion, curved ends, flat spots in portions exposed above the ground, head flow, indentures, such as spike notches, pipes, pits, split ends, split heads and twists. They shall present a smooth, even surface free from pitting and pitholes, and the top shall be sawed and shall present a smooth workmanlike surface. All holes shall be drilled or punched.

Wood posts shall conform to the requirements of M27 Stress Graded Timber and Lumber. Sound red cedar posts may be acceptable if their Modulus of Rupture by static bending test is 4000 psi. or more. They shall be surfaced four sides and shall be of the dimensions shown on the plans before surfacing. Surface dried redwood, red cedar, cypress or black locust may be used untreated. Other lumber including douglas fir, pine, oak, birch, maple and beech, may be used but shall be pressure treated in accordance with M28B, Wood Preservatives-Water Borne. Bituminous preservative treatments will not be permitted. Before using, the contractor shall submit to the Chief Engineer for approval information as to the species of timber to be used and method of preservative treatment to be employed. No posts shall be installed without the prior approval of the Chief Engineer.

HARDWARE. All post connection bolts shall be in conformance with ASTM A 307 and details shown on the plans and shall be galvanized in accordance with M19, Type II.

CERTIFICATION. When shop inspection is not provided, each shipment of guide rail to a project site shall be accompanied by a certificate of chemical analysis and physical tests for the heat of base metal used in fabricating beams, SL & SH posts and terminal sections as well as a certificate of compliance with the galvanizing requirements of this specification.

M14S CABLE GUIDE RAIL

SCOPE. This specification covers requirements for cable, posts and accessory hardware for cable guide rail.

CABLES. Fabrication. The rope shall be composed of three strands, each strand having seven wires. The diameter of the finished rope shall be 3/4 inches nominal. The diameter of the finished wires entering into the rope shall be not less than 0.116 inch.

The lay of the finished rope shall be not more than 7 1/2 inches and the lay of the wires in the strand shall be not more than 4 1/2 inches.

MATERIALS. The wire composing the rope shall be of such quality that the finished rope shall satisfy all the requirements herein set forth. All the wires in the rope shall be of the same grade of steel and shall have approximately the same breaking strain.

STRENGTH. The minimum tensile strength of the rope shall be 25,000 pounds.

GALVANIZING. Each wire from the rope shall have a continuous coating of zinc of a uniform thickness, so applied that it will adhere firmly to the surface of the wire. It shall be capable of withstanding four immersions in a standard testing solution of copper sulphate as specified in Section 3 of AASHO T-66, without showing any trace of metallic copper on the steel. The first three immersions shall be for a period of one minute each and the fourth immersion for a period of 1/2 minute.

MARKING AND SHIPPING. All wire rope must be shipped upon substantial wooden reels. Each reel shall have the length and weight of the rope plainly and indelibly marked on a strong tag, firmly attached. The wooden reel shall be mounted so that it will revolve, and the rope run off by pulling straight ahead.

FITTINGS. Fabrication and Material. All fittings and fastenings, exclusive of offset springs, shall be forged or malleable castings except as otherwise noted on the plans. Threads may be either cut or rolled.

Offset springs shall be 3/16" spring steel, tempered, drawn and formed before galvanizing. They shall be formed to the dimensions and meet the test requirements shown on the plans.

STRENGTH. The tensile strength of the various fittings and fasteners shall be as noted on the plans.

GALVANIZING. Forged or cast fittings shall be galvanized in accordance with M19, Type II. Offset springs shall be galvanized in accordance with M19, Type I.

POSTS. General. The specifications for M14R with regard to Posts shall apply.

M15 ROLLED PHOSPHOR BRONZE

Rolled phosphor bronze shall conform to the requirements of the Standard Specifications for Rolled Copper-Alloy Bearing and Expansion Plates and Sheets for Bridge and other Structural Uses, A.S.T.M. Designation B100, Alloy No. 1.

M16 LEAD PLATES

Lead plates shall be of any grade covered by and in accordance with the Standard Specifications for Pig Lead, A.S.T.M. Designation B29.

M16A COPPER FLASHING

Sheet copper for flashing shall be rolled from copper fulfilling the requirements of A.S.T.M. Specification B5. This sheet metal shall be cold rolled soft copper.

M17 BAR REINFORCEMENT FOR CEMENT CONCRETE

Bar Reinforcement for cement concrete shall consist of deformed bars which conform to the requirements of ASTM A15 intermediate grade except as modified herein.

Bars shall be rolled from billets directly reduced from ingots of properly identified heats of open hearth or electric furnace steel.

Stirrups may be structural grade. Samples shall be taken as directed by the Department and tested by the Laboratory.

Bar reinforcement shall be protected from moisture by being stored in warehouses or other acceptable places prior to use.

The average weight of each size bar, as determined by the Laboratory, from test samples of each lot of bars shall not be more than 3 1/2% under the standard weights of bars as indicated in the following table of standard weights.

The definition of a "lot" shall be as directed by the Laboratory.

Table of Standard Weights

Number or Size Specified	Standard Weight lbs. per foot	Number of Size Specified	Standard Weight lbs. per foot
2 or 1/4" round	0.167	7 or 7/8" round	2.044
3 or 3/8" round	0.376	8 or 1" round	2.670
4 or 1/2" round	0.668	9 equiv. to former 1" square	3.400
5 or 5/8" round	1.043	10 equiv. to former 1 1/8" square	4.303
6 or 3/4" round	1.502	11 equiv. to former 1 1/4" square	5.313

Spiral reinforcement for columns shall conform to the requirements of ASTM Designation A82.

M17A BAR REINFORCEMENT FOR CEMENT CONCRETE PAVEMENT

Bar reinforcement for cement concrete pavement shall conform to the requirements of M17, Bar Reinforcement For Cement Concrete, except that all members may be plain, undeformed section providing they are welded at all intersections in a manner approved by the Department and that bars conforming to ASTM Designation A-432 shall be required where shown on the plans or the appropriate Standard Structure Sheet.

M17AB WIRE FABRIC CONCRETE REINFORCEMENT

Wire fabric concrete reinforcement shall conform to the requirements of ASTM Designation A185 except as shown on the plans or in the proposal or as modified herein. Wire fabric for concrete pipe shall contain no more than two different gages of circumferential wire and any welds in fabric containing two different gages of circumferential wire shall have an average shear value in pounds of not less than 35,000 multipled by the area of the circumferential wire in square inches. The weld shear test will not be required as a prerequisite for initial acceptance of wire fabric for concrete pipe which consists of only one gage of circumferential wire; however, any evidence of weld failure exhibited when the mesh is placed through the forming rolls at the concrete pipe plant shall constitute grounds for immediate rejection of the fabric. Samples shall be taken as directed by the Department.

The diameter of the wire, at any section, shall be the specified nominal diameter with a tolerance of 0.003" under and a tolerance over as shown in the following table.

A.S.&W. Steel Wire Gauge No. From	To*	Tolerance (Inches)
6/0	7/0	.034
5/0	6/0	.038
4/0	5/0	.042
3/0	4/0	.038
2/0	3/0	.037
0	2/0	.031
1	0	.029
2	1	.027
3	2	.024
4	3	.025
5	4	.024
6	5	.021
7	6	.021
8	7	.021
9	8	.020

A.S.&W. Steel Wire Gauge No. From	To*	Tolerance (Inches)
10	9	.019
11	10	.021
12	11	.020
13	12	.020
14	13	.018

* Not inclusive

M17B SPIRAL BAR SHEAR CONNECTORS

Spiral Bar Shear Connectors shall be formed from plain round bars of carbon steel conforming to the Specification for Hot Rolled Carbon Steel Bars A.S.T.M. Designation A107 Grade Designation 1020, Merchant Quality.

M17C STUD SHEAR CONNECTORS

Steel used in the manufacture of stud shear connectors shall conform to Specification for Cold-Finished Carbon Steel Bars and Shafting, A.S.T.M. Designation A108, Grade Designation 1015 or 1020.

M18A PAINTS AND PAINTING MATERIALS

This specification covers the materials, delivery and general specifications common to all paints listed in material specifications M18B through M18K.

Violation of any of these requirements shall be cause for rejection.

GENERAL. All paint furnished must be shipped in strong, substantial containers, sealed in a manner approved by the Chief Engineer plainly marked with the name, weight and volume of paint content, together with the color, formula, date of manufacture, and name and address of manufacture. The containers shall be equipped with a lever type ring seal, to keep the top of the container securely closed.

Tamper-proof tags for installation on the ring seal shall be affixed by representatives of the Department in accordance with directives of the Laboratory. Any unauthorized tampering or breaking of the tags on the container seals between the time of sealing and the time of application of the paint will be cause for rejection of the paint.

Unless otherwise provided, the materials entering into composition of the paint shall conform to the requirements of A.S.T.M. or Federal Specifications as applicable and covering such materials.

REQUIREMENTS. The paints, consisting of ingredients meeting all specified requirements, shall be well ground, shall not settle badly or cake in the container and shall be readily broken up with a paddle into a smooth uniform product of good brushing consistency. The paint shall be applied as specified, shall hide the under-surface completely, and dry within the specified time without running, streaking, sagging, wrinkling, or exhibiting other film defects. The primer and under coat shall dry with a dull gloss, the finish coat with a full gloss. The color shall match the established standard. The hiding power shall be sufficient to obtain complete hiding when applied at normal spreading rates. Normal spreading rates for paints M18B through M18K shall be in the range of 400 to 500 square feet per gallon so as to provide wet film thickness of 3.2 to 4.0 mils.

PAINT RAW MATERIALS—REQUIREMENTS

Following are the composition requirements and properties of those raw material constituents used in the paints not otherwise covered by A.S.T.M. or Federal Specifications. Test methods specifed by A.S.T.M. or Federal Government for identifying raw materials and paints are applicable except where noted.

1. Basic Lead Silico Chromate—A.S.T.M. D1648

2. Siliceous Red Iron Oxide (85% Fe_2O_3)

The pigment shall be a natural siliceous red iron oxide which when used with other constituents of paint M18B will impart a color to match the established reference standard.

Properties	Min.	Max.
Total iron oxide, (Fe_2O_3)	70.00%	97.00%
Coarse particles (total residue retained on 325 sieve)		1.00%
CaO		0.50%
Moisture and other volatile matter		2.00%
Water soluble matter		1.50%
Oil Absorption	16	
Siliceous matter	Balance	
Organic colors		nil

3. Basic Silicate White Lead 48% (PbOType)

Properties	Min.	Max.
Lead Monoxide (PbO)	46.80%	49.00%
Silicon Dioxide (SiO_2)	46.80%	48.60%
Sulfur Trioxide (SO_3)	4.00%	4.40%
Moisture (loss at 105C)	—	0.20%
Coarse Particles	—	0.10%
Oil Absorption	14.0	18.0
Specific Gravity	3.9	4.10

4. Zirconium Drier Catalyst

The Zirconium drier catalyst shall be a clear solution of a Zirconium organic complex containing 6% Zirconium metal. It shall be soluble in and compatible with the vehicles of which it is a component part.

Properties	Min.	Max.
Zirconium	5.9%	6.1%
Color (Gardner)		4
Viscosity (Gardner-Holdt)	Less than A	
Specific Gravity 68F	0.855	0.875

The percentages noted relate to mixture by weight.

M18B MAROON PRIMER

PIGMENT. The pigment shall be composed of:

	Min.	Max.
Basic Lead Silico Chromate ASTM D1648	64.0%	
Siliceous Red Iron Oxide (85% Fe_2O_3)		35.5%
Organo Montmorillonite	0.5%	0.7%

LIQUID. The liquid shall consist of not less than 72% nonvolatile vehicle, the balance to be combined drier and thinner. The non-volatile vehicle shall be composed of raw linseed oil and alkyd resin combined in the approximate proportions of 2:1 respectively by weight and shall contain a minimum of 7.6% phthalic anhydride. The alkyd resin, furnished as a solution, shall meet the requirements of Federal Specification TT-R-266a, Type I, Class A or B. The drier catalyst shall be 0.14% Zirconium and 0.04% Manganese metals based on the non-volatile vehicle by weight introduced therein as soluble Organic metal salts. Small quantities of grinding and wetting aids may be used if desired.

The paint shall consist of:

	Min.	Max.
Pigment	62.0%	
Vehicle		38.0%
Weight/Gallon, Lbs.	14.8	
Water		0.5%
Coarse Particles & Skins (total residue retained on 325 sieve based on paint)		1.0%
Fineness of grind (North Standard)	4	
Viscosity (Stormer—Krebs Units)	74	84

The paint shall dry in not more than eighteen hours.

Note: For the greatest effectiveness the Organo Montmorillonite should be pre-wetted with 20-30% Methyl alcohol (95% methanol by weight).

The percentages noted relate to mixture by weight.

M18CA DULL ORANGE PRIMER

PIGMENT. The pigment shall be composed of:

	Min.	Max.
Basic Lead Silico Chromate	94.0%	
Pure Red Iron Oxide—Federal Specification TT-P-375, Type I		5.3%
Organo Montmorillonite	0.5%	0.7%

LIQUID. The liquid shall consist of not less than 69% non-volatile vehicle by weight, the balance to be combined drier and thinner. The non-volatile vehicle shall be composed of raw linseed oil and alkyd resin combined in the approximate proportions of 2 1/4:1, respectively by weight, and shall contain a minimum of 7% phthalic anhydride. The alkyd resin, furnished as a solution, shall meet the requirements of Federal Specification TT-R-266a, Type 1, Class A or B. The drier catalyst shall be 0.02% Cobalt, 0.06% Zirconium and 0.05% Calcium metals based on the non-volatile vehicle by weight introduced therein as soluble organic metal salts. Small quantities of grinding and wetting aids may be used if desired.

PAINT. The paint shall consist of:

	Min.	Max.
Pigment	64.0%	
Vehicle		36.0%
Weight/Gallon, Lbs.	15.0	
Water		0.5%
Coarse Particles and Skins (total residue retained on 325 sieve based on paint)		1.0%
Fineness of Grind (North Standard)	4	
Viscosity (Stormer—Krebs Units)	74	85
Color - Federal Standard No. 595	22203	32169

The paint shall dry to light handling in not more than eighteen hours under environmental conditions considered satisfactory for application of paint.

Note: For the greatest effectiveness, the Organo Montmorillonite should be pre-wetted with

30-35% wet methyl alcohol (95% Methanol-5% water) by weight.

Paint prepared to meet the requirements of this specification will hide the steel surface well when applied at or above the prescribed minimum wet film thickness (3.2 mils). Inadequate hiding is a guide that the paint has been spread too thinly; not that the paint possesses low hiding power.

The percentages noted relate to mixture by weight.

M18D BLACK PAINT

PIGMENT. The pigment shall be composed of:

	Min.	Max.
Basic Lead Silico Chromate	37.0%	
Synthetic Black Iron Oxide ASTM D769		57.0%
Lampblack ASTM D209		3.0%
Phthalocyanine Blue		3.0%

LIQUID. The liquid shall consist of not less than 82% non-volatile vehicle, the balance to be combined drier and thinner. The non-volatile vehicle shall be composed of raw linseed oil and alkyd resin combined in the approximate proportions of 2:1 respectively by weight and shall contain a minimum of 7.4% phthalic anhydride. The alkyd resin, furnished as a solution, shall meet the requirements of Federal Specification TT-R-266a, Type I, Class A or B. The drier catalyst shall be 0.15% Zirconium and 0.01% Manganese and 0.02% Cobalt metals based on the non-volatile vehicle by weight introduced therein as soluble Organic metal salts. Small quantities of grinding and wetting aids may be used if desired.

The paint shall consist of:

	Min.	Max.
Pigment	37.5%	
Vehicle		62.5%
Weight/Gallon, Lbs.	11.0	
Water		0.5%
Coarse Particles & Skins (total residue retained on 325 sieve based on paint)		1.0%
Fineness of grind (North Standard)	4	
Viscosity (Stormer—Krebs Units)	66	78

The paint shall dry in not more than eighteen hours. The percentages noted relate to mixture by weight.

M18E STAIN RESISTANT WHITE PAINT

PIGMENT. The pigment shall be composed of:

	Min.	Max.
Basic Silicate White Lead (48% PbO Type)	24.0%	
Basic Carbonate White Lead ASTM D81	18.0%	
Free chalking Anatase Titanium Dioxide ASTM D476	20.0%	
Chalk Resisting Rutile Titanium Dioxide ASTM D476	7.0%	
Magnesium Silicate ASTM D605		31.0%

LIQUID. The liquid shall consist of not less than 71% non-volatile vehicle, the balance to be combined drier, mold preservative and thinner. The non-volatile vehicle shall be composed of raw linseed oil and alkyd resin combined in the approximate proportions of 1:1 by weight and shall contain a minimum of 11.0% phthalic anhydride. The alkyd resin, furnished as a solution, shall meet the requirements of Federal Specification TT-R-266a, Type I, Class A or B. The drier catalyst shall be 0.10% Zirconium and 0.02% Manganese metals based on the non-volatile vehicle by weight introduced therein as soluble Organic metal salts. Sufficient preservative must be incorporated in the paint to prevent mold growth on weathered films.

The paint shall consist of:

	Min.	Max.
Pigment	56.0%	
Vehicle		44.0%
Weight/Gallon, Lbs.	13.3	
Water		0.5%
Coarse Particles & Skins (total residue retained on 325 sieve based on paint)		1.0%
Fineness of Grind (North Standard	3	
Viscosity (Stormer—Krebs Units)	80	90

The paint shall dry in not more than eighteen hours.

• Any of the following preservatives may be selected and must be used in an amount not less than that indicated.

0.75% Mercury on the non-volatile vehicle added as Phenyl Mercuric Borate
0.75% Mercury on the non-volatile vehicle added as Phenyl Mercuric Oleate
0.75% Mercury on the non-volatile vehicle added as Super Ad-it (diphenyl mercuric dodecenyl succinate)
6% Butrol on the non-volatile vehicle (containing potassium orthophenyl phenate and phenyl mercuric acetate)

The percentages noted relate to mixture by weight.

M18G GRAY PAINT

PIGMENT. The pigment shall be composed of:

	Min.	Max.
Basic Lead Silico Chromate	65.6%	
Chalk Resisting Rutile Titanium Dioxide ASTM D476		16.6%
Acicular Zinc Oxide ASTM D79		5.8%
Fibrous Magnesium Silicate and tinting colors (Lampblack and Phthalocyanine Blue) No Iron Blue allowed		11.5%
Organo Montmorillonite	0.5%	

LIQUID. The liquid shall consist of not less than 69% nonvolatile vehicle, the balance to be combined drier and thinner. The non-volatile vehicle shall be composed of raw linseed oil and alkyd resin combined in the approximate proportions of 2:1 respectively by weight and shall contain a minimum of 7.5% phthalic anhydride. The alkyd resin, furnished as a solution, shall meet the requirements of Federal Specification TT-R-266a, Type I, Class A or B. The drier catalyst shall be 0.10% Zirconium and 0.02% Manganese metals based on the non-volatile vehicle by weight introduced therein as soluble Organic metal salts. Small quantities of grinding and wetting aids may be used if desired.

The paint shall consist of:

	Min.	Max.
Pigment	56.5%	
Vehicle		43.5%
Weight/Gallon, Lbs.	13.5	
Water		0.5%
Coarse Particles & Skins (total residue retained on 325 sieve based on paint)		1.0%
Fineness of Grind (North Standard)	4	
Viscosity (Stormer—Krebs Units)	72	82

The paint shall dry in not more than eighteen hours.

Note: For the greatest effectiveness, the Organo Montmorillonite should be pre-wetted with 20-30% Methyl alcohol (95% methanol by weight).

The percentages noted relate to mixture by weight.

M18HS SAGE-GREEN PAINT

PIGMENT. The pigment shall be composed of:

	Min.	Max.
Basic Lead Silico Chromate	35.0%	
Chalk Resisting Rutile Titanium Dioxide ASTM D476	15.0%	
Chromium Oxide Green - ASTM D263	24.0%	
Magnesium Silicate - ASTM D605		15.2%
Tinting Colors (Chrome Yellow, Phthalocyanine Blue and Lampblack) (No Chrome Green Allowed)		10.0%
Organo Montmorillonite	0.8%	1.2%

LIQUID. The liquid shall consist of not less than 58.0% non-volatile vehicle, the balance to be combined drier and thinner. The non-volatile vehicle shall be composed of raw linseed oil and alkyd resin combined in the approximate proportions of 1:2 respectively by weight and

shall contain a minimum of 15.5% phthalic anhydride. The alkyd resin, furnished as a solution shall meet the requirements of Federal Specification TT-R-266a, Type I, Class A or B. The drier catalyst shall be 0.15% Zirconium and 0.05% Manganese metals based on the non-volatile vehicle by weight introduced therein as soluble organic metal salts. Small quantities of grinding and wetting aids may be used if desired.

PAINT. The paint shall consist of:

	Min.	Max.
Pigment	43.5%	
Vehicle		56.5%
Weight/Gallon, Lbs.	11.4	
Water		0.5%
Coarse Particles and Skins (total residue retained on 325 sieve based on paint)		1.0%
Fineness of Grind (North Standard)	4	
Viscosity (Stormer—Krebs Units)	70	80

The paint shall dry firm in not more than eighteen hours.

Note: For the greatest effectiveness, the Organo Montmorillonite should be pre-wetted with 30.35% wet methyl alcohol (95% Methanol-5% water) by weight. The percentages noted relate to mixture by weight.

COLOR. The paint shall be such that when a wet film of 3 to 5 mils thick is produced on a color matching panel, Form 010P manufactured by the Morest Co., or equivalent, and allowed to dry the resultant color shall match Munsell Color 7.5 GY 5/4, ASTM D1535. The color standard which shall be used by the Department is Munsell Book Notation 7.5 GY 5/4, Munsell Production No. 10146, and has the following tristimulus values and trilinear coordinates with CIE Illuminant C.

TRISTIMULUS VALUES			TRILINEAR COORDINATES	
X	Y	Z	X	Y
16.17	19.64	13.69	.3267	.3968

These numerical representatives of the color shall be determined using a Photovolt Photoelectric Reflection Meter Model 610, or equivalent.

M18J READY-MIXED ALUMINUM PAINT

GENERAL. Type I—First Field Coat. The first field coat of aluminum paint shall consist of two (2) pounds of leaf-free aluminum paste of standard fineness per gallon of long oil varnish suitable for making a ready-mixed aluminum paint. This paint shall be characterized by its ability to show distinct contrast with the Second Field Coat to ensure adequate coverage, but it shall not contain any added coloring materials for this purpose.

Type II—Second Field Coat. The second or final field coat of aluminum paint shall consist of two (2) pounds of leafing aluminum paste of standard fineness per gallon of long oil varnish suitable for making a ready-mixed aluminum paint.

The aluminum paints shall be manufactured as closely as possible to the application period but in no case shall the lapse between manufacture and usage exceed six months.

PIGMENT. The pigments shall be aluminum pastes of two types. They shall consist of commercially pure aluminum in the form of fine flakes compounded with a volatile paint thinner and a suitable fatty lubricant to form a paste suitable for use as a paint pigment. The paste shall show no skinning or caking in the containers. There shall be no appreciable settling out of the metallic portion of the paste in the container, i.e., no free liquid shall be present.

The two types shall be distinguished as follows:

1. Type I, Standard Leaf-Free Aluminum Paste meeting the following requirements, as evaluated according to methods contained in Federal Specification TT-P-320a:

	Min.	Max.
Matter not volatile at 105-110°C. (Essentially aluminum flakes	65.0%	
Fatty or oily matter		1.50%
Total impurities (other than fatty matter)		0.80%
Mica, fillers and other adulterants		none
Coarse particles retained on No. 325 sieve		1.50%

2. Type II. This pigment shall consist entirely of finely divided, polished aluminum flakes in paste form, and shall meet the minimum requirements of Federal Specification TT-P-320a, Type II, Class B, dated October 7, 1949, or latest revision thereof or ASTM D962, Type II, Class B.

LIQUID. The liquid for both Type I and II shall be a long oil varnish suitable for making a ready-mixed aluminum paint, volatile solvent and driers, and shall meet the following requirements:

	Min.	Max.
Non-volatile matter	50%	
Volatile thinner and drier		50%

The varnish shall conform to the type described in Federal Specification TT-V-81b, Type II, Class B dated February 10, 1949, or latest revision thereof, with certain modifications as given below. The varnish shall be clear and shall contain no limed rosin.

	Min.	Max.
Viscosity (poises at 25°C.)	0.85	1.25
Acid Number (of non-volatile)		7
Non-volatile	50%	
Kauri Reduction	75%	
Drying Time		
Set to touch (Hrs.)	2	4
Dry hard (Hrs.)		18

PAINT. Type I and II paints shall have the following compositions and physical properties.

Composition	Min.	Max.
Pigment	14.0%	
Total impurities (mica, filler or other adulterants)		0.0%
Coarse particles, (Retained on 325 sieve calculated on paint basis)		0.1%
Vehicle		86.0%
Non-volatile in vehicle	45.6%	
Moisture content (calculated on paint basis)		0.1%
Weight/Gallon, Lbs.	8	

Physical Properties	Min.	Max.
Drying Time		
Set to touch (Hrs.)	2	4
Dry Hard (Hrs.)		24
Viscosity, seconds using No. 4 Ford Cup at 25°C.	40	50
Paint Flexibility (based on vehicles solids —not paint solids), Kauri Reduction	60%	

The percentages noted relate to mixture by weight. The paint as received shall show no more than slight settling, shall be readily mixed to a smooth uniform appearance, free from skins or coarse particles and shall be suitable for application by brush or spray.

The paint shall be carefully mixed in such a manner as to avoid excessive agitation, entrapped air, and absorption of moisture. It should not be stored under excessively high temperature. It shall be packaged in containers of not more than five gallons.

The Type II paint when flowed on a clean glass panel, supported at an angle of 45°, and then allowed to dry, protected from all drafts, for 24 hours at room temperature (20-30°C.), shall produce a film comparable in smoothness, color, luster, and capacity to that of a similar film applied at the same time and in the same manner, using a standard comparison paint. The comparison standard shall be prepared by freshly mixing four ounces of aluminum paste meeting ASTM D962, Type II, Class B, with one pint of spar varnish meeting Federal Specification TT-V-81b, Type II, Class B.

The test paints, set aside in a full, tightly closed container for 30 days, at room temperature, shall shown no gas pressure when opened. The Type II paint, after this aging period, shall also pass the leafing test.

Special Method of Test

Pigment Content—Pigment content shall be determined as follows: Transfer about 3 grams of sample into a weighed 100 ml. beaker and reweigh as rapidly as possible. Add 50 ml. of benzol, stir, and filter through a weighed, medium porosity sintered glass crucible. Wash the beaker with acetone and police to insure transferal of all insoluble. Wash the insoluble 6 to 8 times with acetone, dry at 105°C., cool and weigh.

$$\text{Pigment Per cent} = \frac{\text{Weight Insoluble}}{\text{Wt. Sample}} \times 100$$

Vehicle Non-Volatile—To determine vehicle non-volatile, first determine the total solids in the paint by the method described under "Non-Volatile Matter" in ASTM Specification D154 or Federal Test Method Standard No. 141, Method 4053. The vehicle non-volatile can then be calculated as follows:

$$\text{Vehicle Non-Volatile Per cent} = \frac{(\%\text{ total solids} - \%\text{ pigment})}{(100 - \%\text{ pigment})} \times 100$$

Total impurities—Using the pigment extracted in the pigment content test, determine total impurities by the methods described in ASTM Specification D480, paragraph 3, or Federal Specification TT-P-320a, Par. 4.3.2.

Coarse particles—Determine the coarse particles in the mixed paint (using a 35 gram sample of paint) by the method described in ASTM Specification D185, Section 6, or Federal Test Method Standard No. 141, Method 4091. Coarse particles in the pigment can then be calculated as follows:

$$\text{Coarse Particles in Pigment Per cent} = \frac{\text{Weight of residue}}{35 \times \%\text{ pigment}} \times 100$$

Toughness or Flexibility—Determine the ability of the mixed paint (not the clear vehicle) to withstand a 60 percent Kauri reduction test using the method described in ASTM Specification D154 or Federal Test Method Standard No. 141, Method 4151. As the pigment in the paint tends to obscure the cracks, it will be necessary to examine the bent panel with a 10X glass (or higher magnification) to positively identify them.

Moisture content—Determine the amount of moisture in paint using the method described in ASTM Specification D95 or Federal Test Method Standard No. 141, Method 4182 modified as follows: When distillation is complete, a special policeman consisting of a rubber disc attached to a heavy wire of sufficient length to permit policing the entire bore of the condenser should be employed. The diameter of the disc should be about 2/3 that of the bore of the condenser. With the policeman and a stream of dry mineral spirits from a wash bottle, carefully police all moisture from the condenser tube into the trap. Disconnect the trap and with a small policeman police all moisture to the bottom. These operations must be done with great care and attention to detail as the entire success of the test depends on them.

Any required tests with the exception of those detailed above should be run according to applicable ASTM or Federal Specification methods.

M18K ZINC CHROMATE PRIMER

The composition of this paint shall be as shown in the following Table using ingredients conforming to the requirements of the applicable specifications indicated.

	Pounds per 100 Gals.
Zinc Yellow (TT-P-465)	270
Titanium Dioxide (TT-P-442, Type II or III, Grade A)	75
Zinc Oxide (TT-P-463a, Type I, Grade A)	95
Sienna (TT-P-435, Type I)	25
Magnesium Silicate (MIL-M-15173, Type A or B)	75
Aluminum Stearate (MIL-A-15206A)	6
Resin, alkyd, solution (TT-R-266, Type I)	345
Dipentine (TT-D-376)	22
Petroleum Spirits (TT-T-291, Grade I)	235
Lead Naphthenate (TT-D-643b, Type I)	12
Cobalt Naphthenate (TT-D-643b, Type II)	1.2
Manganese Naphthenate (TT-D-643b, Type III)	1.2

The quantitive requirements of the paint shall be as follows:—

	Min.	Max.
Pigment	45.0%	49.0%
Vehicle	51.0%	55.0%
Volatile by weight of paint	29.5%	33.5%
Weight/Gallon, Lbs.	11.0	11.6
Water		0.5%
Coarse Particles & Skins (total residue retained on 325 sieve based on paint)		0.5%
Fineness of Grind (North Standard)	4	
Viscosity, (Stormer—Krebs Units)	68	78
Zinc Oxide (ZnO), by weight of pigment	34.0%	39.0%
Titanium Dioxide (TiO_2), by weight of pigment	12.0%	14.5%
Chromium Trioxide (CrO_3), by weight of pigment	20.0%	
Phthalic Anhydride, by weight of non-volatile vehicle	23.0%	
Flash Point	86°F.	

The paint shall dry set to touch within two hours and dry hard within 6 hours. No rosin and rosin derivatives shall be present in the paint. The paint shall show no evidence of cracking when subjected to 1/8" mandrel flexibility test.

This paint shall meet all the requirements of National Military Establishment Specification JAN-P-735 (current issue).

The percentages noted relate to mixture by weight.

M18M WHITE CURB PAINT

White Curb Paint shall be either a 100% acrylic or a 100% Polyvinyl Acetate emulsion type and shall be thinned with water only.

The requirements of M18A, General shall apply.

The opaque portion of the pigment shall be rutile titanium dioxide, and the vehicle shall consist of either 100% acrylic polymer or 100% Polyvinyl Acetate polymer disbursed in water together with the minimum amounts of necessary additives. No driers shall be used.

The paint shall meet a minimum requirement of total solids (percent by weight of paint) of 50% and a maximum pigment content (percent by weight of paint) of 33%. The white paint shall contain not less than 2.5 pounds per gallon of pure rutile titanium dioxide. A minimum fineness of grind of 4 and a viscosity (Krebs units) of 70 minimum and 85 maximum is required. The paint shall brush easily and have good flowing, leveling, and spreading characteristics and shall be suitable for application by spray equipment.

The paint shall be suitable for use over all types of bituminous surfaces; and, when applied over emulsified asphalt or tar surfaces, it shall not cause lifting, crazing, peeling, or damage to the base. The material shall be approved by the Laboratory before use.

M18TA TEXTURED CONCRETE FINISH PAINT

The general requirements of Material Specification M18A, Paints and Painting Materials, shall apply.

The pigment shall be composed of 7.8% minimum of titanium dioxide plus properly graded, selected mineral aggregate and reinforcing inert pigments.

The titanium dioxide portion of the pigment shall be chalk resisting rutile conforming to the requirements of Federal Specification TT-P-442-Type III, Grade A.

The vehicle shall consist of an Epoxy Ester varnish with suitable aliphatic and aromatic solvents. The vehicle solids shall contain at least 22% Epoxy Resin (condensation product of bis-phenol A and epichlorohydrin). The solids content, by weight of the vehicle, shall be a minimum of 36.0%.

The paint shall meet a minimum requirement for non-volatile content of 68% (percent by weight of paint). The paint shall have a viscosity (Krebs units) of not less than 120 nor more than 130, and shall have a Gray color conforming to Federal Standard No. 595 in the range of 16376 to 16440. The paint shall have a texture when drawn on a panel and allowed to dry that conforms to a standard maintained by the laboratory, and which is available on request. The paint shall dry in not more than 18 hours.

M19 GALVANIZING AND GALVANIZED SHEETS

Where the materials called for are to be galvanized, they shall be galvanized in accordance with specification indicated by Type on the plans or in the specifications.

Type I—ASTM A123, Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
Type II—ASTM A153, Zinc Coating (Hot Dip) on Iron and Steel Hardware.
Type III—ASTM A386, Zinc Coating (Hot Dip) on Assembled Steel Products.
Type IV—ASTM A525, General requirements for delivery of Zinc Coated (Galvanized) Iron or Steel Sheets, coils and cut lengths coated by the Hot Dip Method, 2.5 oz. coating class unless otherwise specified.

Material galvanized in accordance with these Specifications shall be free from wet storage stains (white rust). These corrosion deposits, if present, shall be removed in a manner satisfactory to the Department prior to incorporation of the material in the work. After removal of these deposits, the coating shall have a uniform appearance free from uncoated spots, lumps, blisters, gritty areas, acid, flux and black spots. Materials with these defects will be rejected and immediately removed from the worksite. Acceptable material will be provided to replace the rejected material at no additional expense to the County

The Contractor shall repair any damaged spelter on material with Type I, II, III, and IV Galvanizing when directed by the Engineer, by the following method:

The damaged area shall be cleaned by wire brushing, or sand blasting, or any other suitable method approved by the Engineer, to remove all loose and cracked spelter. The cleaned area shall then be painted with one brush coat or two spray coats of zinc repair material. The brand of material used shall be one which appears on the Department's approved list.

This Repair Method shall be allowed only when it is in the best interest of the Department and all repairs shall be made at no cost to the County.

Samples shall be taken in accordance with the above ASTM specifications under the supervision of the Inspector and shipped to the Laboratory unless otherwise required by the plans or as directed by the Department.

M19A ALUMINUM ANODIC COATINGS

Anodic coatings for Aluminum and its alloys shall conform to the following requirements for the coating designation shown on the plans or in the proposal.

Coating Designation	Sealed with	Minimum Coating Thickness mils*	Minimum Coating weight, milligrams per square inch. On alloys 1100,3003, 5052,5005, 5357,5457, 6463,6563, 6061,6063,	Minimum Coating weight, milligrams per square inch. On alloys 2014,2024
Type 202	Boiling water	0.3	14.0	7.0
Type 302	Nickel Acetate	0.3	14.0	—
Type 204	Boiling water	0.4	21.0	11.0
Type 205	Chromate	0.2	—	—
Type 210	Chromate	0.4	—	—
Type 215	Boiling water	0.8	40.0	17.0
Type 226	None required	2.0	86.0	66.0

*mils. = 1/1000 of an inch.

M20 ALUMINUM COATING (HOT DIP)

The hot dip aluminum coating applied to steel appurtenances in contact with aluminum surfaces, or where applied as shown on the contract plans, shall comply with the following specifications.

The material used shall be 99 per cent pure aluminum conforming to the specifications for Aluminum Alloy Number 1100.

THICKNESS OF ALUMINUM COATING. The thickness of coating shall not be less than .002" on any individual specimen and the average of the specimens tested shall be not less than .0023". The thickness of coating may be determined by the use of a Magne-Gage.

The aluminum coating on threads, except on tapped threads, shall not be subjected to a cutting, rolling, or finishing tool operation, unless specifically authorized by the Engineer.

UNIFORMITY AND ADHERENCE OF ALUMINUM COATING. The Coating shall be continuous and uniform in thickness. The coating shall adhere tenaciously to the surface of the base metal. When the coating is cut or pried into, such as with a stout knife applied with considerable pressure in a manner tending to remove a portion of the coating, it shall only be possible to remove small particles of the coating by paring or whittling, and it shall not be possible to peel any portion of the coating so as to expose the steel.

The aluminum coated articles shall be free from uncoated spots and other defects not consistent with good aluminum coating practice.

M21 ADMIXTURES

This Specification covers the material and quality requirements for air entraining and retarding admixtures as required under the sub-section "Admixtures" of section 7 of these Specifications.

Admixtures specified herein, or approved after testing as herein described, shall be accepted on the basis of the brand name labeled on the containers.

The initial acceptance of any brand name product shall in no way preclude further examination and testing as specified under the General Requirements of Section 6, MATERIALS OF CONSTRUCTION.

Air Entraining Agents

GENERAL. Air entraining agents shall be one of the following four classes:

Class 1 Darex
Class 2 N-Tair
Class 3 Airalon
Class 4 Other approved materials

Department approval of an air entraining agent shall constitute approval for use of that agent as an addition to be interground with the clinker in the manufacture of air entraining Portland cement or as an admixture to be added to the concrete batch before mixing as required by the plans and/or specifications for specific contracts.

PROPERTIES. Air entraining agent shall conform in all respects to the requirements of ASTM Designation C260.

TEST METHODS. The properties required above shall be determined in accordance with ASTM Designation C233.

BASIS OF ACCEPTANCE. Application for approval of an air entraining agent under Class 4 of this specification shall be submitted to the Laboratory accompanied by the following:

1. A statement of the chemical formulation of the product and the raw materials from which it is compounded.

2. A description of the manufacturing process used.

3. A list of agencies currently approving the use of the product and a statement as to whether it is approved as an intergrind, an admixture, or both.

4. A certification by the manufacturer of the product that it is in conformance with ASTM Designation C260 together with a certified copy of the results of all tests required by ASTM Designation C260, except that the results of tests for volume change need to be reported for 28 days and 6 months only. The reference admixture used in the test for resistance to freezing and thawing shall be Darex. All tests shall be performed by a laboratory regularly inspected by the Cement Reference Laboratory of the National Bureau of Standards.

5. When the material proposed for approval is manufactured by neutralizing Vinsol resin with caustic soda (sodium hydroxide), a certificate in the following form shall be submitted in lieu of the test results required in paragraph 4.

"This is to certify that the product (trade name) as manufactured by (the company name) is an aqueous solution of Vinsol resin that has been neutralized with sodium hydroxide. The ratio of sodium hydroxide to Vinsol resin is one part of sodium hydroxide to (number) parts of Vinsol resin. The percentage of solids based on residue resulting from evaporation and subsequent drying at 105°C is (number)."

"No other additive or chemical agent is present in this solution."

Upon approval by the Laboratory of an air entraining agent submitted under Class 4, the name of the product will be placed upon an approved list. Such product shall then be accepted on the basis of the brand name labeled on the containers.

Retarders

GENERAL. Any set retarding admixture shall be furnished in liquid form and shall consist of a formulation having one of the two following general chemical types as an active base:

1. Salt of lignosulfonic acid.

2. Organic acid of the hydroxylated carboxylic type or a salt thereof.

PROPERTIES. Concrete containing a retarder which has been added in a sufficient amount to retard the initial setting time by 50 to 60 percent, when compared with a reference concrete without a retarder added and having an air content within ±0.5% of the retarded concrete, shall exhibit the following properties under the condition of equal slump and aggregate and cement proportion:

1. The volume of mixing water shall be reduced by at least 5 per cent.

2. The compression strength at 48 hours shall be at least equal.

3. The compression strength at 14 days shall be increased by at least 10 percent.

4. The relative durability factor for the freeze-thaw test shall not be less than 95.

5. The volume change at 14 days, after 2 days of moist curing, shall not increase more than 0.01 percentage points.

TEST METHODS. Applicable tests shall be performed in accordance with ASTM Designation C494 except that freeze-thaw tests shall be in accordance with ASTM Designation C291.

BASIS OF ACCEPTANCE. Application for approval of a retarder shall be submitted to the Laboratory accompanied by the following:

1. A statement of the chemical formulation of the product and the raw materials from which it is compounded and a description of the manufacturing process.

2. A sample of the product adequate to treat 20 cubic yards of concrete.

3. A certified copy of the results of all tests required by this Specification. These tests shall be performed by a Laboratory regularly inspected by the Cement Reference Laboratory of the National Bureau of Standards.
Upon approval of the Laboratory of a set retarding admixture, the name of the product will be placed on an approved list. Such product shall then be accepted on the basis of the brand name labeled on the containers.

M22A ASBESTOS CEMENT PIPE

SCOPE. This specification covers the material and quality requirements for asbestos cement sewer pipe and storm drain.

REQUIREMENTS. Asbestos cement pipe shall conform to all the requirements of ASTM Designation C 428 except as modified herein.
The nominal length of any diameter pipe shall be 13 feet. It will be permissible to use 15% of each size and class in random lengths with a minimum length of 7 feet.
When asbestos cement pipe is provided for storm drains, the lengths of pipe may be joined by the use of plastic sleeve couplings which shall not be susceptible to attack by normal atmospheric or soil conditions. The joints shall be flexible yet still maintain alignment and remain tight. The manufacturer shall provide a certification that the resin used in manufacture of the coupling meets the minimum requirements of ASTM D 1248, Type I. Grade 5, Class C. As an alternate or where required, asbestos cement couplings with rubber ring gaskets may be used.

The manufacturer shall furnish the Laboratory certified test results in triplicate for each shipment of pipe in satisfaction of all test requirements of this specification. Test results are not required with the certification specified for storm drain plastic couplings. The Department reserves the right to sample and test delivered material.

M22B CONCRETE PIPE

SCOPE. This specification covers the material and quality requirements for Standard Strength and Extra Strength non-reinforced concrete pipe 24 inches diameter and smaller.

REQUIREMENTS. The following sections of M25A shall apply: Materials, Drawings, Fabrication, Curing, Repair, and Basis of Acceptance except that reinforcement shall not be used and the physical and dimensional requirements shall be as stated below. Joints shall conform to the requirements of M25A for Class III, IV and V pipe.

Physical and dimensional requirements of concrete pipe under 12 inches in diameter shall be as stated in Table I of ASTM Designation C-14. Plain concrete pipe 12 inches to 24 inches shall conform to Table II of ASTM Designation C-14. The strength and absorption requirements shall be as stated in these tables. Details of the crushing strength test and absorption test shall comply with ASTM C-14 except as follows.

Specimens for the absorption test shall consist of 2 or 3 inch diameter cores drilled from the pipe wall or, at the manufacturer's option, sawed specimens four inches square. The number of test specimens for absorption shall be as directed by the Laboratory.

M22C VITRIFIED CLAY PIPE

SCOPE. This specification covers the material and quality requirements for vitrified clay pipe.

REQUIREMENTS. Vitrified clay pipe under 12 inches in diameter shall conform to all requirements of ASTM Designation C 13 and vitrified clay pipe 12 inches and over in diameter shall conform to all requirements of ASTM Designation C 200 except that when tested for absorption the initial drying period of specimens shall be limited to 48 hours at a temperature of 230°F.(110°C.).

A manufacturer's certification in triplicate shall be furnished the Laboratory listing the crushing strength tests results for each shipment of pipe.

M22D PERFORATED ASBESTOS CEMENT PIPE UNDERDRAIN

SCOPE. This specification covers the material and quality requirements for perforated asbestos cement underdrain pipe.

REQUIREMENTS. Perforated asbestos cement pipe shall conform to all the requirements of AASHO Designation M189 except as modified herein.

Perforation requirements shall be as stated in AASHO M189 except that perforations shall be circular and of 5/16 inch ± 1/16 inch diameter.

The manufacturer shall furnish the Laboratory certified test results in triplicate for each shipment of pipe in satisfaction of all test requirements of this specification. The Department reserves the right to sample and test delivered materials.

M22E PERFORATED BITUMINIZED FIBER PIPE UNDERDRAIN

SCOPE. This specification covers the material and quality requirements for perforated Bituminized-Fiber Underdrain.

REQUIREMENTS. Perforated Bituminized Fiber Pipe shall conform to all requirements of AASHO Designation M158. In addition, perforations shall consist of four 5/15 inch ± 1/16 inch diameter holes in the lower half of the pipe as installed, and shall be located symetrically at angles of 10° and 45° from the horizontal axis of the pipe. Groups of holes shall be spaced at 3 inch centers along the longitudinal axis of the pipe.

The manufacturer shall furnish the Laboratory certified test results in triplicate for each shipment of pipe in satisfaction of all test requirements of this specification. The Department reserves the right to sample and test delivered materials.

M22G POROUS CONCRETE PIPE UNDERDRAIN

SCOPE. This specification covers the material and quality requirements for porous concrete pipe underdrains.

MATERIALS. All materials used shall comply with the requirements of the paragraph entitled "Materials" of M25-A, Reinforced Concrete Pipe except that reinforcement shall not be used.

FABRICATION. Porous concrete pipe shall conform in size and shape to the details shown on the Standard Structure Sheet for porous concrete pipe.

The inside surface of the pipe shall be straight and true to dimension with a permissible variation from the true form of not more than 1 1/2 per cent. A tolerance of 5% will be permitted in the diameter of the pipe. The wall thickness of the pipe may be greater than shown on the Standard Structure Sheet, but it shall not be less than the stipulated wall thickness by more than 5%.

The use of high early strength cement, calcium chloride or any other additive not expressly approved is prohibited.

Concrete mix proportions will be such that will produce a concrete mix of such quality that the pipe will conform to the test and design requirements of these specifications.

Each length of pipe shall be clearly marked with the date of manufacture and the name or trademark of the manufacturer.

CURING. All pipe shall be cured in accordance with the provisions of the section of M25A entitled "Curing".

PHYSICAL TESTS. The minimum ultimate strength for the size of pipe being tested shall be as specified on the Standard Structure Sheet.

That portion of the specification for M25A covering strength requirements shall apply except that no determination of 0.01" crack will be required and the ultimate strength values as determined on full length specimens shall be as specified on the Standard Structure Sheet.

Pipe shall be tested for rate of infiltration in accordance with the method of test outlined in AASHO Designation T 33-60. The minimum rate of infiltration shall not be less than one gallon per minute per inch of internal diameter per foot of pipe for all sizes.

All tests shall be performed by the manufacturer at his plant and shall be witnessed by a representative of the Department. The number of samples for test shall be as directed by the Laboratory.

In addition to the above tests the pipe will be subject to inspection at all times prior to placing and rejection will be made through failure to comply with any of the following conditions:

1. The pipe shall not vary in any dimension more than permitted by this specification.
2. The pipe shall have no fractures or cracks passing through the shell or socket of the pipe, except that a single crack not exceeding 2 inches in length at either end of a pipe shall not be considered cause for rejection unless the defect exists in more than 5% of the lot offered for sampling and testing.
3. There shall be no defects that indicate imperfect mixing and molding.
4. There shall be no cracks that are sufficient to impair the strength, durability or serviceability of the pipe.
5. The shape of the pipe shall be such that there shall be no variation in alignment of more than 1/8" per linear foot.

BASIS OF ACCEPTANCE. Pipe will be considered for acceptance in stock lot quantities maintained at the manufacturer's yard by diameter. Samples shall be taken and tested as directed by the Inspector only from the completed lots of pipe they are to represent. The maximum quantity in a lot shall be prescribed by the Laboratory.

Acceptance will be based upon full compliance with these specifications and upon satisfaction of the tests described in this specification. In addition the manufacturer shall furnish the Laboratory an affidavit for each lot manufactured certifying that all pipe in the lot was manufactured in accordance with the terms of this specification. The affidavit shall accompany each submission of test results to the Laboratory.

Pipe shall be considered ready for acceptance when a lot conforms to the indicated test requirements. The manufacturer shall be permitted one retest to determine specification compliance.

Pipe not used within two years after its original acceptance shall be subjected to a retest by the Department before it is permitted in the work.

The manufacturer shall certify all shipments of pipe from accepted stock lots in conformance with directives issued by the Laboratory.

M23A CORRUGATED METAL PIPE, ROUND AND ELONGATED, AND PIPE ARCHES

Corrugated metal pipe and pipe arches shall conform to the requirements of AASHO Designations M190 and M36 except as herein modified, and shall be of the gage shown on the plans.

All pipe and pipe arches shall be either fully bituminous coated or fully bituminous coated and paved as required by the plans or specifications.

The bituminous material for coating and paving shall have the following properties in

addition to those specified by AASHO Designation M190.

Pen. @ 77°F. 100 g. 5 sec.	25 - 50
Pen. Ratio (39.2°F./77°F. X 100)	80 - 90
Soft. Pt. °F. (B & R)	190 - 230

Material shall be homogeneous

Each fabricating shop shall furnish the Laboratory with a sheet manufacturer's certified analysis and guarantee as described in AASHO Specification M36 and at a frequency determined by the Laboratory.

Pipe and pipe arches as well as materials used in their manufacture may be sampled and inspected at the fabricating shop by a representative of the Department in accordance with the directions of the Department. No pipe or pipe-arches shall be installed until accepted by the Department.

Each length of pipe or pipe arch for installations passing under the roadway shall be marked over the coating or tagged as approved by the Department to show gage.

When elongated pipe is specified, the vertical diameter of the pipe shall be elongated 5%. Elongation shall be accomplished during manufacture with the installation of wire struts spaced at two foot intervals. Broken wire struts or the failure of a pipe to maintain 5% elongation after strutting is complete shall be cause for rejection.

The types of pipe shall be as follows:

Type I: Circumferentially corrugated pipe with riveted lap joints.

Type II: Helically corrugated pipe with a continuous lock seam paralleling the corrugations.

Coupling Bands for helically corrugated pipe. The band shall be a one or two-piece helically corrugated band of the same base metal as the pipe. Width of band, length of connecting angles, size and number of bolts shall be as specified in AASHO Designation M36.

Pipe with helical corrugations shall have a continuous lock seam extending from end to end of each length of pipe section. Helical seams shall be fabricated in such a manner that they will develop the full strength of the pipe and not affect shape or nominal diameter of the pipe. Folded lock seams shall be used. Folded lock seams shall be formed with sufficient pressure to prevent any seam slippage that would appreciably affect the load carrying capacity of the pipe but without damaging the metal to such an extent that a plane of weakness is created. The metal used in fabricating lock seams shall be one that will permit cold forming without such damage.

Samples shall be taken as directed by the Department.

Type III: Circumferentially corrugated pipe fabricated by resistance spot welding.

Resistence spot welded lap joints will be permitted provided the welding is done in accordance with AASHO Designation M209.

Type IV: Helically corrugated pipe with a continuous welded seam.

Welded seams shall be controlled such that the combined width of the weld and adjacent spelter coating burned by welding does not exceed three times the metal thickness. If the spelter is damaged by the welding outside the above specified area, the weld and damaged spelter adjacent to the weld shall be cleaned by wire brushing, or sand blasting, or any other suitable method approved by the Engineer, to remove all loose and cracked spelter. The cleaned area shall then be painted with one brush coat or two spray coats of zinc repair material. The brand of material used shall be one which appears on the Department's approved list.

This repair method shall be allowed only when it is in the best interest of the Department and all repairs shall be made at no cost to the County.

M23B CORRUGATED STEEL CULVERT PIPE AND PIPE-ARCHES (3 X 1 Corrugation)

Corrugated metal pipe and pipe arches with the 3-inch pitch by 1-inch depth of corrugation configuration shall conform to the requirements of M23A Corrugated Metal Pipe, Round and Elongated, and Pipe Arches, where applicable and shall conform to all the requirements of the New York State Department of Transportation.

M23AP CORRUGATED STRUCTURAL PLATE FOR PIPE AND PIPE ARCHES

Structural plate, nuts and bolts shall conform to the requirements of AASHO Specification M167 except as herein specified, and shall be of the gage and shape shown on the plans. The requirement of AASHO Specification M167 that Single plates shall weigh not less than 750 pounds shall not apply.

The corrugations shall run at right angles to the longitudinal axis of the structure. Plates shall have approximately a 2-inch lip beyond each end crest, which will result in the actual length of a given structure being approximately 4 inches longer than the nominal length,

except where skewed or beveled.

Each fabricator shall furnish the Laboratory with a certified analysis and guarantee executed by the manufacturer of the base metal as described in AASHO Specification M167 at a frequency determined by the Laboratory.

At the option of the Department, structural plate may be subjected to shop inspection or plates may be shipped to the project site accompanied by a certification of compliance with these specifications executed in form prescribed by the Department.

Each supplier furnishing plate under these specifications shall be fully equipped with weighing devices of a type approved by the Department, capable of determing the weight of the flat galvanized sheet as stated in AASHO Specification M167.

If directed by the Engineer, the Contractor shall, at his own expense, repair damaged spelter on plate items by the following method:

The damaged area shall be cleaned by wire brushing, or sand blasting, or any other suitable method approved by the Engineer, to remove all loose and cracked spelter. The cleaned area shall then be painted with one brush coat or two spray coats of zinc repair material. The brand of material used shall be one which appears on the Department's approved list.

This repair method shall be allowed only when it is in the best interest of the Department and all repairs shall be made at no cost to the County.

When elongated structural plate pipe is specified the plates shall be supplied such that the pipe cross-section, when assembled, is elliptical with the vertical diameter elongated by not less than 5 per cent.

M23D PERFORATED CORRUGATED METAL PIPE UNDERDRAIN

The provisions of AASHO Specification M136 shall be required except as modified and supplemented herein.

Each fabricating shop shall furnish the Laboratory with a sheet manufacturer's certified analysis and guarantee as described in AASHO Specification M36 at a frequency to be determined by the Laboratory.

All pipe as well as materials used in its manufacture may be sampled and inspected at the fabricating shop by a representative of the Department in accordance with the directions of the Department.

The diameter of the perforations shall be 5/16 inch ± 1/16 inch. For Types I and II underdrain pipe the perforations may be located in the tangential section of the corrugation.

M23E GALVANIZED CORRUGATED METAL HEADWALLS

Galvanized corrugated metal headwalls to be attached to inlet and outlet ends of corrugated metal pipe and pipe arches shall conform to the requirements of M23A, Corrugated Metal Pipe and Pipe Arches except that bituminous coating will not be required.

The units shall conform to the shape, dimensions, and gauges as shown on the plans and or the applicable Standard Structure Sheet.

Damaged Spelter Coating at the construction site shall be required in accordance with M23AP, if ordered by the Engineer.

M24 CAST IRON PIPE

Cast iron pipe shall be smooth heavy pipe conforming to the requirements of the standard specifications for cast iron culvert pipe ASTM Designation A142, except as herein modified. Pipe shall withstand, on a 3 point bearing test, 2800 pounds D before first audible or visible crack occurs and 3000 pounds D ultimate.

Dimensions and weights shall conform to the table of cast iron pipe which follows.

M25A REINFORCED CONCRETE PIPE
Classes III, IV, IIIP, IVP, VP

M25E REINFORCED ELLIPTICAL CONCRETE PIPE
Classes HE-II, HE-III, HE-IV
Classes VE-IV, VE-V, VE-VI

SCOPE. The specification covering the material and quality requirements for reinforced concrete pipe for the classes noted above shall be the latest specification for the same of the New York State Department of Transportation.

All pipe used on Suffolk County Department of Public Works Projects shall be "State Accepted Pipe" unless exception is made on the plans or in the project specifications.

TABLE SHOWING DIMENSIONS AND WEIGHTS OF CAST IRON PIPE

Nominal diameter inches	Area, sq. ft.	Nominal thickness, inches	Nominal weight per foot, of barrel, pounds	Minimum weight (without tolerance) of pipe in pounds				
				3' length	4' length	6' length	12' length	Additional ft. length
4	0.09	0.26	11	38	49	70	132	10
6	0.20	0.30	19	66	84	120	229	18
8	0.35	0.31	25	87	111	158	301	24
10	0.55	0.34	34	118	151	215	409	32
12	0.79	0.37	45	147	190	275	532	42
14	1.07	0.40	57	185	239	347	672	54
16	1.40	0.46	74	241	311	452	874	70
18	1.77	0.52	95	308	399	579	1,121	90
20	2.18	0.57	115	373	482	701	1,356	109
24	3.14	0.69	167	538	697	1,014	1,966	158
30	4.91	0.86	261	829	1,077	1,573	3,060	247
36	7.07	1.03	376	1,179	1,535	2,245	4,377	355
42	9.62	1.20	509	1,593	2,076	3,043	5,945	483
48	12.57	1.38	669	2,077	2,713	3,984	7,797	635
54	15.90	1.55	845	2,622	3,424	5,030	9,846	802
60	19.63	1.67	1,011	3,137	4,098	6,019	11,781	960

M26 TIMBER AND LUMBER

Timber and Lumber, unless otherwise specified or noted upon the plans or in the itemized proposal, shall be of any kind acceptable to the Chief Engineer. It shall be sound, square-edged, free from shakes, loose knots or decay.

M27 STRESS GRADED TIMBER AND LUMBER

Stress Graded Timber and Lumber shall be graded for the stress grade selected, in accordance with grading rules for the indicated stress grade, developed from ASTM Designation D-245.

Commercial stress grades of timber and lumber, with grade descriptions providing material which will meet the indicated stress requirements under rules conforming to ASTM Designation D-245, will be acceptable.

Each piece must be clearly branded with the stress grade mark of the manufacturer's inspector. The manufacturer shall certify that the timber and lumber has been inspected under grading rules which conform to the requirements of ASTM Designation D-245 and shall show on the certificate the identifying mark used by his inspector.

Stress graded timber and lumber will be subject to inspection by representatives of the Department whom the manufacturer shall furnish with copies of his certification of inspection and piece tally in triplicate.

The Contractor shall furnish all facilities for the inspection of this material by the Department's representatives and shall allow them free access to all premises where inspections can be made.

M28A WOOD PRESERVATIVE—CREOSOTE OIL

Creosote used in the treatment of piles, timber and lumber shall conform to the requirements of the following Federal Specifications listed:

Type of Preservative		Federal Specification
Type I	Coal-Tar-Creosote	TT-C-645a
Type II	Coal-Tar-Creosote (Crystal-Free)	TT-C-655
Type III	Creosote-Coal Tar Solution	TT-W-566
Type IV	Creosote-Petroleum Solution	TT-W-568

Methods of application shall be in conformance with Federal Specification TT-W-571.

M28B WOOD PRESERVATIVES—WATER BORNE

Water-borne wood preservatives shall conform to the requirements of AASHO M133 and the following Specifications as listed:

Type of Preservative	Specification
Acid Copper Chromate	Federal Spec. TT-W-546a
Ammoniacal Copper Arsenite	Federal Spec. TT-W-549a
Chromated Copper Arsenate	Federal Spec. TT-W-550
Chromated Zinc Arsenate	Federal Spec. TT-W-538
Fluor Chrome Arsenate Phenol, Type A	AASHO M133, Section 7
Fluor Chrome Arsenate Phenol, Type B	Federal Spec. TT-W-535a

Water-borne wood preservatives shall be applied in conformance with Federal Specification TT-W-571c except that the minimum net retention shall be as follows:

Type of Preservative	Retention lbs. dry salts per cubic foot of wood
Acid Copper Chromate (ACC)	1.00
Ammoniacal Copper Arsenite (ACA)	0.50
Chromated Copper Arsenate (CCA)	0.75
Chromated Zinc Arsenate (CZA)	1.00
Fluor Chrome Arsenate Phenol, Type A (FCAP-A)	0.50
Fluor Chrome Arsenate Phenol, Type B (FCAP-B)	0.55

M28C WOOD PRESERVATIVE—OIL BORNE

Pentachlorphenol, for pressure treatment, shall conform to Federal Specification TT-W-570. Solvents used to prepare solutions of pentachlorphenol shall conform to AASHO M133, Section 10; or Liquified Petroleum Gas which meets the requirements of AWPA Standard P9, paragraph 2.

Oil-borne preservatives shall be applied in conformance with Federal Specification TT-W-571, and the net retention of pentachlorphenol shall be 0.40 pounds of pentachlorphenol per cubic foot of wood, or 8.0 pounds of 5 percent pentachlorphenol solution per cubic foot of wood, unless otherwise required by the plans or specifications.

M29A EPOXY RESIN SYSTEM

1. GENERAL. This shall be a two (2) component system of parts A and B which when mixed in accordance to the manufacturer's recommendations shall conform to the following specifications.

2. MATERIALS.

   a. Component A shall consist of a blend of epoxy resin, plasticizer and fillers so that when mixed with component B the mix will have the characteristics described under (c) characteristics of the mixture.

   b. Component B shall consist of an amine adduct curing agent capable of curing the epoxy system from 40° Farenheit and above when mixed according to the manufacturer's recommendations.

   c. Characteristics of the mixture.

	Minimum	Maximum
Pot life for one (1) pint Unit measured from time of original mixing at 75°F±2° Note (1)	10 min.	30 min.
Initial viscosity, CPS Note (2)		2,000 Brookfield Model RVT-Spindle No. 3 @ 20 RPM

Note (1) The pot life shall be determined as follows: The mixed components shall be set on a bench top and probed with a small flat stick every (2) minutes. The time at which a soft ball forms in the center of the container is the pot life.

Note (2) Parts A and B shall be conditioned at 75°F±2° prior to mixing and the reading taken two (2) minutes after mixing.

   d. Cured materials. Mixed with three (3) parts by volume of Ottowa silica sand conforming to ASTM C-109, the resulting mortar shall have the following characteristics:

	Minimum	Maximum
Compressed strength of 2" x 2" cubes cured at 75°±2° for 24 hours	8000 PSI	—
Tensile splitting test - strength of a 2" x 4" cylinder cured at 75°±2° for 24 hours	1500 PSI	—

3. SAMPLING AND ACCEPTANCE. All material furnished must be shipped in strong, substantial containers. The containers shall be identified as "PART A- contains epoxy resin" and "PART B- contains curing agent," and shall be plainly makred with the item number, name of product, mixing proportions and instructions, name and address of manufacturer, the lot number and the date of manufacture. All material shall be furnished in approved containers.

Materials sampled, inspected and approved by the New York State Department of Transportation will be accepted by the Suffolk County Department of Public Works or the material may be sampled and inspected at the place of manufacture or in warehouse lots as determined by the Department, samples submitted to the Laboratory shall be taken as directed by the Department. Any unauthorized tampering or breaking of the seals on the containers between time of sampling and delivery to the job site will be cause for rejection of the material. The expiration date for this material shall be one year after date of manufacture.

M29B EPOXY POLYSULFIDE BINDER

1. GENERAL. The flexible, two-component, polysulfide modified, epoxy binder described in this specification shall be supplied without mineral filler.

The epoxy binder system shall be furnished as Type I (high temperature). The selection of the appropriate type will be governed as defined below:

Type I (high temp.)	To be used when materials and atmospheric temperatures are between 68°F and 104°F.
Type II (low temp.)	To be used when materials and atmospheric temperatures are between 40°F and 68°F.

Whether supplied in Type I (high temp.) or Type II (low temp.), the two-component polysulfide modified, epoxy compound shall have a maximum ratio of epoxy resin to polysulfide polymer of 2:1 by weight (Min. 1 3/4:1). In addition, the ratio of epoxy resin to curing agent shall be 11:1 by weight (Max. 12:1, Min. 10:1).

2. MATERIAL.

3. SAMPLING AND ACCEPTANCE.

The materials shall conform to the requirements of the New York State Department of Transportation Specifications of January 2, 1962, as amended, and shall be furnished from sources sampled and accepted by that authority.

BREAK BEAM TEST. The specimens shall be tested for flexural strength using a simple beam with third point loading. The specimens shall be prepared and tested in accordance with ASTM Methods C 192 and C 78 except that the concrete shall be designed for 800 to 900 psi flexural strength and shall be cast in 3 by 4—by 16-in. molds using a well-graded coarse aggregate all of which passes a 1-in. square sieve. Each beam to be tested shall be sawed transversely at midpoint, the sawed faces etched with NHCL and then thoroughly washed, and bonded with a 10-mil thickness of the epoxy adhesive under test. The surface to be bonded shall be maintained in a vertical position during application and cure of epoxy adhesive and plastic concrete. Hardened concrete specimens shall be cured for at least 96 hours but soaked in water for 24 hours prior to testing. For each series of tests, an unsawed companion beam shall be broken as a reference.

M29G EPOXY POLYSULFIDE GROUT

1. GENERAL. The flexible, two-component, polysulfide modified, epoxy grout described in this specification shall contain a fine inert mineral filler.

The epoxy grout system shall be furnished as Type I (high temperature) or Type II (low temperature). The selection of the appropriate type will be governed as defined below:

Type I (high temp.)	To be used when materials, and atmospheric temperatures are between 68°F and 104°F.
Type II (low temp.)	To be used when materials, and atmospheric temperatures are between 40°F and 68°F.

Whether supplied in Type I (high temp.) or Type II (low temp.) the two-component, polysulfide modified, epoxy compound shall have a maximum ratio of epoxy resin to polysulfide polymer of 2:1 by weight (Min. 1 3/4:1). In addition, the ratio of epoxy resin to curing agent shall be 11:1 by weight (Max. 12:1, Min. 10:1). The fine inert mineral filler when incorporated into the carrying component(s) shall be nonsettling.

2. MATERIAL.

3. SAMPLING AND ACCEPTANCE.

The materials shall conform to the requirements of the New York State Department of Transportation Specifications of January 2, 1962, as amended, and shall be furnished from sources sampled and accepted by that authority.

BREAK BEAM TEST. The specimens shall be tested for flexural strength using a simple beam with third point loading. The specimens shall be prepared and tested in accordance with ASTM Methods C 192 and C 78 except that the concrete shall be designed for 800 to 900 psi flexural strength and shall be cast in 3—by 4— by 16 in. molds using a well-graded coarse aggregate all of which passes a 1-in. square sieve. Each beam to be tested shall be sawed transversely at midpoint, the sawed faces etched with NHCL and then thoroughly washed, and bonded with a 10-mil thickness of the epoxy adhesive under test. The surface to be bonded shall be maintained

in a vertical position during application and cure of epoxy adhesive and plastic concrete. Plastic concrete to hardened concrete specimens shall be burlap cured for 24 hours and placed in a moist room for the duration of the curing period. For each series of tests, an unsawed companion beam shall be broken as a reference.

M30B BITUMINOUS EPOXY PROTECTIVE COATING

SCOPE. This specification covers the quality requirements for a bituminized epoxy protective coating system.

GENERAL. The bituminized epoxy protective coating shall be a one coat, two-component (1:1 ratio by volume), flexibilized, thermosetting system consisting of a modified epoxy resin, Component A, and a curing agent, Component B.

The materials shall conform to the requirements of the New York State Department of Transportation Specifications of January 2, 1962, as amended, and shall be furnished from sources sampled and accepted by that authority.

M30P POLYESTER RESIN PROTECTIVE COATING

SCOPE. This specification covers the quality requirements for a polyester resin protective coating system.

GENERAL. The polyester protective system shall consist of a primer and a finish coat. Each coat shall be a two-component, thermosetting system, free of non-reactive solvents, and consisting of a modified polyester resin, Component A and Catalyst, Component B.

The materials shall conform to the requirements of the New York State Department of Transportation Specifications of January 2, 1962, as amended, and shall be furnished from sources sampled and accepted by that authority.

M31 EMULSIFIED CARBON BLACK

Emulsified Carbon Black shall be a uniform colloidal dispersion of standard carbon black in a liquid medium. The air content of the concrete must not be changed by more than 10% by addition of 2%, by weight of cement, of the dispersed carbon black. At least 25% by weight of the commercial product shall be carbon black. The ash content shall not exceed 3% by weight of the finished product.

The black shall be stable and shall have the same effect on the air entrainment, after standing for a period of 28 days, as specified above.

Portland Cement Type 2 containing 2% by weight of emulsified carbon black shall be used with Standard Ottawa Sand to prepare 1:3 mortar briquettes. The tensile strength of these briquettes at the age of seven days and thereafter shall be not less than 85% of the strength of similar briquettes with no pigment added. The method of test shall conform to the requirements of the Standard Method of Test for Tensile Strength of Hydraulic-Cement Mortars, ASTM Designation C190.

The color produced on the broken surface after the seven day test shall be equal to that produced by a previously established standard of color.

The Emulsified Carbon Black shall show uniform dispersion in mortars or concrete when used in concentrations necessary to produce the desired pigmentation.

M32 CALCIUM CHLORIDE

Calcium chloride shall be in the form of loose dry lumps or flakes and fine enough to feed readily through the common forms of spreaders used in road work and shall meet the requirements of the Standard Specifications for Calcium Chloride, ASTM Designation D98.

The calcium chloride shall be delivered in containers of a type acceptable to the Department. The name of the manufacturer, the approximate net weight and the percentage of calcium chloride ($CaCl_2$), guaranteed by the manufacturer, shall be plainly marked on each container.

M33 SODIUM CHLORIDE

Sodium chloride shall be mined rock salt containing not less than 98% sodium chloride.

The sieve analysis on U. S. Standard series sieves shall comply with the following requirements:

83 to 100	per cent shall pass a No. 4 sieve
5 to 40	per cent shall pass a No. 8 sieve
0 to 7	per cent shall pass a No. 30 sieve

The sodium chloride shall be delivered in containers of a type acceptable to the Department.

M34 PLASTIC CEMENT

Plastic cement shall conform to the requirements of Federal Specifications SS-C-153. Plastic cement is a bituminous base material used as an expansion joint filler for concrete and masonry.

M34A PLASTIC JOINT MATERIAL

Plastic Joint Material, hot-poured or extruded type, shall be an approved material conforming to the requirements of Federal Specification SS-S-164. In addition, the plastic joint material shall conform to all other requirements contained herein.

The materials shall conform to the requirements of the New York State Department of Transportation Specifications of January 2, 1962, as amended, and shall be furnished from sources sampled and accepted by that authority.

M35A CAULKING COMPOUND FOR STRUCTURES

Caulking compound shall be a material which complies with Federal Specification TT-S-00230 Sealing Compound, Synthetic-Rubber Base, Single Component, Chemically Curing. The color of the compound shall be cement mortar grey when tested in a manner described in TT-S-00230 and shall be subject to the approval of the Chief Engineer.

Caulking compound shall be applied with either a pneumatic or ratchet hand gun.

Each shipment of the caulking compound to the site of the work shall be accompanied with a manufacturer's affidavit attesting to conformance with TT-S-00230. This affidavit shall constitute sufficient documentation for acceptance of this material at the site of the work. However, samples may be taken by a representative of the Department after delivery to the site of the work to test for conformance to these specifications.

M36 PREMOULDED BITUMINOUS JOINT FILLER

Premoulded Bituminous Joint Filler shall conform to the requirements of ASTM Designation D1751.

The joint filler shall be of the dimensions shown on the plans or listed in the specifications. When the material is delivered cut to dimension, it shall be banded in bundles of convenient size. Each lot delivered shall be accompanied by the manufacturer's certification attesting to conformance with ASTM Designation D1751, and the supplier's certification that the processed material is the same as covered by the manufacturer's certificate.

In addition, each lift or bundle of joint filler shall be tagged by the supplier. The tag shall show the names of the manufacturer and supplier, if different, and a correlation between the manufacturer's and supplier's certifications.

The Department reserves the right to require samples of any or all materials used in the manufacture of the joint filler.

M36B PREFORMED CORK JOINT FILLER

Preformed Cork Joint Filler shall conform to the requirements of ASTM D1752, Type III (self expanding cork).

The joint filler shall be of the dimensions shown on the plans or in the specifications Each piece shall be plainly makred with the manufacturer's name, and each lot delivered shall be accompanied by the manufacturer's affidavit attesting conformance with ASTM D1752, Type III.

The Department reserves the right to require samples of any or all of the materials used in the manufacture of the joint filler.

M36C PREFORMED RUBBER JOINT FILLER

Preformed Rubber Joint Filler shall conform to the requirements of the Standard Specifications for ASTM Designation D1752 Type I (Sponge Rubber).

The joint filler shall be of the dimensions shown on the plans or in the specifications. Each piece shall be plainly marked with the manufacturer's name, and each lot delivered shall be accompanied by the manufacturer's affidavit attesting conformance with ASTM Designation D1752, Type I.

M37 ASPHALT ROOFING FELT

Roofing felt shall conform to the requirements of the Standard Specifications for Asphalt-Saturated Roofing Felt for use in Waterproofing and in Constructing Built-up Roofs ASTM Designation D226.

M38 JOINT SEALER

The material for filling and sealing joints and cracks shall consist of a cold applied sealing compound conforming to the following specifications:

The sealing compound shall be furnished in two components: a base compound and a curing agent. The base compound shall consist of an elastomeric polymer modified with plasticizers, activators, and inert fillers. The curing agent shall consist of a blend of accelerators and extenders. The sealing compound shall be capable of being homogeneously mixed on-the-job to a consistency appropriate for pressure extrusion. When mixed and applied in the field in accordance with the manufacturer's instructions, the mixture shall completely fill the joints without the formation of air holes (entrapped air) and discontinuities. Within 24 hours of application, the material shall form a tack-free, rubber-like compound which shall seal the pavement joints against infiltration of water, motor fuels, and other foreign matter throughout repeated cycles of pavement expansion and contraction. The rate of curing shall permit traffic on the pavement within one hour of application without wheel pickup.

Before the material is used on a Suffolk County Department of Public Works contract, the manufacturer must supply an affidavit to the Engineer that the material has been tested in accordance with Interim Federal Specification SS-S-00200 (Army-C.E.) and meets the following requirements:

PENETRATION: 0.3 to 1.5 centimeters after being conditioned at laboratory atmospheric conditions for 24 hours.

FLOW: None at 200°F. (±2°F.)

BOND: None of the specimens shall develop any crack separation or other opening in the sealing compound or between the sealing compound and the concrete block after three cycles of extension and compression both non-immersed and water immersed. There shall be no surface hardening or loss of rubber like characteristics when subjected to the water immersed bond test.

RESILIENCE: The recovery shall be more than 70 per cent.

Samples may be required for submission to the Engineer upon request.

M38PD PREFORMED ELASTIC JOINT SEALER AND LUBRICANT

The preformed elastic joint sealer material shall be a vulcanized elastomeric compound using polymerized chloroprene as the only basic elastomer. The shape of any joint sealer, from any manufacturer, shall be approved by the Director, Materials Bureau prior to submission of any individual production lot for approval. Such approval shall be requested in writing and be accompanied by a detailed drawing of the shape and a 15 ft. length of the proposed sealer. The joint sealer material shall conform to the following physical requirements:

Property	ASTM Test Procedure	Requirement
Tensile Strength, psi, min.	D-412	2000
Elongation at Break, %, min.	D-412	250
Hardness, Type A Durometer	D-676 (modified)	55±5
Oven Aging, 70 Hrs./212°F	D-573	
Tensile Strength, change, max.%		-30
Elongation, change, max.%		-40
Hardness, points change		+10
Oil Swell, ASTM Oil No. 3 70 hrs./212°F Volume change, max.%	D-471	80
Ozone Resistance, 20% Strain 300 pphm in air, 70 hrs./100°F (Wipe with solvent to remove surface contamination)	D-1149	No Cracks

The joint sealer shall meet all the current test requirements of the New York State Department of Transportation.

All preformed elastic joint sealer to be used on County projects shall be sampled by a representative or agent of the Department from manufactured lots. Test results on the samples shall be subject to the approval of the Chief Engineer. The lubricant used to install the preformed elastic joint sealer shall conform to the following requirements:

The lubricant shall be a one-component polychloroprene compound containing only soluble phenolic resins blended together with anti-oxidents and acid acceptors in aromatic hydrocarbon solvent mixture and shall have the following physical properties:

Average net weight per gallon - 7.84 lbs.
± 5% Solids Content - 22-28% by weight.

The viscosity shall be such that the lubricant will perform suitably with the installation equipment.

The lubricant shall remain fluid from 5°F to 120°F.

Film strength (ASTM D-412)-2,300 minimum tensile strength, 750% minimum elongation before breaking.

The lubricant shall be stored at a temperature of 50°F to 80°F. Any lubricant not used within 270 days of its manufacture shall be unacceptable.

Each lot of the lubricant shall be delivered in containers plainly marked with the manufacturer's name or trade mark, lot number and date of manufacture and shall be accompanied by the manufacturer's certification as to conformance with this specification.

The Department reserves the right to sample and test this material subsequent to delivery at the project site.

M38PE PREFORMED ELASTIC JOINT SEALER

The specification for M38PD PREFORMED ELASTIC JOINT SEALER AND LUBRICANT shall apply except that the details of the preformed elastic joint sealer shall be shown on the plans. Alternate shapes or materials will not be allowed.

M38PF PREFORMED ELASTIC JOINT SEALER AND LUBRICANT FOR 5/8" TRANSVERSE CONTRACTION JOINTS

The preformed elastic joint sealer material shall be a vulcanized elastomeric compound using polymerized chloroprene as the only basic elastomer. The shape of any joint sealer, from any manufacturer, shall be approved by the Chief Engineer prior to submission of any individual production lot for approval. Such approval shall be requested in writing and be accompanied by a fifteen (15) foot length of the proposed sealer.

The materials shall conform to the requirements of the New York State Department of Transportation Specifications of January 2, 1962, as amended, and shall be furnished from sources sampled and accepted by that authority.

M38T POLYVINYL CHLORIDE EXTRUDED SHAPES AND SHEET MATERIAL

SCOPE. This specification covers the quality requirements for polyvinyl chloride extruded shapes and sheet material for use in expansion, contraction, construction joints and drainage troughs as shown on the plans.

GENERAL. The PVC material from which the shapes shall be extruded shall not contain any reclaimed, reground or reworked material whatsoever but shall be compounded from virgin PVC resins, plasticizers, stabilizers and such materials that when compounded it shall meet the physical requirements contained in this specification.

Material shall be extruded in such a manner that all cross sections shall be dense, homogeneous and free from porosity or other imperfections.

The dimensional tolerances shall be as shown on the plans or as approved by the Engineer.

All splices shall be heat welded as approved by the Engineer.

Each extrusion shall be plainly marked at five foot intervals with the manufacturer's name and batch number.

The materials shall conform to the requirements of the New York State Department of Transportation Specifications of January 2, 1962, as amended, and shall be furnished from sources sampled and accepted by that authority.

M39 WATERPROOF PAPER BLANKETS (for Curing)

Waterproof paper for curing shall consist of blankets of an impermeable fiber filled paper and shall be constructed of two layers of 100 percent sulphate Northern Kraft paper each testing not less than 30 pound Mullen Test and cemented together with a suitable asphalt having a melting point of approximately 180°F. and reinforced with mesh completely imbedded in the asphalt, leaving no voids or white spots when the sheet is open for inspection by the Engineer.

The top surface of the blanket shall be white sulphate reflecting Kraft paper.

Sisal fiber or glass yarn shall be the reinforcing agent and shall run only in transverse

and longitudinal directions and shall average a combined total of at least eight per inch.
The paper shall be treated so as to have a high wet strength and offer good resistance to scuffing and shrinkage.

		Length	Cross
Tensile Strength per 1" width	(Dry)	70 lbs.	50 lbs.
	(Wet)	40 lbs.	25 lbs.

Shrinkage (Crosswise) shall not exceed 3%.

The blankets shall have a water retention efficiency in accordance with the requirements of AASHO Specification M139.
The blankets shall not be less than twenty (20) nor more than seventy-five (75) feet in length and shall be of a width which when in place will provide a complete cover for the surface of the pavement. Supplemental stringer sheets at least eighteen (18) inches wide shall be placed along the edges of the pavement under the blankets. All joints in the blankets shall be securely cemented together in such a manner as to provide seams with a minimum lap of five (5) inches, producing a waterproof joint, using an asphaltic cement having a melting point approximately 180°F.
The words "KEEP OFF" and the name of the manufacturer shall be stenciled on each blanket at the time of fabrication.
Upon request the manufacturer of the blankets shall supply a record of the results of the prescribed tests as made on a sample. Each shipment of blankets shall be accompanied by a notarized certificate attesting to the fact that the shipment meets the specified standards.

M40 QUILTED COVERS (for Curing)

Quilted covers shall conform to the requirements of AASHO Designation M73.

M40A POLYETHYLENE COATED BURLAP BLANKETS (for Curing)

Polyethylene Coated burlap blankets shall be manufactured of new burlap AB mill quality, weighing not less than 9 ounces per square yard with a white, opaque, polyethylene film 4 mils thick impregnated or extruded into one side.
The manufacturer shall certify that the moisture loss does not exceed 1% in a 24 hour period under Test Procedure E ASTM E 96. They shall be white, opaque and have an apparant daylight reflectance of not less than 70 percent (ASTM E 97).
Each shipment shall be accompanied by the Manufacturer's Certificate attesting to the fact that the shipment meets the specified standards. Upon request, the manufacturer of the covers shall apply a record of the results of the prescribed tests as made on the samples.

M40B POLYETHYLENE CURING COVERS (White Opaque)

Polyethylene curing covers shall consist of a single sheet manufactured from virgin resin, containing no scrap or additives. Nominal thickness shall be 4 mils. No specimen shall be less than 3.4 mils thick at any point measured.
They shall be white, opaque and have an apparent daylight reflectance of not less than 70 percent (ASTM E 97).
Tensile strength shall be measured in accordance with ASTM Designation D882, Method A only. Minimum tensile requirements shall be as follows:

	Tensile Strength (psi)		Elongation (%)	
Method	Machine Direction	Transverse Direction	Machine Direction	Transverse Direction
A	1700	1200	250	350

Polyethylene curing covers shall be sufficiently tough and durable to permit their use under the conditions encountered in the course of highway work without tearing or otherwise becoming unfit. They shall be free of visible defects and shall have a uniform appearance. Rolls shall be wound on serviceable handling members which extend beyond the edges of the roll, forming handles to facilitate applying the covers over the concrete.
Each shipment shall be accompanied by the manufacturer's certificate attesting to the fact that the shipment meets the specified standards. Upon request, the manufacturer of the covers shall supply a record of the results of the prescribed tests as made on the samples.

M41 CHLORINATED RUBBER EPOXY CURING COMPOUND (for Curing New Concrete Surfaces and Sealing Old Concrete Surfaces)

SCOPE. This specification covers a chlorinated rubber epoxy curing compound for use as a cure on freshly placed concrete and as a sealer on existing concrete surfaces, without affecting the adhesion or bonding of subsequent concrete placement, joint sealants or coatings.

MATERIALS. The chlorinated rubber epoxy shall be clear in color or with red fugitive dye as directed by the Engineer. It shall meet Federal Interim Specification TT-C-00800 and AASHO Designation M-148 Type I, or ASTM C-309 Type I as modified. Certificate of compliance to the above specification is required, subject to final acceptance by the agency after proper testing as to compliance with the specification. The manufacturer shall provide test data from independent test laboratories or approved agencies to show that the material does meet the requirements of the specification.

M42 HYDRATED LIME

Hydrated Lime shall meet the requirements of the ASTM Designation C-6.

M43 COMMON BRICK

Common brick made from clay or shale for use in the construction of drainage structures shall conform to the requirements of AASHO Specification M91 Grade NA and shall exhibit a saturation coefficient not exceeding 0.80 except that if the average compressive strength of a lot submitted for test is greater than 8,000 p.s.i. or the average water absorption is less than 8.0% after 24-hour submersion in cold water, the requirement for saturation coefficient shall be waived.

Common brick may be furnished in any of the designated standard sizes that will produce the required dimensions in the completed structure.

At the project site individual brick may be culled and rejected by the Engineer for failure to satisfy any of the visual inspection features stated in AASHO M91 or for failure of the brick to exhibit a clear metallic ring when any two bricks are struck together.

M44 CONCRETE BLOCK (Drainage Structures)

SCOPE. This specification covers the material and quality requirements for concrete blocks for use in the construction of catch basins, manholes and drop inlets. (These blocks are not for use in leaching basins).

MATERIALS. The section entitled "Materials" of M25A "Reinforced Concrete Pipe" shall apply except that all references to the table "Composition of Concrete Items", approved working drawings, and reinforcement shall not apply.

FABRICATION. The block shall be 100% solid Portland Cement Concrete and shall be of such dimensions as to satisfactorily construct the drainage structure to the nominal dimensions shown on plans within a tolerance of minus 1/2 inch from those nominal dimensions. The block shall be of such length that only full length or half-length units are required to place any one course. The block may be rectangular in shape.

Corner units for square or rectangular basins or inlets must be "L" shaped with an inside return side not less than one quarter nor more than one half the length of the normal unit.

Units for both manholes and basins shall be so designed that only full length units are required to lay any one course. Inside and outside joints shall not exceed one-half inch. Concrete mix proportions shall be such that the minimum compressive strength as determined on the units themselves shall be as stated in this specification.

The transportation and placement of concrete shall be done by methods that will prevent segregation of the concrete materials.

The use of high early strength cement, calcium chloride, or any other concrete additive not expressly approved is prohibited.

Blocks shall be sound and free from cracks or other defects that would interfere with the proper placing of the block.

CURING. All block shall be subjected to curing by any one of the methods described in the section entitled "Curing" M25A "Reinforced Concrete Pipe" which shall be accomplished to the satisfaction of the Engineer. Units shall be protected from freezing from the time the concrete is placed and until curing is completed.

PHYSICAL TESTS. The minimum average compressive strength of concrete block samples representing any lot, as determined upon the units themselves, shall be 2500 pounds per square inch of cross sectional area of the unit as laid in the structure. The compressive strength of any individual unit shall not be less than 2000 pounds per square inch.

The maximum average absorption of concrete block samples representing any lot shall not exceed eight percent (8%) by weight. The absorption of any individual unit shall not exceed ten per cent (10%) by weight.

All test procedures shall be in accordance with ASTM C-140.

BASIS OF ACCEPTANCE. Block will be considered for acceptance in stock lot quantities maintained at the manufacturer's yard or in job lots consisting of any fraction of contract quantity at the project site. Samples shall be secured for tests by a representative of the Department only from the completed lots of block they are to represent. The maximum quantity in a lot and the number of samples shall be as directed by the Laboratory.

Block shall be considered ready for acceptance when a lot conforms to the specified test requirements regardless of the age of the units. The manufacturer shall be permitted one, and only one, retest to determine specification compliance.

M44A CONCRETE BLOCK (Slope Paving)

SCOPE. This specification covers the material and quality requirements for concrete block for use in concrete block slope paving.

MATERIALS. The section of the specifications for M44 covering materials shall apply.

FABRICATION. The section of the specifications for M44 covering fabrication shall apply except that the shape and dimensions of the units shall be as shown in the plans or specifications.

CURING. The section of the specifications for M44 covering curing shall apply.

PHYSICAL TESTS. The minimum average compressive strength of concrete paving block samples representing any lot, as determined upon the units themselves, shall be 2500 pounds per square inch of cross sectional area of the unit as determined by load application in a direction parallel to the slope upon which the block is to be placed. The compressive strength of any individual unit shall not be less than 2000 pounds per square inch.

The maximum average abosrption of concrete paving block samples representing any lot shall not exceed ten (10) percent by weight. The absorption of any individual unit shall not exceed twelve (12) percent by weight.

All test procedures shall be in accordance with ASTM C-140.

BASIS OF ACCEPTANCE. The section of the specifications for M44 covering basis of acceptance shall apply.

M44B CONCRETE BRICK

SCOPE. This specification covers the material and quality requirements for concrete building brick intended for use in brick masonry.

MATERIALS. The section of the specifications for M44 covering materials shall apply.

FABRICATION. The brick shall be manufactured in an approved plant. The nominal dimensions of the brick shall be 8 inches long, 4 inches wide, and 2 2/3 inches in height. The standard dimensions of the brick shall be the nominal dimension minus 3/8 of an inch. No over-all dimension (width, height, and length) shall differ more than 1/8 inch from the specified standard dimensions.

Concrete mix proportions shall be such that the minimum compressive strength as determined on the units themselves shall be as stated in this specification.

The transportation and placement of concrete shall be done by methods that will prevent segregation of the concrete materials.

The use of high early strength cement, calcium chloride, or any other concrete additive not expressly approved is prohibited.

Brick shall be sound and free from cracks or other defects that would interfere with proper placing of the brick.

CURING. All brick shall be subjected to curing by any one of the methods described in the section entitled "Curing" of M25A "Reinforced Concrete Pipe", which shall be accomplished to the satisfaction of the Engineer. Units shall be protected from freezing from the time the concrete is placed and until curing is completed.

PHYSICAL TESTS. The minimum average compressive strength of concrete brick samples representing any lot, as determined upon the units themselves, shall be 2500 pounds per square inch of average gross area (brick flatwise). The compressive strength of any individual unit shall not be less than 2000 pounds per square inch.

The maximum average water absorption of concrete brick samples representing any lot shall not exceed fifteen (15) pounds per cubic foot. The moisture content of the brick shall not be greater than forty (40) percent of total absorption.

All test procedures shall be in accordance with ASTM C-140.

BASIS OF ACCEPTANCE. The section of the specifications for M44 covering basis of acceptance shall apply except that all references to "block" shall be changed to read "brick".

M45 PAVING BRICK

All paving brick shall meet the requirements of ASTM Designation C7, except that the maximum

loss in rattler per cent for a 2 1/2 inch brick shall not exceed 21, a 3 inch brick 19, and a 3 1/2 inch brick 17.

M46 WATER

Water for concrete shall be free from oil, acid, alkali, vegetable matter, organic matter or other deleterious substances.

Doubtful sources of water for concrete shall be subjected to Laboratory testing before use. Tests shall be in accordance with AASHO T-26.

Water applied to seeded or sodded areas or plants or planted areas shall be free from impurities injurious to vegetation.

PART II

Section 6a

ROADSIDE DEVELOPMENT MATERIALS

M47 TOPSOIL FROM BORROW

QUALITY. Topsoil shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth and shall be reasonably free from subsoil and stumps, roots, brush, stones, clay lumps or similar objects larger than two inches in greatest diameter. Brush and other vegetation which will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary sods and herbaceous growth such as grass and weeds are not to be removed but shall be thoroughly broken up and intermixed with the soil during handling operations. The topsoil or soil mixture, unless otherwise specified or approved, shall have an acidity range of approximately 5.5 pH to 7.6 pH, when tested according to the methods of testing of A.O.A.C. in effect on the date of the invitation of bids. The organic content shall be not less than 3% nor more than 20% as determined by the wet combustion method (chromic acid reduction). There shall be not less than 20% nor more than 80% passing the 200 mesh sieve as determined by the wash test made in accordance with the standard test ASTM Designation D1140.

Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above specifications.

SAMPLING. Samples of the topsoil or soil mixture will be taken by a representative of the Department. The Contractor shall furnish at his own expense suitable approved excavating equipment as required by the Engineer.

TESTING. All topsoil used under this item will be tested unless otherwise directed. Testing will be done by the Department and the material approved by the Chief Engineer in writing before any material is used. The Contractor shall notify the Department of the intended source of the material at least three weeks in advance of the scheduled use of the material to allow time for sampling, shipping of the sample and testing.

M48 WOOD CHIPS

Wood chips for mulching plants may be either hardwood or softwood chips as produced by any standard chipping machine. No leaves, young green growth, wood shavings, sawdust or foreign material such as stones, etc. shall be mixed with the chips. Chips shall not exceed 3 inches in greatest dimension. Inspection shall be made upon delivery unless otherwise approved.

M49 SAND

Sand for amending soils shall be sand wherein 100% shall pass the 1/4" mesh sieve and not more than 10% shall pass the 200 mesh sieve.

M50 HUMUS OR PEAT

QUALITY. The material shall be natural humus, reed peat or sedge peat. It shall be free from excessive amounts of zinc, low in wood content, free from hard lumps and in a shredded or granular form. According to the methods of testing of A.O.A.C. in effect on the date of the invitation of bids, the acidity range shall be approximately 5.5 pH to 7.6 pH and the organic matter shall be not less than 85% as determined by loss on ignition. The minimum water absorbing ability shall be 200% by weight on an oven-dry basis.

SAMPLING. Duplicate samples of the material will be taken by a representative of the Department.

GUARANTEE. A certificate giving an analysis by an approved laboratory at the expense of the Contractor shall be furnished and the material approved before it is used, unless otherwise approved. A copy of the specifications for the material shall be furnished to the laboratory by the Contractor.

M51 PEAT MOSS

QUALITY. Peat moss shall be composed of the partly decomposed stems and leaves of any or several species of sphagnum moss. It shall be free from wood, decomposed colloidal residue and other foreign matter. Acidity range; 3.5 pH to 5.5 pH as determined in accordance with the methods of testing of A.O.A.C. in effect on the date of the invitation of bids. Water absorbing ability: Minimum 1100% by weight on an oven-dry basis.

GUARANTEE. A certificate giving an analysis by an approve laboratory at the expense of the Contractor shall be furnished and the material approved before it is used unless otherwise approved. A copy of the specifications for the material shall be furnished to the laboratory by the Contractor. Quantities of ten bales or less may not require testing.

M52 AGRICULTURAL LIMESTONE

QUALITY. Agricultural limestone shall be ground limestone containing a minimum of 88% of calcium and magnesium carbonates. 100% shall pass the 10 mesh sieve; Minimum 90% shall pass the 20 mesh sieve; Minimum 60% shall pass the 100 mesh sieve.

PACKAGING. Agricultural limestone packed in the manufacturer's standard containers shall weigh not over 100 pounds each, with the name of the material, net weight of contents and the manufacturer's name and guaranteed analysis appearing on each container. Bulk shipments shall be accompanied by a certificate covering the names, weight and analysis as specified herewith for packaged material.

M53 JUTE MESH

Jute mesh shall be of a uniform open plain weave of undyed and unbleached single jute yarn averaging 130 pounds per spindle of 14,400 yds. The yarn shall be of a loosely twisted construction having an average twist of not less than 1.6 turns per inch and shall not vary in thickness by more than one-half its normal diameter. The jute mesh shall be furnished in firm rolls approximately 225 feet long and approximately 48 inches wide or as specified or approved and containing a hollow fiber core approximately 2 inches inside diameter.

Jute mesh shall be woven as follows:

Approximately 60 warp ends per yard of width
Approximately 40 weft ends per lineal yard

Weight of jute mesh shall average .9 pounds per square yard (plus or minus 5%).

M54 FERTILIZER

QUALITY. Fertilizers shall be standard quality commercial carriers of available plant food elements.

The following mixed commercial fertilizers shall contain nitrogen, phosphoric acid and potash in the ratios stated:

Type No. 1, 1-2-1
Type No. 2, 1-1-1

The following fertilizers shall be as specified:

Type No. 3, 10-6-4
Type No. 4—Nitrate of soda shall contain a minimum of 16% nitrogen.
Type No. 5—Ammonium sulphate shall contain a minimum of 20.5% nitrogen.
Type No. 6—A nitrogen carrier containing approximately 20% nitrogen such as cyanamid or equivalent.
Type No. 7—Ammonium nitrate shall contain a minimum of 33% nitrogen.
Type No. 8—A nitrogen carrier containing approximately 45% nitrogen such as Urea or equivalent.
Type No. 9—Bonemeal shall be commercial steamed bonemeal, finely ground with a minimum of 1.0% nitrogen and a minimum of 20% phosphoric acid.
Type No. 10—Shall be as specified on the plans.

PACKAGING. Fertilizers shall be packed in the manufacturer's standard containers weighing not over 100 pounds each with the name of the material, net weight of contents and the manufacturer's name and guaranteed analysis appearing on each container.

GUARANTEE. The Engineer reserves the right to reject any material which has become caked or otherwise damaged.

M55 ROTTED MANURE

Manure shall be animal or poultry excreta. The manure and bedding materials shall be well decayed, reasonably free from firefang, free from sticks, stones and foreign substances injurious to plant growth. Poultry manure shall be shredded or pulverized to permit uniform distribution. Inspection shall be made upon delivery unless otherwise approved.

M56 HAY

Hay for mulching shall be mowings of acceptable herbaceous growth which is free from noxious weeds. Materials which are low grade and unfit for farm use such as "U.S. sample grade" shall be acceptable. Weight shall be calculated on the basis of the material having not more than 15% of moisture content.

M57 STRAW

Straw for mulching shall be stalks of oats, wheat, rye or other approved crops which are free from noxious weeds. Materials which are low grade and unfit for farm use such as "U.S. sample grade" shall be acceptable. Weight shall be calculated on the basis of the material having not more than 15% of moisture content.

M58 SEEDS

QUALITY. Each species, variety and strain of grasses, legumes and cereals shall be as specified on the plans unless otherwise approved.

Material other than pure live seed shall comprise only nonviable seed, chaff, hulls, live seed of crop plants other than those specified, harmless inert matter and weed seeds except that weed seeds other than seeds of noxious weeds will be permitted up to 1% of the gross weight of each kind of seed. Legume seeds shall be accompanied by adequate amounts of their proper inoculants unless accompanied by certification of preinoculation.

The percentage of purity as shown on the label will be acceptable. The percentage of germination shall not be less than the minimum percentage specified on the plans.

NOMENCLATURE. The common and scientific names of grasses, legumes and cereals under this contract are in conformity with the approved names by S.P.N.

WEIGHT OF PURE LIVE SEED. The weight of pure live seed in each lot of seed is computed by the labeled purity percent times the labeled germination percent, times weight (Example: 34 pounds of pure live seed of a particular grass is required. Stock available has 85% purity and 80% germination, which meets the minimum requirements in this example and equals 68.0% pure live seed. 34 divided by 68% equals 50 pounds gross as being required to furnish the 34 pounds of pure live seed.) Other material shall comprise the remaining 32%, between 68% of pure live seed and 100% in the example.

LEGUME INOCULANTS. The inoculants for treating seeds of legumes shall be standard culture of nitrogen fixing bacteria not more than one year old. Each inoculant shall be the specific culture required by each legume. It shall be supplied only from manufacturers licensed to sell legume inoculants in New York State.

PACKAGING. Each kind of seed shall be furnished and delivered, unless otherwise approved, in separate, sealed containers, or bags acceptably sewn tight or sealed.

LABELING. All seed and seed labels shall be in accordance with State and Federal Laws, Rules and Regulations as each is in effect on the date of invitation of bids.

GUARANTEE. The seeds shall meet the minimum specified requirements regardless of the guarantee of qualities or dates of testing. Seed which has become wet, mouldy or otherwise damaged in transit or storage will not be acceptable. Seed, after delivery to the Contractor, shall be stored in such a manner as to protect it from damage or deterioration from any source. Provisional acceptance of seeds must be obtained before the seed is sown. Final acceptance may be subject to the results of official sampling and testing. The Contractor shall furnish the vendor with the specifications for the material.

M59 SOD

Sod shall be living sod procured from areas where the soil is reasonably fertile and from areas similar in the degree of moisture to the area to be planted. It shall be cut or stripped from turf areas relatively free of large stones, roots or other materials which might be detrimental to the sodding operation or to future maintenance. The sods shall contain a sufficient proportion of pasture grasses to insure a good mat of roots and a reasonably dense turf unless Type No. 1 which is a superior quality is specified on the plans.

Any growth more than three inches in height shall be mowed to a height of three inches not more than five days before the sod is lifted.

Sources of sod shall be made known to the Engineer at least five days before cutting and shall be approved before mowing. The sod shall be cut into squares or rectangular portions which shall be twelve inches wide and may vary in length but must be of a size which will permit them to be lifted without breaking. The sod shall be sufficiently moist so the soil will adhere firmly to the roots when it is handled and may require watering before lifting. The sod may be cut with spades or by sod cutters. The sods shall be cut at a depth of one and one-half inches to two inches unless otherwise specified on the plans or unless commercially grown sod is used in which instance the sod may be cut to a minimum thickness of three quarters of an inch.

Type No. 1. At least ninety percent of the plants in the cut sods shall be composed of a vigorous, dense growth of permanent grasses suitable for lawn purposes. The sods shall be free from noxious weeds such as quackgrass and reasonably free from such weeds as plantain and dandelion.

M60 TREES, SHRUBS AND VINES

NOMENCLATURE. The common and scientific names of plants shall be in conformity with the approved names by S.P.N.

QUALITY AND SIZE. Plants including root spread and ball size shall be in accordance with the current edition of "American Standard for Nursery Stock", a code of standards sponsored by the American Association of Nurserymen, or as further specified on the plans. All plants shall have a normal habit of growth and be typically characteristic of their respective kinds. When a minimum and maximum size is specified, an average size is required. Plants shall not be pruned before delivery and no plants shall be cut back from larger sizes to meet the sizes specified. Plants shall be free from injury. Plants shall be nursery grown unless otherwise specified and bear evidence of proper nursery care, including adequate transplanting and root pruning. Plants specified from collected sources shall be clean, sound stock, free from decayed stumps and from fire injury.

DIGGING PLANTS. Plants shall be dug with care and skill immediately before shipment. No cold storage plants will be accepted unless approved. Plants stored temporarily shall be properly heeled-in or otherwise protected from injury. Digging shall avoid all possible injury to, or loss of roots, but roots cut shall be cleanly cut.

ROOT PROTECTION. After plants are dug their roots shall be protected from injury such as caused by heat, sun, wind and freezing temperatures. All bare roots of trees, shrubs and vines shall be puddled at the time of digging unless otherwise approved. Puddling shall be done in a wet clay mixture, of a quality to adhere to all parts of the root system. Roots of bare root plants which have been thoroughly covered at the time of digging with an anti-desiccant as specified under M-61 will not require puddling. Bare roots shall be further protected by wrapping in wet straw, moss, burlap or other suitable material.

TRANSPORTATION. Tarpaulins or other covers shall be placed over plants transported by open trucks or by open freight cars. Doors on closed trucks shall be kept closed to prevent draughts. Shipments made in box cars or closed trucks shall be adequately ventilated to prevent "sweating." The heads of trees shall be tied in carefully to prevent fracturing or breaking the branches. Trunks and branches shall be adequately supported and padded to avoid scraping or bruising.

TREES. Nursery grown trees shall have no cuts of limbs which are not healing and no cuts over 3/4 inch which have not completely calloused over, no cut back crowns or leaders and no abrasions of the bark. Trees must have good fibrous root systems characteristic of the kind. Deciduous trees shall have normal spread of crowns unless otherwise specified.

Bare root (B.R.) trees shall not require earth adhering to the roots except as required for puddling as specified. Any trees specified bare root will be accepted balled and burlapped at the unit price bid for bare root trees.

Balled and burlapped (B & B) trees shall be properly dug and protected to preserve the natural earth in contact with the roots. No manufactured balls will be accepted. The balls shall be of the required size, firmly wrapped and tied with approved materials. No balled plants will be acceptable if the ball is cracked or broken.

Balled and platformed trees (B & P) shall be balled as specified for balled and burlapped trees. Platforms shall be square or octagonal shaped in a size slightly larger than the diameter of the bottom of the soil mass, inserted under each ball and securely lashed to the ball by means of ties from the platform corners to the rope collar on top of the ball.

The tops of trees shall be well formed structurally but they are not required to have more than reasonably straight trunks, nor better than average well balanced crowns, nor be of specimen quality unless Alternate 1 is specified on the plans.

Alternate 1. Trees shall be of specimen quality with straight trunks having a minimum deviation from the vertical which is characteristic of the kind, with well branched, symmetrical tops and with their lowest branches 7 to 9 feet from the ground unless otherwise specified.

SHRUBS. Shrubs shall have good fibrous root systems. The quality of balled and burlapped and balled and platformed shrubs shall be as specified for B & B and B & P trees herein. Plants specified as sods or clumps shall be dug from good soil which has produced a fibrous root system typical of the nature of the plant. The sods shall be dug with earth and incidental vegetation adhering to the roots. If the soil or habit of the root growth is such that the roots are not adequately protected, the sods shall be wrapped in burlap or other suitable material.

VINES. Vines shall be vigorous, well furnished plants with good vigorous root systems. Vines shall be field grown (F.G.) unless otherwise specified. Pot grown plants (P.G.) shall be vigorous, well-developed plants, well established in pots with sufficient roots to hold the earth intact after removal from containers but they shall not be rootbound.

SUBSTITUTIONS. No change of quantity, size, kind or quality of plants as specified will be accepted except upon written approval.

LABELING. Labeling shall be in accordance with normal large scale nursery labeling practice except that the Contractor may be required at any time to supply positive identification of any plant.

GUARANTEE. The Contractor shall furnish the vendor with a copy of the specifications for the plants. The Contractor shall be responsible for all certificates of inspection of plant materials which may be required by federal, state or other authority to accompany shipments of plants. All plants shall be subject to inspection at any place and at any time. Inspections desired by the Contractor, if approved, shall be at the expense of the Contractor. The Contractor shall be represented at all inspections. The Engineer reserves the right and option to place Department seals on any or all materials selected. Selection and/or tagging of material shall cover the type and body quality of the plant only, but shall not constitute final acceptance nor preclude the right of rejecting plants not fully meeting the requirements of the specifications.

M61 MATERIALS FOR PROTECTION OF PLANTS

For methods of construction, see current standard structure sheet.

TREE PAINT. Paint used for tree wounds shall be antiseptic, waterproof, adhesive and elastic such as asphalt, gutta percha and certain oils with a fungicide, and which remains tacky for four hours and retains elasticity after setting when tested under the heat of the hand. It shall not contain kerosene, coal tar creosote, or other material harmful to the living tissue of the trees.

STAKES FOR SUPPORTING TREES. Stakes for supporting trees shall be of White or Red Cedar, or other approved wood. Stakes 8 to 10 feet long shall have a minimum diameter of 2 to 2 1/2 inches. Stakes 12 feet long shall have a minimum diameter of 3 inches. The maximum diameter of stakes shall not exceed approximately 4 inches. Stakes shall have a minimum allowable deflection of 1/2" for every one foot of length. All stakes shall be sound and free from insects and fungi.

DEADMEN AND GUY STAKES. Deadmen and guy stakes used to anchor guy wires or cables which support trees shall be of the quality and sizes required for the operations calling for their use.

WIRE. Wire for guying plants shall be new annealed galvanized wire, A.S.&W. gauge as specified.

BRACING MATERIALS. The size and quality of cables, turnbuckles, thimbles, lag hooks, eye bolts, rods, washers and nuts shall be as specified on the plans or as approved.

JUTE BURLAP. Jute burlap shall be in 4 inch wide strips and weigh eight ounces per square yard.

HOSE. Hose for protecting the bark from guy wires shall be good quality braided rubber or reinforced materials.

TWINE. Twine for use in wrapping trees shall be jute twine not less than two ply for trees three inches or less in diameter, and three ply for trees over three inches in diameter.

PAPER. Wrapping paper for trees shall be waterproof paper 30-30-30 krinklecraft or equal in four inch wide strips.

ANTI DESICCANTS. Anti desiccants shall be emulsions which will provide a protective film over plant surfaces, permeable enough to permit transpiration.

M62 STAKES FOR PEGGING SOD

Stakes for pegging sod shall be approximately 1" x 2" and of sufficient length to penetrate the sod, the topsoil and to a minimum depth of two inches of subsoil.

M63 STONE FOR TREE WELLS OR WALLS

Stone for the construction of tree wells and tree walls shall be roughly rectangular, sound, field or quarry stone. At least four-fifths of the stone shall be over one-third cubic foot. Face stones shall have a minimum thickness of 2 inches and a minimum width of 10 inches.

M64 BACKFILL FOR TREE WELLS

Material for backfilling tree wells shall be coarse granular fill such as broken bricks or crushed stone no smaller than size 3A.

M65 INSECTICIDES

Insecticides shall be packed in the manufacturer's standard containers marked with the name of the material, the brand and name of the manufacturer, the net quantity contained therein and be in accordance with the provisions of the Federal Insecticide Act of 1947 and Article II, entitled "Economic Poisons, of the New York State Agriculture and Markets Law of 1947".

Type 1—Chlordane Granules. Chlordane granules shall be free flowing with 0.3% retained on a U.S. Standard No. 20 sieve and 93% retained on a No. 60 sieve. The granules shall contain a minimum of 5% technical chlordane by weight.

Type 2—Dieldrin Granules. Dieldrin granules shall be free flowing with 0.3% retained on a U.S. Standard No. 20 sieve and 93% retained on a No. 60 sieve. The granules shall contain a minimum of 5% technical dieldrin by weight.

Type 3—Milky Spore Dust. Milky spore dust shall be a powder containing a minimum of 100 million viable spores of the milky spore disease per gram of dust.

Type 4—Shall be as specified on the plans.

M66 HERBICIDES

QUALITY. Herbicides shall be commercial herbicides of the type or kind specified.

PACKAGING. Herbicides shall be packaged in standard containers marked with the name of the material, the name of the manufacturer, the net quantity contained therein and be in accordance with the provisions of the Federal and State Rules and Regulations in effect at the time of delivery.

M136 ASBESTOS SHEET PACKING, (GRAPHITED BOTH SIDES)

Asbestos sheet packing shall conform to the requirements of ASTM Designation D 1170, Type I, P-1161 A. The sheet shall be 1/16" thick and shall be graphited on both sides.

This product will be accepted on the basis of certification of compliance. However, the Department reserves the right to require samples at any time.

M137 REINFORCED PLASTIC STEPS FOR MANHOLES

GENERAL. The step shall consist of Polyprepylene or other suitable or acceptable plastic material extruded, cast or molded into the standard size and shaped manhole step having a steel core in center for strength and completely covered by the plastic coating for corrosion protection.

MATERIAL SPECIFICATIONS.

1. The plastic material shall have the following characteristics:
   a. Be resistant to the following solutions when submerged for 30 days:
      1. 10% Sodium Chloride
      2. 10% Hydrochloric Acid
      3. 10% Sodium Hydroxide
      4. 10% Sulfuric Acid
   b. It shall have a flow point of 325° or greater
   c. It shall remain flexible over a temperature range of -25° F to 250°F and upon long aging
   d. It shall be non-burning, self-extinguishing or very slow burning

2. The steel core shall be not less than 3/8" diameter and having the following physical characteristics:
   Yield - Minimum - 40,000 psi
   Tensile Strength - Minimum - 70,000 psi

3. The plastic step when cast into a concrete block, the proper depth, shall withstand a minimum load of 400 pounds applied on one inch area in the center of the step without cracking or breaking the plastic coating, loosing the step in the concrete or permanently deforming the step.

PART II

Section 7

PORTLAND CEMENT CONCRETE

GENERAL SPECIFICATIONS

DESCRIPTION. Portland Cement Concrete shall consist of a homogeneous mixture of cement, fine aggregates, coarse aggregates, water and admixtures, when required, proportioned and mixed as hereinafter specified.

MATERIALS

Unless otherwise specified in the plans or itemized proposal, the materials to be used in the various items of portland cement concrete shall be as shown in the table "Composition of Concrete Items" in this section.

The materials for manufacturing portland cement concrete shall conform to the following requirements:

CEMENTS. Cements used shall conform with the requirements of M1, Portland Cement, and the requirements of M2, Natural Cement. Where the plans or specifications indicate the use of Natural Cement in conjunction with Portland Cement, all mixtures shall be in the approximate ratio of 8 pounds of Portland Cement to 1 pound of Natural Cement. The ratio of Portland Cement to Natural Cement may be varied from the above as ordered by the Engineer to allow the use of whole numbers of bags of Natural Cement in a batch of concrete. The types of Cement permitted in the several pay items are shown in the table "Composition of Concrete Items." For each particular project, the plans or proposal will indicate the type or types of cement which shall be used in that project.

WATER. Mixing water, and water for curing concrete, shall conform to the requirements of M46, Water.

AGGREGATES. All aggregates used in the manufacture of concrete shall conform to the requirements of M3, Fine Aggregates, and M4, Coarse Aggregates. If, after trial, it is found that sources of supply do not furnish a uniform product or if, for any reason, the product from any source at any time proves to be unsatisfactory to the Chief Engineer, he may require the Contractor to furnish acceptable material from other approved sources of supply, and the Contractor shall have no claim for increased payment on account of such requirement. Aggregates delivered and stockpiled at batching plants from acceptable sources shall be rejected if they fail to conform to gradation requirements.

Unless otherwise specified on the plans or proposal, only Crushed Stone, Crushed Gravel or Crushed Slag shall be used as coarse aggregates for cement concrete items except that Screened Gravel may be used as coarse aggregate for Concrete Pipe Items without special note on the plans or specifications.

Coarse aggregates shall consist of the types and sizes approved in the table of "Composition of Concrete Items" or as specified in the Itemized Proposal and shall be proportioned as ordered by the Engineer within the ranges described below:

a. When the aggregate consists of No. 1 and No. 2 sizes, not more than 50 percent nor less than 30 percent shall be No. 1 size.

b. When the aggregate consists of No. 1, No. 2 and No. 3 sizes, 40 percent to 50 percent of the combination shall be No. 3 size and the remainder shall be of No. 1 and No. 2 sizes.

The general limits shown in the table at the top of Page 100 are expressions of the combined gradations allowable as prescribed in paragraphs a. and b. above. In no case shall the gradation be permitted to fall outside the general limits.

COMPOSITION OF CONCRETE ITEMS

Item Number	Item Name	Class of Concrete	CEMENT Type			Fine Aggregate Type			COARSE AGGREGATE												Item Number
									Crushed Stone or Crushed Gravel					Screened Gravel				Crushed Slag			
									Type		Size			Type		Size		Size			
			1	1A	1A & IN	a	b	c	A	B	1	1 & 2	1, 2 & 3	A	B	1	1 & 2	1 & 2	1, 2 & 3		
18	Class A concrete for structures	A†	V			V	V	V	V	V		V						V		18
20	Class B concrete for structures	B	V		V	V	V	V	V	V			V						V	20
33PC	Precast concrete guide railing	A	V			V	V	V	V	V		V								33PC
46	Concrete foundation for pavement	B	V		V	V	V	V	V	V			V						V	46
47 & 47C	Cement concrete pavement	C	V		V	V	V	V	V	V			V						V	47 & 47C
47B	Cement concrete pavement	A†	V			V	V	V	V	V		V						V		47B
97	Concrete curb	A	V		V	V	V	V	V	V		V						V		97
98	Concrete gutters	A	V		V	V	V	V	V	V		V						V		98
100	Leaching basins, type A or B	A	V		V	V	V	V	V	V		V						V		100
102(all)	Catch basins, manholes and drop inlets	A	V		V	V	V	V	V	V		V						V		102(all)
104	Concrete right of way markers	A	V			V	V	V	V	V		V						V		104
104X	Permanent survey markers—concrete	A	V			V	V	V	V	V		V						V		104X
105	Concrete sidewalk	A	V		V	V	V	V	V	V		V						V		105
110	Concrete cribbing	A	V			V	V	V	V	V		V						V		110

† A retarding admixture shall be added to the concrete produced under Items 18 and 47B if required under the conditions described in the subsection titled 'Admixtures' of these specifications.

Note: All concrete shall be produced with an air content within the limits listed in the ____ table under the subsection, "Admixtures." No requirement for a specific amount of air-entrainment will be made where Type 1A cement is allowed by the specifications.

Screen Sizes	Combined No. 1 & No. 2 Sizes General Limits % Passing	Combined No. 1, No. 2, & No. 3 sizes General Limits % Passing
2 1/2"	—	100
2"	—	95-100
1 1/2"	100	68- 88
1"	93-100	47- 66
1/2"	27- 58	14- 35
1/4"	0- 8	0- 5

Blending of No. 1 and No. 2 size coarse aggregate is permissible prior to batching. However, No. 3 size coarse aggregate shall be batched separately. The above gradation limits for combinations of coarse aggregates shall apply directly to blends of No. 1 and No. 2 sizes but shall apply only to combinations containing the No. 3 size resultant from the proportioning operation.

Aggregate stockpiles shall be sampled and tested for compliance with gradation specifications and for uniformity of gradation in accordance with the Department's instructions to its employees. Stockpiles deemed non-uniform in gradation by the Department or Stockpiles containing visible concentrations of fines shall be rejected. Such rejected stockpiles shall be reprocessed to the satisfaction of the Engineer or removed from the site of the work.

Stockpiles of aggregate shall be formed on prepared bases. The base shall be constructed of the same material as is to be stockpiled with a minimum thickness of twelve (12) inches. The earth under the prepared base shall be graded so as to drain to the edges on a slope of approximately three (3) inches vertical in twelve (12) feet horizontal. The prepared base shall be of such size that a border about ten (10) feet in width shall exist beyond the bottom of the stockpile. Barge floors, wood or metal surfaces shall be considered acceptable alternates for the above-described stockpile aggregate base. The stockpiles shall be located at points approved by the Engineer, and so arranged that aggregate sizes do not become mixed.

The entire batching plant area shall be graded to drain water away from all material stockpiles and batching facilities and shall be treated to eliminate dust or other unsatisfactory conditions as directed by the Engineer. No direct payment will be made for this work.

If ordered by the Engineer, stockpiles for fine aggregates shall be allowed to drain for 12 hours to stabilize moisture content.

Where contract grading or other operations on the right of way are in progress in areas near a batching plant or stockpiles, such areas shall be treated to control dust. Furnishing and applying calcium chloride on the right of way for this purpose will be paid for under its respective item.

Stockpiles of properly graded County approved aggregates shall be separated from stockpiles of non-County approved aggregate wherever batching for both County and non-County work is being conducted at the same site. The presence of non-County approved material in a stockpile will be sufficient cause for rejection of that stockpile for use on County work.

ADMIXTURES. No admixtures other than coloring agents, air-entraining agents and/or retarders shall be used without the written permission of the Chief Engineer.

All air-entraining and retarding admixtures used in the manufacture of Portland Cement Concrete shall conform to the requirements of M-21 Admixtures.

Admixtures shall be added to the mix in accordance with the instructions for the particular type of mixer in use.

Care must be exercised that air-entraining agents and retarders do not come into direct contact prior to mixing.

Concrete shall be placed with an air-content as nearly consistent as is practicable with the "Design %" shown in the following table. Concrete having air contents which fall outside the minimum or maximum limits as determined by one pressure test or the average of three (3) Chace tests shall be rejected for use in the work. Sampling and testing shall be conducted in accordance with the Department's written instructions.

All concrete shall be produced with an air content within the limits below:

AIR CONTENT TABLE

Concrete Class	Min. %	Design %	Max. %
A	4	6.0	8
B	3	5.0	7
C	4	5.5	7
Items containing a maximum of No. 1 aggregate size	5	7.0	9

NOTE: An exception to the above is that the use of air-entrainment is optional with the Contractor on all concrete pipe items. No requirement for a specific amount of air-entrainment will be made on these items or in items where Type 2A cement is allowed by the Specifications.

Class A concrete produced under Item 18 or 47B shall be retarded when, in the opinion of the Engineer, such retardation is necessary for proper placement.

The quantity of retarder to be incorporated in the mix will be determined by the Engineer. The degree of retardation shall be so regulated that the minimum retardation consistent with placing conditions is obtained.

When the temperature is below 60° Fahrenheit and not likely to raise significantly immediately after the concrete is placed, retarders shall not be used unless unusual hydration conditions are known to exist.

PROPORTIONS

Unless otherwise specified, concrete shall be produced under one of three general mix classifications, proportioned as indicated in the following table:

Table of Concrete Proportions

(Weights are based on Saturated Surface Dry Conditions i.e. no allowance has been made for surface moisture)

Sp. Gr. of Aggregate		2.60	2.65	2.70	2.75	2.80	2.85	2.90
		Lbs. of aggregate per bag of cement						
CLASS A	Fine Agg.	164	168	171	174	177	180	183
	Coarse Agg.	305	311	317	323	329	335	341
CLASS B	Fine Agg.	191	195	199	202	206	210	213
	Coarse Agg.	356	363	370	377	384	391	397
CLASS C	Fine Agg.	158	161	164	167	170	173	176
	Coarse Agg.	312	318	324	330	336	342	348

The above table of proportions is based upon air content of 5.5% for Class A mix and 4.5% for Classes B and C. Proportions must be adjusted by the Engineer to reflect the air content specified in the Air Content Table.

Where moisture is present in the aggregates, the weights shown in the above table shall be increased in proportion to the percent moisture present. When crushed slag is used as coarse aggregate, or when stone screenings or artificial sand is used as fine aggregate, a table of weights for fine and coarse aggregate will be furnished to the Engineer by the Laboratory after the sources of supply have been determined and samples of aggregate to be used have been furnished to the Laboratory by the Contractor under the direction of the Engineer.

The ratio of fine to total aggregates may be varied up to 10% by the Engineer in order to secure maximum density or workability. In no case, where the weight of fine aggregate is so varied, shall the combined absolute volume of fine and coarse aggregate be changed. Deviations from the proportions specified in the Table of Concrete Proportions of more than the above described 10 percent will be permitted only upon the favorable recommendation of the Engineer in charge of the Department Laboratory and approval of the Chief Engineer.

PROPORTIONING EQUIPMENT

The Contractor shall provide or have at his disposal, a modern and dependable batch plant within a reasonable distance from the work, as approved by the Chief Engineer.

The accuracy of the weighing equipment on all proportioning plants shall conform to the requirements of the National Bureau of Standards Handbook 44 for such equipment, subject to the provisions of the following paragraph.

All plant scales shall be tested at the expense of the Contractor by a competent scales technician as follows:

1. Annually prior to use in County work.
2. At intervals of not more than 60 calendar days.
3. At any time ordered by the Engineer.

A cradle or platform, approved by the Engineer, for each scale and at least ten (10) standard fifty (50) pound test weights shall be provided for testing scales whenever directed by the Engineer. The use of a set of test weights for two (2) or more plants will be permitted only when they can be made readily available within no more than an hour's notice. If directed by the Engineer, provision shall be made for locking all scales against tampering.

The batching equipment for each constituent shall be capable of controlling the delivery of material so that the combined inaccuracies in feeding and measuring during full production operation of the plant will not exceed:

Material	Percent
Cement	1 (By Weight)
Water*	1 (By Weight or Volume)
Aggregates	2 (By Weight)
Admixtures	3 (By Weight or Volume)

*For approved central mix only.

The weighing equipment shall be so arranged that the batch plant operator can conveniently observe all scales from his operating station.

When bulk cement is used in proportioning concrete, the batching controls shall be so interlocked that:

1. The batcher inlet gates cannot be opened while the discharge gates are open;

2. The batcher discharge gates cannot be opened—

   a. Until the full batch weights are registered on the scales,
   b. While the weigh hopper is being filled,
   c. If batch weights are over or under the above specified delivery tolerances;

3. A new batch cannot be weight until the hopper is entirely empty of the previous batch and the scale has returned to zero.

Only State accepted portland cement shall be used in County projects under the jurisdiction of the Department. Storage facilities for cement including the cement batching bins shall contain only State accepted cement. The provisions of M1 PORTLAND CEMENT under "Storage" shall apply to storage facilities other than batch bins in concrete plants.

Discharge chutes shall be so arranged that materials will not lodge therein, so there will be no losses on discharge, and so they are not suspended from any part of the weighing system.

If the Contractor elects a cumulative weighing system for aggregates rather than individual component weighing, it shall still be required that bulk cement be weighed in a separate hopper and shall be kept separate from the aggregates until the batch ingredients are released for discharge.

Cement weigh hoppers and appurtenances shall be completely shielded against the escape of dust arising from the weighing operation. Cement storage bins or silos shall be sealed against the elements and this equipment shall be such as to exclude moisture from stored cement whether in bulk or in bags.

The Contractor shall install and maintain in operating condition an approved electrically actuated moisture meter that will indicate on a readily visible scale or chart the percentage of moisture in the fine aggregate as it is batched.

At the time of batching, all aggregates shall have been dried or drained sufficiently to result in a stable moisture content such that no visible separation of water from the aggregate will take place during transportation from the proportioning plant to the point of mixing. In no event shall the free moisture content of the fine aggregate at the time of batching exceed 8 percent of its saturated, surface-dry weight.

All scales and other plant control equipment shall be installed so as to insure protection against exposure to dust and the elements. If vibrators are installed on the bins or batchers, they shall be so arranged that no significant vibrations are transmitted to the scales or other plant control equipment during the time the materials are being weighed.

Admixtures shall be added to the batch at the plant by means of an approved mechanical dispenser capable of accurate measurement within the specification tolerance limits. Admixtures shall be dispensed in such a manner as will insure uniform distribution of the material throughout the batch within the specified mixing period.

Each batch plant, furnishing concrete under these Specifications, shall provide facilities for procuring representative samples of aggregates from either bins, discharge gates, conveyor belts or stockpiles. The suitability and location of the sampling system shall be subject to the approval of the Chief Engineer. Such approval shall consider aggregate handling procedures, possibilities of segregation, ease of sampling and plant layout.

Each weighing unit on all proportioning plants shall include a springless dial which shall indicate the scale load at all stages of the weighing operation from zero to full capacity.

Aggregates and bulk cement for use in structural and pavement concrete shall be proportioned by weight by means of automatic proportioning devices of approved type on all contracts unless otherwise shown on the plans or in the proposal.

On contracts not requiring automatic proportioning, standard manual batching methods approved by the Engineer will be allowed.

The specifications for interlocked batching controls outlined above for bulk cement shall, in automatic proportioning plants, apply to all aggregate batchers as well.

An automatic proportioning plant shall be capable of rapid mix changes by means of an approved automatic mix selector so that the weights of the materials being batched for at least the three major classes of concrete may be batched in at least two batch sizes under full production conditions. These provisions will not be mandatory on job-site plants intended for batching only one major class of concrete during the life of a given contract.

An accurate weigh batch recorder or recorders of a type approved by the Department shall be provided and maintained in good operating condition on all automatic proportioning plants. It is preferable that no more than two recorders be used in any one plant; however, the number to be installed shall be subject to the approval of the Engineer. Each recorder shall produce a graphic or digital record on charts or tapes of the weights of all materials batched. If more than one recorder is utilized at a batch plant, they shall be indexed and/or synchronized so that easy correlation of the batch components may be made between the separate tapes. All charts or tapes shall show the date and the time of day for each batch to the nearest minute. The charts or tapes shall be so marked that each batch may be permanently identified and so that variations in batch weight can be readily observed.

Each plant site shall be equipped with an approved instrument capable of automatically applying a time-date stamp to each delivery ticket as the delivery vehicle departs from the batcher or plant site.

All original charts, tapes or other recorded data pertaining to the proportioning of portland cement concrete, after recordation, shall become the property of the County.

If, at any time, automatic proportioning devices or recording instruments become inoperative, the plant may be allowed to batch concrete manually or operate without recordation for a period of not more than 48 hours from the time of the breakdown, if approved by the Engineer. Written permission of the Chief Engineer will be required for periods of operation without automatic batching or recording facilities longer than 48 hours.

PLANT INSPECTION

Each portland cement concrete plant site including those located at, and supplying a Department project, shall provide a suitable enclosed area within reasonable distance of the plant for use as an office and testing facility. This requirement is, in addition to other laboratory buildings, specified under their own payment items. The plant shall provide the area with proper ventilation, adequate space, and other necessary equipment for concrete aggregate testing. Adequate and convenient telephone service or other approved means of communication shall be provided in or nearby the office.

The Department inspector shall have priority over all other parties in the use of these facilities and equipment with the exception of Representatives of the New York State Department of Transportation.

Acceptance and approval by the State Department of Transportation shall also represent approval by the County upon the written advice of the Chief Engineer.

The following list of equipment is the required minimum and shall be properly installed and maintained in good operating condition:

1. Coarse aggregate sieve shaker, power driven with a minimum clear sieve area of 324 square inches and equipped with a shutoff timing device. The shaker shall be mounted on a firm anchorage. Power-driven coarse aggregate shakers provided prior to August 1, 1967, shall be considered acceptable.

2. Fine aggregate sieve shaker, power driven independently of the coarse aggregate shaker, for eight inch minimum diameter sieves equipped with a shut-off timing device.

3. Aggregate sample splitter suitable for splitting samples having a maximum particle size adjustable in range of two inches to one-half inch.

4. Scale, fifty pounds minimum capacity with maximum 0.02 pounds graduations.

5. Scale, one thousand gram minimum capacity with maximum 0.5 gram graduations.

6. Stove or hotplate suitable for sample drying.

7. Two drawer legal size file cabinet with two keys for the exclusive use of the inspector.

8. Necessary accessory equipment for testing purposes, including sieves suitable for all types of material to be produced, and sample containers.

The above laboratory, office and testing equipment will not be a requirement for contracts using less than 500 cubic yards of structural and pavement concrete unless otherwise specified in the plans or proposal.

BATCHING AND MIXING

GENERAL. Reference is made to the current approved pamphlet "Concrete Mixer Standards" by the Associated General Contractors of America, Incorporated. The type of mixers there shown are approved for use. The Chief Engineer shall approve the size used for any particular project. Other sizes and types of mixers, not included in said pamphlet, may be utilized if approved by the Chief Engineer.

All batches of mortar or concrete shall be so adjusted as to come within the capacity of the mixer as hereinafter specified. When cement is delivered in bags for use in any item, the batch shall be so proportioned as to use only full bag batches (i.e. the use of a fraction of a bag of cement will be prohibited).

Hand mixing will not be permitted except by written permission of the Engineer in case of emergency and then only in such manner as he may direct.

All mortar and concrete shall be used while fresh and before there is any evidence of initial set. Any mortar or concrete which has achieved its initial set shall be rejected and not used in the work. No retempering of mortar or concrete will be allowed.

PAVING MIXERS. Concrete material shall be delivered to the mixer in batch boxes or trucks with compartments of sufficient tightness and capacity to carry individual batches so there will be no loss or over-run of concrete materials either during transit or during the operation of dumping the batch into the mixer. Truck bodies or batch boxes used to transport cement and concrete batches shall be equipped with waterproof tarpaulins for protection against rain or wind.

Batch trucks may be charged with a complete dry batch at a central plant provided the time interval between charging and actual mixing does not exceed ninety (90) minutes. However, without exception, when the cement has been in contact with the aggregate for more than ninety (90) minutes before being mixed the entire batch shall be rejected and not used in the work.

Paving mixers shall be not smaller than the 27E and shall not be larger than the 34E single or two compartment machines unless otherwise approved by the Chief Engineer.

Batch sizes for all paving mixers shall be as stated for the following conditions:

1. For paving mixers operating on a maximum grade of 3%—the maximum size of batch shall be the nominal capacity of the mixer plus 20%.

2. For paving mixers operating on grades greater than 3% but not exceeding 6%—the maximum size of batch shall be the nominal capacity of the mixer plus 10%.

3. For paving mixers operating on grades greater than 6%—the maximum size batch shall be the nominal capacity of the mixer.

For dual compartment paving mixers, the interval of mixing time (including transfer time) for each batch shall be not less than 75 seconds after all materials are in the mixer drum. The drum shall revolve at the rate of not less than 14 nor more than 20 revolutions per minute. The compartments shall be so interlocked that no charging of a compartment can occur until that compartment has fully discharged the previous batch.

Mixing in a single compartment mixer shall be continued for at least one and one-half minutes after all the materials are in the mixer drum. The drum shall revolve at a rate of not less than 14 nor more than 20 revolutions per minute. No charging of the drum will be permitted until the drum has fully discharged the previous batch.

All paving mixers shall be equipped with timing devices which will automatically lock the discharge lever of each compartment during the full time of mixing and release it at the end of the mixing period for each compartment. During the progress of the work, should the timing devices become broken or out of order, the Contractor will be permitted to operate, while same are being repaired, provided each batch is mixed 1/2 minute longer, and provided repairs are made promptly. Paving mixers shall be equipped with an accurate automatic water measuring device, capable of introducing mixing water to the drum within an accuracy of 2% and with an approved auxiliary water tank from which the measuring tank or tanks shall be filled. No mixing will be permitted when valves are leaking or otherwise out of order. A by-pass valve shall be placed on the outlet from the measuring tank so that the quantity of water measured for each batch may be checked at any time.

SMALL CONSTRUCTION MIXERS. In miscellaneous work involving small quantities of concrete and where a small mixer is adaptable to the work and permitted by the Engineer, he may waive any requirements for automatic timing, locking mechanical dispensers or automatic water measuring devices. Any concrete placed under such conditions, however, shall be mixed not less than 1 1/2 minutes after all the materials are in the mixer drum.

TRUCK MIXERS. Truck mixed concrete is defined as concrete mixed completely in a truck mixer at the point of deposition following the addition of mixing water at the point of deposition.

Unless otherwise shown on the plans or in the proposal, the Contractor may use approved Truck Mixed Concrete in all concrete items except that equipment for placing pavement concrete shall conform with the subsection titled "Equipment for Laying Concrete" of these specifications. Approved spreader and/or placement devices will be required. When Truck Mix Concrete is used, the Contractor shall maintain a continuity of supply of concrete consistent with the operation and satisfactory to the Chief Engineer. A detailed placement schedule shall be submitted to the Engineer and approval in writing obtained before concreting is begun.

During the use of Truck Mix Concrete the Contractor shall be responsible for making whatever reasonable changes in procedures or equipment that are requested by the Chief Engineer.

Each Truck Mixer shall be of the rotating drum type and must be approved by a representative of the Department of Public Works before it can be used on County Contract Work. Truck mixers shall conform to the requirements of the "Truck Mixer and Agitator Standards" of the Truck Mixer Manufacturers Bureau. Each unit will be subject to frequent inspections during use on County contract work and will be disapproved for further use, if found unfit to function properly, until proper operating condition has been restored. When the blades inside the drum have become loose, broken, bent, scalloped, worn down 20% in any dimension or otherwise damaged they shall be properly repaired or replaced.

A manufacturer's plate indicating the capacity of the unit for both mixing and agitating as well as the manufacturer's recommended drum speeds for each operation shall be permanently affixed to the unit and kept in readable condition.

Truck mixers shall neither mix nor agitate concrete batches or greater volume than the maximum capacities indicated on the manufacturer's rating plate.

Each unit shall mix or agitate at drum speeds within the tolerances indicated on the rating plate. The tolerance listed shall not exceed the following limits:

Mixing—4 rpm minimum to a maximum drum speed which will result in a peripheral velocity of the drum of 225 feet per minute at its largest diameter.

Agitating—2 rpm minimum to 6 rpm maximum.

Each mixer shall be equipped with an approved drum revolution counter mounted so as to be readily visible by the Engineer.

Mixing shall be continued for a minimum of 100 revolutions after all materials are in the drum or until uniform well mixed concrete is produced, whichever is longer.

If uniform well mixed concrete cannot be produced by mixing at the specified speed for fifteen (15) minutes or less, the concrete shall be rejected and not used in the work.

Shrink Mixed Concrete will not be permitted.

Shrink Mixed Concrete is defined as concrete mixed partially in a stationary mixer and then transferred into a truck mixer where mixing is completed. When concrete is transit mixed or central mixed and transported in units approved for mixing, the addition of not more than 10 percent of design water to obtain initial slump at the work site will be permitted.

Before approval for use, each unit must be equipped with a metering device for measuring the volume of mixing water introduced into the drum within an accuracy of two percent (2%).

Suitable devices to insure against the introduction of water into the drum from the washing supply during the mixing and discharge period shall also be provided.

The size of the batches for a mixer shall be such that the time interval between completion of mixing and completion of placement of concrete in its final position shall not exceed 30 minutes.

Where placement of concrete is unusually difficult or slow or for highly reinforced thin sections the size of batch may be reduced by the Engineer to insure proper placement within the permissible discharge period.

Approved truck mixers may be charged with a complete dry batch at the batch plant. The time interval between the batching of cement and the beginning of mixing after the addition of water at the site of placement shall not exceed thirty (30) minutes except as noted below under "A" and "B". During the charging with coarse or fine aggregate the drum may be rocked or revolved to permit the entry of material except as noted under "A".

The time interval between the batching of cement and the addition of water at the site of placement may be extended up to 90 minutes when the following conditions are met:

A. Fine aggregate, coarse aggregate, and cement have been separately batched through a hatch in the side of the drum in the sequence: fine aggregate, coarse aggregate, cement. The drum may be rocked after the addition of each fraction of aggregate.

B. Coarse aggregates are free of surface moisture (saturated surface dry condition, or drier).

Whenever cement has been in contact with aggregates for more than 90 minutes before the beginning of mixing, the entire batch shall be rejected and removed from the site of the work. If these time limits cannot be complied with, the cement batched at a central plant must be charged

into the mixer at the job site or such other location and in such a manner as will insure conformance to these specifications.

During the charging with cement the drum shall not be rocked or revolved but must remain stationary.

Before charging the drum with aggregate for each batch the wash water shall be discharged until less than two (2) gallons remain.

Mixing by truck mixers must be done at the site of pour where the mixing water shall be added. The mixer drum shall not be revolved between the time the concrete is batched and mixing begins at the site of pour.

Discharging shall be through a completely open discharge gate providing unrestricted flow. The discharge area or gate shall remain fully open throughout the discharge period and the rate of discharge shall be controlled by speed of drum. The concrete shall be directly discharged into approved bottom dump buckets, buggies, spreaders or hoppers from the discharge opening or into chutes attached to the mixer.

The time interval between the placement of adjacent batches shall be as ordered by the Engineer such that no cold joint will be formed. The rotating container or truck mixer shall be thoroughly cleaned after each batch. The concrete will be rejected if there is any evidence of setting-up in the mixer or rotating container.

TRANSIT MIXERS. Transit mixed concrete is defined as concrete mixed partially or completely in a truck mixer at the batching plant or while in transit to the point of deposition.

Upon approval of the Chief Engineer, the Contractor may use transit mixed concrete in all concrete and pavement concrete items. When Transit Mixed Concrete is used, the Contractor shall maintain a continuity of supply of concrete consistent with the operation and satisfactory to the Engineer. Approved spreader and/or placement devices will be required. A detailed placement schedule shall be submitted to the Engineer and written approval obtained before concreting is begun.

During the use of Transit Mixed Concrete, the Contractor shall be responsible for making whatever changes in procedures or equipment which may be required by the Engineer to secure conformance with these specifications.

Approval may be withdrawn by the Chief Engineer if unsatisfactory results are obtained.

The concrete produced shall meet the uniformity requirements as prescribed in the following table:

REQUIREMENTS FOR CONCRETE UNIFORMITY

TEST	Requirement Expressed as Maximum Permissible Difference in Results of Tests of Samples Taken for Two (2) Locations in the Concrete Batch
1. Weight per Cubic Foot Calculated to an Air-Free Basis.	2.0 lb/ft.^{3}
2. Air Content, % by Volume of Concrete	1.0%
3. Slump:	
If Average Slump is 4" or less	1.0"
If Average Slump is 4" or greater	1.5"
4. Coarse Aggregate Content, Portion by Weight of each Sample Retained on a No. 4 Sieve, Percent	6.0%
5. Unit Weight of Air-Free Mortars Based on Average for all Comparative Samples Tested, Percent	1.6%
6. Average Compressive Strength at 7 Days for each Sample, Based on Average Strength of all Comparative Test Specimens, Percent	10.0%

NOTE: Sampling and Testing procedures shall be in accordance with the Department's instructions to its employees. Samples shall be taken at the point of discharge of the plastic concrete from the mixing equipment.

Each truck mixer shall be of the rotating drum type and must be approved by the Chief Engineer, before it can be used on County Contract work. Truck mixers shall conform to the requirements of

the "Truck Mixer and Agitator Standards" of the Truck Mixer Manufacturer's Bureau. Each unit will be subject to frequent inspections during its use on County Contract work and will be disapproved for use whenever improper operating conditions are observed. When the blades inside the drum have become loose, broken, bent, scalloped, worn down 20% in any dimension or otherwise damaged, they shall be acceptably repaired or replaced.

A plate indicating the capacity of the unit in conformance with the above mentioned "...Mixer .....Standards" for both mixing and agitating as well as the manufacturer's recommended drum speeds for each operation shall be permanently affixed to the unit and maintained in readable condition. Truck Mixers shall not be allowed to mix batches of greater volume than the maximum capacities indicated on the manufacturer's rating plate and a volume below the rated capacity may be specified by the Chief Engineer to secure satisfactory mixing.

Each unit shall mix or agitate at drum speed within the tolerances indicated on the rating plate. The tolerance listed shall not exceed the following limits:

MIXING – 6 RPM minimum to 12 RPM maximum.

AGITATING – 2 RPM minimum to 6 RPM maximum.

The above tolerance limits may be reduced if necessary to produce concrete meeting the uniformity requirement specified herein.

Each truck mixer used in a transit mixed concrete operation shall be equipped with an approved electric revolution counting device which will show only drum revolutions at speeds within mixing range on one counter and total drum revolutions on a separate counter. These counters shall be clearly visible and readable to one (1) revolution. Both counters shall be capable of being reset to zero at the time of loading at the batch plant by the use of a non-standard electric plug designed specifically for this purpose. The Contractor shall be responsible for insuring that the device is reset prior to the mixing of each load. The device shall be interlocked so that the unit will become inoperative or otherwise indicate that it has been tampered with in any manner including the interruption of electric power to the device. The device shall be adjusted so that it counts revolutions in the mixing speed range as prescribed by the manufacturer's rating plate, but not exceeding the limits prescribed by this specification. Revolutions may be counted only in the direction of drum rotation used for mixing.

Before charging the drum with aggregates and cement, the drum shall be drained of wash water. Horizontal drum mixers shall be loaded in such a manner that achieve satisfactory results. The drums of inclined axis mixers shall be revolved during the loading of all mix constituents.

Water may be added to the mix from either the truck mix water system or the batch plant water system. A minimum of 90% of the total required water shall be added at the plant.

Mixing shall begin at the plant not longer than five (5) minutes after cement has come in contact with the aggregates. Mixing may be continued while the truck is at the plant or in transit to the point of deposition. The load shall be mixed from 70 to 100 revolutions and then checked for consistency. If the truck is enroute to the project, the mixer speed shall be changed to agitating speed after 70 to 100 mixing revolutions. Under no circumstances shall the mixer drum be completely stopped.

No more than two (2) additions of water required to bring the mix to the required consistency shall be permitted. After any such addition, the concrete shall be mixed at least 30 revolutions in the mixing range before discharge.

The total number of all revolutions in the mixing range shall not be less than 100 nor more than 160.

After the completion of mixing and prior to discharge, the mixer shall be revolved at agitating speed. Once discharge has commenced, the entire load shall be discharged in not more than 50 minutes. No retempering will be allowed. Discharging shall be through a completely opened discharge gate providing unrestricted flow. The discharge area or gate shall remain fully open throughout the discharge period and the rate of discharge shall be controlled by the speed of the drum. The concrete shall be directly discharged into approved dump buckets, buggies, spreaders or hoppers from the discharge opening or into chutes attached to the mixer. The time interval between the placement of adjacent batches shall be as ordered by the Engineer such that no cold joint will be formed. The truck mixer shall be thoroughly cleaned after each batch.

The total time between the time the cement comes in contact with the aggregates and the completion of discharge shall not exceed 90 minutes. The concrete will be rejected if there is any evidence of setting up in the mixer. The Engineer may reduce the total time limit in hot weather or under other unusual conditions if unsatisfactory results are obtained.

CENTRAL MIXERS. Central mixed concrete is defined as concrete mixed completely in a stationary mixer and the mixed concrete transported to the point of deposition in approved agitating or non-agitating units. When central mixed concrete is transported in units approved for truck mixing, the addition of not more than 10 percent of design water to obtain initial slump at the work site will be permitted. After any such addition, the concrete shall be mixed at least 30 revolutions in the mixing range before discharge.

Central Mixed Concrete may be used for all concrete items unless otherwise shown on the plans or in the proposal. Approved spreader and/or placement devices will be required.

Approval of any method of transportation will be based upon the ability of the Contractor to deliver a satisfactory uniform, non-segregated mix to the point of deposition and to properly

place the concrete in the forms or pavement as required by the specifications. Concrete for structural concrete items shall be transported in agitating units only unless the Chief Engineer, in writing, authorizes the use of non-agitating units.

A detailed placement schedule shall be submitted to the Engineer and approval in writing obtained before concreting is begun.

Mixing units shall be of an approved type equipped with an acceptable timing device that will not permit a batch of concrete to be discharged until the specified mixing time has elapsed. Mixing units and control devices must be maintained in good operating condition and shall be disapproved if at any time they are found unfit to function properly. When the blades inside the drum have become loose, broken, bent, scalloped, worn down 20% in any dimension or otherwise damaged they shall be properly repaired or replaced.

Batch sizes for any given mixer shall be no larger than the "guaranteed capacity" for said mixer as defined in the aforementioned pamphlet "Concrete Mixer Standards."

The speed of drum and length of mixing time shall be as directed by the Engineer. The minimum mixing time after all materials are in the drum shall be 90 seconds unless uniformity of the concrete equivalent to that specified under "Transit Mixers" can consistently be obtained at a lesser time as approved by the Chief Engineer.

The charging of Central Mixers shall be in an approved manner and consistent with the requirements of the specifications.

The plant mixer shall discharge the entire batch in an unrestricted manner into a hopper or directly into a delivery unit. If discharge is into a hopper the entire batch of concrete shall be immediately transferred into a delivery unit.

Agitating units shall rotate at a drum speed of two (2) to three (3) RPM unless otherwise approved by the Engineer. Agitating units shall conform to the requirements for Truck Mixers as they pertain to operating condition and condition of drum.

Non-agitating units shall have bodies that are smooth, round cornered, water-tight, metal containers equipped with gates that will permit control of the discharge of the concrete. Covers meeting the approval of the Engineer shall be provided for protection against the elements. Delivery by non-agitating units shall be over a smooth haul road free from holes, wash-boarding, or any other features that would result in the segregation of the mix.

A manufacturer's plate indicating the capacity of the delivery unit shall be permanently affixed to the unit and kept in readable condition.

Central Mixed Concrete shall be delivered to the site of the work in a thoroughly mixed and uniform mass and discharged with a satisfactory degree of uniformity. The time interval between completion of mixing and completion of placement of concrete in its final position shall not exceed 50 minutes between completion of mixing and completion of placement. The concrete shall be discharged directly into approved bottom dump buckets,buggies, chutes, spreaders, or hoppers from the discharge opening. The time interval between the placement of adjacent batches shall be as ordered by the Engineer such that no cold joint will be formed.

Each delivery unit must be approved by a representative of the Department of Public Works before it can be used on County Work. Each unit will be subject to frequent inspections during its use on the work and will be disapproved for further use, if found unfit to function properly, until proper operating condition has been restored. Both the agitating and non-agitating delivery units shall be completely emptied, clean and free from all concrete and/or wash water before receiving the next load of Central Mixed Concrete. The concrete shall be rejected if there is any evidence of setting-up in either type of unit.

SLUMPS

GENERAL. Slump shall be determined in accordance with the Standard Method of Slump Test for Consistency of Portland Cement Concrete, ASTM Designation C-143.

Concrete shall be placed at a slump as nearly consistent with the "Design Slump" shown in the following table as is practicable. Any batches with slumps in excess of the maximum values specified below shall be rejected for use in the work.

Concrete slumps, which in the judgment of the Engineer, are too low to produce satisfactory results shall be either corrected by additions of water with proper remixing in those situations where such a procedure is permitted under the specifications, or rejected for use in the work.

SLUMP TABLE

	Design Slump	Maximum Slump
Concrete Pavement	1-1/2"	3"
Sidewalks, Deck Slabs	2-1/2"	3-1/2"
Footings, Headwalls, Piers, Pedestals, Walls over 1 foot 6 inches thick	2-1/2"	4"
Walls less than 1 foot 6 inches thick, Box Culverts throughout, Rigid Frames or Arches	3"	4"
Tremie Concrete-6 inches minimum		9"

STRUCTURAL CONCRETE

All the requirements under "Portland Cement Concrete—General Specifications" shall apply to all structural concrete included under Item Nos. 18, 18M and 20, with the following additional requirements.

The Contractor is advised that wasted concrete, that is concrete not actually incorporated in the work, will not be paid for. The Contractor should take this into account when determing his unit bid price for such items.

MATERIAL. The materials permitted in these items are shown in the Table "Composition of Concrete Items", under "Portland Cement Concrete—General Specifications".

For each particular project the plans or proposal will indicate the types of cements and kinds of coarse aggregates which shall be used in that project.

The same source of aggregate shall be used throughout the whole structure where it has a face exposed to view.

HANDLING AND PLACING CONCRETE. The type and capacity of all equipment used for mixing, transporting, placing and finishing concrete, shall be subject to the approval of the Chief Engineer.

All foreign matter of every kind shall be removed from the interior of forms before placing concrete. Temporary struts or braces within the forms shall be removed when concrete has reached an elevation rendering their further service unnecessary.

Concrete shall be placed so as to avoid segregation of the materials and displacement of the reinforcement. Long troughs, chutes and pipes for placing or conveying concrete may be used only on written authorization of the Chief Engineer, and he may also order their discontinuance in case an inferior quality of concrete is produced.

If open troughs and chutes are permitted, they shall be of metal or metal lined. Where steep slopes are required, the chutes shall be equipped with baffles or be in short lengths that reverse the direction of movement.

All chutes, troughs and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run; water used for flushing shall be discharged clear of the concrete already in place.

Dropping the concrete a distance of more than 5 feet or depositing a large quantity at any point and running or working it along the forms will not be permitted.

Special care shall be taken to fill each part of the forms by depositing concrete directly in as near its final position as possible, to work the coarser aggregates back from the face and to force the concrete under and around the reinforcement without displacing it. After the concrete has taken its initial set, care shall be exercised to avoid jarring the forms or placing any strain on the ends of projecting reinforcement.

Concrete shall be compacted by continuous working with a suitable tool in a manner acceptable to the Engineer. Slab and girder work, arch ribs and all thin section work shall be thoroughly worked with a steel slicing rod.

In order to secure a smooth, even surface on the exposed surfaces of concrete structures, fine stone forks or spades shall be used to work the coarser aggregate back into the mass and allow the mortar and fine particles to occupy the space adjacent to the forms. In addition, the concrete shall be thoroughly vibrated while it is being placed. All exposed edges of concrete and exposed joints shall be chamfered one inch, unless otherwise shown or noted.

Concrete shall be placed in horizontal layers not more than 12 inches thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding batch has taken its initial set to prevent injury to the green concrete and avoid cold joints between the batches. Each layer shall be compacted so as to avoid the formation of a joint with a preceding layer which has not taken initial set.

When the placing of concrete is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete. To avoid visible joints as far as possible upon exposed faces, the top surface of the concrete adjacent to the forms shall be smooth and level whenever concreting is discontinued. Where a "feather edge" would be produced at a construction joint, as in the sloped top surface of a wing wall, an inset form work shall be used to produce a blocked out portion in the preceding layer which shall produce an edge thickness of not less than 6 inches in the succeeding layer. Work shall be continuous from the bottom to the top of any face. The surface of all unformed areas, whether permanent or at construction joints, shall be finished by placing an excess of material in the forms and striking off the excess with a suitable screed, forcing the coarse aggregate below the level of the finished surface.

Construction joints shall be placed only where shown on the plans or as permitted by the Chief Engineer.

Following the discontinuance of placing concrete all accumulation of mortar splashed upon the reinforcing steel and the surfaces of forms shall be removed. Dried mortar chips and dust shall not be puddled into the plastic concrete.

VIBRATING. Concrete shall be thoroughly compacted during and immediately after depositing by vibrating the concrete internally by means of mechanical vibrating equipment.

Internal mechanical vibrators shall be of a type to be approved by the Engineer. They shall be of sturdy construction adequately powered, capable of transmitting vibration to the concrete in frequencies of not less than 3500 impulses per minute and shall produce a vibration of sufficient intensity to cause flow or settlement of the concrete into place without a separation of the ingredients.

The vibratory element shall be inserted into the concrete at the point of deposit and in the areas of freshly placed concrete. The time of vibration shall be of sufficient duration to accomplish thorough consolidation, complete embedment of the reinforcement, the production of smooth surfaces free from honey-combing and air bubbles, and to work the concrete into all angles and corners of the forms. However, overvibration shall be avoided and vibration shall continue in a spot only until the concrete has become uniformly plastic and shall not continue to the extent that pools of grout are formed. The length of time of vibration depends upon the frequency of the vibration (impulses per minute), size of vibrators and the slump of the concrete. This length of time must be determined in the field.

The internal vibrators shall be applied at points uniformly spaced not farther apart than the radius over which the vibration is visibly effective and shall be applied close enough to the forms to effectively vibrate the surface concrete.

The vibrator shall not be used to push or distribute the concrete laterally. The vibrating element shall be inserted in the concrete mass a sufficient depth to vibrate the bottom of each layer effectively, in as nearly a vertical position as practicable. It shall be withdrawn completely from the concrete before being advanced to the next point of application.

To secure even and dense surfaces, free from aggregate pockets or honeycomb, vibration shall be supplemented by working or spading by hand in the corners and angles of forms and along form surfaces while the concrete is plastic.

A sufficient number of vibrators shall be employed so that, at the required rate of placement, thorough consolidation is secured throughout the entire volume of each layer of concrete. Extra vibrators shall be on hand for emergency use and for use when other vibrators are being serviced.

The use of surface vibrators to supplement internal vibration will be permitted when satisfactory surfaces cannot be obtained by the internal vibration alone and when the Contractor has obtained the approval of the Engineer of the equipment to be used. Surface vibrators shall be applied only long enough to embed the coarse aggregate and to bring enough mortar to the surface for satisfactory finishing.

The use of approved form vibrators will be permitted only when it is impossible to use internal or external vibrators. When permitted, they shall be attached to or held on the forms in such a manner as to effectively transmit the vibration to the concrete and so that the principal path of motion of the vibration is in a horizontal plane. Internal vibrators shall not be applied to the forms or reinforcing steel.

DEPOSITING STRUCTURAL CONCRETE UNDER WATER. Concrete shall not be exposed to the action of water before setting, nor be deposited in water, except with the approval of the Engineer and under his direct supervision. When concrete is so deposited, it shall be mixed in the proportions indicated on the plans or in the specifications, with the addition of one bag of cement per cubic yard. The cost of the additional cement shall be included in the unit price bid for the concrete. The method and manner shall be as hereinafter designated.

Concrete deposited under water shall be carefully placed in a compacted mass in its final position by means of a tremie, a closed bottom dump bucket or other approved method and shall not be distributed after being deposited. Special care must be exercised to maintain still water at the point of deposit. No concrete shall be placed in running water and all form work shall be constructed to properly retain concrete under water. The consistency of the concrete shall be carefully regulated and special care shall be exercised to prevent segregation of the materials. The method of depositing concrete shall be so regulated as to produce approximately horizontal surfaces.

For parts of structures under water, concrete seals shall be placed without interruption from start to finish. The surface of the concrete shall be kept as nearly horizontal as practicable at all times. To insure thorough bonding, each succeeding layer of a seal shall be placed before the preceding layer has taken initial set.

When a tremie is used, it shall consist of a tube having a diameter of not less than 10 inches, constructed in sections having flanged couplings fitted with gaskets. The means of supporting the tremie shall be such as to permit the free movement of the discharge end over the entire top surface of the work and shall be such as to permit it to be rapidly lowered when necessary to choke off or retard the flow. The discharge end shall be entirely sealed at all times and the tremie tube kept full to the bottom of the hopper. When a batch is dumped into the hopper, the tremie shall be raised slightly, but not out of the concrete at the bottom, until the batch discharges to the bottom of the hopper. The flow is then stopped by lowering the tremie. The flow shall be continuous and in no case shall be interrupted until the work is complete.

When concrete is placed by means of a bottom dump bucket, the bucket shall have a capacity of not less than 1/2 cubic yard. The bucket shall be lowered gradually and carefully until it rests upon the concrete already placed. It shall then be raised very slowly during the discharge travel, the intent being to maintain, as nearly as possible, still water at the point of discharge and to avoid agitating the mixtures.

Unwatering may proceed when the concrete seal is sufficiently hard and strong. All laitance or other unsatisfactory material shall be removed from the exposed surface by scraping, chipping or other means until sound concrete is exposed.

JOINTS IN CONCRETE. Joints in concrete shall be classified as Construction Joints, Contraction Joints or Expansion Joints.

Construction Joints for the purpose of these specifications shall be considered joints used for the sole purpose of providing for interruptions in the concrete placement. Construction joints shall be designed to transfer shear and moment at the joint. Unless otherwise shown on the plans, a shear key shall be provided at each construction joint by embedding saturated wooden blocks or similar form materials in the plastic concrete. The shear key thus provided shall be approximately 1/3 of the width of the parts joined. The key depth shall be equal the thickness of standard form lumber approximately 1/2 the key width in thickness. Shear keys need not exceed 5 1/2 inches in depth regardless of the key width.

Forms for female shear keys shall be beveled on four sides to facilitate their removal and shall be securely fastened to the forms to prevent displacement before the concrete has set. Key forms shall be removed in such a manner as to avoid injury to the concrete.

Contraction Joints shall be placed at locations shown on the plans and unless otherwise specified, shall be formed the same as construction joints except that reinforcement shall not extend through the joint.

Expansion Joints shall be placed at locations shown on the plans and shall be constructed as detailed thereon. Expansion joints shall provide for expansion, contraction and the transfer of shear at the joint unless otherwise specified. When expansion joints are formed by the insertion and subsequent removal of joint templates this work shall be done in such a manner that joint edges are not chipped or broken down in the process.

When concrete is to be placed against a joint filler, holes or joints in the filler shall be suitably filled with mastic to prevent mortar or concrete from entering the joint and restricting its movement.

The face edges of all joints shall be carefully finished or formed true to line and elevation for a minimum distance of two inches back from all exposed surfaces.

WATERSTOPS. Waterstops shall be installed in joints as shown on the plans. Should the drawings fail to indicate a waterstop in any joint exposed to view or where the seepage of any material is objectionable, the Contractor shall install a waterstop of polyvinyl chloride or other approved flexible material, copper strip, zinc strip or lead sheet. The waterstop shall extend at least three inches into the concrete on each side of the joint, shall be joined to be continuous and watertight and shall be carefully protected from damage until covered by concrete or backfill.

Waterstops shall be manufactured, formed and installed so as to provide for the expansion and contraction movements present at the joint.

BONDING CONSTRUCTION JOINTS. When joining fresh concrete to that which has already set, the concrete in place shall have its surface cut over with a suitable tool to remove all loose and foreign materials. This surface shall be scrubbed with wire brooms and kept wet until the new concrete is placed. Immediately before placing the new concrete the forms shall be drawn tight against the concrete already in place and the old surface shall be thoroughly coated with a thin coating of 1:1 mortar or neat cement paste thoroughly brushed into the surface.

FALSEWORK. Detailed plans for falsework or centering shall be supplied to the Engineer by the Contractor on request. The Engineer's approval of them, or acquiscence in the work constructed according to them will not relieve the Contractor of responsibility for satisfactory results. In the design of falsework or centering, a weight of 150 pounds per cubic foot shall be assumed for plastic concrete, and in addition thereto a live load of 50 pounds per square foot shall be applied to all horizontal surfaces.

In general, falsework which cannot be founded upon a solid footing, shall be supported by falsework piling. Falsework piling shall be spaced and driven as ordered by the Engineer. No extra compensation for falsework or falsework piling will be allowed, such work being considered as part of the form work.

The Engineer may require the Contractor to employ screw jacks or hardwood wedges in connection with the centering or falsework in order to take up any slight settlement in the form work, either before or during the placing of concrete.

Falsework shall be set to give the finished structure the camber indicated on the plans or specified, plus allowance for shrinkage and settlement.

FORMS. If required, form work plans shall be submitted by the Contractor and approved by the Engineer before being used on the work. In all cases the Contractor shall be responsible for and shall make good any injury arising from inadequate forms. No special remuneration will be made for form work, the cost of such work being included in the price bid for concrete.

All forms shall be built mortar tight and of material sufficient in strength to hold the concrete without bulging between supports.

Forms shall be so maintained as to eliminate the formation of joints due to shrinkage of the lumber.

Concrete mis-shapen by bulges or deformations caused by inadequate forms shall be removed or corrected as ordered by the Engineer. All replacements or corrections shall be made at the expense of the Contractor.

Forms shall be designed to resist a pressure resulting from a weight of 150 pounds per cubic foot and in addition thereto a live load allowance of 50 pounds per square foot on horizontal surfaces.

When concrete is transported by buggies, conveyor belt or other approved methods of conveyance, suitable provisions shall be made to support the buggy runways, transportation and distribution, equipment and any concentrations of concrete which may occur during transportation and distribution.

Buggy runways and other supporting platforms may be supported by the top bars provided sufficient supports are used under the bars to prevent displacement of the reinforcing steel. If in the opinion of the Engineer the reinforcement is being displaced or damaged by the loads imposed upon runways or platforms, all such loads shall be supported directly by the forms. The form design shall provide for the loads above described in addition to the live load allowances of 50 pounds per square foot.

Forms for slabs, beams and girders shall be cambered as indicated on the plans or ordered by the Engineer.

Forms shall be so constructed that the portions, where finishing may be required, may be removed without disturbing the portions of forms to remain.

Forms shall be filleted at all exposed sharp corners unless otherwise shown on the plans or directed by the Engineer. In the case of railings or similar fine details, where fillets have been omitted, the concrete shall be thoroughly worked into the corners of the forms and, upon removal of forms, the sharp edges of the concrete shall be carefully rubbed down to a one-quarter inch radius.

Forms may be constructed of wood, metal or other approved materials. When curved, patterned or other special forms are required, the Contractor shall submit details of the form construction to the Engineer for approval prior to constructing the forms.

Unless otherwise specified, approved corrugated metal forms may be used for the structural slab, provided the specified cover for the reinforcing steel is maintained above the crest of the corrugations.

Details of corrugated metal forms shall be submitted to the Chief Engineer for approval.

The additional concrete required by corrugated metal forms shall be provided at no cost to the County.

Special attention must be paid to bracing and where the forms appear to be insufficiently braced or unsatisfactorily built, either before or during the placing of concrete, the Engineer will order work stopped until the defects have been corrected to his satisfaction.

Any metal ties or anchorages, which are required within the forms to hold them to correct alignment and location, shall be so constructed that the metal work can be removed to a depth of at least 2 inches from the face surface of the concrete without injury to such surface. Wire ties will not be permitted without written permission of the Engineer. In case wire ties are permitted, all wires, upon removal of the forms, shall be cut back at least 1/4 inch from the face of the concrete with sharp chisels or nippers. (Nippers are necessary for green concrete.) All cavities produced by the removal of metal ties shall be carefully filled with a mortar in the proportion that has been employed for the particular class of concrete treated and the surface left smooth, even and uniform in color. The surface film of all such repaired surfaces shall be carefully removed before setting occurs.

All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. In general, form work shall remain in place, after placing of concrete, for the approximate periods hereinafter specified under "Removal of Forms".

For narrow walls where access to the bottom of the forms is not readily attainable otherwise, the lower form boards or panels shall be left loose so that they may be removed for cleaning out all chips, dirt, sawdust or other extraneous material immediately prior to placing concrete.

Forms to be re-used shall be maintained in good condition as to accuracy of shape, strength, rigidity, watertightness and smoothness of surface. Any warped or bulged forms must be carefully re-sized before being re-used. Forms unsatisfactory in any respect shall not be used and, if condemned, shall be removed immediately from the work.

All surfaces of wooden forms that will be in contact with the concrete shall be thoroughly treated with an approved form lacquer in the manner, and at the rate specified by the manufacturer. Forms so treated shall be protected against being damaged or dirtied prior to the placing of the concrete.

Any material that will stick to or discolor the concrete shall not be used.

Metal forms shall be treated with an approved form lacquer as specified above or may be treated with an approved form oil. If form oil is used, it shall be applied in a thin continuous film immediately before the forms are erected.

The metal used for forms shall be of such thickness that the forms will remain true to shape. All bolt and rivet heads shall be countersunk. Clamps, pins or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injury to the concrete. Metal forms, which do not present a smooth surface or line up properly, shall not be used. Special care shall be exercised to keep metal forms free from rust, grease or other foreign matter that would tend to discolor the concrete.

Forms and their supports shall be removed when ordered by the Engineer and then only in such manner as he may direct.

Forms are to be removed in such a manner as to permit the concrete to take the stresses uniformly and gradually. Any method of form removal likely to cause overstressing of the concrete shall not be used.

MINIMUM PERIODS FOR REMOVING FORMS

The minimum periods listed below are for supporting surfaces when the temperature of the concrete is above 40°F.

Arch centers	8 days
Centering under beams	8 days
Floor slabs	10 days

All other forms may be removed as soon as they are no longer necessary to support the concrete during setting, or may be left on to protect the concrete during the curing period.

PROVISIONS FOR CONCRETING IN COLD WEATHER. a. GENERAL. No concrete shall be placed when the atmospheric temperature is below 40°F, unless permission to do so is granted in writing by the Engineer.

When permission is granted for cold weather concreting the required curing temperature may be maintained by either of two methods: (1) Provision of external heat, or (2) Utilization of the heat of hydration retained by insulated forms.

When concrete is to be placed in contact with steel members, cold reinforcing steel or previously placed concrete, measures shall be taken, as directed by the Engineer, to raise the temperature of the steel and concrete to approximately 50°F before concreting shall begin.

The temperature of the plastic concrete shall be not less than 50°F or more than 70°F at the time of placing in the forms.

In cases of extreme weather conditions the Engineer may, at his discretion, raise or lower the limiting temperatures for the plastic concrete.

When air temperatures are 30°F or above, and when the aggregates are free of ice and frozen lumps, the desired temperature of the plastic concrete may be obtained by heating the mixing water only, unless otherwise ordered by the Engineer. When temperatures are below 30°F, or whenever ordered by the Engineer, both mixing water and aggregates shall be heated as herein specified.

All water used for mixing concrete shall be heated to a temperature of at least 70 but not over 100°F. Aggregates shall be heated either by steam or by dry heat to a temperature of at least 40 but not over 100°F. The heating apparatus shall be such as to heat the mass uniformly and preclude the possibility of the occurrence of hot spots which will overheat the material.

A sufficient number of thermometers shall be furnished by the Contractor. These thermometers shall have a range of at least zero to 120°F and shall be of the maximum-minimum type.

A permanent temperature record shall be kept for the first 6 days after the concrete has been placed, showing the date, hour, outside temperature and temperatures at several appropriate points.

b. Provision of External Heat. When it is elected to maintain curing temperatures by this method, the Contractor shall furnish sufficient canvas and framework, or other type of housing, to enclose and protect the structure in such a way that the air, surrounding the fresh concrete, can be kept at a temperature above 50°F but not over 80°F for a period of 6 days after the concrete is placed. At the end of this 6 day period the heat shall be gradually reduced no faster than 1 degree per hour until it equals the surrounding outdoor temperature.

Sufficient heating apparatus, such as stoves, salamanders or steam equipment, and fuel shall be supplied by the Contractor to furnish all required heat.

Within the enclosure, such means of artificial heat shall be provided as will maintain the temperatures specified continuously and with a reasonable degree of uniformity in all parts of the enclosure. All exposed concrete surfaces within the heated area shall be kept wet during the heating period unless artificial heat is supplied in the form of live steam.

Materials and equipment necessary to erect the enclosure and provide external heat shall be present on the job and the equipment shall be in good working order before any concrete is placed.

The Contractor shall provide adequate fire protection equipment which is accessible at all times where heating is in progress and shall maintain watchmen or other attendants to keep the heating units in continuous operation.

Heating appliances shall not be placed in such a manner as to endanger formwork or centering or expose any area of concrete to drying out or injury due to excessive temperatures.

Thermometers shall be so placed within the enclosure, to show the most favorable and unfavorable conditions to which the concrete is subjected.

c. Insulated Forms. When it is elected to maintain curing temperatures by this method, the Contractor shall furnish sufficient insulation and protection to maintain a uniform temperature of 50 to 70°F within the insulation for a period of 6 days after the concrete is placed. If the temperature falls below 40°F or rises above 85°F the concrete may be rejected subject to the concurrance of the Chief Engineer.

Discontinuance of protection shall be accomplished in such a manner that the drop in temperature of any portion of the concrete shall be gradual. The surface temperature of concrete sections more than 24" in thickness shall not drop faster than 20°F in a 24 hour period. The surface temperature of concrete sections less than 24" in thickness shall not drop faster than 40°F

in a 24 hour period. Unless specifically directed by the Engineer, the forms shall not be removed when the outside air temperature is 0°F or below, or when the weather forecast for the next 24 hours is for a temperature of 0°F or below. Forms may be removed when the outside temperature is below 32°F providing the temperature difference between the air and the surface of the concrete is not more than 30°F and the cooling gradient of the surface of the concrete is maintained as noted above. If possible, forms shall be removed about the middle of the day to take advantage of the generally higher afternoon temperatures and radiant heat from the sun. However, in no case shall the forms be removed before the end of six (6) full days after the final placement of concrete in an individual unit.

INSULATING MATERIAL.

1. Blankets for use in insulating forms may be any of the products appearing on the approved list. Application for approval of insulating blanket material shall be submitted to the Laboratory accompanied by a minimum two square foot sample of the material and a certification, together with pertinent test results, that the product conforms to the following requirements:

2. The thermal conductivity (k) of the insulating blanket shall not exceed .27 Btu per sq. ft. per hour, per degree F per inch of thickness.

3(a). The 1" and 2" insulating blankets used on vertical forms shall have, on the side exposed to the weather, a 90 lb. double creped kraft liner or a polyethylene plastic liner minimum thickness .004" or approved equal. The 5/8" insulating blanket shall have a minimum 50 lb. asphalt coated and creped kraft liner or a polyethylene plastic liner minimum thickness .004" or approved equal. The interior liner completing the total enclosure of the blankets shall be a minimum 40 lb. kraft liner. The liners shall be asphalt bonded to both sides of the insulating mat. The liners shall have an extension on each side to form a flange so the blanket can be applied to the frame work on the form.

3(b). Insulation used on horizontal concrete slabs shall have a polyethylene plastic liner, minimum thickness .004" or approved equal on both faces. The liner shall be asphalt bonded to both sides of the insulating mat. All edges shall be sealed.

4(a). The blanket insulation shall be applied tight against the wood form with the nailing flanges extending out from the blanket so they can be stapled or battened to the sides of the framing, which are either horizontal or vertical and spaced 12" to 16" o.c. The ends of the blanket shall also be sealed by removing a portion of the mat in order to bring the liners together and stapled or battened down to headers so as to exclude air and moisture. All corners or angles shall be well insulated and insulation securely held in place.

4(b). In the case of steel forms the insulating blanket shall be applied tight against the form and held secure in an approved manner with ends sealed to exclude air and moisture.

5. Where practicable, the insulation (or insulated forms) shall overlay any previously placed (cold) concrete by at least one foot.

6. Insulation of slabs on steel members shall be applied in such a manner as the Engineer shall direct in order that heat may be provided to insure steel temperatures of approximately 50°F.

7. Any tears in the liner shall be patched or covered with a tacky waterproof tape or a piece of vapor barrier asphalted in place.

8. Where tie rods extend through the insulated form a plywood washer (3/4" x 6" x 6" approximately) shall be placed on top of the insulating blanket and secured in a manner to provide adequate protection satisfactory to the Engineer.

9. The tops of all unit placements (horizontal and vertical) shall be covered with insulating blanket except for inaccessible areas around protruding reinforcement bars which may be insulated with salt hay or wrapped with approved insulation. Tarpaulins shall be used to cover the top of such placements as directed by the Engineer.

10. Outside temperatures at which concrete walls, piers, abutments or floor slabs above ground may be protected with insulation under various conditions are shown in Table 1.

TABLE 1 - INSULATION REQUIREMENTS FOR CONCRETE WALLS, PIERS, ABUTMENTS AND FLOOR SLABS ABOVE GROUND

Concrete Placed at 50°F

Wall Thickness Ft.	Minimum air temperature allowable for these thicknesses of commercial blanket or bat insulation - Deg F			
	0.5 in.	1.0 in.	1.5 in.	2.0 in.
Cement content - 500 lb per cu yd				
0.5	45	35	22	14
1.0	35	15	- 5	-26
1.5	27	- 3	-33	-65
2.0	23	-10	-50	
3.0	18	-20		
4.0	17	-23		
5.0	16	-25		
Cement content - 600 lb per cu yd				
0.5	44	32	16	6
1.0	32	8	-16	-41
1.5	21	-14	-50	-89
2.0	18	-22		
3.0	12	-34		
4.0	11	-38		
5.0	10	-40		
Cement content - 700 lb per cu yd				
0.5	43	29	10	0
1.0	29	1	-27	-56
1.5	15	-25	-69	
2.0	13	-33		
3.0	7	-48		
4.0	5			
5.0	4			

Insulation Equivalents

Insulating Material	Equivalent Thickness, in.
1 in. of commercial blanket or bat insulation	1.000
1 in. of loose fill insulation of fibrous type	1.000
1 in. of insulating board	0.758
1 in. of sawdust	0.610
1 in. (nominal) of lumber	0.333
1 in. of dead-air space (vertical)	0.234
1 in. of damp sand	0.023

The table is calculated for the stated thickness of blanket type insulation with a thermal conductivity of 0.25 Btu per hour per sq. ft. for a thermal gradient of 1 degree F per in. Thermal resistance of the forms was not included, therefore, temperatures more accurately apply to concrete in steel forms. Use of wood forms would permit somewhat lower outside temperatures. Values given are for still air conditions and will not be realized where air infiltration, due to wind, occurs.

An enclosure shall be provided above the slab during and immediately after the placing of the concrete. This enclosure shall provide protection for the slab and personnel during the placing and finishing operation. External heat shall be provided to the enclosure before placement of the

concrete as directed by the Engineer. Insulating blankets shall be placed on the surface of the slab as soon as the concrete has set sufficiently to prevent the surface from being marred. The blankets shall be tightly butted together with the top of joints covered and edges held down with planks to prevent the wind from penetrating under the insulation.

All thermometers shall be placed against the forms under the insulation.

Thermometers shall be placed as follows:

Walls. Both sides at the third points vertically, and as close to the ends or corners as is practicable and at the midpoint horizontally. On the ends at the third points vertically and at the midpoint horizontally. On the top as close to each corner as is practicable and at the midpoint as close to the side forms as is practicable.

Beams. Both sides at the midpoint vertically and as close to the ends or corners as is practicable and at the midpoint horizontally. On the ends at the midpoint vertically and horizontally. On the top and bottom as close to each corner as is practicable and at the midpoint as close to the side forms as is practicable.

Pier Columns. On the windward side only, two-thirds of the unit height from the base. On the top, two diametrically opposite and as close to the forms as is practicable.

Slabs. On the bottom and top midway between the stringers transversely and as near the end as is practicable and at the midpoint longitudinally.

CURING CONCRETE. Careful attention shall be given to the proper curing of all parts of superstructures, substructures and retaining walls. No special provisions for curing shall be required on surfaces where forms are left in place except that in extremely hot weather the Engineer may require that the forms be wetted down to reduce surface heat.

All other exposed surfaces of structural concrete and all concrete pavement on bridges shall be cured by means of quilted covers which shall be kept wet or may be cured using polyethylene coated burlap blankets which will not require wetting. Polyethylene coated blankets shall be laid dry with the burlap side against the concrete, and adjoining blankets shall be lapped sufficiently to provide a moisture seal.

Curing covers shall conform to the requirements of Materials of Construction M40 or M40A.

Retention of moisture for curing, by any of the above methods, shall be continued for a minimum of 7 days, during which time the temperatures of the concrete shall not be allowed to fall below 40°F.

Curing covers as specified above, shall be placed on all exposed surfaces, which do not require forms, as soon as they may be placed without damage to the concrete surface. This work shall be performed in a manner satisfactory to the Engineer.

Immediately prior to the placing of a separate concrete wearing surface on bridges the top of the structural slab shall be thoroughly wetted down, as directed by the Engineer. If the air temperature is above 70°F. sufficient water shall be applied to reduce the heat in the slab to that temperature. Slabs shall be wetted with enough water to provide a uniform moist surface and all puddles and excess water shall be removed before the concrete is placed.

In lieu of the above methods of curing structural concrete, the Contractor may use a chlorinated rubber epoxy material as a cure and sealer to all exposed concrete surfaces when permitted by the Chief Engineer in writing. The chlorinated epoxy material shall meet the requirements of M41 Chlorinated Rubber Epoxy Curing Compound. When used, it shall be applied at a rate not to exceed 200 sq. ft. per gallon on upper horizontal or slightly inclined surfaces and at a rate not to exceed 100 sq. ft. per gallon on vertical faces, steeply inclined surfaces and on the under surfaces of all structural members, unless otherwise specified by the Chief Engineer. The material shall be clear in color or may contain a red fugitive dye as directed by the Chief Engineer. Only chlorinated rubber epoxy material approved by the Department shall be used.

SIDEWALK FINISH ON BRIDGES. Sidewalks shall be constructed by placing concrete continuously to elevation slightly higher than shown on the plans. The concrete shall then be screeded to the correct elevations and worked with a wooden float to give a uniform surface. Floating shall be kept to a minimum consistent with the desired finish in order to avoid overworking the concrete. Surface scoring will not be permitted.

FINISHING BEARING SURFACES. The surfaces of bridge seats or other bearing surfaces shall be floated and troweled to true grade; or, at the option of the Engineer, left approximately 1/4 of an inch high and bush hammered or otherwise finished to the exact elevations indicated on the plans.

FINISHING SURFACES EXPOSED TO VIEW. Immediately after forms have been removed, surfaces exposed to view shall have all projections and irregularities carefully removed and all cavities neatly filled with mortar of the proportion used in the concrete. The same brand of cement and the same kind of aggregate shall be used for filling cavities as was used in the original concrete mix. Plastering of surfaces will not be allowed. The surface film of all such repaired surfaces shall be carefully removed before setting occurs.

Surfaces exposed to view shall be rubbed unless otherwise ordered by the Engineer. The following rubbing procedure shall be repeated as many times as the Engineer deems it necessary in order to secure a satisfactory finish. Immediately before starting this work the concrete surfaces shall be kept thoroughly saturated with water for a minimum period of three hours and then rubbed with a No. 16 carborundum brick or other abrasive until the surfaces are even, smooth and of uniform appearance, without applying any cement or other coating. The final finish shall be obtained by a thorough rubbing with a No. 30 carborundum brick or other abrasive of equal quality. After the final rubbing is completed, the surface shall be cured as described under "Curing Con-

crete", unless otherwise directed.

Concrete surfaces which have been disfigured by the drip from the abrasive which cannot be removed by scrubbing with a stiff brush and water shall be thoroughly cleaned by means of a dilute solution of muriatic acid.

All upper horizontal surfaces such as the tops of handrail posts and caps and the tops of parapets, copings, walls and bridge seats shall be formed by placing an excess of material in the forms and removing or striking off such excess with a suitable screed, forcing the coarse aggregate below the mortar surface. The use of mortar topping for concrete railing caps and other surfaces falling under this classification will in no case be permitted.

The final finish for caps and railings shall be obtained in one of the following ways as specified:

After the concrete has been struck off as above described, the surface shall be thoroughly worked and floated with a wooden, canvas or cork float, the operation to be performed by skilled and experienced concrete finishers. Before this last finish has set, the surface shall be lightly striped with a fine brush to remove the surface film, leaving a fine-grained, smooth, but sanded texture.

In lieu of the above, if permitted by the Engineer, the surface may be finished with a rough carpet float or other suitable device leaving the surface even but distinctly sandy or pebbled in texture.

EMBEDDED STONE. Boulders and fragments of rock may be embedded in large masses of Class B Concrete when this procedure is specifically approved on the plans, in the proposal or ordered by the Engineer in writing.

When permission is granted to embed stone in the concrete, each stone, before being embedded or placed, shall be thoroughly washed and scrubbed, if necessary, to free it from all dirt. Stones embedded in concrete shall be at least three inches apart at all points, and no stones shall be placed within three inches of any face of the concrete. Stone shall be laid on their largest bed and worked down into the concrete by bars so as to extrude the air from any pookets in the lower surface of the stone.

WEEP HOLES. The Contractor shall construct weep holes in all retaining walls and abutments at such points as are indicated on the plans or designated by the Engineer. Payment for all labor and materials required to construct and protect these weep holes will be included in the contract price for concrete.

DAMAGED CONCRETE. All defective concrete discovered prior to the final acceptance of the work, shall be repaired by the Contractor at his own expense as specified herein or as directed by the Engineer. However, the Chief Engineer shall be the sole judge as to whether spalled, honeycombed or otherwise defective concrete areas shall be repaired by the methods outlined below or be completely removed and replaced in kind as originally called for in the Contract Documents.

Prior to beginning the repair, all spalled, honeycombed, and disintegrated concrete shall be removed, as designated by the Engineer, by chipping the unsuitable material to sound concrete with pneumatic tools. The type and size of tools and depth at which sound concrete is reached shall be subject to the approval of the Engineer.

All surfaces to be repaired shall be thoroughly blast cleaned with No. 40 boiler slag grit or No. 2 sandblast sand, or as ordered by the Engineer.

Small spalls and areas where minor concrete removal is required shall be repaired using an epoxy mortar which is made of epoxy binder meeting the requirements of Material Specification M29B and aggregates meeting the requirements of Material Specification M3. The Contractor, if ordered by the Engineer, shall mix trial batches to determine the correct blend of binder and aggregate.

Large spalls and areas where major concrete removal is required shall be repaired by covering the freshly cleaned surface with epoxy grout to provide a bond between the cured concrete and the fresh concrete used for repair. The epoxy grout shall meet the requirements of M29G. Concrete used for major repairs shall be of the same class as required by the original item unless the size of the coarse aggregate is greater than 1/4 the least dimension of the repaired section. If such is the case, Class A concrete shall be used or a modified mix design shall be obtained from the Laboratory as required by the limits imposed on the maximum size of coarse aggregate.

FOUNDATION FOR CONCRETE. The excavation lines and bases of structures shown on the plans shall be considered as approximate only and, when ordered in writing by the Chief Engineer, shall be placed at such an elevation or changed to such dimensions as will give a satisfactory foundation. Any additional concrete that may be ordered by the Chief Engineer, below or beyond the lines shown on the plans, will be paid for at the contract price.

Concrete shall not be placed in any foundation without the Engineer's approval.

CONCRETE PARAPETS. In no case shall concrete parapets, balustrades, railings or pylons be placed until the centering or falsework for the span has been released and in the case of steel bridges, the permanent field connections have been completed. In the case of earth filled arch bridges, they shall not be poured until the fill has been placed.

CONCRETE FLOORS. Before concrete floors are placed on steel spans, all permanent field connections shall be completed, the centering under the bridge shall be released and the span swung free on its supports.

The operation of placing the concrete in any floor slab shall be continuous between construction or expansion joints.

Superstructure slabs that are to receive a separate wearing pavement shall be screeded to a surface tolerance of 3/8 of an inch in 10 feet.

On steel truss or open spandrel concrete arch spans, unless otherwise noted on the plans, the concrete in the floor system shall be placed about the center line of the span, beginning at the center and working simultaneously toward each end; or beginning at the ends and working simultaneously toward the center. Care shall be taken to prevent the displacement of reinforcement during the placing of concrete.

If for any reason it becomes necessary to introduce a construction joint, this shall be formed by means of a vertical bulkhead so constructed as to produce a key joint, placed as shown on the plans or as permitted by the Chief Engineer.

Concrete floor slabs may be submitted to a load not to exceed two tons, 36 hours after being poured, if approved by the Engineer. The minimum period for additional loading, including pavement, shall be 10 days after which time the slab may be loaded with a maximum of 10 tons. At the completion of a 28 day curing period, the slab may be subjected to its full legal load. The minimum curing periods for the loadings mentioned shall consist of days on which the temperature of the concrete is in excess of 40°F.

When placing concrete around steel shapes it shall be placed on one side of the shape only until it flushes up over the bottom flange of the shape on the opposite side, after which it shall be placed on both sides to completion.

FINISHING INTEGRAL WEARING SURFACES ON BRIDGE SLABS. a. GENERAL. The provisions of Section 7, Pavement Concrete shall apply except as hereinafter modified.

Machine finishing shall be used throughout all bridge paving operations with the exception of small irregular areas unless otherwise stated on the plans or in the proposal.

Screed supports shall be accurately set and of substantial construction so that the finished roadway surface will conform to the profile and transverse sections shown on the plans.

Screed supports shall be placed and adjusted to properly provide for the deflection of forms, falsework and structural supporting members which will occur during the placement of the concrete.

Pavement surfaces shall be uniformly smooth, dense and even. Variations in the pavement surface in excess of 1/4" above or below the elevations required by the plans, or pavement surface irregularities of more than 1/8" in 10 feet, will not be accepted.

The concrete surface shall be checked by the Engineer by means of an approved straight edge not less than 10 feet long. The straight edge shall be furnished by the Contractor and maintained in good condition at the paving site at all times.

Surface irregularities in excess of the above stated limits shall be corrected as the Engineer may direct or approve. Surface irregularities shall be filled, while the pavement concrete is still plastic, with concrete of the same consistency, as specified for the paving operation. Excess thin mortars and laitance accumulating ahead of the finishing screeds or lutes shall be removed and not used in filling depressions.

All pavement surfaces shall be subject to final finishing with a lute as described in pavement concrete. When the surface, as finished with the lute, is acceptable to the Engineer a transverse broom finish shall be applied to the surface as a final finish. It shall be done by drawing an approved stiff bristled push broom transversely across the pavement surface. One pass shall be made for each broom width. Brooming shall be performed immediately prior to applying the curing compound.

Care shall be taken not to overwork the pavement surface.

b. MACHINE FINISHING. Machine finishing shall be accomplished with power driven transverse or longitudinal finishing machines. The specific method and equipment that the contractor proposes to use will be subject to the approval of the Chief Engineer. Approval of the method and equipment will not relieve the contractor of full responsibility for obtaining the required finished surface.

Finishing machines shall be equipped with adjustable strike-off and finishing screeds, the bottom surface of which shall be adjusted to produce the required contour of the finished surface. Machines shall be kept in true adjustment. Machines out of adjustment shall not be used until proper adjustments have been made and the adjustments have been approved by the Engineer.

Just prior to beginning concreting operations the finishing machine shall be operated over the full length of the bridge segment to be paved. This test run shall be made with the screed adjusted to its finishing position. While operating the finishing machine in this test the screed rails shall be checked for deflection and proper adjustment, the cover on slab reinforcement measured and the controlling dimensions of slab reinforcement and forms checked. All necessary corrections shall be made before concreting is begun.

After the concrete has been placed, spread and consolidated to provide a uniformly dense structural slab, the surface shall be struck off immediately by the passage of the finishing machine. The finishing machine shall carry sufficient concrete in front of the screed to fill low and porous places. This operation shall be repeated as may be necessary to produce a uniformly consolidated dense smooth surface of the required contour. The first passages of the finishing machine shall provide a concrete surface slightly above grade so that after settlement, if any, and the disappearance of excess water from the surface, a final passage or passages of the finishing machine will result in a uniform surface at the required grade and contour over its entire area.

c. HAND FINISHING. Hand finishing shall be performed in such a manner as to produce the same wearing surface quality and uniformity as that produced by machine finishing. Finishing screeds shall be 10 inches or more in width and the contacting surfaces shall be steel. Hand operated screeds shall be used in such a manner as to duplicate the action of a transverse finishing machine. Hand finishing shall be performed in the same sequence and manner as machine finishing unless otherwise directed by the Engineer.

d. CURING OF INTEGRAL WEARING SURFACES ON BRIDGE SLABS. Concrete placed under the provisions of this section shall be cured using a Chlorinated Rubber Epoxy curing compound which conforms to the requirements of Material Specification M41. The compound shall be sprayed on the concrete surface immediately following the finishing operation. Care shall be taken to obtain a uniform and even coverage free from holidays and other defects. The rate of application shall be one gallon for each 200 sq. ft. or as directed by the Engineer.

Proper curing temperatures shall be maintained from the moment the concrete is placed as specified under "Curing Concrete" in the Structural Concrete subsection of these specifications.

SEALING JOINTS IN BRIDGE DECKS. When the plans call for the use of M38PD or E, PREFORMED ELASTIC JOINT SEALER AND LUBRICANT, to seal joints in bridge decks, the following procedures shall be followed:

The sealer shall be installed in a smooth-sided joint of constant width. The joint shall be sawed, formed or steel armored as indicated on the plans. The depth of the recess for the sealer shall be constant and as indicated on the plans. Joints may not be sawed until the concrete has cured for eight (8) days.

Any spalled or honey-combed surfaces, which will be in contact with the sealer, shall be repaired with an epoxy mortar mixture composed of three parts of Dry M3, Fine Aggregate and one part M29A, Epoxy Resin System.

Cement shall be added to the mortar mixture to provide a color match with the existing pavement. The techniques used in the repair shall be in accordance with the instructions of the Chief Engineer.

The sealer shall be inserted into the joint with tools that will not injure the material and will place the sealer at the proper level in the joint without stretching the material. The lubricant-adhesive shall cover both sides of the sealer over the full area in contact with the sides of the joint. The lubricant-adhesive may be applied to the sides of the joint or both the joint and the sealer.

The length of sealer furnished shall be one (1) foot longer than the length of the joint in which it is to be placed. The surplus one foot length shall be cut off in the field and shall become the property of the County. This piece of sealer will be used for a check analysis of the material furnished. The length of the sealer shall equal the actual length of the joint and shall be installed in the joint without stretching so that after the installation there will be no need to cut off any material.

Field splices will not be permitted.

In the event that the completed joint has dimensions outside of the tolerances shown on the plans the Contractor shall submit a joint sealer, with dimensions designed to fit the actual opening, to the Chief Engineer for approval.

When the plans call for filling joints in structural concrete with M34A PLASTIC JOINT MATERIAL the following procedure shall be followed.

The joints at the time of sealing shall be dry and thoroughly cleaned of all scale, dirt, dust, curing compound and other foreign matter to the satisfaction of the Engineer.

Extruded or hot poured material may be used. Hot poured material may only be used where all exposed surfaces of the joint material will be approximately horizontal.

Immediately before installing the plastic joint material, joint surfaces shall be sandblasted and then blown clean with compressed air. Air pressure used in this operation shall not be less than 90 psi. Protective coverings on extruded type material shall be removed just prior to the installation of the material in the joint.

The pouring temperature of the plastic joint material shall be a minimum of 400°F and a maximum of 450°F. The sealer shall be poured as soon as possible after being heated to pouring temperature.

The heating and melting of the plastic joint material shall be done in a portable (rubber-tired) melting kettle of the double boiler, indirect heating type which utilizes oil or other suitable material as the heat-transfer medium. The kettle must be equipped with an effective mechanically operated agitator and incorporate positive temperature control to prevent overheating of the material. The melting kettle shall be equipped with a metal shield beneath the fire box to protect the surface of the pavement from excessive heat.

Mechanical (pressure type) applicators shall be used unless otherwise approved by the Engineer. When approved by the Engineer, a hand pouring pot may be used where pressure application is not feasible.

The mechanical (pressure type) applicator for applying the hot plastic joint material shall be equipped with a satisfactory means of keeping the sealer heated, positive temperature control, an effective mechanically operated agitator and a suitable shoe at the point of discharge to strike off the plastic joint material so as to obtain a completely filled joint, neat in appearance and without an excess of material. Any excessive material must be removed before the work is accepted. The joints must be filled in a neat workmanlike manner so upon completion of the work the surface of the sealing material will be flush or not more than 1/8" below the adjacent surface.

The cost of sealing joints in bridge decks shall be included in the unit price bid for the Structural Concrete. The cost of sealing joints shall include the cost of all labor, equipment and material.

PAVEMENT CONCRETE

All requirements under "Portland Cement Concrete—General Specifications" shall apply to all pavement concrete included under Concrete Foundation for Pavement and Cement Concrete Pavement with the following additional requirements.

The Contractor is advised that wasted concrete, that is concrete not actually incorporated in the work, will not be paid for. The Contractor should take this into account when determining his unit bid price for such items.

FORMS. The forms for this work shall be made of metal of a minimum length of 10 feet for tangents and for curves of a radius of 200 feet and more. These forms shall be of a depth equal to the depth of the concrete and the forms shall have a minimum width of base equal to at least the height of the form.

All metal side forms shall be at least 7/32 inch in thickness. For curves of radius less than 200 feet, wooden side forms may be used if approval is received from the Chief Engineer.

Suitable metal straight edges shall be furnished for checking the forms after placing.

All forms shall be of approved section with vertical face rounded on the upper corner to not more than three quarters of an inch radius with a horizontal top face at least two inches wide. Forms shall have a joint connection to insure unbroken lines across the joint.

All forms shall be straight, free from bends and warps at all times, and shall be cleaned thoroughly and oiled before concrete is placed against them. Cleaning and oiling shall be repeated as often as the forms are reused. The forms shall rest firmly upon a thoroughly rolled and compacted sub-grade throughout their entire length, shall be joined neatly, tightly and staked securely to exact line and grade at least 500 feet in advance of the point of placing concrete, by using at least three bracing pins or stakes to each ten foot length of side form, so that they will resist the pressure of the concrete and the impact of finishing equipment without springing.

Before placing concrete all forms shall be carefully checked by "eyeing-in" the horizontal and vertical alignment and corrections made for any irregularities.

EQUIPMENT FOR LAYING CONCRETE. All equipment for laying of pavement concrete must be on hand and inspected and approved by the Engineer before concreting operations are started by the Contractor. Any equipment becoming worn or defective shall be immediately replaced or repaired. Pavement concrete shall be thoroughly mixed in a paving mixer conforming to the requirements for "Paving Mixers" as listed in this section. Other sizes or types of suitable mixers may be used subject to the prior approval of the Chief Engineer.

WEATHER LIMITATIONS. Concrete for pavement and foundation for pavement may be placed when the air temperature is 40°F. and rising or warmer and when the surface of the ground or base is at or higher than 40°F. Paving shall be discontinued when a falling air temperature reaches 40°F. All temperatures are to be measured in the shade. Materials containing frost shall not be used. Cement or fine aggregate containing lumps or crusts of hardened materials shall not be used. The concrete shall be mixed only in such quantity as is required for immediate use, and any which has developed initial set or has been mixed longer than thirty minutes shall not be used.

When concrete is being placed during cold weather and the air temperature may be expected to drop below 35°F., a sufficient supply of straw, hay or other approved blanketing material shall be provided along the work, and when ordered by the Engineer the material so provided shall be spread over the pavement to a sufficient depth to prevent freezing of the concrete, and maintained as directed by the Engineer.

Any concrete laid during cold weather is done at the Contractor's risk and sections of concrete that are damaged, in the opinion of the Engineer, must be removed and replaced by the Contractor at his expense.

Whenever Pavement Concrete is mixed in a paving mixer, the paver will be allowed to operate on an adjoining paved lane under the following conditions: Between June 1 and September 15, after the pavement is 14 days old, and before June 1 and after September 15, when the pavement is 21 days old; a mat of at least 6 inches wider than the treads, at least 2 inches in thickness and of a length not less than the length of treads shall be maintained at all times while the mixer is on the pavement. The Contractor will be held responsible for any damage caused by any of his

operations, such as pavement cracks, etc. Where the pavement is damaged, the Contractor shall remove and replace the damaged sections at his own expense.

PLACING CONCRETE. Before any concrete may be placed, each section of the subgrade must be checked with a standard subgrade tester and approved. This operation shall be continued as the work progresses. A standard subgrade tester shall be kept in place on the forms at the discharge end of the mixer at all times. Loose dry material shall be thoroughly rolled into the subgrade and all soft or objectionable material shall be removed from the subgrade before any concrete is placed. Concrete shall be placed only on a moist subgrade.

If the subgrade is dry, it shall be sprinkled with as much water as will be absorbed readily. When the subgrade is of loose dust, it shall be thoroughly wet down, on the day or night preceding the laying of the concrete, so as to permit the preparation of a uniform, moist and compacted subgrade.

At least 500 linear feet of fine grade shall be prepared ahead of the mixer at all times. Where the concrete is to be laid adjacent to railway tracks or around structures, concrete shall not be placed until the tracks and structures have been set to the required grade and alignment in advance, and all structures which project through, or into the pavement shall be cleaned thoroughly to permit adhesion of the concrete.

During placing of concrete a roller, weighing not less than five tons, shall be maintained in readiness to re-roll the fine grade if the surface, for any reason, has become uneven or defective.

The concrete shall be laid in sections of the width shown on the plans or as directed by the Engineer. All edges shall be protected by planking or other approved method where traffic is permitted prior to completion of the full pavement width.

The concrete shall be deposited on the subgrade in successive batches directly from the mixer by means of an approved boom and bucket discharging device. Concrete shall be distributed to the required depth and for the entire width of the slab by an approved mechanical spreader. The use of a mechanical spreader may be dispensed with on small or irregular areas if a satisfactory substitute is provided. When Truck Mix or Central Mix Concrete is used it shall not be deposited directly on the grade, but shall be first discharged into an approved bottom dump bucket or mechanical spreader.

Placing and finishing cement concrete pavement without the use of fixed forms may be utilized. The methods and equipment must be approved by the Chief Engineer.

Where reinforcement is required it shall be securely held in place to insure its being in the prescribed position after the concrete has been poured. The concrete shall be struck off by means of a template to the required depth below the finished surface before the reinforcement is placed, except when the reinforcement is supported by approved metal supports.

Where existing concrete pavement is being widened 6 feet or less, the concrete may be placed using an approved road widener providing the results obtained by this method are satisfactory to the Engineer. Longitudinal forms will not be required when an approved concrete widening machine is used.

VIBRATION. After the concrete has been placed and spread so as to produce the specified depth, and before it is screeded or finished, the surface shall be vibrated as set forth below:

The vibrator shall be of an approved surface-type so constructed as to operate satisfactorily in conjunction with or as a part of the mechanical concrete spreader or the transverse concrete finishing machine. The vibrator shall be constructed so as to permit its being raised or lowered while moving along the pavement. The vibrator shall be mounted so as to transmit a minimum of vibration to the spreader or finishing machine, and forms, and shall not be in contact with the forms. The space between the ends of the pan and the forms shall not exceed three inches and if multiple pans are used, the space between the ends of adjacent pans shall not exceed six inches.

Each vibrating element shall operate at a frequency of over 4,000 cycles per minute. The vibrating elements shall be of a proper type, number and weight to produce impulses of sufficient force, proper direction and point of application such that no more than one passage of the vibrator will be required to thoroughly consolidate the concrete mass throughout its entire depth and width, with all surfaces free from honeycomb or voids.

While vibrating the pavement, the vibrating equipment will not be permitted to operate in a stationary position.

In addition to the foregoing surface vibration of the concrete pavement the contractor will be required to use an approved immersion type of vibrator adjacent to each edge of the pavement and on both sides of every transverse joint. The vibrating element shall be inserted and withdrawn vertically at intervals of approximately 18 inches and shall remain in the concrete for approximately 4 seconds at each insertion.

Paving shall be discontinued at any time the vibrating equipment is out of order or in the opinion of the Engineer not producing satisfactory results.

FORMING JOINTS. Transverse joints shall be placed where shown on the plans or as directed by the Engineer. Transverse joints for Cement Concrete Pavement shall be constructed as contraction joints except at structures where expansion joints shall be used at each end of the structure and in addition at the two joints immediately adjacent to each end.

Joint support assemblies shall be utilized at all transverse joints in cement concrete pavement unless otherwise indicated.

If due to any emergency, concreting must be stopped within 10 feet after forming a transverse joint, the contractor shall remove the concrete to the joint previously formed and no payment will be made for placing or removing this concrete.

At construction joints formed when it is necessary to stop the placing of concrete pavement, a special joint support assembly incorporating a bulkhead device shall be installed. This device shall consist of a joint support assembly with the center plate extended downward to the bottom of pavement elevation and with a bulkhead cap extending to the top of pavement elevation. The bulkhead device must be approved by the Chief Engineer before pavement operations are begun. Whenever concrete paving operations are stopped and the bulkhead installed, concrete must immediately be removed from the grade in front of the bulkhead device and from all of the exposed parts of the joint support assembly and bulkhead plate. Paving operations may not be started if there is any concrete ahead of or on any exposed parts of the joint support assembly or on the exposed side of the bulkhead plate.

Expansion joint material shall be supported by a joint support assembly of an approved design which has at the center of the joint a one-piece premoulded bituminous fiber felt meeting the requirements of M36, Premoulded Bituminous Joint Filler. The joint material shall be in one piece unless the width of the slab is in excess of thirteen feet, and shall be 3/4 inch in thickness. It shall be not less than 2" from the top of the surface of the pavement, shall extend to the bottom of the pavement, and shall be protected by a suitable removable metal cap. The felt shall be long enough to prevent concrete from running around the ends of the felts. In the event concrete does get around the end of the felt it shall be cut out at the same time that the forms are removed. The felt must fit tightly into the groove of an adjacent slab to positively prevent concrete from being forced around this end of the felt. The details will be as shown on an approved Standard Structure Sheet or otherwise approved by the Chief Engineer.

Contraction joints in all pavement shall be supported by a one-piece (up to 13 feet) or continuous joint support assembly of an approved design. The basic requirements as well as approved designs of specific joints are shown in the Standard Structure Sheets or in the plans and/or proposal. The joint opening at the top of the pavement shall be constructed using a method and/or procedure approved by the Chief Engineer.

All transverse joints and transverse joint support assemblies shall be normal to the center line, perpendicular to the surface and in a straight line across the full width and where applicable shall extend to the bottom of the pavement. Trenching will not be permitted. All joints will be securely fastened by pins or spikes of a type approved by the Engineer which shall be spaced as directed by the Engineer. The pins or spikes utilized to secure the transverse joint support assemblies to the subgrade shall be not less than 12 inches in length and shall have flat heads rather than hooks. Form pins or other types of removable pins will not be acceptable for this purpose. Bent, warped or distorted joint supports will not be used.

Under the Item for Concrete Foundation for Pavement no transverse joints need be formed or joint material used except as specified at bridges and culverts and wherever it is necessary to stop concreting. However, in the event that a delay occurs in the placing of the pavement course, or that pavement course is not placed until the next construction season, all cracks shall be sealed in accordance with the section entitled "Sealing of Joints and Maintenance of Cracks".

Transverse Joint Supports will not be required in the transverse joints formed in Concrete Foundation for Pavement unless indicated on the plans or in the itemized proposal.

Alongside curbing, edging and around manholes, premoulded or poured joints shall be used as shown on the plans. These poured joints shall be formed by placing a temporary joint form, shaped to the section, of a type and material approved by the Engineer, which shall afterwards be removed and the joint immediately filled with joint material. Temporary metal wedge shaped joints may be used having one-sixteenth inch less thickness at its bottom and one-sixteenth inch greater thickness at its top than that specified on the plans.

Temporary joint forms shall be held securely in place by means of pins driven two feet apart. Temporary wood joints will not be permitted. As the filler cools and/or subsides, additional material shall be added so that the joint will be flush full when the filler operation is completed unless otherwise directed. The joint opening shall be free from all foreign material, open to full depth and the faces clean and dry when the filler is applied.

The joint material installation shall be done by means of a device acceptable to the Engineer, and shall be manipulated in such a manner that the material shall not spread over the surface on either side of the joint, and care shall be taken in order that the material shall not be spilled on the exposed surfaces of adjacent curbs and structures.

Longitudinal joints shall be constructed so as to form a continuous tongue and groove joint between adjacent slabs and between concrete curbing and slabs as shown on the Standard Structure Sheets, Plans or as approved by the Engineer.

Where a pavement slab is placed one lane wide, the longitudinal joint between adjacent slabs shall be sawed along the joint to a width of either 5/16" + 0 - 1/16" or 3/8" ± 1/16".

When two lane pavement is placed full width, the longitudinal joint shall be sawed or formed, by an approved method, halfway between the outside edges of the placed double lane and centered over the longitudinal joint ties. The joint shall be either 5/16" + 0 - 1/16" or 3/8" ± 1/16" in width.

Contraction joints shall be constructed in two stages. The first stage shall consist of either (a) sawing not greater than 1/4" wide to a depth of 2-1/2" as early as sawing can be done in order to prevent random cracking or (b) forming by an approved method to a width not greater than 3/8" and to a depth of 2-1/2". The second stage shall consist of sawing to a width of 5/8" ± 1/16" and to a depth of 2" minimum from the surface of the pavement. This sawing shall not be done sooner than 72 hours after the concrete at the joint has been placed. Each joint shall have 1/8" nominal, 1/4" maximum beveled edges. These edges may be beveled using a cutting or grinding device attached to the second stage sawing blade, or a cutting or grinding device following the second stage sawing operation. The Contractor shall modify or change his method of producing bevels when undesired results are being obtained, at the order of the Engineer. Other methods shall have the prior approval of the Chief Engineer. This second stage sawing may be delayed at the Contractor's convenience except that if this second stage sawing is done after October 15 and the joint to be sawed has opened more than 1/8", as determined by measuring edge cracking, the Contractor shall saw an additional 1/16" in width for each 1/16" of opening over and above the 1/8". Expansion joints shall be sawed or formed by an approved method 7/8" wide ± 1/8" and shall also have 1/8 nominal 1/4" maximum beveled edges.

If the Contractor can demonstrate a satisfactory alternate method of forming the longitudinal joint to the above-indicated dimensions, such method will be permitted after prior approval by the Chief Engineer. All manipulation of the concrete in the forming process must be completed within 30 minutes of the time the concrete is placed. Such forming method, even if approved, will be permitted only as long as a satisfactory joint is obtained.

Any honey-combing along the edge of a slab will be patched smoothly before placing concrete for the adjacent slab. If the edge of the slab is not smooth the Engineer may require that a coating of suitable material be applied to the face before constructing the adjacent slab, in order to substantially eliminate bonding.

When called for on the plans or in the itemized proposal Longitudinal Joint Ties will be used where longitudinal joints are to be constructed.

The concrete along all joints shall be carefully consolidated and finished to a true surface. All joints shall be tested with a 10-foot straight edge or template immediately after forming. Any variation from the true surface shall be immediately corrected. Joints shall be open on the edges for their entire depth upon the removal of the forms.

Before opening the pavement to any traffic, including construction traffic, joints and cracks will be sealed in accordance with the section titled "Sealing Joints and Maintenance of Cracks".

Where the concrete is laid continuously across a bridge or culvert whose floor is below grade, transverse joints shall be formed at such distance from the abutment as to insure a bearing at the end of the slab of not less than five feet beyond the limit of the backfill area.

Where the concrete pavement joins a bridge or culvert, whose floor is at grade, transverse joints shall be formed at each abutment and also at such distance from the abutment as to insure a bearing at the end of the slab of not less than five feet beyond the limit of the backfill area.

Any spall, including cracked spalls, which have not yet been displaced, occuring on the pavement during the life of the contract along either the transverse or longitudinal joints shall be repaired by the Contractor using an epoxy mortar mixture composed of three parts Dry M3, Fine Aggregate and one part of M29A, Epoxy Resin System along with enough dry cement to provide a suitable color match with the existing pavement. The repairs shall be made as soon as possible and in all events prior to acceptance of the contract.

FINISHING CONCRETE. Finishing concrete shall meet the following requirements for Cement Concrete Pavement. Competent concrete finishers shall be employed at all times. The surface of the concrete shall be screeded by an approved transverse finishing machine operated by a qualified operator. The number of passes shall be the minimum number required to secure a smooth surface without overfinishing, as approved by the Engineer. Care shall be taken to keep the screed bearing directly on the side forms at all times and to secure a smooth and even surface. Sufficient finishing equipment, tools and operators shall be used so that placing and finishing operations can progress at a uniform rate of production.

When finishing equipment is operated on adjoining new concrete pavement approved rubber tired flangeless wheels shall be provided to avoid edge damage of adjacent lanes.

For two lane pavement poured full width the pavement section may be crowned to a parabolic shape approximating the typical section if approved by the Engineer.

Immediately after the concrete has been screeded a trowel shall be inserted between the form and the concrete for a depth of three inches for the entire length of slab.

After the mechanical transverse screeding has been completed, approved hand-operated smoothing lutes starting from the form or adjacent concrete slab, shall then be moved slowly over the surface of the concrete transversely from one side to the other and returned in such a manner that the cutting edge of the lute shall be parallel to the center line of the pavement at all times. Longitudinal movements of the lute shall be made by raising it completely above the surface and proper lapping. This manipulation shall continue as directed until visible irregularities are removed. Excess thin mortar accumulating ahead of the finishing lutes shall be removed from the surface of the pavement and shall not be used in filling depressions. One lute and operator shall be furnished and used for each 1,000 linear feet of pavement, or fraction thereof laid during any eight-hour working day.

Smoothing lutes may be of aluminum, steel or wood construction. Metal lute dimensions shall be substantially the same as for wood construction, hereafter described, except for the thickness of materials used. Metal lutes to be satisfactory must be sufficiently rigid and strong as to retain their shape and true straight lines under constant use and should be as light in weight as is consistent with meeting these specifications. The handle shall be 24 inches longer than the width of the pavement lane upon which it is used and may be made sectional for easy adjustment for variable width lanes. The angle between the handle and the smoothing face shall be 14°.

The wood smoothing lute shall be constructed of a smoothly finished approved wood plank 2 inches in thickness by 7 inches in width and 10 feet in length. Three feet six inches of the blade on both ends shall be tapered from the full width of 7 inches to points 4 inches at the ends above the bottom face which shall be true and straight. The handle for this blade is to be constructed of white pine 3 inches square in cross-section for the first 3 feet of its length, the end of which shall be firmly mortised into a square hole in the longitudinal center of the blade at an angle of 14 degrees with the flat bottom face of the blade. The handle shall be 2 feet longer than the width of the pavement lane upon which it is being used and 2-1/2 inches in diameter beyond the 3 inch square section. It shall be braced with respect to the ends of the blade with 1 inch by 2 inch slats extending on either side of the handle from the upper termination of the 3 inch square section to points on the top of the blade 18 inches distant from either end.

Care shall be exercised to ensure that the 2 inch by 10 foot bottom working surface of the blade is perfectly straight and plain. The edges shall be kept sharp and smooth. A master gauge shall be kept near the finishing operations and the blade carefully checked twice daily to ensure its accuracy.

Immediately upon completion of smoothing operations and prior to the application of curing compound, the concrete surface shall be broomed at right angles to the center line of pavement. The broom shall be a stiff bristled street or factory type, minimum width 18". Striations made by the broom in fresh concrete shall be not less than 1/16" nor more than 1/8" in depth, and such capability must be demonstrated to the satisfaction of the Engineer. Spacing of the striations shall be about the same as their depth. Brooms may be operated individually by hand or mechanically in gangs with brooms placed end to end. In any case brooming shall take place with the plane of the bristle ends coincident with the plane of the concrete surface being broomed. All brooms shall be kept free of hardened concrete particles and shall be immediately replaced if for any reason they fail to produce the desired texture in the concrete.

The edging tool for transverse joints shall have a flat horizontal face approximately three inches in width and the vertical and horizontal faces shall be joined with a radius of 1/8 inch. The edging is used only for rounding the corners and to fix the vertical face of the joint.

In edging concrete placed adjacent to a finished slab, an edging tool having a lip at least 1/4 inch deeper than the tool used on the finished slab shall be used.

Necessary hand finishing of joints and surface irregularities shall be done with a wooden float, from a bridge which shall not rest on the unset concrete at any point.

Workmen who perform the final hand finishing and tooling of transverse joints shall be equipped with a 30 inch long straight edge to check and correct any surface irregularities resulting from joint finishing operations.

Except on irregular or small areas, hand finishing will not be permitted unless specified on the plans or in the itemized proposal or in the case of breakdown of the finishing machines. If hand finishing is authorized, the surface of the concrete shall be struck off by means of two transverse screeds. The first or forward screed shall be 12 inches in width, at least 2 feet longer than the width of slab and shall be constructed of a channel or angle irons weighing not less than 20 pounds per foot. The second or follow up screed shall be 10 inches in width, of the same length and construction as the first screed, and shall weigh not less than 15 pounds per foot. The screeds shall be moved forward with a longitudinal and crosswise movement. After the above screeding has been completed the approved hand operated smoothing lutes shall be used as previously specified.

The surface of the pavement shall be tested after the mechanical and hand lute screeding but before the initial set of the concrete with a standard 10 ft. straight edge laid in successive positions parallel to and transverse to the center line of the pavement in contact with the surface and the whole area tested from one side to the other. Any irregularities shall be promptly corrected to the satisfaction of the Engineer. The surface of the completed pavement shall not vary more than one-eighth of an inch within 10 feet.

TESTING THE SURFACE. After the concrete has hardened sufficiently, the pavement surface shall be tested with a 10 foot straightedge. Areas that show high spots of more than 1/8 inch but not exceeding 3/8 inch in 10 feet shall be marked and immediately ground down with an approved grinding tool. These areas shall be ground to such a plane that when tested with the 10 foot straightedge, the surface deviations shall not exceed 1/8 inch in 10 feet. Where the surface deviations exceed 3/8 inch, the pavement shall be removed and replaced by and at the Contractor's expense or the condition remedied to the satisfaction of the Chief Engineer.

Finishing concrete for Concrete Foundation for Pavement shall be as follows:

The concrete shall be spread, vibrated and finished by mechanical means as specified for Cement Concrete Pavement. Where mechanical means are impracticable, in the opinion of the Engineer, the surface of the concrete may be struck off by means of a hand operated screed at least 12 inches in width, at least 2 feet longer than the width of the concrete slab. Care shall be taken to keep the screed bearing directly on the side forms at all times and to secure a smooth and even surface.

The Contractor shall conduct the finishing operations by hand in such a manner as to produce a surface true to template section and satisfactory to the Engineer. Necessary hand finishing shall be done with a wooden float from a bridge which shall not rest on the unset concrete at any

point. When hand finished the concrete will not be vibrated. The use of the smoothing lute will not be required.

The surface of the concrete shall be tested immediately after finishing with the standard ten foot straight edge laid parallel with the center line, and any irregularity exceeding 3/8 inch shall be immediately corrected to the satisfaction of the Engineer.

After the concrete has been placed the surface shall be roughened slightly to the satisfaction of the Engineer.

TOLERANCES - MULTILAYER PAVEMENTS. Tolerances indicated for the thicknesses of individual layers of multilayer pavements (including composite pavements) are basically guides which should be met as closely as practical. Tolerance for the total thickness of such pavement is also a guide.

In order to attain the ultimate objective of a smooth riding pavement, substantially true to line and grade, pavements which substantially conform to the plans and specifications, even though the thickness tolerances may not be exactly met, may be accepted and paid for under the following conditions: Where the total thickness of such pavements is less than the specified thickness, including tolerances, the Chief Engineer may approve, accept and pay for such pavements; where the total thickness of such pavements is greater than the specified thickness, the Chief Engineer may exercise his judgment and accept and pay for such pavements when, in his opinion, the excess thickness was necessary to attain a smooth riding pavement surface.

PROTECTION OF CONCRETE. Traffic shall be excluded from the concrete by the erection and maintenance of substantial barricades for the entire period during which the pavement is to remain closed to traffic; and logs, ties or other obstructions shall be placed at proper intervals so that traffic cannot turn out or run on the pavement.

As ordered by the Engineer temporary "Cross Overs", consisting of a 4-inch layer of suitable soil free from stone and a 3-inch plank roadway at least 16 feet wide securely held in place, shall be constructed at street and road intersections and private drives to accommodate traffic. For immediate use after laying pavement, "Cross Overs" shall be bridged.

During threatening weather the concrete shall be protected with waterproof paper blankets as soon as it is finished.

CURING OF CONCRETE. At the Contractor's option either Quilted Covers, Waterproof Paper Blankets, Polyethylene Coated Burlap Blankets, Polyethylene Curing Covers (White Opaque) or chlorinated rubber epoxy curing compound conforming to the requirements of M41 and applied in accordance with the subsection "Curing Concrete" under the Structural Concrete Section may be used for curing Concrete Foundation for Pavement and Cement Concrete Pavement. The Hay and Water Cure can be used for curing Concrete Foundation for Pavement.

Other methods of curing may be used when approved by the Chief Engineer.

QUILTED COVERS. Quilted covers shall be securely held in place and weighted down to completely cover the edges, as well as the top of the pavement. Adjoining quilts shall be lapped at least 12 inches.

These quilted covers shall be laid directly on the pavement as soon as practicable after the finishing operations in such a manner that the surface of the concrete will not be appreciably marred. They shall be thoroughly wetted and kept wet for the curing period shown in the following table of curing periods.

Quilted covers shall meet the requirements of M40 Quilted Covers (for Curing).

WATERPROOF PAPER BLANKETS. Waterproof Paper Blankets shall be placed as soon as practicable after the finishing operations in such a manner that the surface of the concrete will not be appreciably marred. They shall be unrolled from poles or timbers. The blankets shall be securely weighted down by placing a row of earth on the edges of the blankets just inside the forms or by other approved methods. When placed, the adjoining blankets shall overlap at least twelve (12) inches. This lap shall also be securely weighted down to form a closed joint. The forms shall be removed the next morning. Upon removal of the forms, the supplemental stringer sheets shall be pulled out and carried down to the bottom of the pavement and be secured with a continuous bank of earth or by other approved methods.

After the concrete has hardened sufficiently, additional earth or other materials shall be placed along all overlapping paper joints and elsewhere as may be required to satisfactorily secure the blankets.

In the event that weather conditions are such that hair checking occurs before the paper can be applied, initial curing with wet burlap, quilted covers or other approved methods to produce a water film will be required followed by curing with waterproof paper blankets.

Blankets shall be protected by proper barricades, especially when used in heavy traffic areas. Walking on the blankets will not be permitted at any time. Any tears or holes in the paper at any time shall be repaired by cementing patches over the openings. Whenever blankets are no longer in satisfactory condition and fail to provide a moisture retaining cover they shall be rejected by the Engineer.

Waterproof Paper Blankets shall meet the requirements of M39 Waterproof Paper Blankets (for Curing).

POLYETHYLENE CURING COVERS. Polyethylene curing covers shall conform to the standards for M40A Polyethylene Coated Burlap Blankets (for Curing) or M40B Polyethylene Curing Covers (White Opaque). The covers shall be placed immediately after finishing operations, care being taken to avoid appreciably marring the surface of the pavement. When placed, covers shall be of sufficient width to cover the full slab width, plus sufficient additional material to cover the area at the edge of the slab. Joints shall overlap at least 12 inches, and the overlap shall be securely weighted down to form a closed joint. Upon the removal of the side forms, the edges of the pavement shall be protected by the additional width provided.

Each cover shall be anchored in place by a windrow of earth or by other approved methods along the edge of the pavement until such time as the forms are removed, at which time the edges of the pavement are to be covered as indicated above and the covers again secured by a windrow of earth or by other approved methods on the subgrade adjacent to the pavement. After the concrete has hardened sufficiently, additional earth or other material may be placed on the cover, as required, to anchor the covers satisfactorily.

In the event that weather conditions are such that hair checking occurs before the covers can be applied, initial curing with wet burlap, quilted covers or other approved methods to produce a water film will be required followed by curing with polyethylene curing covers.

Polyethylene covers shall be protected by proper barricades, especially when used in heavy traffic areas. Walking on the covers shall not be permitted at any time during the cure. All tears and holes in the cover shall be repaired by cementing patches over the openings. Whenever covers are no longer in satisfactory condition and fail to provide a moisture retaining cover, they shall be rejected by the Engineer. The decision as to the fitness of the plastic for further use shall be made by the Engineer.

HAY AND WATER CURE. The concrete shall be protected with burlap or quilted covers laid directly on the pavement as soon as completed. The strips shall be at least two feet wider than the pavement and shall overlap not less than twelve inches and must be thoroughly wetted when placed, and kept wet by spraying until the covering is placed. Sufficient covers for pavement laid in any single day must be provided. The covers shall be kept wet until removed.

After 24 hours, the burlap or quilted covers shall be removed and the entire surface of the pavement including the edges and sides shall be wetted thoroughly and covered with hay or buckwheat straw to a depth of not less than 6 inches which covering shall be kept wet by sprinkling with water for the curing period shown in the table. The water shall be applied by means of a tank truck sprinkler with a fan spray unless otherwise ordered by the Engineer.

CURING PERIODS. The following table shows the minimum period before laying adjacent slabs, the minimum period before opening to traffic and curing periods for different types of curing:

Item No.	Period before laying adjacent slabs	Period before opening to traffic	Types of curing				
			Quilted covers	Waterproof paper Blankets	Polyethylene curing covers	Polyethylene Coated Burlap Blankets	Hay and Water
			Concrete laid from June 1st to September 15th DAYS—MINIMUM				
46	5*	10	4	4	4	4	8
47	5	10	4	4	4	4	8
Pavement laid before June 1st and after September 15th when average temperature is above 40°F. unless otherwise authorized by the Engineer.							
46	7*	15	6	6	6	6	12
47	7	15	6	6	6	6	12

*When a finishing or spreading machine is not used for placing the concrete this time may be reduced by two days.

WATER SUPPLY. When the pipe line necessary for concreting and curing operations is two and one-half miles or less in length, a pipe of at least two inches in diameter shall be used. When the pipe line is more than two and one-half miles in length, the additional pipe shall be at least two and one-half inches in diameter and shall be placed at the end nearest the source of water supply.

There shall be installed in the main water supply line to pavers a 2-inch pressure regulating (spring loaded) relief valve of approved type, capable of being adjusted to maintain an inlet pressure of from 50 to 100 lbs. and provided with a gauge having 2-1/2 inch dial, so connected as to

indicate the inlet pressure. The valve shall be adjusted to a pressure of not less than 50 lbs. per sq. inch and shall be so arranged that it can be sealed after installing. No bypass of water to the mixer will be permitted.

If, at any time and for any reason, the Contractor's pumping and pipe line equipment is inadequate to furnish sufficient water supply for the mixer and to do the necessary pavement concrete and fine grade sprinkling as specified, operations shall be discontinued until an adequate water supply is provided.

DAMAGED CONCRETE. All porous or defective concrete, occurring prior to the final acceptance of the work, shall be repaired by the Contractor at his own expense using the methods outlined below and/or directed by the Engineer. However, the Chief Engineer shall be the sole judge as to whether spalled, honey-combed or concrete areas damaged otherwise shall be repaired by the methods outlined below or shall be completely removed and replaced in kind as originally called for in the contract specifications.

Small spalls and areas where minor concrete removal is required:

All spalled, honeycombed, and disintegrated concrete shall be removed, as designated by the Engineer, by chipping the unsuitable material to sound concrete with pneumatic tools. The type and size of tools and the depth at which the sound concrete is reached shall be approved by the Engineer.

All chipped surfaces to be repaired shall be thoroughly cleaned by means of sandblasting with No. 40 boiler slag grit or No. 2 sandblast sand, or as ordered by the Engineer.

The repairs shall be made with an epoxy mortar. The epoxy binder shall meet the requirements of M29A and the aggregates used shall meet the requirements of M3 Fine Aggregates. The Contractor, if ordered by the Engineer, shall mix trial batches to determine the correct blend of resin and aggregate.

Large spalls and areas where major concrete removal is required:

All spalled, honeycombed, and disintegrated concrete shall be removed, as designated by the Engineer, by chipping the unsuitable material to sound concrete with pneumatic tools. The type and size of tools and the depth at which the sound concrete is reached shall be approved by the Engineer.

All chipped surfaces to be repaired shall be thoroughly cleaned by means of sandblasting with No. 40 boiler slag grit or No. 2 sandblast sand, or as ordered by the Engineer.

The repairs shall be made by covering the freshly cleaned surface with epoxy grout that will be used to provide a bond between the cured concrete and the fresh concrete used for repair. Concrete used for major repairs shall be of the same class as required by the original item unless the Engineer in his judgment orders a modified mix design which shall be obtained from the Laboratory. The epoxy grout shall meet the requirements of M29G.

SEALING JOINTS. All expansion, contraction, construction and longitudinal joints shall be sealed any time after the removal of the curing paper or other medium and before the pavement is opened to traffic, including construction traffic, and before discontinuing operation when the work is suspended during the winter. The joints shall be thoroughly cleaned, using whatever equipment or method is necessary and when they are free of foreign material, M38PD sealer for expansion and longitudinal joints and M38PF sealer for contraction and construction joints shall be installed by suitable machine tools and thoroughly secured in place with the lubricant which shall cover both sides of the sealer over the full area in contact with the sides of the concrete joint. The lubricant may be applied to the concrete or sealer or both. For beveled joints the sealer shall be installed in a compressed condition at a depth of not less than 1/16" nor more than 3/16" below the bottom edge of the bevel. For joints with vertical sides, the joint sealer shall be installed in a compressed condition at a depth of 1/4" ± 1/16" below the level of the pavement surface. The method of installation shall be such that the joint sealer shall not be stretched more than 5% of the minimum theoretical length. The method of installation shall be checked for stretching, using transverse joint sealer. The check shall consist of installing sealer in five joints and removing the sealer immediately after installation and checking the length. This check may be modified by pre-marking or pre-cutting the sealer to length prior to installation if this is compatable with the equipment being used. If the measurement of any of these five sealers demonstrates that stretching in excess of 5% is occurring, the installation method shall be modified so that stretching greater than 5% no longer occurs. Once sealing operations have started, one joint per every hundred shall be checked for stretch in excess of 5%. If a stretched condition is detected, the joint sealers on either side shall be removed until the condition disappears and the affected joints shall be resealed in a satisfactory manner at no cost to the County. The sealer shall be in one piece for the full width of the transverse joint for the entire pavement width and down the full depth of the exposed pavement edges. In longitudinal joints no splices in the sealer shall be allowed between transverse joints. The longitudinal joint sealer shall be cut where it crosses a transverse joint. All intersections between longitudinal sealer and transverse sealer shall be sealed with lubricant. The Contractor may elect to place a temporary filler, of such material as is approved by the Engineer, in the joints and to delay the placing of the sealer until the fall. Thorough cleaning of the joint and joint faces must precede the installation of the permanent sealer.

TEST CORES. Test cores will be taken from the finished concrete pavement at 1,000 ft. intervals in each lane of pavement previous to acceptance. Areas of pavement from which cores

more than 1/2 inch short of the specified thickness are taken shall be removed and replaced at the Contractor's expense unless the Chief Engineer agrees to permit the deficient pavement to remain in place at no cost to the County. Where defective cores are found, additional cores may be taken for testing.

Holes left as a result of core drilling operations will be filled by the Contractor, unless directed otherwise in writing by the Engineer, at the earliest possible time and not later than seven calendar days after the core is taken. Before filling, the holes will be carefully cleaned to remove dust, dirt, water and other foreign material. The holes will be completely filled with concrete of the same mix as was used in the pavement. Any damage by traffic to any of the core holes must be repaired by the Contractor.

PART II

Section 8

BITUMINOUS CONCRETE

GENERAL SPECIFICATIONS

These general specifications apply to all plant mixed bituminous concrete items.

PAVING PLANT

ACCEPTANCE AND UNIFORMITY. Each bituminous mixing plant (fixed or portable) shall be inspected and approved by the Engineer. The right is reserved for the Engineer to discontinue the use of any previously approved equipment at any time, providing unsatisfactory results occur during the progress of the work. The mixing plants shall be so designed, coordinated and operated as to produce a uniform mixture for the type of material specified.

EQUIPMENT FOR PREPARATION OF BITUMINOUS MATERIALS. Tanks for the storage of Bituminous Material requiring heat shall be capable of heating the material under effective and positive control at all times to the temperatures required by the specifications or ordered by the Engineer. Heating shall be accomplished by steam or oil coils, electricity, or other means such that no flame shall come in contact with the heating tank. Storage tank capacity shall be sufficient for at least one day's run. Separate tanks and pipe lines shall be provided when mixtures containing asphalt cement and liquid asphalt materials are to be mixed in the same mixer. When tar products or emulsified asphalts are to be used as the binding medium in bituminous mixtures, separate storage tanks as well as separate pipe lines shall be provided.

All mixing plants shall be equipped with a sampling valve so designed and installed as to be nonclogging, safe and completely divorced from any solvent cleanout operation. The type of valve and its location shall be approved by the Chief Engineer. When samples are taken through such valves in accordance with Department instructions, they shall be considered to be representative of all material used by the plant until the time of the next sampling.

DRYER. All plants shall be equipped with a dryer or dryers for drying the mineral aggregates. The dryer used for heating the mineral aggregates shall be of the cylindrical rotating type and shall be capable of drying and heating mineral aggregates in quantities in excess of the operating capacity of the plant.

Any size aggregate shall be considered dry when its moisture content just prior to batching does not exceed 0.5% of oven dried weight. It shall also be capable of maintaining the temperatures required by the specifications without leaving any unburned oily residue on the aggregate when it is discharged from the dryer.

The aggregates shall be so fed to the dryer, by such procedures or feeders as are satisfactory to the Chief Engineer, that they will be in substantially the same proportions as are required in the finished mix.

SCREENS. Each mixing plant shall be equipped with screens capable of screening all aggregates to the sizes required for proportioning the mix. The operating capacities of the screens shall be in excess of the full capacity of the mixer.

AGGREGATE STORAGE BINS. The bituminous mixing plant shall include storage bins of sufficient capacity to insure uniform and continuous operation. There shall be at least four storage bins so arranged as to insure separate and adequate storage of the appropriate fractions of the aggregates required to give proper proportioning of the mix. Each bin shall be provided with an overflow chute that shall be of such a size and location as to prevent any backing up or overflow of material into other bins. Bins shall be provided with adequate "telltale" devices to indicate the position of the aggregate in the bins at the lower quarter points.

Sampling facilities shall be provided which allow the Inspector to obtain representative samples from the full width and depth of the discharge area from each bin. The sampling tray shall be structurally supported during the sampling operation. Alternate sampling facilities may be provided subject to the approval of the Chief Engineer. In no case shall a shovel be considered a satisfactory sampling device. Access to the sampling facilities shall be provided with no more difficulty than that required to climb a ladder leading to a secure platform with railings.

BITUMINOUS CONTROL UNIT. Satisfactory means, either by weighing, metering or volumetric measurements, shall be provided to obtain the proper amount of bituminous material in the mix. Suitable means shall be provided, either by steam jacketing or other insulating, for maintaining the specified temperatures of the bituminous materials in the pipe lines, meters, weigh buckets, spray bars and other containers or flow lines.

Where metering or a volumetric device is used to proportion bituminous materials for plant mixtures, a suitable valve and by-pass shall be provided so that the measuring device may be conveniently checked by actual weight.

THERMOMETRIC EQUIPMENT. An armored thermometer, with a temperature range in degrees Fahrenheit sufficient to cover the required temperature range of the bituminous material used to manufacture the mix produced at the plant, shall be fixed in the bituminous feed line at a suitable location near the discharge valve at the mixer unit. The plant shall be further equipped with an approved thermometric instrument placed at the discharge chute of the dryer and in the lower quarter of the fine bin so as to indicate the temperature of the heated aggregates. The above thermometers shall be accurate to 2.5 degrees Fahrenheit above or below the indicated reading.

DUST COLLECTORS. Bituminous mixing plants shall be equipped with adequate dust collecting systems so that objectionable dust and fumes will be removed.

TRUCK SCALES. Each bituminous mixing plant shall be equipped with approved platform scales of sufficient capacity and size to accurately weigh the heaviest loaded trucks or tractor-trailers, that are used for the delivery of the plant mixed bituminous materials from that plant unless otherwise approved by the Chief Engineer. Such approval will not be given unless approved automatic recording equipment in compliance with these specifications is in use in the plant to accurately record batch weights.

SAFETY REQUIREMENTS. Adequate and safe stairways to the mixer platform and guarded ladders to other plant units shall be placed at all points required for accessibility to plant operations. All gears, pulleys, chains, sprockets and other dangerous moving parts shall be thoroughly guarded and protected. Ample and unobstructed space shall be provided on the mixing platform. A clear and unobstructed passage shall be maintained at all times in and around the truck loading space. This space shall be kept free from drippings from the mixing platform.

Each mixing plant shall be equipped with adequate fire fighting equipment.

PLANT INSPECTION. Each bituminous mixing plant site shall provide a suitable building or room for use as an office and testing facility by the Engineer or his Inspectors. Department representatives shall be given priority of access to these facilities. The plant shall provide a building with adequate space and necessary equipment for a testing of bituminous concrete. The space shall be properly ventilated by windows, exhaust fans or other approved means. The Department representative shall be provided with convenient access to a telephone or other approved means of communications. The following list of equipment is the required minimum and shall be properly installed and maintained in good operating condition:

1. Bitumen extraction apparatus, power driven centrifuge or reflux, with a minimum capacity of 1000 grams.

2. Coarse aggregate sieve shaker, power driven, with a minimum clear screen area of 324 sq. inches and equipped with a shut-off timing device. The shaker shall be attached to a firm anchorage.

3. Fine aggregate sieve shaker, power driven, independent of the coarse aggregate shaker, for eight-inch (8") diameter sieves and equipped with a shut-off timing device.

4. Scale, 1000 gram minimum capacity with maximum 0.5 gram graduations.

5. Scale, Thirty-pounds (30) minimum capacity with maximum 0.01 pound graduations.

6. Fine aggregate sample splitter suitable for splitting samples having a maximum particle size of one-half inch (1/2").

7. Stove, oven, or hotplate suitable for sample drying.

8. Necessary accessory equipment for testing bituminous concrete including sieves suitable for all types of material to be produced, solvent, filters, and sample containers.

9. Two (2) drawer, legal size, file cabinet with two (2) keys for the exclusive use of the Inspector.

The suitability of office and testing facilities, including the equipment, shall meet the approval of the Chief Engineer.

BATCHING PLANTS

AUTOMATIC PROPORTIONING. All batch type mixing plants used to produce bituminous concrete for County work shall be equipped with approved automatic proportioning devices unless otherwise shown on the plans or proposal. Such devices shall include equipment for accurately proportioning batches of the various components of the mixture by weight or volume in the proper sequence and for controlling the sequence and timing of mixing operations. There shall be auxiliary interlock cutoff circuits to interrupt and stop the automatic cycling of the batching operations at any time an error in weighing occurs, when any aggregate bin becomes empty or when there is a malfunctioning of any portion of the control system.

RECORDING EQUIPMENT. A recorder or recorders of a type and number approved by the Department shall be provided in all bituminous mixing plants used to produce bituminous concrete for County work unless otherwise shown on the plans or proposal. Each recorder shall produce a printed graphic or digital record on a chart or tape of the weights of the materials batched. All charts or tapes shall show the date and time of day to the nearest minute for each batch and shall be so marked that each batch may be permanently identified and so that variations in batch weights can be readily observed.

All originals of charts, tapes or other recorded data pertaining to the proportioning of bituminous concrete, after recordation, shall become the property of the County.

EQUIPMENT FAILURE. If at any time the automatic proportioning or recording devices become inoperative, the plant may be allowed to batch and mix bituminous materials for a period of not more than 48 hours from the time of the breakdown if approved by the Engineer. Written permission of the Chief Engineer will be required for periods of operation without automatic proportioning facilities longer than 48 hours.

WEIGH BOX OR HOPPER. This equipment shall include a means for accurately weighing each bin size of aggregate in a weigh box or hopper suspended on dial scales. The weigh box shall be of ample size to hold a full batch without hand raking or spillage. The gates on the aggregate bins and the hopper shall be so constructed as to prevent leakage when closed.

AGGREGATE SCALES. Scales for any weight box or hopper shall be of the springless dial type, having a full complement of index pointers and shall be of a standard make and design. They shall be accurate to 0.5 percent, have minimum graduations not greater than 0.5 percent and shall be readable and sensitive to 0.25 percent or less, the preceding percentages based on total batch weight. Scales shall be so located as to be easily readable by direct sight or through repeating dials from the operator's normal work station.

The batching controls shall meet the following delivery tolerances with respect to the various components weighed in each batch:

Aggregate Components	± 1.5% of total batch weight
Mineral filler	± 0.5% of total batch weight
Asphalt	± 0.1% of total batch weight

The total weight of the batch shall not vary more than plus or minus 2% from the theoretical design weight.

All plant scales, including truck scales, shall be tested at the expense of the contractor by a competent scales technician as follows:

1. Annually prior to use in County work.
2. At intervals of not more than 60 calendar days.
3. At any time ordered by the Engineer.

A cradle or platform, approved by the Engineer for each scale and at least ten (10) standard fifty (50) pound test weights shall be provided for testing scales whenever directed by the Engineer. The use of a set of test weights for two (2) or more plants will be permitted only when they can be made readily available within no more than an hour's notice. If directed by the Engineer, provision shall be made for locking all scales against tampering.

BITUMINOUS BUCKET. If a bituminous bucket is used it shall have a working capacity of not less than 11 percent by weight of the rated capacity of the mixer. It shall be heated in an approved manner by steam, oil, electricity or other approved means. It shall be suspended on dial scales so that the tare weight can be conveniently brought to zero reading at all times. The bucket shall be so arranged that it will deliver the bituminous material in a thin uniform sheet or in multiple streams the full length of the mixer.

The asphalt cement may be introduced into the mixer by means of an asphalt bucket, by steam pressure and a spray bar or by a pressure pump and spray bar.

If spray bars are used to introduce the bituminous material into the mixer they shall be so heated and so constructed as to distribute the bituminous material uniformly upon the mineral aggregates.

BITUMINOUS MEASURING DEVICES. All measuring devices shall be accurate to 0.10 percent, have minimum graduations not greater than 0.050 percent and shall be readable and sensitive to 0.025 percent or less, the preceding percentages being based on total batch weight. They shall be so located as readable by direct sight or through repeating dials from the operator's normal work station.

Where bitumen is proportioned by weight, the scales shall be of the springless dial type of standard make and design.

MIXER UNIT. The mixer unit shall be of an approved twin shaft pugmill type. It shall be capable of producing a satisfactory uniform mixture within the limits of the specifications. The mixer shall have a capacity of not less than two thousand pounds. The blades of the pugmill shall have a clearance from all fixed and moving parts not in excess of three-quarters of an inch. Paddle blades reduced by wear in excess of 25 percent in face area from their new condition shall be replaced. The mixer shall be so constructed as to prevent leakage of contents until the batch is discharged.

The use of batteries of small batch mixers will not be allowed.

TIME LOCKING DEVICE. The mixer shall have an accurate time locking device to control the operation of a complete mixing cycle by locking the weigh box gate after charging the mixer, until the closing of the mixer discharge gate at the completion of the cycle. It shall lock the bituminous material feed throughout the dry mixing period and shall lock the mixer discharge gate throughout the dry and wet mixing periods. The dry mixing period is defined as the interval of time between the opening of the weigh box gate and the commencement of application of the bituminous material. The wet mixing period is the interval of time between the commencement of application of the bituminous material and the opening of the mixer discharge gate.

The control of the timing shall be flexible and capable of being set at intervals of not more than five seconds throughout the cycles up to three minutes. Changes in mixing time shall be made only when ordered by the Engineer.

The point of control of the time locking device shall be so located that it is not readily accessible to the operator of the mixing plant.

CONTINUOUS MIXING PLANTS

GENERAL. The Contractor may, at his option, use a continuous mixing plant of an approved type meeting the following requirements:

RECORDING EQUIPMENT. Each continuous mixing plant shall be provided with approved platform scales in conformance with the requirements of the National Bureau of Standards Handbook 44 subject to the provisions herein. They shall be equipped with a recorder of a type approved by the Department. The recorder shall produce a printed digital record on a ticket of the gross and tare weights of the delivery trucks along with a time-date print for each ticket. Tare weights shall be printed either by weighing each truck empty for each delivery or by setting the tare weight on the recorder so that it is printed along with the gross weight. If the latter system is adopted, tare weights of each truck shall be checked at least twice a day or more frequently as ordered by the Engineer. Provisions shall be made so that scales may not be manually manipulated during the printing process. In addition, the system shall be so interlocked as to allow printing only when the scale has come to a complete rest. The scales and recorder shall be of sufficient capacity and size to accurately weigh the heaviest loaded trucks or tractor trailers that are used for the delivery of the bituminous concrete from that plant.

GRADATION CONTROL UNIT. The unit shall include interlocked feeders mounted under the compartment bins. Each bin shall have an accurately controlled individual gate to form an orifice for volumetrically measuring the material drawn from each respective bin compartment. The feeding orifice shall be of adequate dimensions to provide a positive feed without bridging and with dimension adjustable by positive mechanical means and to be provided with a lock. Indicators graduated to tenths of an inch shall be provided on each gate to show the calibrated gate opening. When added mineral filler is specified, a separate bin and feeder shall be furnished with its drive interlocked with the aggregate feeders. The interlocked feeders shall be equipped with a revolution counter reading to .01 of a revolution to facilitate the calibration of the aggregate flow.

Each hot aggregate bin shall be equipped with an approved indicating device which shall automatically stop plant operations when the aggregate level falls below that required for uniform aggregate flow.

WEIGHT CALIBRATION OF FEEDS. The plant shall be provided with approved devices capable of automatically sampling, weighing, and recording the quantities of each hot bin aggregate size and sampling, weighing or metering and recording the bitumen fed to the pugmill during either a known number of revolutions of the plant or known interval of time. The resultant sample size shall be sufficient to yield repeatable results of 0.5% for aggregates and 0.1% for bitumen, the preceding percentages based on the total amount of bituminous concrete delivered per revolution or interval of time. The weighing and recording of each aggregate size and bitumen may be either individual

or cumulative. The recording equipment may be either digital or graphical type. In addition to the recording of the sample quantities, the time and date, accurate to the nearest minute, shall also be recorded. The sampling and recording system shall be so designed and situated as to allow operations with minimum production delay and maximum facility of inspection.

The plant shall proportion each size of aggregate to the pugmill with such accuracy and uniformity that the variation and weight of material from each hot bin per revolution or interval of time shall not exceed an amount equal to 1.5% of the total weight of bituminous concrete delivered per revolution or interval of time. Where the separate addition of mineral filler is required, it shall be added with a uniformity of 0.5% on the basis stated above for aggregates. The bitumen shall be added with a uniformity of 0.1% on the basis stated above for aggregates. In no case shall the total weight of bituminous concrete vary from the design weight by more than ±2% of the design weight.

SYNCHRONIZATION OF FEEDS. Satisfactory means shall be provided to afford positive mechanical interlocking control between the flow of aggregate from the bins and the flow of bitumen from a positive displacement metering pump. The point of control of the metering pump capacity shall be so located that it is not accessible to the operator from the mixer platform.

The bituminous feed system shall be so interlocked as to automatically stop plant operations whenever the flow of bitumen is interrupted.

MIXER UNIT. The plant shall be equipped with a continuous, steam jacketed, twin shaft pugmill type mixer which shall be capable of producing a uniform mixture within the job mix tolerances. The paddles shall be of a type adjustable for angular position on the shafts and shall be reversible to retard the flow of the mixture. The pugmill shall be equipped with a discharge hopper having a capacity of approximately one ton. The hopper shall be equipped with dump gates which will permit rapid and complete discharge of the bituminous mixture and shall be of a design approved by the Department. The mixer shall carry a manufacturer's plate showing the net volumetric contents of the mixer at the several heights inscribed on a permanent gauge.

Charts shall be provided showing the rate of feed of aggregate per feeder revolution for the specific aggregate being used. Determination of mixing time shall be by weight method using the following formula:

$$\text{Mixing time in seconds} = \frac{\text{Pugmill dead capacity in lbs.}}{\text{Pugmill output in lbs. per second}}$$

The weights shall be determined for the job by tests made by the Engineer.

The plant shall have a rated capacity of not less than 40 tons per hour.

MATERIALS

APPROVED MATERIALS. Laboratory approval of the sources of supply of the coarse and fine mineral aggregates and the acceptance of the mineral filler, hydrated lime, bituminous materials, liquefiers and any other materials that are used in the mix shall be obtained from the Chief Engineer or his Representative before the delivery is made of mixed material from any bituminous mixing plant.

BITUMINOUS MATERIALS. All bituminous materials used in the various mixes shall comply with the standard specifications, M5, Bituminous Materials, or with the special specifications for the particular type of mixed product that is being produced at the plant.

The suppliers of bituminous materials shall furnish the Department with data on the temperature-viscosity relationship for each lot of asphalt to be used on a project. These data shall take the form of a graph as approved by the Laboratory and shall cover the range of temperatures and viscosities within which the asphalts may be used.

MINERAL FILLER. The mineral filler shall conform with the requirements of M3E, Mineral Filler. In all bituminous mixing plants where mineral filler is required to be added, it shall be accurately weighed and introduced in the required amount into the mix through the weigh box. It shall not be passed through the drier, but shall be fed by elevator or other acceptable means directly to the designated bin. The portion of the approved fine and coarse aggregates which passes a No. 200 sieve will be considered as filler and the added mineral filler shall be reduced proportionately.

HYDRATED LIME. Hydrated Lime shall conform to the requirements of M42, Hydrated Lime. The amount of hydrated lime for each batch may be measured by volume on the basis of a volume weight relation.

AGGREGATES. Fine aggregates shall consist of material conforming to the requirements of M3, Fine Aggregates, except for gradation and rational analysis, and except that approved limestone screenings may be used.

Coarse aggregates (retained on the 1/8 inch screen) shall consist of approved broken stone, crushed gravel, Types A or B or approved broken slag

Slag aggregates, fine or coarse, shall not be used except when indicated on the plans or in the itemized proposal.

When slag is permitted, as the aggregates to be used in the mix, the asphalt content of that mix shall be increased by approximately 25 percent.

Crushed gravel shall not be used except when indicated on the plans or in the itemized proposal.

Mineral aggregates that have a hydrophilic (electro-negative) characteristic may be approved by the Department for use in bituminous plant cold mixes provided a satisfactory anti-stripping agent is used in the mix. Mineral aggregates that have a hydrophilic (electro-negative) characteristic shall not be used in hot mixes.

PREPARATION OF MINERAL AGGREGATES. All aggregates shall be heated and dried at the mixing plants.

Both fine and coarse aggregate may be fed simultaneously into the same dryer in approximately the proportions that are required in the mix, but in all cases, immediately after heating, they shall be screened into the bins necessary to control the proper aggregate sizes required in the mix.

PREPARATION OF BITUMINOUS MATERIALS. Bituminous material shall be delivered to the mixer at a temperature within the range specified for the type material being mixed.

PREPARATION OF MIXTURE. The introduction of the materials into the mixer, and the mixer operation, shall be carried out as outlined below unless the specification for the particular type of material that is being manufactured calls for some other method of procedure, in which case, the mixing operation detailed in that particular specification shall be followed.

Each size of properly heated aggregate, the dry mineral filler, if required, and the bituminous material shall be measured separately and accurately to the proportions in which they are to be mixed. The volume of the mineral aggregates and the bitumen, when placed in the mixer, shall not be so great as to extend above the tips of the mixer blades when these blades are in vertical position nor such as to exceed the manufacturer's rated capacity of the mixer. In no case shall the total quantity of material mixed be less than 50 percent of the manufacturer's rated capacity of the mixer unit.

MIXING AND CYCLE TIME. Terms relating to timing of the mixing cycle are defined as follows:

Cycle Time: The interval of time between successive openings of the pugmill discharge gate for succeeding batches.

Mixing Time: The interval of time between the opening of the aggregate weigh box gate and the opening of the pugmill discharge gate.

Dry Mixing Time: The interval of time between the opening of the aggregate weigh box gate and the beginning of application of bituminous material.

Wet Mixing Time: The interval of time between the beginning of application of bituminous material and the opening of the pugmill discharge gate.

Finishing Mixing Time: The interval of time between the termination of application of bituminous material and the opening of the pugmill discharge gate.

Standard dry and wet mixing times for any plant mixed bituminous concrete shall be 15 and 45 seconds, respectively. Any deviation from standard mixing times shall be as approved by the Chief Engineer as necessary to meet the requirements outlined below.

Base course mixes shall be dry mixed for at least the period of time necessary to discharge all aggregates into the mixer. The wet mixing period shall then commence and continue at least until 85 percent of the coarse aggregate particles are fully coated or the finish mixing time exceeds 10 seconds, whichever is longer. Top and binder course mixes shall be dry mixed for at least the period of time necessary to discharge all aggregates into the mixer or 10 seconds, whichever is longer. The wet mixing period shall then commence and continue until at least 95 percent of the coarse aggregate particles are fully coated or the finish mixing time exceeds 10 seconds, whichever is longer.

In no case shall the cycle time be so short as to result in a rate of production exceeding the operating capacities of the plant.

JOB MIX FORMULA. For any bituminous mixture required by the plans or proposal, the Contractor shall formulate and submit to the Chief Engineer, a job mix formula that satisfies the General Limits imposed by the table, "Composition of Mixtures for Plant Mixed Bituminous Materials".

Once approved, the mix shall be used within the Job Mix Tolerances set forth in the table, "Composition of Mixtures for Plant Mixed Bituminous Materials". The aggregate tolerances shall be based on the total weight of the aggregate and the asphalt cement tolerances shall be based on the total weight of the mix. However, in no case shall the Job Mix Tolerances fall outside the General Limits for a particular item.

If for any reason a change in materials occurs or is contemplated, a separate Job Mix Formula shall be used to fit each change in materials or conditions.

COMPOSITION OF BITUMINOUS PLANT MIXTURES

Screen Sizes	Binder Course		Base Course Bituminous Concrete Type 1A		Top Courses							
					Type 1A (Hot Process)		Type 1AC		Type 2A		Type 2B	
	General Limits % Pass	Job Mix % Tol.	General Limits % Pass	Job Mix % Tol.	General Limits % Pass	Job Mix % Tol.	General Limits % Pass	Job Mix % Tol.	General Limits % Pass	Job Mix % Tol.	General Limits % Pass	Job Mix % Tol.
2"			100	0								
1½"	100	0	75–100	±5								
1"	90–100	±5	55– 80	±5	100	0						
½"	35– 65	±6	23– 42	±6	90–100	±5	100	0	100	0	100	0
¼"	10– 35	±4	5– 20	±4	65– 85	±5	95–100	±5	90–100	±5	88– 93	±5
#2	5– 20	±3	2– 15	±3	32– 65	±6	45– 70	±6	65– 80	±6	58– 72	±6
20	See Note 1		See Note 1		15– 39	±7	8– 40	±7				
40					7– 25	±6			35– 70	±6	35– 54	±6
80					3– 12	±3	3– 15	±3	17– 40	±3	14– 32	±3
200					2– 6	±2	2– 8	±2	5– 12	±2	6– 12	±2
Asphalt Cement	4.0–5.5	±0.4	2.5–5.0	±0.4	5.8–7.0	±0.4	6.0–8.0	±0.4	7.5–8.5	±0.4	7.0–8.0	±0.4
Penetration of Asphalt Cement	See Note 2		85–100		85–100		85–100		60–70 See Note 4		60–70 See Note 4	
Placing Temp	225–300 °F.		225–300		225–300		250–325		275–350		275–350	
Texture of Surface			Coarse		Granular		Smooth-Gritty		Smooth-Gritty		Smooth-Gritty	
Typical Uses			Base Course		Interurban-Urban		Resurface Interurban		Urban		Bridge-Pavement	

Note 1. The 20 mesh screen and subsequent screens do not apply to the aggregates of the binder or macadam courses passing the 1/8" screen.

Note 2. The asphalt cement used in the binder course shall be the same type as that specified for the top course except that 85–100 penetration asphalt may be substituted in the binder course underlying Type 2A or Type 2B top courses.

Note 3. All aggregate percentages are based on the total weight of the aggregate. All other percentages are based on the total weight of the mix.

Note 4. An asphalt cement having a penetration from 85–100 with 15% powered gilsonite or powered asphalt, added by weight of the asphalt cement, may be used instead of 60–70 penetration asphalt cement.

BITUMINOUS PAVING CONSTRUCTION

GENERAL. The Contractor shall construct a pavement as specified and shown on the plans on a prepared base course in accordance with the specifications and in conformity with the lines, grades and typical cross-section shown on the plans. The Contractor shall stakeout a grade line on stakes spaced at 25 feet centers measured parallel to the pavement center line unless otherwise directed by the Chief Engineer.

BITUMINOUS PAVEMENT THICKNESS AND SURFACE TOLERANCE. The thickness indicated for each of the various courses of bituminous pavement is the nominal thickness. The pavement shall be so constructed that the final compacted thickness is as near to the nominal thickness as is practical. A tolerance not to exceed 1/4" from the nominal thickness of any one pavement item will be acceptable where the required nominal thickness is 4" or less. Where the required nominal thickness of any pavement item is over 4" a tolerance not to exceed 1/2" will be acceptable. However, the sum total thickness of all bituminous treated courses shall not vary from the total of the nominal thickness indicated on the plans by more than 1/4" where the total nominal thickness is 4" or less, or more than 1/2" where the total nominal thickness is over 4" but not more than 8"; and by not more than 5/8" where the total nominal thickness is more than 8".

Determination for final acceptance and payment will be made from cores or thickness measurements taken on the completed pavement. The Contractor shall replace the cored material in a manner satisfactory to the Engineer.

No payment will be made for the extra thickness over and above the indicated tolerance except as provided for in "Tolerances - Multilayer Pavements".

Material which is part of a truing or leveling course will not be considered in pavement thickness determinations.

TOLERANCES - MULTILAYER PAVEMENTS. Tolerances indicated for the thicknesses of individual layers of multilayer pavements (including composite pavements) are basically guides which should be met as closely as practical. Tolerance for the total thickness of such pavement is also a guide. In order to attain the ultimate objective of a smooth riding pavement substantially true to line and grade, pavements which substantially conform to the plans and specifications, even though the thickness tolerances may not be exactly met, may be accepted and paid for under the following conditions: Where the total thickness of such pavements is less than the specified thickness, including tolerances, the Chief Engineer may approve, accept and pay for such pavements; where the total thickness of such pavements is greater than the specified thickness, the Chief Engineer may exercise his judgment and accept and pay for such pavements when, in his opinion, the excess thickness was necessary to attain a smooth riding pavement surface.

TESTING SURFACE. The surface shall be tested with a 16 foot straight edge or string line placed parallel to the center line of highway and with a 10 foot straight edge or string line placed transversely to the center line of highway on any portion of the highway surface. Variations exceeding 1/4 inch shall be satisfactorily eliminated or the pavement relaid at no additional cost to the County.

When a two course pavement is to be constructed the fine mix top course shall constitute approximately one-third and the coarse mix bottom course approximately two-thirds of the thickness of the finished consolidated pavement, unless otherwise shown on the plans. The consolidated top course shall have a minimum thickness of three-quarters of an inch.

Prior to the arrival of the bituminous concrete mixture for paving courses, the underlying course shall have been brought to the grade and surface in accordance with the tolerance indicated under the appropriate fine grade item. All courses of bituminous concrete pavement shall be brought to grade in accordance with the tolerances indicated above. All loose and foreign material shall be cleaned from the surface of the base course by brooming or other satisfactory method.

FORMS. When forms are required for bituminous paving work it shall be noted on the Plans and their location and use defined. Forms will be required for gutters and paved ditches unless other methods are approved in writing by the Chief Engineer. They may be of wood or metal and in lengths of 10 feet unless directed otherwise by the Engineer. All forms shall be straight, free from bends and warps and of a thickness large enough to be able to resist all forces incident to their use and retain a rigid and straight face and profile. They shall be cleaned and oiled thoroughly each time they are used. The forms shall rest firmly upon the thoroughly compacted subgrade throughout their entire length and be securely staked or pinned to the subgrade in such a manner as to resist successfully any movement or displacement of the bituminous material while being placed, formed or compacted into its final shape and position. The finished result should have straight or smoothly curved lines and profile, without pockets or hollows and fit the topography of the area which it is designed to serve.

TRANSPORTATION AND DELIVERY OF MIXTURES. The mixture shall be transported from the mixing plants to the work site in tight vehicles previously cleaned of all foreign materials and each load shall be covered with canvas or other suitable material of sufficient size and thickness to protect it from weater conditions. No loads shall be sent out so late in the day as to

interfere with spreading and compacting the mixture during daylight. The mixture shall be delivered within 20°F. of the temperature specified by the Engineer.

The temperature of the delivered material shall not be greater than is necessary for good workability.

When air temperature is near the minimum temperature permitted for laying the pavement, the Engineer shall require the Contractor to insulate the sides of steel bodied vehicles used for the transportation of plant mixed material.

Rail shipment shall be made in cars free from dirt, cinders or other foreign matter. The plant mix shall be so loaded into tight vehicles, carts, wagons or trucks, previously cleaned of all foreign material, and delivered to the work, that it will not become contaminated in any way.

The inside surfaces of the vehicles used for the transportation of plant mixes shall be lightly coated with a whitewash of lime and water, soap solution or detergents approved by the Chief Engineer just before the vehicles are loaded. The use of any asphalt or tar solvents for coating the inside of the vehicles will not be permitted.

WEIGHT OF TRUCK LOADS. When the net weight of a truck load of plant mixed bituminous material varies by more than two percent from the product of the batch weights times the number of batches in the truck, the load of material may be rejected.

The net weight of each truck load of bituminous material shall be obtained by first weighing the truck empty, and then weighing the truck load of bituminous material.

The only vehicles that will be permitted for the delivery of plant mixed bituminous materials will be those that can dump directly into the hopper of the spreading machine. The extreme outside dimensions of the rear tires of such machines shall be at least one inch less than the width between the supports of the wheels of the spreader. Base and binder course material may be delivered from more than one plant so long as no placing or compaction difficulties are evident to the Engineer.

The delivery of top course material from two or more plants, in alternate deliveries to the same spreader, will not be permitted unless both the same aggregate source and job mix formula are used by all plants.

PLACING. The course shall be laid with an approved mechanical, self-powered finishing machine, which has an edging attachment to aid in securing a satisfactory joint between lanes and is capable of spreading and finishing the mixture true to the line, grade, and crown required. THE FINISHING MACHINE SHALL BE EQUIPPED WITH AN ELECTRONICALLY CONTROLLED DEPTH AND SLOPE DEVICE WHICH, BY FOLLOWING A PRE-DETERMINED GRADE REFERENCE, AUTOMATICALLY CONTROLS THE SCREED AND ASSURES AN ACCURATE CONTROL IN PLACING THE COURSE TO THE LINE AND GRADE AS SHOWN ON THE PLANS AND PROVIDES A PRECISE TRANSVERSE PITCH FOR THE SURFACE OF THE ROAD. THE PRE-DETERMINED GRADE REFERENCE SHALL BE ESTABLISHED BY SETTING A TAUT STRING LINE ON STAKES SPACED TWENTY-FIVE FEET ON CENTERS MEASURED PARALLEL TO THE CENTERLINE OF THE PAVEMENT. DURING LAYING OPERATIONS, THE SCREED SHALL BE HEATED TO MAINTAIN THE REQUIRED TEMPERATURE AS SET FORTH IN THE ITEMIZED SPECIFICATIONS FOR THE MIX. THE SCREED SHALL BE OF THE VIBRATING TYPE. The finishing machine shall be in the charge of an experienced operator. If there are less than 1,500 square yards in the contract, or the areas to be paved are small and scattered, a finishing machine may be dispensed with and the course spread by hand methods as directed by the Engineer.

In placing and compacting abutting courses of bituminous concrete pavement items, which constitute the final or wearing surfaces (binder and top courses), joint heater devices shall be used on all joint, both transverse and longitudinal. These joint heater devices shall be of the infra-red type or equal which will not oxidize the bituminous material. Direct flame heaters are expressly prohibited. The joint heater devices will be so constituted as to permit adjustment of the heat applied to the joints in order to suit conditions at the time of paving. The joint heater units will be such that they will uniformly heat the joints against which adjacent lanes are being placed, to a temperature of not more than 275°F., and operations will be scheduled so that the previously placed pavement material at the joints is heated to a temperature of not less than 200°F. at the time the adjacent hot paving material is placed against them. Paving operation in cool and windy weather will be carried on at the upper range of temperature indicated above. A sufficient number of heater units shall be utilized to attain the above indicated temperatures while operating at the desired rate of speed.

No separate or additional payment will be made for the joint heater devices. The cost of furnishing all the necessary labor, equipment, and materials shall be included in the unit price bid for the paving items.

The type of joint heaters used must be approved by the Chief Engineer before use on the work.

When the paving operation is done by tandem pavers operating closely behind the other, the Engineer may dispense with the use of joint heater devices on the common longitudinal joint provided the temperature of the material at the joint, where the back paver is placing the material, is greater than 150°F.

Mixtures shall be placed only where the surface to be covered is dry and clean. Mixtures shall be laid only when weather conditions, in the opinion of the Engineer, are suitable. All defective areas in a foundation for a course shall be repaired, as directed, in advance of laying the bituminous course.

Placing of the mixture by machine shall be continuous at a desired rate of not less than 50 tons per hour. The engineer may in his discretion permit a lesser rate if a satisfactory job is obtained.

The contact surfaces of all curbings, gutters, manholes and of adjacent pavement edges shall be painted or sealed with approved bituminous material before placing the course. Upon arrival, the mixture shall be dumped into the approved mechanical spreader and immediately spread and struck off to the full width required and to such appropriate loose depth that when the work is completed the compacted thickness of mixture required in each square yard will be secured. The course shall be struck off by mechanical equipment. For use in striking off the course, the machine shall be equipped with easily adjustable strike-off plates.

When hand spreading is permitted, the mixture, upon arrival, shall be dumped on approved dump sheets outside of the area on which it is to be spread and shall then be immediately distributed into place by means of suitable shovels and other tools and spread with rakes in a uniformly loose layer of such depth, as shown by template cut to proper crown, as will result in a completed pavement having the thickness per square yard required. Any deviation from standard crown or section shall be immediately remedied by placing additional material or removing surplus as directed. The Engineer may direct that other means of placing the material in addition to the rakes be used to insure a better control of the depths of material and the surface finish.

The depth of any one course of plant mixed material shall not be greater than 4 inches before consolidation except for any Bottom Course Asphalt Concrete.

Before any rolling is started, the finished surface struck off by the machine shall be checked, any inequalities adjusted, and all fat spots or fat areas from any source shall be removed and replaced by satisfactory material.

COMPACTING THE COURSE. After placing and while still hot or workable the course shall initially be rolled with a 10-12 ton three-wheel power-driven roller, an 8-10 ton tandem roller or a roller producing a compression with the rear wheels of not less than 250 pounds per inch of tread. The rollers used for this rolling shall have steel wheels. During the initial rolling, the roller shall travel parallel to the centerline of the pavement beginning at each edge and working toward the center, overlapping on successive trips by one half the rear wheel of the roller.

Immediately following the above mentioned initial rolling the bituminous course shall be compacted using pneumatic rubber-tired rollers meeting the following requirements:

Maximum Wheel Load	5,600#
Tire compression on pavement (area of contact as measured on a hard, unyielding surface)	80 p.s.i. ±5 (for each wheel)
Total Maximum Load on front or back axle	22,400# (an axle is assumed to be a single axle or a group of axles in the same alignment.)

The rubber-tired rollers shall be self-propelled and shall consist of two axles on which are mounted multiple pneumatic-tired wheels in such a manner that the group of wheels will not follow in the tracks of the forward group and will be spaced to give essentially uniform coverage with each pass. The axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. The wheels shall be so mounted as to oscillate individually or in pairs. Rollers shall be equipped with tires of equal size and diameter which shall be uniformly inflated so that the air pressure of the several tires shall not vary more than five pounds per square inch.

Tires shall be smooth and show no tread pattern. The wheel loads and tire pressure shall be controlled so as to produce the required degree of compaction without resultant rutting of the pavement surface. Rubber-tired rolling is to take place at pavement temperatures consistent with the mix used. A minimum of 8 passes of the rubber-tired roller will be required.

The rollers shall be operated at a speed satisfactory to the Engineer but not to exceed 3 miles per hour and the rolling shall proceed continuously. When in the opinion of the Engineer, additional roller capacity is needed it will be furnished. The Engineer is authorized to approve such a combination of rollers as he deems necessary when a multiple paver operation is being carried on. The added rolling capacity of three axle tandem rollers will be considered in determining the necessary number of rollers.

Shallow ruts and ridges which may develop from pneumatic-tired rolling shall be smoothed with a tandem roller. The entire surface should be finished with a tandem roller after pneumatic compaction. This final rolling shall immediately follow the pneumatic-tired roller, and shall be both longitudinal and diagonal, as ordered by the Engineer.

The Contractor may be required to adjust and change both the equipment and the procedure as directed by the Engineer. The Contractor may furnish equivalent equipment, if approved by the Chief Engineer in writing.

When trench widening of existing pavements is made with bituminous materials, and this widening is such that, in the opinion of the Engineer, pneumatic tire rollers cannot be utilized, the subgrade and all materials that are placed in the trench shall be consolidated by means of a trench roller which has a compression under the roller of not less than 325 pounds per inch of tread.

In all places inaccessible to a roller, the required compression shall be secured with tampers. Each tamper shall weigh not less than 25 pounds and shall have a tamping area of not more than 50 square inches.

The wheels of the roller and paver shall be kept clean at all times. They may be kept moist with water or a mixture of water with not more than 10% lubricating oil as directed. Dirty water, petroleum solvents or grease shall not be allowed to drop from the roller or paver onto the pavement.

If depressions remain after rolling, more of the mixture shall be added at such points and firmly rolled into place. After the rolling has been finished, the surface of the course shall have the required crown, density, and thickness and be at the grade established for the surface of the finished pavement. At the direction of the Chief Engineer, any unsatisfactory areas that develop during the life of the contract shall be removed and replaced with suitable material at the expense of the Contractor.

The Contractor shall provide suitable means for keeping all small tools clean and free from bituminous accumulations. The surface of pavement shall be protected from drippings of oil, kerosene, etc. used for the cleaning of small tools. The Contractor shall provide and have ready for use at all times sufficient tarpaulins or covers as may be directed by the Engineer for use in any emergency, such as rains, chilling winds or unavoidable delays, for the purpose of covering or protecting any material that may be dumped and not spread.

After the top course has been completed to the satisfaction of the Engineer and before opening to traffic an approved fine aggregate may be uniformly dusted over the surface, if shown on the plans and in the specifications or if ordered by the Engineer. For mixers using a fluxing agent surface dusting will be delayed until the fluxing agent has passed out of the mixture after placing and prior to opening to traffic.

SEASONAL AND WEATHER LIMITATIONS. Unless otherwise stated in the plans and specifications no bituminous paving material shall be placed on any surface when the temperature of surface on which the paving is to be placed is less than 45°F. All temperatures shall be measured on the surface where the paving is to be placed and the controlling temperature shall be the average of three temperature readings taken at locations 25 feet ± apart.

The Chief Engineer may, however, authorize in writing the placing of bituminous gutters, bituminous curbs and cold-mixed materials on surfaces whose temperatures, measured above, are 35°F or higher, subject to such conditions as he may indicate in the authorization. These may include but are not limited to added bituminous material, additives, extra sealing or treatment, insulation of carrying vehicles and containers or any other condition that, in his judgment will provide a satisfactory result. No extra payment will be made for any conditions imposed or for any material, labor or equipment used to meet these conditions.

Bituminous pavement for temporary detours, which are not and will not become part of a permanent pavement, will not be subject to the above regulations in regard to seasonal and temperature requirements.

PART II

Section 8a

PAINTING

GENERAL SPECIFICATIONS

Painting of Metal Structures

GENERAL. The painting of metal structures shall include, unless otherwise provided in the contract, the proper preparation of the metal surfaces, the application, protection and drying of the paint coatings, the protection of pedestrian, vehicular or other traffic upon or underneath the structure, the protection of all portions of the structure against disfigurement by spatters, splashes, and smirches of paint or of paint materials, and the supplying of all tools, labor and materials necessary to complete the entire work.

Field painting shall not be started until so directed by the Engineer, and in no case shall surfaces which are liable to be damaged by concrete work be painted until after the concrete work is completed and the forms removed.

Structural steel members which are embedded in cast or pneumatically projected concrete shall not be painted.

Structural members which are partly embedded in cast or pneumatically projected concrete shall be painted one shop coat of M18CA Dull Orange Primer only on the surfaces which are not covered with concrete.

Where high-strength bolts are to be used, contact surfaces of structural parts, nuts, and washers shall not be painted.

The Contractor shall furnish and apply the paint. Mixed paint and ingredients, where mixing is done in the field, shall be delivered in sealed packages, and the Inspector shall be permitted to re-seal the packages at any time during the progress of the work. The seals shall be broken by the Inspector only and no paint shall be used until approved by the Engineer. No thinning of the paint, or addition of any material whatever will be permitted except by order of the Engineer.

No thinner other than petroleum spirits meeting Federal Specification TT-T-29/a may be stored and used on the site. The quantity of thinner permitted on the site should be a reasonable amount necessary for the cleaning of brushes, wiping of grease and dirt from surfaces to be painted and cleaning off of paint spatters. The painters will not be permitted to carry containers of thinner with them when painting.

All paint must be delivered on the site at least three-weeks in advance of the time it is to be used, to allow sufficient time for sampling and analysis.

APPLICATION OF PAINT. All structural steel work shall, unless otherwise especially provided for upon the plans or in the proposal, be painted three coats of paint. The first coat is to be applied immediately after the shop fabrication is complete except that all surfaces coming into contact are not to be painted before being assembled. Surfaces not in contact, which after fabrication, will be inaccessible shall be given three coats of primer, successive coats to be M18CA, M18B, and M18CA in that order. The second and third coats (Field Coats) are to be applied after all erection is complete, and the concrete work is finished (unless otherwise permitted by the Engineer), except that immediately following the field connecting of the members, the heads of field rivets, the heads, nuts and washers of all permanent bolts, all field welds, after removal of residual flux, all abrasions of the shop coat, and all field erection marks shall be thoroughly covered with one coat of shop paint and permitted to become thoroughly dry before the first field coat is applied.

The color of each succeeding coat shall be sufficiently different from that previously applied to readily permit the discovery of an incomplete application of the paint coat.

Paint shall be applied only when the air temperature is at or above forty degrees Fahrenheit, and the relative humidity is less than 85%. Paint shall not be applied upon damp surfaces or upon metal containing frost, nor shall it be applied when the air is misty. Paint shall not be applied when in the opinion of the Engineer conditions are such as to produce unsatisfactory results.

Material painted under cover in damp or cold weather shall remain under cover until dry or until weather conditions permit its exposure. Painting in open yards or upon erected structures shall not be done when the metal has absorbed sufficient heat to cause the paint to blister and produce a porous paint film.

Paint shall be applied by means of brushes unless otherwise permitted. No wide, flat brushes shall be used. All brushes shall be either round or oval in shape. All surfaces inaccessible for brush painting shall be painted by an approved spray method.

The paint, when applied with brushes, shall be so manipulated under the brush as to produce a uniform even coating in close contact with the metal or with previously applied paint. In general the primary movement of the brush shall describe a series of small circles to thoroughly fill all irregularities in the surface, after which the coating shall be smoothed by a series of parallel strokes. To secure a maximum thickness of paint film upon rivet heads, bolt heads, welds, nuts and edges of plates, angles or other rolled shapes, these areas shall be "striped" in advance of the general painting and shortly afterward shall be given a second coat when the general coat is applied. The paint shall be well worked into all joints and open spaces.

Spray painting of the shop coat will be permitted when equipment used is of the type approved by the Chief Engineer. Equipment approved for spray painting is the air-less type. When the spray method is used all rivet heads, bolt heads, welds, nuts and edges of plates, angles or other rolled shapes shall be brush striped in advance of application of the general full coat.

General spray painting of the field coats will not be permitted.

Paint shall be thoroughly stirred, preferably by means of mechanical mixers before being removed from the containers, and shall be kept stirred to keep the pigments in suspension while being used.

All painting must be done in a neat and workmanlike manner.

All metal coated with unauthorized paint shall be thoroughly cleaned and repainted to the satisfaction of the Engineer, at the expense of the Contractor.

If it is necessary in cool weather to reduce the consistency of the paint in order that it shall spread more freely, this shall be done only by heating in hot water or on steam radiators.

SHOP PAINTING. All surfaces of metal to be painted shall be thoroughly cleaned of rust, loose mill scale, dirt, oil or grease and all other foreign substances. The removal of rust, scale and dirt shall be done generally by the use of metal brushes, scrapers, chisels, hammers or other effective means. Blast cleaning may be ordered at the discretion of the Chief Engineer if in his opinion the condition of the steel and the service requirements of the structure to be painted are sufficiently severe. Blast cleaned surfaces shall be thoroughly dusted to remove any residual deposits before painting. Oil and grease shall be removed by the use of gasoline or benzine. Bristle or wood fibre brushes shall be used for removing loose dust. On welded work particular care shall be taken to properly remove all weld spatter, flux, slag and fume deposit which will promote paint failure.

When fabrication work is complete and has been accepted as such, all surfaces not painted before assembling shall be painted one coat of M18CA Dull Orange Primer. The manufacturer or the fabricator shall not paint his name upon any structural member. Shipping pieces shall not be loaded for shipment until thoroughly dry. No painting shall be done after loading material on cars.

Erection marks for the field identification of members shall be painted upon previously painted surfaces.

With the exception of abutting chord and column splices and column and truss shoe bases, machine finished surfaces shall be coated, as soon as practicable, after being accepted, with a hot mixture of White Lead and Tallow before removal from the shop. Surfaces of iron and steel castings milled for the purpose of removing scale, scabs, fins, blisters or other surface deformation shall be given a shop coat of paint.

The composition used for coating machine finished surfaces shall be mixed in the following proportions:

4 lbs. pure tallow
2 lbs. pure white lead
1 qt. pure linseed oil

FIELD PAINTING. When the erection work is complete including all riveting, permanent bolting, welding, straightening of bent metal, etc., all adhering rust, scale, dirt, grease or other foreign matter shall be removed as specified under Shop Painting.

As soon as the concrete work is finished, forms removed and the field cleaning is done to the satisfaction of the Engineer, the heads of field rivets, bolts, welds and any surfaces from which the shop coat of paint has become worn off or has otherwise become defective and all shipping and erection marks shall be thoroughly covered with one coat of the same paint as used in the shop.

When the paint applied for "touching up" rivet heads, permanent bolts, welds and abraded surfaces has become thoroughly dry, the first and second field coats may be applied, if permitted by the Engineer. At least forty-eight hours shall elapse between application of any two coats. In no case shall a succeeding coat be applied until the previous coat has dried throughout the full thickness of the paint film.

The first field coat shall be M18G Gray Paint and the second field coat shall be M18SH-Sage-Green Paint.

All small cracks and cavities which have not become sealed in a watertight manner by the first field coat shall be filled with a pasty mixture of Red Lead and Linseed Oil and repainted with M18G Gray Paint before the second field coat is applied.

PAINTING TIMBER AND LUMBER

When painting of timber or lumber is required, the material shall be primed with a brush coat or primer composed of Stain-Resistant White Paint in accordance with M18E, Linseed Oil in accordance with A.S.T.M. D-234, and Mineral Spirits in accordance with A.S.T.M. D-235 in the ratio of 6:1:1 respectively.

When painting of wood which has been treated with Creosote Oil, or Oil Borne wood preservative is specified or noted upon the plans or in the proposal, the clean, dry, cured surface shall be given a prime coat of ready-mixed aluminum paint conforming to the specified requirements for Item M18J, Ready-Mixed Aluminum Paint, before the application of the specified finish paints.

Succeeding coats of paint shall be as required by the specifications.

No thinning of the paint or the addition of any material whatever will be permitted except by order of the Engineer.

Paint shall be applied by means of brushes unless otherwise permitted.

At least twenty-four (24) hours shall elapse between the application of any two (2) coats. In no case shall a succeeding coat be applied until the previous coat has dried throughout the full thickness of the paint film.

PART II

Section 8b

EXCAVATION

GENERAL SPECIFICATIONS

a. WORK. The Contractor shall remove all rock, earth and other material required by the plans and as ordered by the Engineer. He shall dispose of this material as required by the various items of this Specification, or otherwise dispose of the material in spoil areas.

The Contractor shall conduct all excavation operations in a safe and prudent manner in order to avoid damage to private property and utilities and to vegetation outside of the grading limits. All damages caused by the Contractor's operations shall be repaired by the Contractor at his own expense and to the satisfaction of the Engineer. No direct payment will be made for any precautionary measures. The cost of these measures shall be included in the price bid for the applicable excavation item.

Topsoil shall be removed in accordance with the methods outlined under the paragraph "Topsoil". Unsuitable material shall be excavated within the road section to the depths ordered. The entire length of the roadway, ditches, side slopes, highway junctions and driveways shall be graded to the required lines and elevations and within the tolerances specified under the various contract items. Driveways shall be constructed or adjusted as shown on the plans or as directed by the Engineer. The preparation of the embankment foundations and the placing and compacting of the excavated materials, including any borrow that may be required, shall be included in the work to be done. All culverts shall be cleaned. Old foundations, culverts, floors and structures shall be completely demolished and all objectionable material removed from the entire highway except as provided for under other items or as shown on the plans.

Where the alignment of the existing highway is changed, the Contractor shall excavate, and place or cover with suitable material and regrade, as directed, all or part of any existing old road metal lying outside of the area of the pavement under construction unless otherwise directed by the Engineer.

Grading operations shall not be started until the Engineer is satisfied that sufficient equipment is available to perform the work properly. Grading operations shall not be performed from November 1 to April 1, except with written permission of and under such special conditions and restrictions as may be imposed by the Chief Engineer.

b. EXCAVATION AND DISPOSAL. All suitable materials from the excavation shall be placed in roadway embankments and at such other places as called for on the plans. "Topsoil" and "Unsuitable Material" shall be disposed of as described under their respective paragraphs. Structure excavation or trench and culvert excavation shall be disposed of as directed and will be paid for under their respective items.

Any surplus suitable material shall be used for flattening the embankment slopes, or shall be deposited in spoil areas within the right-of-way as designated by the Engineer or in spoil banks, not visible from the highway, provided by the Contractor at his expense. No additional payment will be allowed for such disposal. Before laying the pavement at any location, the Contractor shall remove and dispose of all surplus material within reasonable limitations of pavement operations.

When the Contractor elects to stockpile any portion of the excavated suitable material for later use under the same item, or for disposal, no extra payment will be made for placing the material in stockpiles or removing material from stockpiles for its disposal or use, the cost of such shall be included in the price bid for excavation.

Excavated materials when suitable may, with permission of the Engineer, be used in other items of the contract. In such cases, the Contractor shall furnish at his own expense an amount of satisfactory material equivalent to that which the excavated material would occupy in the embankments. Payment will be made under the respective item for the excavation of the material taken from within the limits of the neat lines. No payment will be made for excavation of borrow made necessary for the substitution and replacement of materials.

c. TOPSOIL. Topsoil shall be considered the surface layer of soil and sod suitable for use in seeding and planting. It shall contain no admixture of refuse or any material toxic to plant growth, and shall be free from subsoil and stumps, roots, brush, stones, clay lumps or similar objects larger than two inches in greatest dimension.

The required amount of suitable topsoil called for on the plans for topsoiling, including sod within the road section, shall be removed by excavations, stripping or other approved methods from those areas shown on the plans or as designated by the Engineer. The depth to which topsoil is removed shall be determined by the Engineer. Topsoil shall be removed before other excavation is commenced.

Payment for material designated as topsoil and material which is used as topsoil in the contract shall be made (1) under unclassified excavation and (2) under the appropriate topsoil item.

Payment for topsoil material not required for use as topsoil in the contract which is excavated or stripped in accordance with these specifications shall be paid for only as unclassified excavation.

In areas where the topsoil is not required for use as a contract item the following procedures shall apply:

(1) Where the final grade is less than six feet above the original ground surface, sod and topsoil shall be stripped as shown on the plans or as directed by the Engineer and disposed of in spoil banks, not visible from the highway, provided by the Contractor at his own expense, or incorporated in the construction as designated on the plans. No extra payment will be made for any stockpiling or rehandling, except that designated and used as topsoil. The cost of disposal of stripped material, other than that designated and used as topsoil shall be included in the price bid for excavation.

(2) Where the final grade is six feet or more above the original ground surfaces, no removal of sod or topsoil will be required unless ordered by the Engineer.

When topsoil is within the area of the spread of branches and shrubs to be saved, no topsoil shall be stripped unless otherwise directed. Topsoil intended for the topsoil item, shall be kept separate from all other classes of excavated material and shall be stockpiled in approved locations within the limits of the right-of-way. Unless otherwise approved, such stockpiles shall contain not less than two hundred cubic yards, have a height of not less than four feet and be trimmed in a workmanlike manner to fairly uniform surfaces and slopes. The cost of removing and stockpiling topsoil will be paid for at the price bid for "Excavation".

(3) Where an embankment is to support a bridge substructure, regardless of the height of fill, the topsoil shall be removed from the area under the embankment beneath the footing, and from an additional area which shall extend horizontally in each direction for a distance of fifty feet from the outer limits of the footing.

d. UNSUITABLE MATERIAL. The Contractor shall remove all humus, spongy material, roots, stumps, and any other objectionable materials as directed by the Engineer. The Engineer shall be the sole judge of what constitutes unsuitable material. The Contractor shall also remove all muck, peat and other organic swamp deposits to the payment limits as shown on the plans, cross sections or as established by the Engineer prior to such excavation. No reimbursement will be made for any excavation or approved backfill in excess of such payment limits. Unsuitable materials shall be placed in spoil banks, not visible from the highway, provided by the Contractor at his expense, or incorporated in the construction as designated on the plans. No extra payment will be made for any stockpiling or rehandling of unsuitable material, the cost of such shall be included in the price bid for excavation.

e. DITCHING AND GRADING. The Contractor shall provide and maintain slopes, crowns and ditches on all excavations and embankments to insure satisfactory drainage at all times. If it is necessary to interrupt existing surface drainage, sewers or underdrainage, then temporary drainage facilities shall be provided until the permanent drainage work is complete. The construction of all temporary drainage facilities shall be considered as incidental to the construction of the project and no additional payment will be allowed. Interception ditches shall be completed before adjacent excavation operations are begun, as directed by the Engineer.

The grading of earth back slopes in cut sections shall be so conducted as to avoid removing or loosening any material outside of the required slopes, and any such material removed or loosened shall be replaced and thoroughly compacted to the required cross-section at the Contractor's expense. The equipment used in the grading work and the procedures of operation followed shall assure satisfactory results.

The Contractor shall also excavate and dispose of seepage pockets of soft, wet, unstable materials on cut slopes at locations designated by, and as directed by the Engineer. Payment for this work will be made at unit price bid for the "Excavation" item for the number of cubic

yards of material in its original position on the slope. The excavated areas shall be immediately backfilled and blanketed with approved granular material as directed by the Engineer. Payment for backfilling will be made at the unit price bid per cubic yard measured in final position, for the granular material item designated in the plans and proposal for this use or, in the absence of such designation, any granular material item, included in the proposal, as selected by the Engineer.

f. BORROW. If there is not sufficient excavated material of a suitable quality to complete the embankment, subgrades, shoulders and backfilling to the required lines and grades, the Contractor shall borrow the necessary additional material. Borrow may be necessary, even though not shown on the plans. Borrow, if required, shall be paid for under the regular item of unclassified excavation, unless specifically provided for in the contract. The source and acceptability of the borrow material shall be subject to the approval of the Engineer at all times. Acceptability of the borrow will be determined not only by the characteristics of the material itself, but also whether it will be satisfactory in that portion of embankment in which it is to be used. Any soil having a natural in-place moisture content in excess of 2 percent wetter than Optimum Moisture Content, as determined by the A.A.S.H.O. Designation: T-99, Method C, will not be considered as acceptable borrow material.

The Contractor shall request the Engineer's approval of proposed borrow areas at least ten working days before taking any material from such areas. All test pits and explorations required by the Engineer to evaluate the acceptability of borrow shall be done by the Contractor at his own expense.

All borrow pits outside the highway shall be acquired by the Contractor at his own expense.

The Contractor shall not remove materials for more than one item from any source or pit except with written permission of, and under such conditions and restrictions as may be imposed by the Engineer.

g. EMBANKMENT FOUNDATION. The foundation for the embankment shall be prepared by removing the topsoil and sod as specified under "Topsoil", removing all existing unsuitable material and removing surface boulders, larger than the sizes specified under Sections (h) "Embankments" and (i) "Subgrade Areas", all as directed by the Engineer. The entire embankment foundation area shall be rolled until the underlying soil is thoroughly compacted to the satisfaction of the Engineer before any construction of the embankment is begun.

Where embankments are to be constructed across ground which will not support the weight or repeated heavy loads of the construction equipment, the first layer of the fill may be constructed by placing successive loads of material in a uniformly distributed layer of a minimum thickness required to support the construction equipment. However, the maximum allowable thickness for such layer shall be 3 feet. This exception to normal procedure will not be permitted where, in the opinion of the Engineer, the embankments could be constructed in the approved manner over such ground by the use of lighter or modified equipment after proper ditching and draining have been provided. Where this exception is permitted, the selection of the material and the construction procedure to obtain an acceptable layer shall be the responsibility of the Contractor. No extra payment will be made for such treatment, but the cost shall be included in the price bid for the "Excavation" item. The cost of providing suitable trafficability conditions for construction equipment over any area of the contract will be the responsibility of the Contractor, and no extra payment will be made therefor; such cost shall be included in the price bid for the "Excavation" item. The remainder of the embankments shall be constructed in layers as specified below. Where filling or backfilling is to be placed under water, only acceptable granular material or rock shall be used. Acceptable granular material shall consist of well graded hard, durable particles, so graded that, of the material passing the 4 inch square sieve, not more than 70 percent by weight shall pass the No. 40 mesh sieve and not more than 10 percent by weight shall pass the No. 200 sieve, as determined by washing through the sieve in accordance with ASTM Designation D1140. Unless provided for on the plans or in the proposal, such material will be paid for under the item of "Excavation".

Where old pavement is encountered within 2 feet of the elevation of the top of the Subbase Course, it shall be thoroughly broken up or scarified. No direct payment will be made for any extra work nor expense which may be necessary due to this requirement, and payment shall be included in the price bid for "Excavation".

Where the embankments are to be constructed on hillsides or placed against existing embankments the slopes of which are 1 on 3 or steeper, the slopes shall be benched as the fill is constructed in layers, unless otherwise designated on the plans. Where constructed, the width and depth of the bench shall be as shown on the plans or as directed. Suitable material from the benches shall be recompacted in the new fill and shall be measured and paid for under the item "Excavation".

h. EMBANKMENTS. Embankments shall be formed of suitable materials. Sod, roots, stumps, trees, brush and frozen soil or other objectionable material shall not be used. The manner in which the materials are placed, the type, weight and condition of the equipment, including rollers, shall provide an embankment uniformly compacted to the required densities, herein specified.

Any portion of an embankment or subgrade which has, in the opinion of the Engineer, been damaged by the Contractor's equipment in progressing his construction operations, shall be repaired and recompacted by the Contractor to the satisfaction of the Engineer, and no extra payment will be made therefor.

The Maximum Density is defined as the maximum dry weight density in pounds per cubic foot as determined by the A.A.S.H.O. Designation: T-99, Method C.

A thoroughly and satisfactorily compacted earth embankment is defined as having a minimum dry density of 90 percent of the Maximum Density. However, where the embankment material consists of sand, or sand and gravel mixtures containing less than 20 percent, by weight, of particles passing the No. 200 mesh sieve, as determined by washing through the sieve in accordance with ASTM Designation D1140, a minimum dry density of 95 percent of the Maximum Density will be required. The in-place density shall be determined by the sand cone method in accordance with ASTM Designation D1556.

Where the embankment material contains less than one third, by volume, of stones or rocks larger than 6 inches in greatest dimension, it shall be placed in successive uniform layers not exceeding 8 inches in thickness, loose measure, over the entire area of the embankment. All stones or rocks over 6 inches, but less than 2 feet, in greatest dimension shall be placed in the embankment outside the limits of the sides of the subgrade area or the downward extension of the sides, except in the shoulder subgrade area as described below. Each layer shall be thoroughly rolled over its entire area as described under "Compaction". At the close of each day's work, smooth steel wheel or pneumatic tired rollers shall be used to roll the entire working area after it has been crowned, shaped and drained.

For rock embankments and embankments in which the material contains more than one-third by volume, of stone or ledge rock larger than 6 inches in greatest dimension, the thickness of the construction layers shall not exceed the maximum size of the rock or stone. In no case, shall the layer thickness exceed 2 feet. Spreading shall be done by bulldozer operation in such manner that the maximum amount or the rock fragments of each succeeding deposited load will sift into the voids of the layer under construction. The entire area of each layer of rock embankment shall be rolled as described under "Compaction".

Unless designated on the plans or in the proposal, rock, boulders, broken pavement or slabs, larger than 2 feet in the greatest dimension will not be permitted to be placed within the limits of any embankment.

Shoulders shall be considered an integral part of the embankment and must be formed and compacted to the elevation of the bottom of the Subbase Course for the full width of the typical section before any type of pavement is placed.

No stone larger than 6 inches in greatest dimension shall be placed within the area of the embankment above a line drawn 4 feet below, and parallel to, the top surface of the shoulder. The material within this area shall be compacted to the requirements as specified in "Subgrade Areas".

i. SUBGRADE AREAS. The subgrade area shall mean a cross-sectional area with top dimension equal to the width of pavement plus 1 foot on each side thereof, and with sides sloping downward and outward on a 1 on 1 slope to a depth of 4 feet below the top outer edges of the pavement. No stone larger than 6 inches in greatest dimension shall be placed within this area. This depth of 4 feet need not apply in areas of cuts or shallow fills where in the opinion of the Engineer, the existing material is satisfactory. After compaction, the top surface of the subgrade area shall not extend above true grade and surface at any location.

The Contractor shall conduct the excavation operations so that available and suitable material will be utilized in the subgrade area. No direct payment will be made for any delay, extra work or expense which may be necessary due to this requirement, the cost thereof shall be included in the priced bid for excavation.

Where the subgrade area changes from embankment to excavation longitudinally and the angle between the center line grade of the proposed new pavement and the line of slope of the existing intersecting ground surface is 3 degrees or more, a subgrade transition shall be provided as indicated on the plans or as directed by the Engineer.

Where the subgrade area changes from embankment to excavation transversely and the slope of the existing ground surface is 1 on 3 or steeper, the existing ground slopes shall be benched to an elevation 4 feet below finished grade for the width of the subgrade area, backfilled with suitable material, and thoroughly compacted as indicated on the plans or as directed by the Engineer.

A thoroughly and satisfactorily compacted subgrade area is defined as having a minimum dry density of 95 percent of the Maximum Density as defined under "Embankment". However, where the subgrade area material consists of sand, or sand and gravel mixtures containing less than 20 percent by weight, of particles passing the No. 200 mesh sieve, as determined by washing through the sieve in accordance with ASTM Designation D1140, a minimum dry density of 100 percent of the Maximum Density will be required. However, where the material contains more than 30%, by weight, of particles retained on the 3/4 inch sieve, a minimum dry density of 95% of the Maximum Density will be required. The in-place density shall be determined by the sand cone method in accordance with ASTM Designation: D1556.

Where soils are suitable, the subgrade of the pavement subbase course in cuts shall be rolled to obtain the above required densities to a depth of at least 8 inches.

Where unsuitable material has been removed within the subgrade area, the material used for replacement shall not contain stones larger than 6 inches in greatest dimension, sod, roots, frozen soil or other objectionable material.

It shall be placed in successive uniform layers not exceeding 8 inches in thickness, loose measure, and each layer shall be thoroughly rolled over its entire area as described under "Compaction".

The Contractor shall proof roll the entire top surface of the subgrade with two (2) complete passes of a pneumatic tire roller, between the vertical projections of the outside edges of the shoulders. Proof rolling shall be done immediately prior to the placement of the subbase. Embankments upon which subbase will not be placed under this contract shall be proof-rolled at the level and time as ordered by the Engineer.

The intent and purpose of the proof rolling procedure specified herein is to ascertain the uniformity of the subgrade compaction and to locate deficiencies that, in the judgment of the Engineer, require correction. Any deficiencies disclosed during the proof rolling operation shall be corrected and these areas compacted and proof-rolled again.

The roller shall have a total ballasted weight of 50 tons. This total required load shall be transmitted through axles acting in a single line perpendicular to the longitudinal center line of the roller. The total load shall be transmitted to the ground surface on four 18:00 x 25 pneumatic tires spaced evenly across the entire width of the roller. The tires shall be attached either individually or two to each axle, so that oscillation will be obtained in each tire or in each set of two tires. A minimum air pressure of 90 p.s.i. shall be maintained in each tire during rolling unless a lower air pressure is ordered by the Engineer.

The above proof rolling requirements may be modified only upon receipt of written permission from the Chief Engineer.

After the proof rolling operation, the surface of the subgrade shall be shaped and compacted to provide satisfactory surface drainage. The finished surface of the subgrade shall not extend above true grade and surface at any location.

The Contractor shall exercise all care necessary to prevent disturbance or damage to conduits, pipes, culverts and underdrains.

Unless otherwise ordered by the Engineer, proof rollers shall not pass over nor approach closer than five feet to conduits, pipes, culverts, and underdrains unless a cover of at least five feet is provided.

No direct payment will be made for proof rolling nor for any delays caused by the need for corrective work. Such cost shall be included in the price bid for the embankment construction item.

No direct payment will be made for any work required to correct deficiencies in embankments; the cost of such work shall be included in the price bid for the embankment construction item. All work required to correct subgrade deficiencies in cuts shall be paid for under the appropriate item(s), unless in the judgment of the Engineer, the deficiency is the result of the Contractor's operations. All work required to correct deficiencies in cuts resulting from the Contractor's operations shall be done at the Contractor's expense.

All culverts, ditches, and drains shall be constructed satisfactorily and completed to drain the highway effectively before the placing of any pavement or subbase course will be permitted.

j. COMPACTION. Equipment, suitable and adequate for uniform compaction to the specified densities, must be on hand and approved by the Engineer before any embankment or backfill operations are started by the Contractor. All compaction equipment must be in good working order and any worn or defective equipment shall be immediately replaced or repaired to the satisfaction of the Engineer. Sheepsfoot rollers shall exert a pressure of not less than 300 pounds per square inch of foot area. Pneumatic tired rollers shall have an operating weight of not less than 1000 pounds per tire. Smooth steel wheel rollers shall have a minimum weight of 10 tons and shall exert a pressure of not less than 300 pounds per lineal inch of compression wheel or roll width. Earth moving and other equipment not specifically manufactured for compaction purposes will not be considered as compaction equipment. The use of sheepsfoot rollers with tamping feet worn to less than 7 inches in length and less than 5 square inches of flat end surface will not be permitted.

All fill material shall be compacted at a moisture content determined by the Engineer to be suitable for obtaining the required density.

When the moisture content of the material in the layer is less than the required amount, water shall be added by pressure distributors or other equipment; water may be added also in the excavation or borrow pits. The water shall be uniformly and thoroughly incorporated into the soil by disking, harrowing, blading or by other approved means. This manipulation may be omitted for coarse sand and gravel soils.

When the moisture content of the material is in excess of the required Optimum amount, dry material shall be thoroughly incorporated into the wet material, or the wet material shall be dried to the required Optimum moisture content by disking, harrowing, blading, rotary mixing or by other approved means, or compaction of the layer of wet material shall be deferred until the layer has dried to the required Optimum by evaporation.

No extra payment will be made for any special manipulation or delay in drying soils to the Optimum Moisture Content, but the entire cost of such manipulation and delay shall be included in the price bid for the excavation item.

Any method or combination of methods used for the purpose of drying shall be as approved by the Engineer.

When the moisture content of the layer is within the limits, as determined by the Engineer, for proper compaction, the entire surface shall be rolled with the appropriate type of roller or compactor. In no cases, shall the number of passes of the roller over each portion of the fill area be less than the minimum number specified.

A pass of a piece of compaction or proof rolling equipment over any area is defined as a direct vertical contact of the compactor wheel, tire, drum or plate load upon all elements of that area in such a manner as to assure complete coverage of the area. No successive layers shall be placed until the layer under construction has been approved by the Engineer.

The minimum number of passes required for each layer will vary in accordance with the following descriptions:

(1) A minimum of 6 passes will be required for each successive layer for sheepsfoot rollers of the type exerting between 300 and 450 pounds of foot pressure per square inch; pneumatic tired rollers having operating weights between 1000 and 2500 pounds per tire; and smooth steel wheel rollers with a minimum weight of 10 tons. In all cases, loads shall be adjusted to give the most suitable rolling results on the type of material being compacted. These loadings shall be as approved by the Engineer.

Where the Contractor chooses to use the above types of equipment, sheepsfoot rollers shall be used to compact silt-clay soils, pneumatic tired rollers shall be used to compact sands and gravels, and smooth steel wheel and/or pneumatic tired rollers shall be used to compact slag, coarse gravel, rock, or layers of soil and rock.

(2) For heavier, vibratory or more efficient types of approved compaction equipment, the minimum number of passes required on all portions of each successive layer shall be determined by the Engineer after appropriate field tests to evaluate the efficiency of the equipment. However, layer thicknesses shall not, under any circumstances exceed those specified under, "h. Embankments".

Compaction equipment shall be operated at speeds not exceeding the manufacturer's recommendations. Vibratory compaction equipment shall not be operated faster than four miles per hour. Compaction equipment other than vibratory shall not be operated at speeds in excess of 10 miles per hour. In no case, shall the rate of application of fill or backfill exceed the capacity of the compaction equipment based on the actual operating speed of that equipment, all as determined by the Engineer.

In areas inaccessible to the equipment designated in the foregoing, other types of compaction equipment shall be used, as approved by the Engineer. Where the impact rammer type is used, such rammer shall weigh not less than 200 pounds, have a ramming foot area not exceeding 80 square inches and be capable of delivering not less than 200 foot pounds of compacting energy per blow. Where plate vibratory compactors are used, such compactors shall be capable of delivering blows of a minimum of 2500 pounds impact at a rate of not less than 1100 per minute. A minimum coverage of 3 passes will be required for either rammer or vibrator equipment. For other types of compaction equipment used in areas of limited space, the minimum number of passes required on all portions of each successive layer shall be determined by the Engineer after appropriate field tests to evaluate the efficiency of the equipment. The use of hand tamps will not be permitted.

k. INTERSECTING HIGHWAYS. At all intersecting public highways the Contractor shall grade back to a sufficient distance with acceptable materials so that a smooth riding and satisfactory junction will be produced.

l. EXCAVATION AND DRAINAGE OF EXCAVATION AT STRUCTURES. Where the item of "Cofferdams" appears in the estimate of quantities for a structure, the excavation only will be paid for under the item of "Structure Excavation". Payment for all labor, materials and equipment necessary for maintaining the excavations for a structure free from earth, water, ice and snow during construction will be included in the unit price bid for the item of "Cofferdams".

If the Contractor, instead of actually constructing a cofferdam, elects to divert the water from the site of the work by means of dikes, ditches and pipe lines, no payment for the item of Cofferdams will be made but the Contractor will be paid for the excavation work necessary for the diversion at the unit price bid for the item of "Structure Excavation". Such payment will include the cost of furnishing all labor, materials and equipment necessary for maintaining the excavations for the permanent structure free from earth, water, ice and snow during construction. Substitution of the diversion method of construction for cofferdams shall be made only with the approval of the Chief Engineer.

Where the item of "Cofferdams" does not appear in the estimate of quantities for a structure, no direct payment will be made to the Contractor for labor, materials and equipment necessary for maintaining the excavations for a structure free from earth, water, ice and snow during construction. Payment for such work will be included in the unit price bid for the item of "Structure Excavation".

Where the item of "Cofferdams" or items for temporary or permanent sheet piling are not included for any individual unit of a structure in the estimate of quantities, any sheet piling which the Contractor may elect to use in progressing the work will be included for payment in the unit price bid for the item of "Structure Excavation" and no direct payment will be made therefor.

SAFE OPERATION AND SHEET PILING. Sheeting shall be used as required for the safety of employees exposed to the hazard of falling or sliding material from any trench or applicable excavation more than five feet above the employees' footing. Sheeting shall be adequate and conform with the provisions of the current Industrial Code Rule 23 as established by the New York State Department of Labor, Board of Standards and Appeals. These requirements are minimum requirements and may have to be increased depending on the hazard and/or as ordered by the Engineer.

Payment for sheeting will be made in accordance with the appropriate sheeting item.

The Contractor shall be responsible at all times for the carrying out of all excavation operations in a safe and prudent manner so that the workmen and the public will be protected from unreasonable hazard. All applicable local and/or State requirements shall be observed and necessary permits acquired by the Contractor.

It is intended that the Contractor shall not leave unsheeted trenches open overnight. In the event that he does, he shall protect such trenches with temporary fencing at his own expense. No payment will be made for temporary fencing to protect unsheeted trenches unless otherwise noted on the plans or specifications.

m. FILLING AND BACKFILLING AT STRUCTURES, CULVERTS AND PIPES. The type of materials to be used in bedding, filling and backfilling at structures, culverts and pipes and the procedure of placement shall be in accordance with details shown on the plans or in the specifications. No direct payment will be made for rehandling of any excavated materials for this work, but compensation for rehandling will be included in the unit price bid for "Excavation". Where granular fill or granular backfill is specified, it shall be paid for separately.

Unless otherwise shown or indicated on the plans, filling or backfilling material shall be deposited in horizontal layers not to exceed 6 inches in thickness before compaction, and thoroughly compacted as described under "Compaction". A thoroughly and satisfactorily compacted backfill is defined as having a minimum dry density of 100 percent of the Maximum Density as defined under "h. Embankments". However, where the material contains more than 30%, by weight, of particles retained on the 3/4 inch sieve, a minimum dry density of 95% of the Maximum Density will be required. Water shall be added in such amounts as the Engineer may consider necessary to obtain satisfactory compaction.

Fill or backfill adjacent to structures shall be deposited on both sides to approximately the same elevation at the same time, and when in back of abutments and walls shall not be placed until material in front of these structures has been entirely placed and compacted. Unless otherwise designated on the plans, in the proposal or ordered by the Engineer, fill or backfill inside of sheet piling shall be placed before the sheet piling is removed.

Special care shall be exercised in placing and compacting material immediately adjacent to pipe to avoid damage either to the pipe or its alignment. Any pipe that is damaged or moved out of alignment, regardless of cause, shall be replaced at the Contractor's expense.

All culverts shall be completed and backfilled before the road is rough graded.

The limits to which "Filling and Backfilling at Structures, Culverts and Pipes" will apply, shall be in accordance with the Standard Structure Sheets, or as modified on the plans.

n. EARTH EXCAVATION. Earth excavation shall include excavation of all materials as specified above and shall include so-called muck, boulders, hardpan, concrete curb, sidewalk and pavement, old macadam and topsoil and sod. Preliminary blasting and/or rippers may be required to loosen and assist in the handling of the above materials.

o. UNCLASSIFIED EXCAVATION. Unclassified excavation shall include excavation and disposal of all material as specified above under "Earth Excavation". Unless otherwise specified all excavation shall be considered unclassified.

p. VARIATION IN EARTH QUANTITIES. The limits or extent of the materials included in earth excavation as shown or indicated on the contract plans or supporting data are in accordance with the judgment of the Department. The Contractor's attention is called to the fact that variations in these limits affecting the quantities of earth excavation may occur and that, in accordance with Article 3 of the Contract Agreement, the Contractor must obtain information pertaining thereto by personal investigation and research.

q. MAXIMUM PAYMENT LINES. The Contractor's attention is called to the maximum payment lines as shown on the plans. No payment will be made beyond these lines, unless specifically directed in writing by the Engineer previous to the performance of the work.

r. EXCAVATION FOR CONDUITS AND UTILITIES. When the Contractor, in placing conduits or utilities, excavates into the subgrade, subbase or shoulder courses, such courses must be replaced in kind, character and condition, in order to maintain a uniform road section.

s. SEQUENCE OF WORK. Unless otherwise directed in writing by the Engineer, grading operations shall be so scheduled and carried out that all cut slopes which are started and which are to be seeded will be completed, trimmed and seeded, from the bottom of the ditch to the top of the slope, in the fall or spring planting season next following the initiation of the cut or when ordered by the Engineer. This shall not prevent the Contractor, if he so elects, from grading and seeding such portions of the road section from the bottom of the ditch toward the pavement or shoulder as he sees fit. Ditches that are filled or inoperative will be cleaned and kept operative before the Contractor stops work for any day.

Fill slopes shall be similarly completed and seeded to the extent possible depending on the availability of excavated material, each case to be determined by the Engineer.

Other graded or disturbed areas specified for seeding shall be similarly completed and seeded at the earliest possible time consistent with the work; each case to be determined by the Engineer.

It is the intent of this specification to complete the cut and fill slopes and to trim and seed them as the job progresses and not to leave these items until near the end of the contract period.

The term "seeded" as used in this subsection (s) shall mean seeding and/or fertilizing and/or mulching; the specific operations required to be as indicated on the plans or specifications for each contract.

t. CONSTRUCTION CONTROL DEVICES. The Contractor shall install and maintain all construction control devices required by the plans and specifications. The details of the construction control devices are shown on the standard sheets or on the plans.

The cost of all materials, labor and equipment necessary to install and maintain settlement stakes shall be included in the price bid for the unclassified excavation item. The number of settlement stakes required will be shown on the plans.

u. SELECT MATERIAL FOR USE IN SEEDING. Select material shall be considered the surface layer of soil and sod suitable for use in seeding and/or the layer of subsoil below the surface layer but above the sand or gravel parent soil material. This select material shall contain a minimum of 15% silt and clay passing a #200 sieve as determined by Standard Test Procedure ASTM Designation D-1140.

Select material shall be excavated and disposed of in accordance with the plans and specifications and directions of the Engineer.

The required amount of select material called for on the plans to be used in seeding shall be removed by excavations, stripping or other approved methods from those areas shown on the plans or as designated by the Engineer. The depth to which select material is removed shall be determined by the Engineer. Select material shall be removed before other excavation is commenced.

PART III

Section 9

GENERAL CONSTRUCTION

PAYMENT ITEMS AND ITEM SPECIFICATIONS

GENERAL. All materials referred to in the following payment items shall comply with the detailed requirements of the specifications for that particular material except when a special specification is found for any particular payment item indicated upon the plans or in the itemized proposal.

The specifications for materials appear in PART II.

Whenever the letter "A" appears in the items that mention Bituminous Materials, the letter "A" refers to Asphalts.

REFERENCED SPECIFICATIONS. Whenever any specifications or methods of test are referred to in these specifications the same shall mean that the latest specifications or method of test, given by the serial designation mentioned or bulletins referred to, shall apply.

ITEM 1—CLEARING AND GRUBBING (per Lump Sum)

1. DESCRIPTION. Under this item the Contractor shall clear and grub the area where construction is to be done; and such other areas as specified or directed; he shall clear such additional areas within the limits of the right of way and easement lines as specified or directed he shall protect existing features which are to be retained and repair injuries as specified and as directed by the Engineer.

2. CONSTRUCTION DETAILS. a. Location of Work. The engineer will define the limit of areas where clearing and grubbing is to be done. They shall be the areas of construction which include the road section, stream channels, ditches, temporary approaches to bridges, detours and other areas shown on the plans or as specified or as directed. The Engineer will designate the fences, structures and debris and trees and bushes to be cleared where grubbing is not required. Clearing beyond the areas of construction shall be only where specified or directed. It shall not include clearing or grubbing of borrow or other pit areas from which material is secured. It shall include all trees on the right-of-way which are dead or in a hazardous condition and it may include a strip above the upper limits of cut slopes.

b. Grubbing and Cutting. All roots and stumps within the limits of the road section shall be grubbed and excavated unless otherwise specified or approved. Where trees are cleared and grubbing is not required the trunks shall be cut off not more than six (6) inches above the original ground surface.

At the completion of the work on the contract the Contractor shall cut all grass, weeds and brush within the limits of the right-of-way and easement lines as directed by the Engineer.

c. Disposal. All wood and brush shall be burned where permitted or otherwise disposed of as specified or approved. All elm wood cut on the contract shall be burned or debarked and the bark burned on those contracts where burning is permitted. On those contracts where burning is not permitted, all elm wood shall be disposed of in a manner satisfactory to the Engineer. No tree trunks, stumps or other debris shall be felled, sidecast or placed outside the limits of the road section. No debris shall be left within 300 feet of the highway unless approved in writing by the Engineer. The location of disposal areas shall be approved in writing by the Engineer and shall be acquired by the Contractor at his own expense.

d. Protection and Restoration. The contractor shall prevent all damage to pipes, conduits, wires, cables or structures above or below ground. No land monuments, property markers, or official datum points shall be damaged or removed until an authorized agent has witnessed or otherwise referenced their location and approved their removal. The contractor shall so control his operations as to prevent damage to trees and shrubs which are to be preserved. Protection may include fences and boards lashed to trees to prevent damage from blasting or machine operations.

The contractor shall carefully cut off all branches of trees hanging within 16' above any part of the roadway or which have been broken or injured during construction. All tree repairs and painting of tree wounds shall be as specified under Item 129. Where soil over the roots of trees to be preserved has become compacted it shall be restored by proper cultivation to a condition to permit adequate aeration of the soil. The Contractor will be required to replace at his own expense, in accordance with Item 127, all plants destroyed or damaged beyond repair as determined by the Engineer. The species and size of the replacements shall be as determined by the Engineer except that their maximum size shall not exceed four (4) inches caliper.

Areas disturbed beyond the limits of the road section as shown on the plans or as determined by the Engineer shall be regraded, fertilized, seeded and mulched, as provided for on the rest of the contract or as ordered by the Engineer. Where such areas extend beyond the limits covered by contract payment items, the cost of this work shall be included in the price bid for the various items of the contract.

All fires shall be in accordance with local regulations. Where ordered by the Chief Engineer, the contractor shall attend a meeting at which the local District Ranger or a representative of the local fire department or local fire district will discuss and explain the existing fire laws, fire permit system and forest fire prevention and suppression.

When required by the Chief Engineer:

(1.) The Contractor shall furnish and maintain fire fighting equipment to include barrels of water, pack pumps, shovels, fire rakes, axes and saws at the sites of fires and at other points as ordered by the Engineer to suppress fires at burning areas.

(2.) The Contractor shall provide watchmen at all burning areas so that no fires will be left unattended at any time including non-working hours and non-working days unless otherwise directed by the Engineer.

All fires shall be located and supervised to avoid scorching of vegetation to be saved, and the sites of fires shall be restored to a satisfactory condition.

3. METHOD OF MEASUREMENT. Monthly payments will be made under this item in proportion to the amount of work done as determined by the Engineer.

4. BASIS OF PAYMENT. The lump sum bid for this item shall include the cost of furnishing all materials, labor and equipment necessary to satisfactorily complete the work.

ITEM 1A—CLEARING AND GRUBBING (per Acre)

1. DESCRIPTION. All work under this item shall be as specified for Item 1, Clearing and Grubbing.

2. METHOD OF MEASUREMENT. The area of completed clearing and grubbing under this item will be measured in acres.

3. BASIS OF PAYMENT. The payment for clearing and grubbing will be made at the contract unit price for the number of acres of surface areas computed to the nearest tenth thereof which payment shall include the cost of furnishing all materials, labor and equipment necessary to satisfactorily complete the work as specified.

Monthly payments will be made under this item in proportion to the amount of work done as determined by the Engineer.

ITEM 1B—CLEARING AND GRUBBING, BURNING PERMITTED (per Lump Sum)

1. DESCRIPTION. All work under this item shall be as specified for Item 1, Clearing and Grubbing, except that the amount bid shall be on the basis of permissable burning of trees, brush and wood under the provisions set up in Item 1.

All other conditions and provisions shall be as provided under Item 1.

ITEM 1BA—CLEARING AND GRUBBING, BURNING PERMITTED (per Acre)

1. DESCRIPTION. All work under this item shall be as specified under Item 1B, Clearing and Grubbing, Burning Permitted, except that payment shall be made as provided in Item 1A, Clearing and Grubbing (per Acre).

ITEM 1NB—SUPPLEMENTAL CLEARING AND GRUBBING (per Lump Sum)

1. DESCRIPTION. The work under this item shall be the extra work involved in clearing and grubbing as provided for under Item 1, Clearing and Grubbing, on the basis that NO burning be allowed on the contract site.

2. CONSTRUCTION DETAILS. All the provisions of Item 1 shall be complied with except that no burning of wood, trees, brush or other debris will be allowed on the contract site.

3. METHOD OF MEASUREMENT. Monthly payments will be made under this item in proportion to the amount of work done under this item as determined by the Engineer.

4. BASIS OF PAYMENT. The lump sum bid for this item shall be the extra cost for work performed over and above the cost for work done pursuant to Item 1B, Clearing and Grubbing, Burning Permitted (per Lump Sum), and shall include the cost of all labor, materials, equipment and disposal areas necessary to satisfactorily dispose of the cleared and grubbed material when burning is not permitted on the contract site. When this item is included in a proposal, the lump sum amount bid for the item shall be included along with that for Item 1B, Clearing and Grubbing, Burning Permitted (per Lump Sum), in determining the total bid for the project. In the event that arrangements can be made to permit burning on the site, no payments will be made to the contractor under and for this item.

ITEM 1NBA—SUPPLEMENTAL CLEARING AND GRUBBING (per Acre)

1. DESCRIPTION. All work under this item shall be as set forth under Item 1NB, Supplemental Clearing and Grubbing (per Lump Sum) except that payment for the supplemental clearing and grubbing shall be at the unit price bid per acre.

2. METHOD OF MEASUREMENT. The area of completed supplemental clearing and grubbing under this item will be measured in acres.

3. BASIS OF PAYMENT. The payment for supplemental clearing and grubbing will be made at the contract unit price per acre for the number of acres of surface area computed to the nearest tenth thereof which payment shall include the extra cost for work performed over and above the cost for work done pursuant to Item 1BA, Clearing and Grubbing, Burning Permitted (per Acre) and shall include the cost of all labor, materials, equipment and disposal areas necessary to satisfactorily dispose of the cleared and grubbed material when burning is not permitted on the contract site. When this item is included in a proposal, the amount bid for the item shall be included along with the amount bid for Item 1BA, Clearing and Grubbing, Burning Permitted (per Acre) in determining the total bid for the project. In the event that arrangements can be made to permit burning on the site, no payments will be made to the contractor under and for this item.

ITEM 1M—MOBILIZATION

1. DESCRIPTION. Under this item the Contractor shall set up his necessary general plant, including shops, storage areas, office and such sanitary and other facilities as are required by local or state law or regulation. Unless provided for elsewhere, the cost of required insurance and bonds and/or any other similar significant initial expense required for the initiation of the contract work may be included in this item. The determination of the adequacy of contractor's facilities except as noted above shall be made by the Contractor.

2. MATERIALS. Any materials that are required but are not to be a part of the completed contract shall be as determined by the Contractor, except that they shall conform to any pertinent local or state law, regulation or code.

3. CONSTRUCTION DETAILS. Such work as is done in providing the facilities and services under this item shall be done in a safe and workmanlike manner and shall conform with any pertinent local or state law, regulation or code. Good housekeeping consistent with safety shall be maintained.

4. BASIS OF PAYMENT. Payment will be made by lump sum. The amount bid shall include the furnishing and maintaining of any plant, services or other facilities noted under "Description" to the extent and at the time the Contractor deems them necessary for his operations, consistent with the requirements of this item and this contract. The amount bid for this lump sum item shall be payable to the Contractor whenever he shall have completed ten (10%) per cent of the work of this contract. For the purposes of this item, 10% of the work shall be considered completed when the total of payments earned, as reflected by estimates of work done, as set forth in Article 7, Payment of Estimates, not including the amount bid for this item, shall exceed 10% of the total amount of the Contractor's bid for this contract.

ITEM 1W—FURNISHING WATER EQUIPMENT

1. DESCRIPTION. Under this item the Contractor shall furnish equipment for pumping, supplying and distributing water. This equipment shall consist of pumps, pipe lines, meters, hose, pressure sprinklers, and other necessary items. Suitable pressure regulating devices shall be

supplied so that the water pressure may be adjusted to any specific application.

2. METHOD OF MEASUREMENT. Seventy-five (75%) per cent of the amount bid shall be paid when the water system and distributors are furnished and operative. The remaining twenty-five (25%) per cent will be paid when the equipment is dismantled and removed and the distributor trucks are no longer required. When water is obtained from a water supply where only distributor trucks are required, the entire 100% of the amount bid will be paid when an adequate amount if distributor equipment is on the job and operative. Failure to have such equipment available after payment and when needed will result in withdrawing of such payment by deducting the amount of the payment from monies due the Contractor for work done on any item of the contract. In the event of such withdrawal, payment will be made at the time all contract work is completed provided adequate water equipment has again been furnished and maintained for use as needed.

3. BASIS OF PAYMENT. Payment will be by lump sum. The price bid shall include the cost of furnishing all labor, materials and equipment necessary for furnishing, erecting, relocating, re-erecting, dismantling and removing the entire water equipment.

ITEM 1WA—APPLYING WATER

1. DESCRIPTION. Under this item the Contractor shall furnish and apply water for the laying of dust within the contract limits, the proper compaction of materials in roadway embankments and foundation courses, sprinkling sodded and seeded areas, and for such other purposes as called for on the plans, in the itemized proposal, or as directed by the Engineer.

When used for roadway purposes the water shall be applied uniformly over a width of not less than 8 feet by means of an approved pressure distributor spray bar.

When used to sprinkle sodded and seeded areas, the water shall be free from oil, acids, alkalis, salts or any other substance injurious to plant growth.

2. METHOD OF MEASUREMENT. The quantity of water to be measured in thousand gallon units will be determined by measurement in tanks or tank trucks of predetermined capacity or by means of satisfactorily installed meters.

3. BASIS OF PAYMENT. The unit price bid per thousand gallons shall include the cost of furnishing all water and the labor necessary to apply the water.

ITEM 1WP—WATERING PLANTS

1. DESCRIPTION. Under this item the Contractor shall furnish watering equipment and water and shall apply water to plants as called for on the plans or as directed by the Engineer.

2. MATERIALS. The water shall be free from oil, acids, alkalis, salts or any other substance injurious to plant growth.

3. CONSTRUCTION DETAILS. Water shall be applied in such a manner that the required volume of water will be provided without damage to plants, mulch, stakes, guys or plant saucers. Damage resulting from watering operations shall be repaired at the Contractor's expense.

4. METHOD OF MEASUREMENT. Water shall be measured in thousand gallon units by means of satisfactorily installed meters, or by measurement in tanks or tank trucks of predetermined capacity.

5. BASIS OF PAYMENT. The quantity of water to be paid for will be the number of thousand gallons applied. The unit price bid shall include the cost of furnishing all watering equipment, water, labor and incidentals necessary to complete the work.

ITEM 2—UNCLASSIFIED EXCAVATION

1. DESCRIPTION. The Contractor shall remove and dispose of Unclassified Excavation in accordance with the General Specifications for "Excavation".

Where the use of select material is called for on the plans or in the specifications, the Contractor shall excavate sufficient select material to place on slopes, mall areas, sidewalk areas and other locations as designated on the plans or as ordered by the Engineer. Select material shall be removed before other excavation is commenced. The required amount of select material to be used as called for on the plans or as directed by the Engineer shall be removed by excavation, stripping or other approved methods from those areas shown on the plans or designated by the Engineer, who shall also determine the depth to which the select material is to be removed. Select Material shall be the material so defined under subheading "U" of PART II, Section 8b - EXCAVATION.

In areas where the surface has already been prepared for the placing of the select material, it shall be excavated and placed directly thereon, otherwise, it shall be placed in stockpiles, as directed by the Engineer, for use when the areas upon which it is to be placed have been prepared in accordance with the plans and specifications. The locations of the stockpiles shall be approved by the Engineer, and, in the event that sufficient approved locations cannot be found within the right-of-way, the Contractor shall provide storage areas, approved by the Engineer, outside the right-of-way limits. The cost of providing the storage areas outside the right-of-way limits, if any, shall be included by the Contractor in the price bid for this Item.

Unsuitable and unusable material not approved for use in widening the slopes outside the pavement prism shall be disposed of outside the right-of-way limits at the Contractor's expense and in conformity with all local laws and ordinances.

Existing drainage and other structures which are to be abandoned and left in place, shall be broken up to a depth of at least four feet below the finished subgrade and the hole backfilled with suitable material and compacted, as directed by the Engineer. No additional payment will be made for the demolition of the abandoned structures or for backfilling and compacting the hole.

2. METHOD OF MEASUREMENT. The quantity of excavation to be paid for under this item will be the number of cubic yards of unclassified material measured in its original position, excavated and disposed of as required by the plans and specifications. The payment limits of the excavation shall not exceed those shown on the plans unless otherwise ordered in writing by the Engineer. For computations of quantities of excavation, no deduction shall be made in the area of any cross-section for any pipe or similar obstruction unless the end area shall be greater than four square feet.

3. BASIS OF PAYMENT. The unit price bid per cubic yard for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that Furnishing Water Equipment and Applying Water will be paid for under their respective items.

Material designated as select material and which is excavated or stripped and placed directly on the prepared areas to be seeded, as shown on the plans or as directed by the Engineer, will be paid for only under Unclassified Excavation. Payment for material designated as select material and which is excavated, stockpiled and used in areas to be seeded under the Contract, shall be made

(1) Under Unclassified Excavation, and
(2) Under Item 2L - Select Material Placed from Stockpiles.

Select material which is excavated or stripped in accordance with these Specifications, and which is not used in seeding under the Contract, shall be paid for only as Unclassified Excavation.

Payment for the necessary excavation for removing existing drainage pipe lines which are to be abandoned, as shown on the plans or as directed by the Engineer, will be paid for under Trench, Culvert and Bridge Excavation.

ITEM 2A—UNCLASSIFIED EXCAVATION

The specifications for Item 2—UNCLASSIFIED EXCAVATION shall apply except that payment will be made as follows:

3. BASIS OF PAYMENT. The unit price bid per cubic yard for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that Furnishing Water Equipment and Applying Water will be paid for under their respective items.

Material designated as select material may be excavated or stripped and placed directly on the prepared areas to be seeded, as shown on the plans or as directed by the Engineer, or may be stockpiled for future use by the Contractor on areas to be seeded under the contract. The cost of placing the select material on designated areas and/or the stockpiling, removal and spreading of the material in its final position from the stockpiles shall be included in the unit price bid for Unclassified Excavation.

Payment for the necessary excavation for removing existing drainage pipe lines which are to be abandoned, as shown on the plans or as directed by the Engineer, will be paid for under Trench, Culvert and Bridge Excavation.

ITEM 2B—EMBANKMENT IN PLACE

1. DESCRIPTION. Under this item, the Contractor shall construct embankments in accordance with the general specifications for Excavation, Section 8b using material obtained from borrow pits.

The Contractor shall secure at his own expense all rights, leases or permits for obtaining the material for embankment. Overhaul will not be allowed.

All material shall be subject to the approval of the Engineer. Any unsuitable material deposited in the work shall be removed and replaced by acceptable materials by the Contractor at his own expense.

No direct payment will be made for any losses of material which may result from shrinkage, compaction, foundation settlement, waste, overflow, erosion, leakage or any other causes.

2. METHOD OF MEASUREMENT. The quantity of embankment to be paid for under this item will be the number of cubic yards of material measured in its final compacted position, placed as required by the plans and specifications within the payment limits shown on the plans unless otherwise ordered in writing by the Engineer.

3. BASIS OF PAYMENT. The unit price bid per cubic yard for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that Furnishing Water Equipment and Applying Water will be paid for under their respective items.

ITEM 2EC—SELECTED BORROW

1. DESCRIPTION. Under this item, the Contractor shall furnish and place selected borrow necessary to complete the embankments, shoulders, subgrade foundation and backfill to the required lines and grades as shown on the plans in accordance with the general specifications for "Excavation".

All selected borrow shall be obtained in accordance with the procedure outlined under "Excavation, General Specifications".

The material shall be sound, hard, durable Stone, Run-of-Bank Gravel, Sand, Blast Furnace Slag, or other acceptable granular material, the particles of which shall be of such size that, of that portion passing the 4 inch square sieve, not more than 70 percent, by weight shall pass the No. 40 mesh sieve, and not more than 10 percent, by weight, shall pass the No. 200 mesh sieve, as determined by washing through the sieve in accordance with ASTM Designation: D422.

2. METHOD OF MEASUREMENT. The quantity of selected borrow to be paid for under this item will be the number of cubic yards of material measured in its original position, placed and disposed of as required by the plans and specifications within the limits shown on the plans unless otherwise ordered in writing by the Engineer.

3. BASIS OF PAYMENT. The unit price bid per cubic yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that Furnishing Water Equipment and Applying Water will be paid for under their respective items. Overhaul will not be paid for on this item.

ITEM 2EC-B—SELECTED FILL

1. DESCRIPTION. The specifications for Item 2EC will apply, except as herein modified.

2. BASIS OF PAYMENT. The quantity of Selected Fill to be paid for under this item will be the number of cubic yards measured in place between the maximum payment lines as designated on the plans or as ordered by the Engineer, in writing, prior to the work. No direct payment will be made for any losses of material which may result from shrinkage, compaction, foundation settlement, waste, overflow, erosion, leakage or any other causes; the cost of such losses shall be included in the price bid for this item.

ITEM 2EF-B—SELECTED GRANULAR FILL

The specifications for this item will appear in the proposal if and when it is to be included in the work items of the contract.

ITEM 2L—SELECT MATERIAL PLACED FROM STOCKPILES

1. DESCRIPTION. Under this item the Contractor shall remove Select Material from stockpiles, transport and place it at designated locations as specified on the plans or as directed by the Engineer.

2. MATERIALS. Select Material shall be the material so defined under subheading "U" of PART II, Section 8b - EXCAVATION.

3. CONSTRUCTION DETAILS. The Contractor shall complete subgrading within the areas to be covered by Select Material by bringing the surface of the subgrade to the lines and grades as specified for Item 7.

Select Material shall be placed and spread over the areas shown on the plans or as directed by the Engineer to a sufficient depth so that the completed work shall conform to the lines, thickness and grades specified.

The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded and/or seeded if required. Seeding, when required, shall be at the Contractor's expense and shall be done in accordance with the seeding item in the contract or Item 123A if no seeding item is specified.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of cubic yards of material measured in its final position incorporated in the work in accordance with the plans and specifications and as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price bid per cubic yard of Select Material shall include the cost of all labor, materials and equipment necessary to complete the work.

ITEM 2LA—SELECT MATERIAL FURNISHED AND PLACED

1. DESCRIPTION. Under this item, the Contractor shall furnish and place Select Material at designated locations as specified on the plans or as directed by the Engineer.

2. MATERIALS. Select Material shall be the material so defined under subheading "U" of PART II, Section 8b - EXCAVATION.

3. CONSTRUCTION DETAILS. The Contractor shall complete subgrading within the areas to be covered by Select Material by bringing the surface of the subgrade to the lines and grades as specified for Item 7.

Select Material shall be placed and spread over the areas shown on the plans or as directed by the Engineer to a sufficient depth so that the completed work shall conform to the lines, thickness and grades specified.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of cubic yards of material measured in its final position, furnished and incorporated in the work in accordance with the plans and specifications and as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price bid per cubic yard of Select Material shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 2SP—GRANULAR FILL, SLOPE PROTECTION

1. DESCRIPTION. Under this item, the Contractor shall furnish and place a blanket of Granular Fill, Slope Protection on slopes of cuts, as shown on the plans or as ordered by the Engineer. The work shall be done immediately, as ordered by the Engineer, so as to prevent deterioration of the cut slopes by erosion, seepage and sloughing.

2. MATERIALS. Granular Fill, Slope Protection material shall be composed of sound, durable particles, free from soft shale and other deleterious substances, as approved by the Engineer. This material shall have the following gradation as determined by ASTM Designation: D422.

Material Size	Percent Passing by Weight
Maximum dimension of 6 inches	100
2 inch square sieve	0-30
1/4 inch square sieve	0-10

3. CONSTRUCTION DETAILS. The blanket shall be placed in one layer in a manner approved by the Engineer. Compaction by rolling, tamping or vibration will not be required.

4. METHOD OF MEASUREMENT. Payment for this item will be made, at the unit price bid, for the number of cubic yards of material, measured in its final position between the maximum payment lines as shown on the plans or as ordered by the Engineer.

5. BASIS OF PAYMENT. The unit price bid per cubic yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work. No direct payment will be made for any losses of material which may result from shrinkage, compaction, foundation settlement, waste, overflow, erosion, leakage or any other causes. The cost of such losses shall be included in the price bid for this item.

ITEM 2UF—UNDERDRAIN FILTER

1. DESCRIPTION. Under this item, the Contractor shall furnish and place Underdrain Filter material, as shown on the plans or as ordered by the Engineer.

2. MATERIALS. Underdrain Filter material shall conform to the quality and Plasticity Index requirements of Item 4, and shall have the following gradation as determined by ASTM Designation: D422:

Passing Sieve	Percent by Weight
2 inch	100
1/2 inch	45 to 85
1/4 inch	30 to 65
No. 10	15 to 45
No. 200	0 to 5

3. CONSTRUCTION DETAILS. Requirements of Item 4 - STABILIZED SOIL AGGREGATE SUBBASE for "Stockpiling and Sampling" shall apply to all material furnished for this item. A carefully levelled and thoroughly compacted bed of this material shall be prepared just prior to the placement of the underdrain pipe. The thickness of the bed shall be as shown on the plans or as ordered by the Engineer.

After the pipe has been placed and properly aligned on the bed, Underdrain Filter materia shall be hand shoveled around the sides and to a level of 6 inches above the top of the underdrain pipe without compaction. Backfilling will then continue in accordance with "m. Filling and Backfilling at Structures, Culverts and Pipes" of Section 8b, using such material as shown on the plans or as ordered by the Engineer.

4. METHOD OF MEASUREMENT. The quantity of Underdrain Filter material to be paid for under this item will be the number of cubic yards of material comprising the product of the area bounded by the payment lines indicated on the contract plans or called for in the specifications multiplied by the length of the filter material backfill.

Any material excavated outside such payment lines shall be replaced with Underdrain Filter material meeting the requirements of this specification, and shall be furnished and installed at the Contractor's expense.

5. BASIS OF PAYMENT. The unit price bid per cubic yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work. No direct payment will be made for any losses of material which may result from shrinkage, compaction, foundation settlement, waste, overflow, erosion, leakage or any other causes; the cost of such losses shall be included in the price bid for this item.

ITEM 3—SUBBASE COURSE—GRANULAR MATERIAL

1. DESCRIPTION. Under this item, the Contractor shall furnish and place a granular material subbase course of Gravel, Sand, Blast Furnace Slag, Stone, Stone Screenings or other acceptable granular material in the places designated on the plans and in such locations as field conditions require. Depths and locations of this "subbase-granular material course" will be as shown on the plans or as required by field conditions and ordered by the Engineer.

2. MATERIALS. All granular material acceptable for this item shall be of sound, hard, durable stone or blast furnace slag and shall meet the approval of the Engineer. The particles shall not exceed such size as will pass through a 4 inch square hole; not less than 30 percent by weight shall pass the 1/4 inch square sieve; not more than 70 percent by weight shall pass the No. 40 mesh sieve and not more than 10 percent by weight shall pass the No. 200 mesh sieve as determined by washing through the sieve, in accordance with ASTM Designation: D422. The particles retained on the 1/4 inch square sieve shall have a loss, after four cycles of the Magnesium Sulfate Soundness Test, not exceeding 30 percent by weight. The particles passing the No. 40 mesh sieve shall have a maximum Plasticity Index of 5. The source of the material shall be stripped of all sod, topsoil, overburden, and other objectionable material before the excavation operations for the subbase course granular material are started, and shall be kept stripped at a minimum of thirty (30) feet from the top of the working face of the pit at all times. The Contractor shall so select the source or sources and so regulate his excavating operations in the pit that suitable, acceptable material will be produced at all times.

3. CONSTRUCTION DETAILS. The material shall be spread in such depths that the maximum thickness of any layer, after compaction, shall be 8 inches. Water shall be added in such amounts as the Engineer may consider necessary to obtain satisfactory compaction.

When the moisture content of the layer is within the limits for proper compaction, the entire surface shall be rolled with a pneumatic tired roller having an operating weight of between 1,000 and 2,500 pounds per tire, or a smooth steel wheel roller having a minimum weight of 10 tons. All portions of each layer shall be covered by a minimum of 8 passes of the roller.

For heavier, vibratory, or more efficient types of approved compaction equipment, the minimum number of passes required on all portions of each layer shall be determined by the Chief Engineer. Compaction shall be continued until the course has been thoroughly compacted and shows no signs of weaving.

In limited areas where the use of a roller is impractical, approved vibrating plate compactors or impact rammers shall be used to compact the material.

Any depressions that develop during rolling shall be filled with "subbase-granular material" and further rolled until the entire surface of the "subbase-granular material course" is true to grade and cross-section. The finished surface of the "subbase-granular material course" shall not extend above the true grade and surface for this course, at any location.

Should the subgrade become churned up into, or mixed with the "subbase-granular material course" through any cause whatsoever, the Contractor shall, at his own expense, remove such mixture of subgrade and replace with "subbase-granular material".

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of cubic yards of compacted material in the completed work between the payment lines as shown on the plans or as ordered by the Engineer in accordance with the specifications.

5. BASIS OF PAYMENT. The unit price bid per cubic yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work. The cost of adding water shall be included in the price bid, unless Items 1W and 1WA are included in the proposal. No direct payment will be made for any losses of material which may result from shrinkage, compaction, foundation settlement, waste, overflow, erosion, leakage or any other causes; the cost of such losses shall be included in the price bid for this item.

ITEM 4—STABILIZED SOIL-AGGREGATE SUBBASE

1. DESCRIPTION. Under this item, the Contractor shall construct a Stabilized Soil-Aggregate Subbase consisting of a well-blended mixture of soils and aggregate in the proportions indicated in the "Table of Proportions for Soil-Aggregate Subbase" shown on the plans, for the pavement and shoulders and in other locations designated on the plans or ordered by the Engineer. The Stabilized Soil-Aggregate Subbase shall be constructed to the lines, grades and thicknesses shown on the plans or as directed by the Engineer.

2. MATERIALS. The Stabilized Soil-Aggregate Subbase shall consist of a natural or an artificial mixture of approved native soils and aggregates intimately mixed, at optimum moisture content and in the proportions indicated on the plans.

The soil binder shall be the soil from the layer of subsoil below the vegetative topsoil but above the sand and gravel parent soil material. It shall consist of fine particles of clay and/or silt and may contain some sand and gravel, but shall contain no particles larger than will pass a one and one-half (1-1/2) inch square opening and shall be free from injurious amounts of organic matter. The soil binder shall be of such character than when properly combined with the course and fine aggregates, a stabilized subbase having the characteristics required for the finished mixture will result.

The course and fine aggregate shall consist of bank run material, sand, screenings or other finely divided mineral matter of such gradation that when combined with the soil binder the final mixture will conform to the requirements for the finished mixture as indicated in the "Table of Proportions for Soil-Aggregate Subbase".

The fraction of the Stabilized Soil-Aggregate Subbase passing the No. 200 sieve shall not be greater than two-thirds (2/3) of the fraction passing the No. 40 sieve. The fraction passing the No. 40 sieve shall have a liquid limit not greater than twenty-five (25) and a plasticity index not greater than six (6).

All material shall be free from vegetable matter and lumps or balls of clay.

At any time during the work, and if for any reason the material fails to conform to the limits set for the plasticity index, liquid limit and gradation requirements, the Contractor shall, by the addition of selected acceptable material and/or satisfactory manipulation, produce a material meeting the requirements set forth herein.

Material found at the subgrade elevation in sufficient depth, which meets the specified requirements in its natural position, may be manipulated and combined in place as set forth under 3. CONSTRUCTION DETAILS.

If the local material in place at the subgrade elevation does not meet the specified requirements, it shall be combined with suitable materials from other locations within the contract limits in order to secure the desired result. This will be accomplished by:

(1) Adding aggregate to the local soils in place;
(2) Adding soil or soil binders to local granular materials;
(3) By proportioning mixtures of soils and aggregates to produce the required finished mixture

When it will be necessary to import materials from without the contract limits for use as an admixture to materials native within the contract limits so as to meet the specified requirements of the stabilized soil-aggregate subbase mixture, it will be so stated on the plans

together with an estimate of the type and quantity of materials that must be imported. Where it is necessary to import materials as an admixture, the Contractor shall notify the laboratory for approval of his source of materials at least two (2) weeks in advance of starting work under this item.

3. CONSTRUCTION DETAILS. The materials meeting the specified requirements for the stabilized soil-aggregate subbase shall be deposited on the site to be covered in a sufficient quantity and manner so as to provide a uniform layer of the required thickness after compaction. After placing, the material shall be thoroughly manipulated by discing, blading, roto-tilling and/or other mechanical means approved by the Engineer to insure uniformity of mix and the satisfactory incorporation of all materials without segregation. When the materials for the stabilized subbase have been thoroughly mixed to the satisfaction of the Engineer, calcium chloride meeting the requirements of M-32 shall be spread over the prepared area by means of an approved lime spreader at the rate of approximately 3/8 lb. per square yard per inch of depth of the mixture, or as otherwise directed by the Engineer. The calcium chloride shall be mixed with the materials for the stabilized subbase by discing and roto-tilling until it is uniformly blended with the material being stabilized to the depth of the subbase specified and for the full width of section or other linear limits to which the stabilized soil-aggregate subbase is to be constructed. Immediately after the calcium chloride has been incorporated in the mixture, sufficient water shall be evenly distributed over the surface of the prepared area to bring the blended material to the optimum moisture content for maximum density as determined by laboratory tests. The mixing shall be conducted until a uniform moisture content is obtained throughout the entire course.

When the mixing operation has been completed, and with the moisture content of the mixture within the limits for proper compaction, and when the thickness of the prepared material in its loose state is sufficient to provide the required thickness of the course when compacted, the entire surface shall be rolled with a pneumatic tired roller, having an operating weight of between 1,000 and 2,500 pounds per tire, or a smooth steel wheel roller having a minimum weight of ten (10) tons. Final rolling shall be with a ten (10) ton flat wheel roller to a stability such that no rutting or movement of material is indicated and until the soil has been uniformly compacted to obtain a density of 100 percent of the maximum dry weight density in pounds per cubic foot as determined by the A.A.S.H.O. T-99 Method "C" density test.

The Contractor shall assume full responsibility for any contamination and/or degradation of any part of the subbase course at any stage of its preparation or construction and shall, at his own expense, remove any and all portions of the subbase course which do not conform to the requirements of the specifications and shall replace the rejected portions with specified materials.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of square yards of stabilized soil-aggregate subbase blended, manipulated, placed and compacted as shown on the plans or where directed by the Engineer.

5. BASIS OF PAYMENT. The unit price bid per square yard shall cover all excavating, hauling, mixing, blending and all other operations necessary to prepare, place and compact the stabilized subbase as specified, together with the costs of all labor, equipment, tools and incidentals necessary to complete the Item as specified. Preparing Fine Grade and Furnishing and Applying Calcium Chloride will be paid for under their respective Items. The cost of adding water shall be included in the price bid for this Item unless Item 1W and Item 1WA are included in the proposal. When there is insufficient material within the contract limits to prepare the Stabilized Soil-Aggregate Subbase, the plans will so indicate, and the material to be furnished from without the contract limits for use as an admixture will be paid for under its proper item. No direct payment will be made for any losses of material which may result from shrinkage, compaction, waste, erosion or any other causes; the cost of such losses shall be included in the price bid for this Item.

ITEM 4A—ADMIXTURE FOR SOIL-AGGREGATE SUBBASE

1. DESCRIPTION. Under this Item, the Contractor shall furnish soils and/or aggregates from outside the contract limits and deliver the same to areas within the contract limits when necessary to amend the native materials therein by the addition of an admixture to meet the requirements of Item 4 - Stabilized Soil-Aggregate Subbase.

2. MATERIALS. The materials furnished shall meet the requirements of 2. MATERIALS under Item 4 - Stabilized Soil-Aggregate Subbase. The quantities and types of material to be imported from without the contract limits, when required, will be shown as "Required Admixtures to be Imported" in the "Table of Proportions for Soil Aggregate Subbase" shown on the plans.

3. METHOD OF MEASUREMENT. The quantity of admixture for soil-aggregate subbase to be paid for under this Item will be the number of cubic yards of material measured in its original position, excavated and delivered to within the contract limits where required for the preparation of Item 4- Stabilized Soil-Aggregate Subbase.

4. BASIS OF PAYMENT. The unit price bid per cubic yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

Where broken slag, screened gravel or broken stone are specified as an admixture, they will be paid for under Item 91, Item 92 or Item 93.

ITEM 5—TRENCH, CULVERT AND BRIDGE EXCAVATION

1. DESCRIPTION. The General Specifications for "Excavation" of Section 8b shall apply except as hereinafter modified. Under this item the Contractor shall excavate for all pipe lines, rip-rap, culverts, walls, bridge foundations and other structures within the payment limits shown or indicated on the contract plans or called for in this specification. He shall keep the site of the work free from earth, water, snow and ice during construction, dispose of excavated materials, and backfill, all as required by the plans and specifications.

Special care shall be taken not to disturb the bottom of the excavation, and the final removal of material to grade shall not be made until just before the structure is placed.

Payment Limits. Unless otherwise shown or indicated on the contract plans, payment limits for excavation for pipe lines will be considered as follows:

1. The bottom width of pipe culvert and underdrain trenches shall be in accordance with the details shown on the appropriate Standard Structure Sheet or on the plans.

2. The side surfaces of the trench; these surfaces shall have an inclination of 3 vertical to 1 horizontal.

3. The subgrade of the roadway when under a cut section, otherwise the ground surface existing at the site prior to beginning the work.

2. METHOD OF MEASUREMENT. The quantity of excavation paid for under this item will be the number of cubic yards of material (measured in its original position) actually excavated from within the payment limits shown or indicated on the contract plans or called for in the specifications. Where incidental sheeting and bracing is used by the Contractor, at his own expense and for his own convenience, the quantity of excavation to be paid for under this item will be the quantity included within the payment lines shown on the plans.

3. BASIS OF PAYMENT. The unit price bid per cubic yard for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 5B—STRUCTURE EXCAVATION

1. DESCRIPTION. Under this item, the Contractor shall excavate for all bridge foundations, walls and other major structures within the payment lines shown on the contract plans. He shall keep the site of the work free from earth, water, snow and ice during construction, dispose of the excavated materials and backfill, all as required by the plans and specifications. Excavation shall be unclassified and shall include removal of all earth and other materials.

2. CONSTRUCTION DETAILS. Work under this item shall conform to the requirements of Section 8b - "EXCAVATION" of the Specifications except as modified herein. Attention is directed to the sub-section 1. "Excavation and Drainage of Excavation at Structures" and "Safe Operation and Sheet Piling". The Contractor may provide sheet piling as required therein or he may, with the approval in writing from the Chief Engineer, protect workmen from falling or sliding material by sloping back the sides of the excavation to the natural angle of repose of the material being excavated. In sloping back the sides of the excavation, the Contractor shall, in addition, remove any stones, construction materials, equipment or similar hazard as required by the current Industrial Code Rule 23 that might conceivably endanger the workmen working in the excavation.

Special care shall be taken not to disturb the bottom of the excavation and the final removal of material to grade shall not be made until just before the structure is placed. The forms for footings shall be stripped from the concrete within the excavation in the minimum time permitted by the specifications and the backfill placed immediately.

3. METHOD OF MEASUREMENT. The quantity of excavation paid for under this item will be the number of cubic yards of material, measured in its original position, within the payment lines shown on the contract plans.

If the Contractor elects to slope the sides of the excavation in lieu of sheeting, no payment will be made for any sheeting not installed to support the sides of the excavation or for any excavation beyond the payment lines as shown on the contract plans.

Payment for Sheeting or Cofferdams if required by the plans, specifications, Industrial Code Rule 23 or ordered by the Engineer in writing will be made in accordance with the appropriate item.

4. BASIS OF PAYMENT. The unit price bid per cubic yard for this item shall include the cost of furnishing all labor, materials and equipment required to satisfactorily complete the work.

ITEM 5T—TRENCH & CULVERT EXCAVATION

1. DESCRIPTION. The General Specifications for "EXCAVATION" of Section 8b shall apply except as hereinafter modified. Under this item the Contractor shall excavate for all culverts, pipe lines, conduits, rip rap, and other minor structures including but not limited to leaching basins, catch basins, field inlets, manholes and drop inlets within the payment lines shown or indicated on the contract plans or called for in this specification. Excavation shall be unclassified and shall include removal of all earth and other unclassified excavation materials. He shall keep the site of the work free from earth, water, snow and ice during construction, dispose of excavated materials, and backfill, all as required by the plans and specifications.

Sheeting conforming to Industrial Code Rule 23 as amended or as shown on the plans shall be used as required by the Code. Where conditions are favorable the Contractor may elect to open the excavation with the sides sloped to the natural angle of repose of the material provided he obtains approval in writing from the Chief Engineer. In such cases the Chief Engineer shall impose such conditions in the approval as he deems necessary for both the safety of the operation and the satisfactory execution of the work.

Special care shall be taken not to disturb the bottom of the excavation and the final removal of material to grade shall not be made until just before the structure or bedding is placed.

Payment Lines. Unless otherwise shown or indicated on the contract plans payment lines for excavation for pipe lines and other minor structures will be considered as follows:

a. The bottom width or dimension of trenches or excavation shall be in accordance with the details shown on the appropriate Standard Sheet or on the plans. Where no dimension is shown the bottom width or dimension shall be the nominal outside dimension of the pipe or minor structure (not including bells, joints or occasional projections) plus four (4) feet.

b. The payment lines for side surfaces of the trench or excavation shall have an inclination of 3 vertical to 1 horizontal where no sheeting is used, and shall be the inner face of the sheeting where sheeting is used.

c. The subgrade of the roadway when under a cut section, otherwise the ground surface existing at the site prior to beginning the work shall be the top surface.

2. METHOD OF MEASUREMENT. Where sheeting is not required by the Code the quantity of excavation paid for under this item will be the number of cubic yards of material comprising the product of the area bounded by the payment lines indicated on the contract plans or called for in the specifications multiplied by the length of the excavation. Where incidental sheeting and bracing is used by the Contractor for his own convenience no payment will be made for sheeting and bracing and the quantity of excavation to be paid for under this item will be as indicated above for no sheeting.

Where sheeting is required by the Code or on the plans and used, the quantity of excavation will be the number of cubic yards of material comprising the product of the area bounded by the payment lines indicated on the contract plans or called for in the specifications multiplied by the length of the excavation.

Where sheeting is required by the Code and the Contractor obtains written approval to dispense with sheeting and open the sides of the excavation on the angle of repose of the material, the quantity of excavation to be paid for will be the number of cubic yards of material computed for a "no sheeting" condition except that the payment made for excavation for any linear foot of trench or excavation shall not exceed the combined total payment of excavation and sheeting which would have been made in the event that sheeting had been utilized, i.e., the sum of payment for excavation to the face of sheeting and for the sheeting, both computed at the prices bid for the respective items. The computed material shall comprise the product of the area bounded by the payment lines indicated on the contract plans or called for in the specifications multiplied by the length of the excavation."

3. BASIS OF PAYMENT. The unit price bid per cubic yard for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 6—LABORATORY BUILDING

1. DESCRIPTION. Under this item the Contractor shall furnish buildings or trailers to be used as field laboratories for soil and material testing purposes. No construction shall be started until this building or trailer is erected, furnished and made available to the Engineer. Each laboratory building or trailer shall be approved weather-proof construction, portable, and shall have a floor space of not less than 7 x 10 feet with a ceiling height of at least 7 feet. It shall have one door and three windows equipped with screens. The windows shall be situated one on each end and one in the side opposite the door. The windows and door shall be provided with adequate locking devices. Each building shall be furnished with a heavy work table 3 feet high, 3 feet wide and having its length equal to the width of the building, and a wooden locker of not less than 2 x 2 feet in area, 6 feet in height with door and lock, and suitable shelves and benches, as directed by the Engineer. Each building shall be furnished with a clean water tank, having a minimum capacity of 55 gallons, which shall be kept supplied with potable water as directed by the Engineer. This tank shall be gravity piped to a faucet at an approved sink within the building. The sink shall drain to the outside of the building or trailer as directed by the Engineer. Each building or trailer shall be placed on skids or suitable rolling devices to permit moving to various locations on the contract. When directed by the Engineer, it shall be moved by the Contractor to the site of operations and shifted as work progresses.

The Contractor may elect to furnish equivalent facilities in existing buildings provided such facilities and buildings are so located as to provide convenient service and provided that the building, location and facilities are approved by the Chief Engineer in writing.

The Contractor shall furnish suitable lighting and oil, gas or electric heating equipment together with necessary fuel.

The Contractor shall furnish a complete bottled gas burner assembly for use in drying soil and/or granular material samples. The unit shall have a minimum of two burners. The bottled gas burner unit shall be maintained in satisfactory operating condition with adequate fuel supply on hand at all times for drying soil samples and shall conform to the following specifications:

(1) The liquefied petroleum gas cylinder shall comply with I.C.C. specifications, shall be of a minimum capacity of 20 pounds, shall contain the required shutoff P.O.L. valve and an additional regulator valve for adjusting the outlet pressure between the LP gas cylinder and the two burner stoves. The Contractor shall furnish a minimum of two LP gas cylinders which shall be satisfactorily mounted on the outside of the building, such that not less than 20 pounds of LP gas is available at all times.

(2) The necessary fittings for connecting between the LP gas cylinder, P.O.L. regulator and gas burner shall be furnished and installed in accordance with Underwriter Laboratory requirements.

(3) The minimum two burner, low leg hot plate shall be A.G.A. approved, minimum dimensions of 7-inch height x 20-inch length x 10-inch depth. Normal input per hour shall be a minimum of 7,000 BTU, per hour, per burner adjusted for use with Liquefied Petroleum Gas. The burners shall be equal to Model 32 as manufactured by Vestal Mfg. Co. of Sweetwater, Tennessee, or Model Topton No. 102 manufactured by Caloric Corp., of Topton, Pennsylvania.

2. METHOD OF MEASUREMENT. Payment will be made for each building or trailer furnished under this item as follows: Seventy-five percent (75%) of the amount bid will be paid when the building or trailer equipped as specified has been placed on the work site and is fully operative. The remaining twenty-five percent (25%) will be paid when the % completion of the Contract work as determined by the Engineer on a dollar basis reaches 90%.

3. BASIS OF PAYMENT. The price bid for each building or trailer shall include the cost of furnishing all labor, materials and equipment necessary to erect, relocate and remove the building or trailer as directed by the Engineer, together with all fuel, water, ground rental, or other expenses incidental thereto.

ITEM 6E—ENGINEER'S OFFICE (Type A, B or C)

1. DESCRIPTION. The Contractor shall furnish during the period of the work of construction, an approved weather-proof building or mobile trailer of the type indicated for the use of and occupancy by the field engineers of the Department as well as for the comparable personnel employed by a Consultant, if any, who may be retained by the Department with relation to the contract. Such use and occupancy shall be made available as aforesaid and shall be so continued after the work has been accepted by the Department for such a period of time as specified under the type of Engineer's Office designated in the proposal.

No construction shall be started until the building is erected, furnished as herein specified with all utilities and services in working order and made available to the Engineer unless permission is granted in writing by the Chief Engineer. This building shall be erected at a location

to be selected by the Engineer and shall be separate from any building used by the Contractor. All offices shall have a minimum ceiling height of 7 feet. Each window shall have an area of at least 8 square feet. All windows and doors shall be equipped with adequate locking devices, be weatherproof and screened to provide adequate ventilation. Windows shall be the type that will open and close as required.

The Contractor may elect to furnish equivalent facilities in existing buildings provided such facilities and buildings are so located as to provide convenient service and provided that the building location and facilities are approved by the Chief Engineer in writing.

General Requirements for All Engineer Offices

1. Adequate electric lighting.

2. Adequate heating with the necessary fuel therefor.

3. A calculating machine with answer registered to at least eleven digits.

4. A long carriage typewriter.

5. A separate telephone for the exclusive use of the said field engineers and the Consultant's Personnel.

6. Drinking water.

7. Adding machine, tape type, registering to at least ten digits.

8. A toilet enclosed in a separate room, properly ventilated and complying with applicable sanitary codes. Wherever possible the contractor shall provide a lavatory with running water and flush-type toilet.

9. A wooden locker of sufficient size for storage of surveying instruments and testing equipment.

All facilities and equipment furnished under this item shall be maintained in good working order.

TYPE A. This office shall provide a minimum of 160 square feet of floor space with one (1) door and four (4) windows. The furnishings shall be as follows:

1—Suitable office desk, with drawers and locks.

2—Office Chairs.

2—Bracketed wall tables each 3 feet by 6 feet

1—Fire resistant 2-drawer legal size file cabinet with lock and 2 keys, meeting the requirements for "Filing Devices, Insulated (360 E9) Class D Label," of the Underwriters' Laboratories, Inc., Specifications

4—Draftsman's stools.

1—Plan Rack.

This office shall be made available to the aforesaid engineers and shall be so continued if required by the Engineer for a period not to exceed two months after the work has been accepted by the Department.

If Consultant Personnel are retained by the Department, the said continued use and occupancy of said building by the personnel employed by the Consultant shall be for a period not to exceed the aforesaid period of two months. The Consultant shall procure and maintain at his own expense an Owners', Landlords' and Tenants' Liability Insurance Policy for a period of two months.

TYPE B. This office shall provide a minimum of 330 square feet of floor space with two (2) doors and six (6) windows. It shall be partitioned to provide two rooms with an adjoining door. The smaller room shall not be less than 96 square feet in floor area and shall contain two of the windows. The furnishings shall be as follows:

2—Suitable desks with drawers and locks.

4—Office Chairs.

1—Fire resistant 4-drawer legal size file cabinet with lock and 2 keys, meeting the requirements for "Filing Devices, Insulated (360 E9)" Class D, Label, of the Underwriters' Laboratories, Inc., Specifications.

2—Bracketed wall tables each 3 feet by 6 feet.

6—Draftsman's stools.

1—Table not less than 3 feet by 8 feet.

2—Plan Racks, each capable of holding 4 sets of plans.

1—Compartmented cross section bin capable of holding 8 rolls of cross sections.

This office shall be made available to the aforesaid engineers and shall be so continued if requested by the Engineer for a period not to exceed three months after the work has been accepted by the Department.

If Consultant Personnel are retained by the Department, the said continued use and occupancy of said building by the personnel employed by the Consultant shall be for a period not to exceed the aforesaid period of three months. The Consultant shall procure and maintain at his own expense an Owners', Landlords' and Tenants' Liability Insurance Policy for a period of three months.

TYPE C. This office shall provide a minimum of 460 square feet of floor space and shall be partitioned to provide three (3) rooms with adjoining doors: Two small rooms and one large room. The smaller rooms shall be not less than 96 square feet in area, and shall contain two of the windows. Two (2) doors and eight (8) windows will be required. The furnishings shall be as follows:

3—Suitable Office Desks with drawers and locks.

6—Office Chairs.

2—Fire resistant 4-drawer legal size file cabinet with locks and 2 keys for each, meeting the requirements for "Filing Devices, Insulated (360 E9)" Class D Label, of the Underwriters' Laboratories, Inc., Specifications.

3—Bracketed wall tables each 3 feet by 6 feet.

8—Draftsman's stools.

1—Office table, 3 feet by 12 feet.

3—Plan Racks, each capable of holding 4 sets of plans.

1—Compartmented cross section bin capable of holding 12 rolls of cross sections.

This office shall be made available to the aforesaid engineers and shall be so continued if requested by the Engineer for a period not to exceed four months after the work has been accepted by the Department.

If Consultant Personnel are retained by the Department, the said continued use and occupancy of said building by the personnel employed by the Consultant shall be for a period not to exceed the aforesaid period of four months. The Consultant shall procure and maintain at his own expense an Owners', Landlords' and Tenants' Liability Insurance Policy for a period of four months.

After the period of usage has expired the required building and equipment herein specified shall become the property of the Contractor.

2. METHOD OF MEASUREMENT. Payment will be made at the lump sum price bid for this item as follows: Fifty percent (50%) of the amount bid will be paid when the building or mobile trailer, equipped as specified, has been placed on the work site and is fully operative. The remaining 50% will be paid in monthly payments in proportion to the amount of Contract work completed beginning with the estimate following the payment of the first 50%.

3. BASIS OF PAYMENT. The lump sum price bid shall include the cost of all labor, material, equipment, ground rental and utility charges necessary to complete the work.

ITEM 7—TRIMMING ROAD SECTION
(per Linear Foot of Road)

1. DESCRIPTION. Under this item the Contractor shall form and trim the road sections, the median areas, malls, recharge basins and other areas in a workmanlike manner to the lines and grades shown on the plans or as ordered by the Engineer. The slopes outside the Roadway

and Ditch areas may be machine-trimmed providing they are graded in a smooth workmanlike manner and providing they do not deviate from the true line and slope by more than 4 inches at any location. Machinery used in trimming shall run generally parallel to the center line of the highway. The surface shall be tested with a 16 foot straight edge and any variation more than 4 inches from a true surface shall be satisfactorily eliminated. At the completion of the contract the road section shall be left in a compact and satisfactory condition free of large stones or other objectionable material.

2. METHOD OF MEASUREMENT. The quantity to be paid for will be the number of linear feet of road measured along the axis of roadway where the work is actually performed. No deduction shall be made for bridges, culverts or intersecting roads, except when indicated on the plans or in the proposal.

For divided pavements, the payment length shall be the sum of the measured lengths along the centerline of each roadway. Divided pavements, for this purpose, shall be defined as those for which the distance between inside edges of pavement is equal to or exceeds 12 feet plus the adjacent shoulder widths, and shall not include pavement divided by raised medians, markings or contrasting surfaces.

For undivided pavements, the payment length shall be measured along the center line of pavement in the case where no median is utilized, and along the centerline between pavements for highways divided by raised medians, markings, contrasting surfaces, or medians with widths less than 12 feet plus the adjacent shoulder widths.

For intersecting roads, the quantity to be paid for will be the number of linear feet of road measured along the axis of the roadway beginning at its intersection with the edge of the Mainline pavement and extending to the end of the work performed.

For ramps, the quantity to be paid for will be the number of linear feet of ramp measured along the axis of the ramp beginning opposite the point of intersection of the nearest adjacent pavement edges of the Mainline and ramp and extending to the end of the work performed.

For recharge basins, the quantity to be paid for will be the number of linear feet measured around a perimeter defined by the intersection of the plane of the side slopes of the recharge basin with the plane of the top area surrounding the said side slopes.

For service roads, the quantity to be paid for will be the number of linear feet of road measured along the axis of the roadway as designated on the plans.

For areas other than those defined above, the number of feet to be paid for under this item will be as shown on the plans.

3. BASIS OF PAYMENT. The unit price bid per linear foot of road shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily trim, form and compact the shoulders, ditches, malls and slopes to the lines and grades shown on the plans and as herein specified.

ITEM 7A—TRIMMING ROAD SECTION
(per Lump Sum)

The specifications for Item 7 shall apply with the following modifications:

Measurement and Payment. Payment will be made at the lump sum price bid for this item. The price bid shall include the cost of furnishing all labor, materials and equipment necessary to form, trim and compact the shoulders, ditches and slopes to the lines and grades shown on the plans or ordered by the Engineer.

ITEM 8—PREPARING FINE GRADE

1. DESCRIPTION. Under this item the Contractor shall prepare the fine grade to receive pavement in conformity with the lines and grades as shown on the plans. This item will be paid for in the construction of all pavement installed with high type wearing surfaces on which it is desirable to secure the smoothest possible riding surface. The cost of accurately meeting the line and grade specified for gravel surface course pavements, subbase courses, resurfaced existing pavements, private driveways, sidewalks and shoulders both paved and unpaved, shall be included in the prices bid for the respective items of work involved, unless otherwise specifically indicated.

2. CONSTRUCTION DETAILS. Before any paving material is placed upon the fine grade, it shall be shaped to line and grade and compacted with an approved self-propelled roller weighing not less than 10 tons. When existing pavement is to be widened less than the full width of one lane, an approved self-propelled roller providing a compression of not less than 325 pounds per linear inch of tread may be used. All hollows and depressions which develop under rolling shall be filled with acceptable granular material and shall again be rolled. Granular material used to fill depressions shall conform to M3, Fine Aggregates Type a, b or c. This process of shaping, rolling and filling shall be repeated until no depressions develop. After compaction, the top

surface of the fine grade shall not extend above nor more than 1/2" below, true grade and surface at any location. The subgrade shall not be muddy nor otherwise unsatisfactory when the pavement is placed upon it. If the fine grade becomes rutted or displaced due to any cause whatsoever the Contractor shall regrade same without additional payment.

Any scarified old macadam used for the subgrade shall be forked or raked over, after which the surface shall be compacted by rolling with a self-propelled roller weighing not less than 10 tons until an even and firm surface is produced, after which suitable earth, fine gravel or screenings shall be used to fill all voids, and again rolled. If necessary in order to satisfactorily compact the stone, the surface shall be sprinkled during the process of rolling and filling.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of square yards of the course of pavement placed directly on the subbase course in accordance with the plans and specifications or on the subsoil if a subbase course is not used. This shall include widening areas beyond the limits of existing pavement and areas where existing pavement is removed and replaced with new pavement.

4. BASIS OF PAYMENT. The unit price bid per square yard shall include the cost of furnishing all labor, materials and equipment necessary to form, trim and compact the fine grade to the lines and grades shown on the plans. If the addition of water has been necessary for compaction, the cost thereof shall be included in the price bid for this item unless Items 1W and 1WA are included in the contract.

ITEM 9AC—ASBESTOS CEMENT PIPE, CLASS....

1. DESCRIPTION. Under this item the Contractor shall furnish and place asbestos cement pipe of the class indicated and in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. Asbestos cement pipe shall conform to the specifications for M22A, Asbestos Cement Pipe and the following table:

Pipe Size	Min. Thickness Coupling *	Class 1500	Class 2400	Class 3300	Class 4000	Class 5000
	Minimum Strength Requirements (Pounds Per Foot of Length)					
6"		1500	2400	3300	....	....
8"		1500	2400	3300	....	....
10"		1500	2400	3300	4000	5000
12"	.15 in.	1500	2400	3300	4000	5000
14"	.15 in.	....	2400	3300	4000	5000
15"	.15 in.	....	....	....	....	....
16"	.15 in.	....	2400	3300	4000	5000
18"	.18 in.	....	2400	3300	4000	5000
20"	.18 in.	....	2400	3300	4000	5000
21"	.18 in.	....	....	....	....	....
24"	.21 in.	....	2400	3300	4000	5000
27"	.21 in.	....	....	....	....	....
30"	.25 in.	....	....	3300	4000	5000
33"	.25 in.	....	....	....	....	....
36"	.25 in.	....	....	....	4000	5000

*Minimum thickness of storm drain plastic coupling.

3. CONSTRUCTION DETAILS. The section titled (a) General Requirements under Construction Details of Item 14 shall apply. Joint assemblies with proper accessories shall be in accordance with the manufacturer's standards and instructions.

When using the plastic coupling for joining pipe lengths the pipes are to be pulled together until the machined shoulder of each pipe contacts the plastic coupling. The coupling and joint shoulder configuration shall be such that the maximum space between the ends of the pipe inside the coupling shall be not greater than 3/8".

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe, including specials, furnished and incorporated in the work in accordance with the plans and specifications and as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that all excavation in connection therewith will be paid for under the item, Trench, Culvert and Bridge Excavation, and granular material when required under the appropriate item. The cost of adding water shall be included in the price bid, unless Items 1W and 1WA are included in the proposal.

ITEM 9C—CONCRETE PIPE

1. DESCRIPTION. Under this item, the Contractor shall furnish and place concrete pipe in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. Concrete pipe shall conform to the specifications for M22B, Concrete Pipe.

3. CONSTRUCTION DETAILS. The section titled (a) General Requirements under Construction Details of Item 14 shall apply.

Joints shall be sealed with flexible, water-tight elastomeric gaskets or approved bituminous or plastic sealers as specified under M25A. When pipe is of such design that a gap greater than 3/8 of an inch would be left when sections are laid together, oakum shall be used as a joint filler in conjunction with the bituminous or plastic sealant unless the Department's approved list for such sealants indicates otherwise. The oakum shall be a closely twisted hemp or jute gasket of suitable diameter to fill the annular space when caulked and in one piece of sufficient length to pass around the pipe and lap at the top. The bituminous or plastic jointing compound shall be applied in accordance with the manufacturer's instructions. Only those bituminous and plastic sealers appearing on an approved list issued by the Laboratory shall be used. No cement mortar shall be applied to joints in any of the pipe.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe, including specials, furnished and incorporated in the work in accordance with the plans and specifications and as ordered by the Engineer.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that all excavation in connection therewith will be paid for under the item Trench, Culvert and Bridge Excavation, and granular material when required, under its appropriate item. The cost of adding water shall be included in the price bid, unless Items 1W and 1WA are included in the proposal.

ITEM 9V—VITRIFIED CLAY PIPE

1. DESCRIPTION. Under this item the Contractor shall furnish and place vitrified clay pipe in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. Vitrified pipe shall conform to the specifications for M22C, Vitrified Clay Pipe.

3. CONSTRUCTION DETAILS. The section titled (a) General Requirements under Construction Details of Item 14 shall apply.

Joints for storm sewers shall be formed by caulking into the hubs a gasket of jute or oakum and then filling with mortar composed of equal parts of M1, Portland Cement and M3A Mortar Sand or, at the Contractor's option, a pre-formed or poured caulking compound of a type approved by the Engineer may be used.

Joints for sanitary sewers, if so labeled in the proposal or plans, shall utilize a joint material meeting the requirements of ASTM Designation: C425.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe, including specials, furnished and incorporated in the work in accordance with the plans and specifications and as ordered by the Engineer.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that all excavation in connection therewith will be paid for under the item for Trench and Culvert Excavation and granular material, when required, under its appropriate item. The cost of adding water shall be included in the price bid, unless items for furnishing and applying water are included in the proposal.

ITEM 10—VITRIFIED CLAY PIPE UNDERDRAIN

1. DESCRIPTION. Under this item, the Contractor shall furnish and place self centering vitrified clay pipe underdrain in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. Self Centering Vitrified Clay Pipe shall conform to the material specifications for M22C Vitrified Clay Pipe.

A minimum of three wedge shaped lugs shall be constructed as integral parts of the bell of each section of pipe underdrain. The lugs shall be equally spaced around the inside circumference of the bell. They shall be of such dimension as to center the spigot in the bell and to allow a 3/8" opening between the end of the spigot and the inside of the bell when the pipes are snugly fitted together.

3. CONSTRUCTION DETAILS. The section titled (a) General Requirements under Construction Details of Item 14 shall apply. The inlet end of the underdrain shall be closed as directed by the Engineer or as shown on the contract plans.

No wrapping of the joints will be required.

Pipes shall be laid and positioned in such a manner that equal bearing will be obtained on two of the self centering lugs.

Pipe installed in a subgrade section shall be bedded on not less than four inches of compacted filter material and shall have not less than six inches of filter material each side and above the pipe. The remainder of the underdrain installation section shall be completed, using the materials in accordance with the Standard Structure Sheet or as indicated on the plans.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe furnished and incorporated in the work in accordance with the plans and specifications and as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price per linear foot for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that excavation and backfill shall be paid for under their respective items as indicated on the plans.

ITEM 10AC—PERFORATED ASBESTOS CEMENT PIPE UNDERDRAIN

1. DESCRIPTION. Under this Item the Contractor shall furnish and place perforated asbestos cement pipe underdrain in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. Perforated Asbestos Cement Pipe shall conform to the specifications for M22D Perforated Asbestos Cement Pipe Underdrain.

3. CONSTRUCTION DETAILS. The section titled (a) General Requirements under Construction Details of Item 14 shall apply. The inlet end of the underdrain shall be closed as directed by the Engineer or as shown on the contract plans. The pipe shall be laid with holes down unless otherwise directed.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this Item will be the number of linear feet (laying length) of pipe incorporated in the completed work in accordance with the plans and specifications and as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price per linear foot for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that excavation and backfill shall be paid for under their respective items as indicated on the plans.

ITEM 10BP—PERFORATED BITUMINIZED-FIBER PIPE UNDERDRAIN

1. DESCRIPTION. Under this item the Contractor shall furnish and place perforated bituminized-fiber underdrain in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. Perforated bituminized-fiber pipe shall conform to the specifications for M22E Perforated Bituminized-Fiber Pipe Underdrain.

3. CONSTRUCTION DETAILS. The section titled (a) General Requirements under Construction Details of Item 14 shall apply. The inlet end of the underdrain shall be closed as directed by the Engineer or as shown on the contract plans. The pipe shall be laid with holes down unless otherwise directed.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe furnished and incorporated in the work in accordance with the plans and specifications and as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price per linear foot for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that excavation and backfill shall be paid for under their respective items as indicated on the plans.

ITEM 10C—POROUS CONCRETE PIPE UNDERDRAIN

1. DESCRIPTION. Under this item the Contractor shall furnish and place porous concrete pipe underdrain, tongue and groove type (slip joint) in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. Porous concrete pipe shall conform to the specifications for M22G, Porous Concrete Pipe Underdrain.

3. CONSTRUCTION DETAILS. The section titled (a) General Requirements under Construction Details of Item 14 shall apply. The inlet end of the underdrain shall be closed as directed by the Engineer or as shown on the contract plans.

Pipe installed in a subgrade section shall be bedded on not less than four inches of compacted filter material and shall have not less than six inches of filter material each side and above the pipe. The remainder of the underdrain installation section shall be completed, using the materials in accordance with the Standard Structure Sheet or as indicated on the plans.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe furnished and incorporated in the work in accordance with the plans and specifications and as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price per linear foot for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that excavation and backfill shall be paid for under their respective items as indicated on the plans.

ITEM 10P—PERFORATED VITRIFIED CLAY PIPE UNDERDRAIN

1. DESCRIPTION. The specifications for Item 10, Vitrified Clay Pipe Underdrain, will apply except for the following modifications:

The pipe shall be perforated with holes 5/16" ± 1/16" in diameter, spaced 3 inches apart longitudinally, the rows of holes being 2 inches apart and extending approximately half way around the pipe.

The pipe shall be laid with holes down unless otherwise directed.

Pipe installed in a subgrade section shall be bedded on not less than four inches of compacted filter material and shall have not less than six inches of filter material each side and above the pipe. The remainder of the underdrain installation section shall be completed, using the materials in accordance with the Standard Structure Sheet or as indicated on the plans.

ITEM 10RC—SELF-CENTERING CONCRETE PIPE UNDERDRAIN

1. DESCRIPTION. Under this item, the Contractor shall furnish and place self-centering pipe of the size or sizes specified, as shown on the plans and as indicated in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. Self-centering concrete pipe underdrain shall conform to the specifications for M22B except as herein modified.

Two equally and oppositely spaced lugs shall be constructed as integral parts of the spigot for each section of the pipe underdrain. Each lug shall extend over an arc of 90 degrees around the outside circumference of the spigot. The lugs shall be of such dimension as to center the spigot in the bell, leave a 5/16" ± 1/16" opening between the end of the spigot and the inside of the bell, and allow each lug to project one inch beyond the bell when the pipes are snugly fitted together. The lugs shall be of constant thickness for a length equal to the depth of the bell socket.

3. CONSTRUCTION DETAILS. Pipes shall be laid and positioned such that full, firm and even bearing is established at each joint and along the entire length of pipe and such that the lugs are centered top and bottom with the recessed openings centered at the springline.

All pipe shall be installed true to line and grade in accordance with the method specified on either the plans or the Standard Structure Sheet and shall be in conformance with one of the following criteria:

1. Pipe shall be placed in the direction of increasing gradient with bell sections placed in the same direction.

2. Pipe installed in a subgrade section shall be bedded on not less than four inches of compacted filter material and shall have not less than six inches of filter material each side and above the pipe. The remainder of the underdrain installation section shall be completed, using the materials in accordance with the Standard Structure Sheet or on the plans.

3. Pipe installed in a trench section shall be bedded on filter material in accordance with the requirements for underdrain as shown on the Standard Structure Sheet. The filter material shall be carefully placed by hand shoveling on each side and to a depth of at least six inches over the top of the pipe. The pipe trench shall then be filled with materials in accordance with the Standard Structure Sheet. Special care shall be taken to insure that neither the alignment nor grade of the pipe is disturbed.
   No wrapping of joints will be required.
   Any pipe, which, in the judgment of the Engineer, is damaged or disturbed through any cause, shall be replaced as directed by the Engineer, at the expense of the Contractor at no cost to the County.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe furnished and incorporated in the work in accordance with the plans and specifications and as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price per linear foot for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that excavation and backfill shall be paid for under their respective items as indicated on the plans.

ITEM 11—ROUND CORRUGATED METAL PIPE

1. DESCRIPTION. Under this item, the Contractor shall furnish and place bituminous-coated, galvanized, circular corrugated metal pipe of the size and gage as shown on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. Pipe shall conform to the requirements of M23A, Corrugated Metal Pipe, Round and Elongated, and Pipe Arches. Pipe which is defective from any cause, including damage during handling, shall be unacceptable for installation and shall be replaced at no cost to the County as directed by the Engineer, except damage to the bituminous coating and/or paving may be repaired in the field by hot applications of a 85-100 penetration asphalt or cold asphalt repair material of a brand which appears on the Department's approved list.

3. CONSTRUCTION DETAILS. All pipe shall be handled and assembled in accordance with the manufacturer's instructions, except as modified herein, on the plans, or by the Engineer in writing.
   The pipe shall be placed in accordance with the requirements indicated on the Standard Structure Sheet, unless other special construction methods are called for on the plans or in the proposal. Filling and backfilling shall be done in accordance with the details shown on the Standard Structure Sheet and shall conform with the general specifications for Excavation, section "m. Filling and Backfilling at Structures, Culverts and Pipes."
   Connections for making field joints shall consist of corrugated bands, so constructed as to lap on equal portions of each of the culvert sections to be connected. All such connections shall be of an approved type and they shall be so fabricated that a secure and firm connection of the sections of pipe may be readily made in the field. All pipe used under driveways shall have galvanized metal end sections meeting the requirements of Item 11ES.
   Movement of construction equipment and all other vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk. Any pipe, which in the judgment of the Engineer is damaged or disturbed through any cause, shall be replaced as directed by the Engineer, at the expense of the Contractor and at no cost to the County.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of linear feet designated along bottom center line on the plans or as ordered by the Engineer in writing for each pipe culvert furnished and incorporated into the work in accordance with the plans and specifications. Bottom center line lengths shall be designated on the plans or ordered by the Engineer in multiples of two (2) feet.

5. BASIS OF PAYMENT. The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that the excavation necessary will be paid for under the Item, Trench and Culvert Excavation, and granular fill and backfill, where required, under Selected Granular Fill. The cost of adding water for compaction of the granular fill and backfill shall be included in the price bid, unless Items 1W and 1WA are included in the proposal. Galvanized metal end sections, when required, shall be paid for under Item 11ES.

ITEM 11A—CORRUGATED METAL PIPE-ARCH

1. DESCRIPTION. Under this item, the Contractor shall furnish and place bituminous-coated, galvanized, corrugated metal pipe-arches of the dimensions and gages as shown on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. Pipe-arches shall conform to the requirements of M23A, Corrugated Metal Pipe, Round and Elongated, and Pipe Arches. All pipe arches or sections thereof which are defective due to poor workmanship, or damaged from any cause, including handling, or where the Span, Rise, or other dimension varies from that specified plus or minus the manufacturing tolerance from any cause whatsoever shall be replaced at the Contractor's expense as ordered by the Engineer, except damage to the bituminous coating and/or paving may be repaired in the field by hot applications of an 85-100 penetration asphalt, or cold asphalt repair material of a brand which appears on the Department's approved list.

3. CONSTRUCTION DETAILS. All pipe-arches shall be handled and assembled in accordance with the manufacturer's instructions, except as modified herein, on the plans, or by the Engineer in writing.

Pipe-arches shall be placed in accordance with the requirements shown on the Standard Structure Sheet, unless other special construction methods are called for on the plans or in the proposal. Filling and backfilling shall be done in accordance with the details shown on the Standard Structure Sheet and shall conform with the general specifications for "m. Filling and Backfilling at Structures, Culverts and Pipes" of Section 8b.

Connections for making field joints shall consist of corrugated bands, so constructed as to lap on equal portions of each of the culvert sections to be connected. All such connections shall be of an approved type and they shall be so fabricated that a secure and firm connection of pipe-arch sections may be readily made in the field. All pipe-arches used under driveways shall have galvanized metal end sections meeting the requirements of Item 11ES.

Movement of construction equipment and all other vehicles and loads over and adjacent to any pipe-arch shall be done at the Contractor's risk. Any pipe-arch, which, in the opinion of the Engineer, is damaged or disturbed through any cause shall be replaced as directed by the Engineer, at the expense of the Contractor and at no cost to the County.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of linear feet designated along bottom center line on the plans or as ordered by the Engineer in writing for each pipe-arch culvert furnished and incorporated into the work in accordance with the plans and specifications. Bottom center line lengths shall be designated on the plans or ordered by the Engineer in multiples of two (2) feet.

5. BASIS OF PAYMENT. The section of the specifications for Item 11 covering basis of payment shall apply.

ITEM 11AP—CORRUGATED METAL PIPE-ARCH—PAVED INVERT

1. DESCRIPTION. Under this item, the Contractor shall furnish and place bituminous-coated, paved invert, galvanized corrugated metal pipe-arches, of the dimensions and gages as shown on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. The section of the specifications for Item 11A covering materials shall apply.

3. CONSTRUCTION DETAILS. The section of the specifications for Item 11A covering construction details shall apply.

4. METHOD OF MEASUREMENT. The section of the specifications for Item 11A covering method of measurement shall apply.

5. BASIS OF PAYMENT. The section of the specifications for Item 11 covering basis of payment shall apply. The cost of bituminous paving shall be included in the price bid for this item.

ITEM 11ES—GALVANIZED METAL END SECTIONS

1. DESCRIPTION. Under this item, the Contractor shall furnish and place galvanized metal end sections to be attached to the inlet and/or outlet ends of corrugated metal pipe and pipe-arches, of the dimensions specified, as shown on the plans, the appropriate Standard Structure Sheet or in the itemized proposal to serve as wing walls for the installation.

2. MATERIALS. All materials shall conform to the requirements of M23E, Galvanized Corrugated Metal Headwalls.

Provisions of M23B, Corrugated Steel Culvert Pipe and Pipe Arches (3 x 1 Corrugation) shall also apply in the event the connecting portions of the end sections are fabricated from material with 3" x 1" corrugations.

3. CONSTRUCTION DETAILS. Each unit shall be installed as shown on the plans or as ordered by the Engineer.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of units of each size or diameter furnished and incorporated into the work in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that the excavation necessary will be paid for under the Item, Trench and Culvert Excavation, and granular fill and backfill, where required, under Selected Granular Fill. The cost of adding water for compaction of the granular fill and backfill shall be included in the price bid, unless Items 1W and 1WA are included in the proposal.

ITEM 11R—PERFORATED CORRUGATED METAL PIPE UNDERDRAIN

1. DESCRIPTION. Under this item, the Contractor shall furnish and place perforated galvanized corrugated metal pipe underdrain of the sizes specified as shown on the plans and as indicated in the itemized proposal or as ordered by the Engineer.

2. MATERIALS. Pipe shall conform to the requirements of M23D—Perforated Corrugated Metal Pipe Underdrain.

3. CONSTRUCTION DETAILS. The pipe shall be installed true to line and grade in accordance with the method specified on either the plans or the Standard Structure Sheet and shall be in conformance with one of the following criteria:

1. Pipe installed in a subgrade section shall be bedded on not less than four inches of compacted filter material and shall have not less than six inches of filter material each side and above the pipe. The remainder of the underdrain installation section shall be completed using materials in accordance with the Standard Structure Sheet or as indicated on the plans.

2. Pipe installed in a trench section shall be bedded on filter material in accordance with the requirements for underdrain as shown on the Standard Structure Sheet. The filter material shall be carefully placed by hand shoveling on each side and to a depth of at least six inches over the top of the pipe. The pipe trench shall then be filled with materials in accordance with the Standard Structure Sheet. Special care shall be taken to insure that neither the alignment nor grade of the pipe is disturbed.

Perforations shall be placed down unless the plans or special provisions indicate otherwise.

Any pipe, which, in the opinion of the Engineer, is damaged or disturbed through any cause, shall be replaced as directed by the Engineer, at the expense of the Contractor and at no cost to the County.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe furnished and incorporated in the work in accordance with the plans and specifications and as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price bid per linear foot for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that excavation and backfill shall be paid for under their respective items as indicated on the plans.

ITEM 11HA—PERFORATED CORRUGATED ALUMINUM PIPE UNDERDRAIN

1. DESCRIPTION. Under this item, the Contractor shall furnish and place perforated corrugated aluminum pipe underdrain of the sizes specified as shown on the plans and as indicated in the itemized proposal or as ordered by the Engineer.

2. MATERIALS. Materials shall conform to the requirements of Materials Specification M23DL - Perforated Corrugated Aluminum Pipe Underdrain.

3. CONSTRUCTION DETAILS. The pipe shall be installed true to line and grade in accordance with the method specified on either the plans or the Standard Structure Sheet and shall be in conformance with one of the following criteria:

1. Pipe installed in a subgrade section shall be bedded on not less than four inches of compacted filter material and shall have not less than six inches of filter material each side and above the pipe. The remainder of the underdrain installation section shall be completed using materials in accordance with the Standard Structure Sheet or on the plans.

2. Pipe installed in a trench section shall be bedded on filter material in accordance with the requirements for underdrain as shown on the Standard Structure Sheet. The filter material shall be carefully placed by hand shoveling on each side and to a depth of at least six inches over the top of the pipe. The trench shall then be filled with materials in accordance with the Standard Structure Sheet. Special care shall be taken to insure that neither the alignment nor grade of the pipe is disturbed.

Perforations shall be placed down unless the plans or special notes indicate otherwise.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe furnished and incorporated in the work in accordance with the plans and specifications and as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price per linear foot for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that excavation and backfill shall be paid for under their respective items as indicated on the plans.

ITEM 11HW—GALVANIZED METAL HEADWALL

1. DESCRIPTION. Under this item, the Contractor shall furnish and place galvanized corrugated metal headwalls to be attached to the ends of corrugated metal or reinforced concrete pipe as shown on the plans or appropriate Standard Structure Sheet, or as ordered by the Engineer.

2. MATERIALS. Galvanized corrugated metal headwalls shall conform to the specifications for M23E Galvanized Corrugated Metal Headwalls.

3. CONSTRUCTION DETAILS. The headwall units shall be attached to the ends of the pipes in accordance with the manufacturer's instructions and in a manner satisfactory to the Engineer.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of units of each size or diameter furnished and incorporated into the work in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid shall include all labor, materials and equipment necessary to complete the work, except that the necessary excavation will be paid for under the Item, Trench and Culvert Excavation, and granular fill and backfill, where required, under Selected Granular Fill. The cost of adding water for compaction of the granular fill and backfill shall be included in the price bid, unless Items 1W and 1WA are included in the proposal.

ITEM 11L—ROUND CORRUGATED ALUMINUM PIPE

1. DESCRIPTION. Under this item the Contractor shall furnish and place corrugated aluminum alloy pipe of the dimensions and gages as shown on the plans and in the itemized proposal.

2. MATERIALS. Materials shall conform to the requirements of Materials Specification M23AL Corrugated Aluminum Pipe and Pipe Arches.

3. CONSTRUCTION DETAILS. All pipe shall be handled and assembled in accordance with the manufacturer's instructions, except as modified herein, on the plans, or by the Engineer in writing.

Pipe shall be placed in accordance with the requirements shown on the Standard Structure Sheet "INSTALLATION DETAILS FOR CORRUGATED METAL AND STRUCTURAL PLATE PIPE AND PIPE ARCHES" unless other special construction methods are called for on the plans or in the proposal. Filling and backfilling shall be done in accordance with the details shown on the Standard Structure Sheet and shall conform with the general specifications for Excavation, section "m. Filling and Backfilling at Structures, Culverts and Pipes".

Pipe shall be placed so that when Type I pipe is used, the longitudinal seams face towards the sides of the trench, and shall be oriented so that the section joints lap in the downstream direction, so that the water is directed over instead of under each succeeding downstream section.

Connections for making field joints shall consist of coupling bands, so installed as to lap on equal portions of each of the sections to be connected. All such connections shall be of an approved type and they shall be so installed as to secure a firm connection of pipe sections. All pipe under driveways shall have corrugated aluminum end sections meeting the requirements of Item 11LE.

Any aluminum to be in contact with concrete shall be coated with zinc Chromate Primer in accordance with M18K. The primer shall be allowed to dry prior to placement of the concrete.

Movement of construction equipment and all other vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk. Any pipe which, in the opinion of the Engineer, is damaged or disturbed through any cause shall be replaced as directed by the Engineer, at the expense of the Contractor and at no cost to the County.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of linear feet designated along the bottom centerline on the plans or as ordered by the Engineer in writing for each pipe furnished and incorporated into the work in accordance with the plans and specifications. Bottom centerline lengths shall be as designated on the plans or ordered by the Engineer in multiples of two (2) feet.

5. BASIS OF PAYMENT. The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to complete the work including the cost of furnishing and applying zinc Chromate Primer. The excavation necessary will be paid for under the Item, Trench and Culvert Excavation, and granular fill and backfill, where required, under Selected Granular Fill. The cost of adding water for compaction of the granular fill and backfill shall be included in the price bid, unless Items 1W and 1WA are included in the proposal. Corrugated aluminum end sections, when required, shall be paid for under Item 11LE.

ITEM 11LA—CORRUGATED ALUMINUM PIPE-ARCH

1. DESCRIPTION. Under this item the Contractor shall furnish and place corrugated aluminum alloy pipe-arch of the dimensions and gages as shown on the plans and in the itemized proposal.

2. MATERIALS. Materials shall conform to the requirements of Materials Specification M23AL, Corrugated Aluminum Pipe and Pipe Arches.

3. CONSTRUCTION DETAILS. All Pipe-arch shall be handled and assembled in accordance with the manufacturer's instructions, except as modified herein, on the plans, or by the Engineer in writing.

Pipe-arch shall be placed in accordance with the requirements shown on the Standard Structure Sheet "INSTALLATION DETAILS FOR CORRUGATED METAL AND STRUCTURAL PLATE PIPE AND PIPE-ARCHES", unless other special construction methods are called for on the plans or in the proposal. Filling and backfilling shall be done in accordance with the details shown on the Standard Structure Sheet and shall conform with the general specifications for Excavation, section "m. Filling and Backfilling at Structures, Culverts and Pipes".

Pipe-arch shall be placed so that when Type I pipe-arch is used, the longitudinal seams face towards the sides of the trench, and shall be oriented so that the section joints lap in the downstream direction, so that water is directed over instead of under each succeeding downstream section.

Connections for making field joints shall consist of coupling bands, so installed as to lap on equal portions of each of the sections to be connected. All such connections shall be of an approved type and they shall be so installed as to secure a firm connection of pipe sections. All pipe-arch under driveways shall have corrugated aluminum end sections meeting the requirements of Item 11LE.

Any aluminum to be in contact with concrete shall be coated with Zinc Chromate Primer in accordance with M18K. The primer shall be allowed to dry prior to placement of the concrete.

Movement of construction equipment and all other vehicles and loads over and adjacent to any pipe-arch shall be done at the Contractor's risk. Any pipe-arch which, in the opinion of the Engineer, is damaged or disturbed through any cause shall be replaced as directed by the Engineer, at the expense of the Contractor and at no cost to the County.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of linear feet designated along the bottom centerline on the plans or as ordered by the Engineer in writing for each pipe-arch furnished and incorporated into the work in accordance with the plans and specifications. Bottom centerline lengths shall be as designated on the plans or ordered by the Engineer in multiples of two (2) feet.

5. BASIS OF PAYMENT. The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to complete the work including the cost of furnishing and applying zinc chromate primer. The excavation necessary will be paid for under the Item, Trench, Culvert and Bridge Excavation and granular fill and backfill, where required, under Selected Granular Fill. The cost of adding water for compaction of the granular fill and backfill shall be included in the price bid, unless Items 1W and 1WA are included in the proposal. Corrugated aluminum end sections, when required, shall be paid for under Item 11LE.

ITEM 11LAP—CORRUGATED ALUMINUM PIPE-ARCH - PAVED INVERT

1. DESCRIPTION. Under this Item the Contractor shall furnish and place corrugated aluminum alloy pipe-arch with a paved invert of the dimensions and gages as shown on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. Materials shall conform to the requirements of Materials Specification M23AL, Corrugated Aluminum Pipe and Pipe Arches. In addition, the bottom 30 percent of the inside periphery shall be paved with bituminous material as designated in M23A. The paving shall have a minimum thickness of 1/8 inch over the crests of the corrugations.

3. CONSTRUCTION DETAILS. The section of the specifications for Item 11LA covering Construction Details shall apply.

4. METHOD OF MEASUREMENT. The section of the specifications for Item 11LA covering Method of Measurement shall apply.

5. BASIS OF PAYMENT. The section of the specifications for Item 11LA covering Basis of Payment shall apply. The cost of bituminous paving shall be included in the price bid for this Item.

ITEM 11LE—CORRUGATED ALUMINUM END SECTIONS

1. DESCRIPTION. Under this Item the Contractor shall furnish and place corrugated aluminum alloy end sections to be attached to the inlet and/or outlet ends of corrugated aluminum pipe and/or pipe arch as shown on the plans and in the itemized proposal to serve as wingwalls for the pipe.

2. MATERIALS. All materials shall conform to the requirements of Materials Specification M23AL Corrugated Aluminum Pipe and Pipe Arches.

3. CONSTRUCTION DETAILS. Each unit shall be installed as shown on the plans or as ordered by the Engineer. Any aluminum to be in contact with concrete shall be coated with Zinc Chromate Primer in accordance with M18K. The primer shall be allowed to dry prior to placement of the concrete.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this Item shall be the number of units of each size or diameter furnished and incorporated into the work in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The section Basis of Payment of the ITEM 11L - ROUND CORRUGATED ALUMINUM PIPE, or ITEM 11LA - CORRUGATED ALUMINUM PIPE-ARCH shall apply. The cost of furnishing and applying zinc chromate primer when used, shall be included in the unit price bid for this Item.

ITEM 11LP—ROUND CORRUGATED ALUMINUM PIPE—PAVED INVERT

1. DESCRIPTION. Under this Item, the Contractor shall furnish and place corrugated aluminum alloy pipe with a paved invert of the size and gage as shown on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. Materials shall conform to the requirements of Materials Specification M23AL, Corrugated Aluminum Pipe and Pipe Arches. In addition the bottom 25 percent of the inside circumference shall be paved with bituminous materials as designated in M23A. Paving shall have a minimum thickness of 1/8 inch over the crests of the corrugations.

3. CONSTRUCTION DETAILS. The section of the specifications for Item 11L covering Construction Details shall apply.

4. METHOD OF MEASUREMENT. The section of the specifications for Item 11L covering Method of Measurement shall apply.

5. BASIS OF PAYMENT. The section of the specifications for Item 11L covering Basis of Payment shall apply. The cost of bituminous paving shall be included in the price bid for this Item.

ITEM 11P—ROUND CORRUGATED METAL PIPE—PAVED INVERT

1. DESCRIPTION. Under this item, the Contractor shall furnish and place bituminous-coated, galvanized, corrugated metal pipe with a paved invert, of the size and gage indicated on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. The section of the specifications for Item 11 covering Materials shall apply.

3. CONSTRUCTION DETAILS. The section of the specifications for Item 11 covering Construction Details shall apply.

4. METHOD OF MEASUREMENT. The section of the specifications for Item 11 covering Method of Measurement shall apply.

5. BASIS OF PAYMENT. The section of the specifications for Item 11 covering Basis of Payment shall apply. The cost of bituminous paving shall be included in the price bid for this item.

ITEM 11S—ELONGATED CORRUGATED METAL PIPE

1. DESCRIPTION. Under this item, the Contractor shall furnish and place bituminous-coated, elongated corrugated metal pipe of the size and gage indicated on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. The section of the specifications for Item 11 covering Materials shall apply.

3. CONSTRUCTION DETAILS. The section of the specifications for Item 11 covering Construction Details shall apply with the following addition. The wire struts shall be horizontal during bedding and backfilling of the pipe, in accordance with the plans. Any pipe with broken wire struts shall be rejected unless such struts are replaced, with the 5% elongation maintained to the satisfaction of the Engineer. The wire struts shall be left intact until the fill is completed and then removed when and as ordered by the Engineer.

4. METHOD OF MEASUREMENT. The section of the specifications for Item 11 covering Method of Measurement shall apply.

5. BASIS OF PAYMENT. The section of the specifications for Item 11 covering Basis of Payment shall apply. The cost of furnishing and removing wire struts shall be included in the price bid for this item.

ITEM 11SP—ELONGATED CORRUGATED METAL PIPE—PAVED INVERT

1. DESCRIPTION. Under this item, the Contractor shall furnish and place bituminous coated, paved invert, elongated, galvanized corrugated metal pipe, of the size and gage indicated on the plans and in the itemized proposal or as ordered by the Engineer.

2. MATERIALS. The section of the specifications for Item 11 covering materials shall apply.

3. CONSTRUCTION DETAILS. The section of the specifications for Item 11S covering construction details shall apply.

4. METHOD OF MEASUREMENT. The section of the specifications for Item 11 covering method of measurement shall apply.

5. BASIS OF PAYMENT. The section of the specifications for Item 11P covering basis of payment shall apply. The cost of furnishing and removing the wire struts shall be included in the price bid for this item.

ITEM 12—CORRUGATED STRUCTURAL PLATE PIPE—ROUND

1. DESCRIPTION. Under this item the Contractor shall furnish and place galvanized, corrugated structural plate pipe, of the size and gage (or gages) indicated on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. All structural plate and accessories shall comply with the requirements of M23AP, Corrugated Structural Plate for Pipe and Pipe Arches.

3. CONSTRUCTION DETAILS. All pipe shall be assembled and handled in accordance with the manufacturer's instructions, except as modified herein, on the plans or by the Engineer, in writing.

Plates shall be assembled to form a circular cross-section with joints staggered such that not more than three (3) plates come together at any one point. All nuts shall be tightened to at least 150 but not more than 200 foot-pounds of torque before filling and backfilling are commenced.

The pipe shall be placed in accordance with the requirements shown on the Standard Structure Sheet unless other special construction methods are called for on the plans or in the special provisions. Filling and backfilling shall be done in accordance with the details shown on the Standard Structure Sheet and shall conform with the general specifications for "m. Filling and Backfilling at Structures, Culverts and Pipes" of Section 8b.

Movement of construction equipment and all other vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk. Any pipe, which in the judgment of the Engineer is damaged or disturbed through any cause, shall be replaced as directed by the Engineer at the expense of the Contractor and at no cost to the County.

4. METHOD OF MEASUREMENT. The section of the specifications for Item 11 covering method of measurement shall apply.

5. BASIS OF PAYMENT. The section of the specifications for Item 11 covering basis of payment shall apply.

ITEM 12A—CORRUGATED STRUCTURAL PLATE PIPE—ARCH

1. DESCRIPTION. Under this item, the Contractor shall furnish and place galvanized, corrugated structural plate pipe-arches of the dimensions and gage (or gages) shown on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. The section of the specifications for Item 12 covering materials shall apply.

3. CONSTRUCTION DETAILS. All pipe-arches shall be assembled and handled in accordance with the manufacturer's instructions, except as modified herein, on the plans, or by the Engineer in writing.

Plates shall be assembled to form the pipe-arch cross-section as commonly defined by the manufacturers of this product. Joints shall be staggered such that not more than three (3) plates come together at any one point. All nuts shall be tightened to at least 150 but not more than 200 foot-pounds of torque before filling and backfilling are commenced.

The pipe-arch shall be placed in accordance with the requirements shown on the Standard Structure Sheet unless other special construction methods are called for on the plans or in the proposal. Filling and backfilling shall be done in accordance with the details shown on the Standard Structure Sheet and shall conform with the general specifications for "m. Filling and Backfilling at Structures, Culverts and Pipes" of Section 8b.

Movement of construction equipment and all other vehicles and loads over and adjacent to any pipe-arch shall be done at the Contractor's risk. Any pipe-arch which, in the judgment of the Engineer, is damaged or disturbed through any cause shall be replaced as directed by

the Engineer at the expense of the Contractor and at no cost to the County.

4. METHOD OF MEASUREMENT. The section of the specifications for Item 11 covering method of measurement shall apply.

5. BASIS OF PAYMENT. The section of the specifications for Item 11 covering basis of payment shall apply.

ITEM 12E—ELONGATED CORRUGATED STRUCTURAL PLATE PIPE

1. DESCRIPTION. Under this item, the Contractor shall furnish and place galvanized, elongated corrugated structural plate pipe, of the size and gage (or gages) indicated on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. The section of the specifications for Item 12 covering materials shall apply.

3. CONSTRUCTION DETAILS. The section of the specifications for Item 12 covering construction details shall apply with the following addition. The pipe shall also be field strutted when and as specified on the plans and in the proposal. Field strutting shall constitute the installation of structurally sound timber sills, compression caps and struts of the sizes specified in accordance with the plans. Compression caps shall be straight grain soft wood, preferably pine, and free from knots. Sills and struts shall be a hard wood. The strutting system of caps, sills and struts shall be left intact until the fill is completed and then removed when and as ordered by the Engineer.

4. METHOD OF MEASUREMENT. The section of the specifications for Item 11 covering method of measurement shall apply.

5. BASIS OF PAYMENT. The section of the specifications for Item 11 covering basis of payment shall apply. The cost of field strutting and the removal thereof shall be included in the price bid for this item.

ITEM 12U—CORRUGATED STRUCTURAL PLATE UNDERPASS

1. DESCRIPTION. Under this item, the Contractor shall furnish and place galvanized corrugated structural plate underpass, of the dimensions and gage (or gages) and details shown on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. The section of the specifications for Item 12 covering materials shall apply.

3. CONSTRUCTION DETAILS. The section of the specifications for Item 12A covering construction details shall apply except as modified on the plans or in the itemized proposal.

4. METHOD OF MEASUREMENT. The section of the specifications for Item 11 covering method of measurement shall apply.

5. BASIS OF PAYMENT. The section of the specifications for Item 11 covering basis of payment shall apply.

ITEM 13—CAST IRON PIPE

1. DESCRIPTION. Under this item, the Contractor shall furnish and place smooth bore pipe for culverts, drains and other necessary uses, of the sizes indicated. It shall be laid to the line and grade shown on the plans and shall have a full, firm, even bearing.

2. MATERIALS. Cast iron pipe shall conform to the specifications for M24 Cast Iron Pipe.

3. CONSTRUCTION DETAILS. The pipe shall be placed in accordance with the requirements shown on the Standard Structure Sheet unless other special construction methods are called for on the plans or in the proposal.

The joints shall be formed by caulking into the hubs a gasket of jute or oakum and then filling with mortar composed of equal parts of M1, Portland Cement and M3A, Mortar Sand or at the Contractor's option, a preformed or poured caulking compound of a type approved by the Engineer may be used, except that joints need not be caulked for pipe having approved locked joints.

Filling and backfilling shall be done in accordance with the details shown on the Standard Structure Sheet and shall conform with "m. Filling and Backfilling at Structures, Culverts and Pipes" of Section 8b.

Movement of construction equipment and all other vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk. Any pipe, which in the judgment of the Engineer is damaged or disturbed through any cause, shall be replaced as directed by the Engineer, at the expense of the Contractor and at no cost to the County.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe furnished and incorporated in the work in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that the excavation necessary will be paid for under the Item, Trench and Culvert Excavation and granular bedding or backfill material, when required, under the appropriate item.

The cost of adding water shall be included in the price bid, unless Items 1W and 1WA are included in the proposal.

ITEM 14—REINFORCED CONCRETE PIPE CLASS IV
ITEM 14R—REINFORCED CONCRETE PIPE CLASS III
ITEM 14X—REINFORCED CONCRETE PIPE CLASS V

1. DESCRIPTION. Under these items the Contractor shall furnish and place reinforced concrete pipe of the size and class shown on the plans and in the itemized proposal, or as ordered by the Engineer.

2. MATERIALS. Pipe shall conform to the requirements of M25A—Reinforced Concrete Pipe, Class III, IV and V. Pipe which is defective from any cause, including damage during handling, shall be unacceptable for installation and shall be replaced at no cost to the County as directed by the Engineer.

3. CONSTRUCTION DETAILS. (a) General Requirements. Pipe shall be placed in accordance with the requirements shown on the Standard Structure Sheet unless special methods are called for on the plans or in the itemized proposal.

All pipe shall be laid true to line and grade and shall have a full, firm and even bearing. Pipe laying shall begin at the down-grade end and progress in the up-grade direction. Pipe with bell and spigot type joints shall be laid with the bells up-grade.

Bedding, filling and backfilling shall be in accordance with "m. Filling and Backfilling at Structures, Culverts and Pipes" of Section 8b.

Movement of construction equipment and all other vehicles and loads over and adjacent to any pipe shall be done at the Contractor's risk. When determined by the Engineer, any pipe that is damaged or disturbed through any cause, shall be replaced as directed by the Engineer, at the expense of the Contractor and at no cost to the County.

(b) Joints shall be sealed with flexible water-tight, elastomeric gaskets or approved bituminous or plastic sealers. Bituminous or plastic sealants shall be applied at the time that pipe is being laid to line and grade. Such sealants shall be applied consistent with the sealant manufacturer's application instructions so that the joint is completely filled with sealant. When pipe is of such design that a gap of greater than 3/8 of an inch would be left when sections are laid together, based upon the measurement of separation in the joint at the inner surface of the pipe barrel, oakum shall be used as a joint filler in conjunction with the bituminous or plastic sealant unless the Department's approved list for such sealants indicates otherwise. The exterior gap between the barrel and the bell in a bell and spigot pipe joint is not required to be filled with either oakum and/or a sealant. When joints are sealed with approved bituminous sealants, the mating surfaces of the pipe joint shall be wiped clean and dry before applying the bituminous sealer. The oakum shall be a closely twisted hemp or jute gasket of suitable diameter to fill the annular space when caulked and in one piece of sufficient length to pass around the pipe and lap at the top. Only the bituminous and plastic sealers acceptable to the County shall be used. No cement mortar shall be applied to joints in any of the pipe.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe incorporated in the work in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, with the following exceptions: Excavation will be paid for under Trench and Culvert Excavation and granular fill and backfill, where required, will be paid for under Selected Granular Fill. The cost of adding water for compaction of the granular fill and backfill shall be included in the price bid, unless Items 1W and 1WA are included in the proposal. Where a concrete cradle is specified or ordered, payment for the cradle will be included under the respective concrete item.

ITEM 14ES—REINFORCED CONCRETE PIPE END SECTIONS

1. DESCRIPTION. Under this item, the Contractor shall furnish and place reinforced concrete end sections to be attached to the inlet and/or outlet ends of culvert installations at the locations shown on the plans or as ordered by the Engineer.

2. MATERIALS. The end sections shall be precast units of the sizes and dimensions shown on the appropriate Standard Structure Sheet. The applicable provisions of Item 14 and M25A, Reinforced Concrete Pipe shall apply except as modified on the Standard Structure Sheet.

3. CONSTRUCTION DETAILS. The applicable provisions of Construction Details for Item 14 shall apply.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of units of each size or diameter furnished and incorporated into the work in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that the excavation necessary will be paid for under the item, Trench and Culvert Excavation and granular material when required under an appropriate item. The cost of adding water for compaction shall be included in the price bid unless Items 1W and 1WA are included in the proposal.

ITEM 14P—REINFORCED CONCRETE CATTLE PASS

1. DESCRIPTION. Under this item the Contractor shall furnish and place reinforced concrete cattle passes as shown on the Standard Structure Sheet and at locations shown on the plans.
The provisions of Item 14 shall apply except no strength test will be required.
Sections shall have a minimum length of four feet.
The two cages of reinforcement shall consist of 2" Transverse x 8" Longitudinal spacing of No. 00 and No. 4 gages, respectively.

2. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet (laying length) of pipe incorporated in the work in accordance with the plans and specifications.

3. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that all excavation in connection therewith will be paid for under the item, Trench and Culvert Excavation and granular material, when required, under its appropriate item. The cost of adding water for compaction purposes shall be included in the price bid unless Items 1W and 1WA are included in the proposal.

ITEM 14WT—REINFORCED HORIZONTAL ELLIPTICAL CONCRETE PIPE CLASS HE-II
ITEM 14WR—REINFORCED HORIZONTAL ELLIPTICAL CONCRETE PIPE CLASS HE-III
ITEM 14W—REINFORCED HORIZONTAL ELLIPTICAL CONCRETE PIPE CLASS HE-IV

1. DESCRIPTION. Under these items, the Contractor shall furnish and install reinforced horizontal elliptical concrete pipe of the size and class shown on the plans and in the itemized proposal or as ordered by the Engineer. Elliptical pipe shall be designated by its equivalent round pipe diameter.

2. MATERIALS. Pipe shall conform to the requirements of M25E, Reinforced Elliptical Concrete Pipe, Classes HE-II, HE-III, HE-IV. Pipe which is defective for any cause, including damage during handling, shall be unacceptable for installation and shall be replaced at no cost to the County, as directed by the Engineer.

3. CONSTRUCTION DETAILS, METHOD OF MEASUREMENT, BASIS OF PAYMENT. The corresponding provisions for Item 14 shall apply.

ITEM 14WV—REINFORCED VERTICAL ELLIPTICAL CONCRETE PIPE CLASS VE-IV
ITEM 14WVX—REINFORCED VERTICAL ELLIPTICAL CONCRETE PIPE CLASS VE-V
ITEM 14WVZ—REINFORCED VERTICAL ELLIPTICAL CONCRETE PIPE CLASS VE-VI

1. DESCRIPTION. Under these items the Contractor shall furnish and install reinforced vertical elliptical concrete pipe of the size and class shown on the plans and in the itemized

proposal, or as ordered by the Engineer. Elliptical pipe shall be designated by its equivalent round pipe diameter.

2. MATERIALS. Pipe shall conform to the requirements of M25E, Reinforced Elliptical Concrete Pipe, Classes VE-IV, VE-V, VE-VI. Pipe which is defective for any cause, including damage during handling, shall be unacceptable for installation and shall be replaced at no cost to the County, as directed by the Engineer.

ITEM 15-1—PORTLAND CEMENT, TYPE 1
ITEM 15-1A—PORTLAND CEMENT, TYPE 1A
ITEM 15-2—PORTLAND CEMENT, TYPE 2
ITEM 15-2A—PORTLAND CEMENT, TYPE 2A
ITEM 15-6—PORTLAND CEMENT, TYPE 6
ITEM 15-6A—PORTLAND CEMENT, TYPE 6A

1. DESCRIPTION. Under these items the Contractor shall furnish Portland Cement of the type or types indicated on the plans, in the proposal, or as ordered by the Engineer.

2. MATERIALS. Portland Cement shall conform to the requirements of "M1, Portland Cement" for the type specified.

3. METHOD OF PAYMENT. No direct payment will be made for cement under this item. The cost of such cement shall be included in the cost of the item in which the cement is used.

ITEM 15N—NATURAL CEMENT, TYPE N

1. DESCRIPTION. Under this item the Contractor shall furnish Natural Cement conforming to the requirements of "M2 Natural Cement".

2. METHOD OF PAYMENT. No direct payment will be made for cement under this item. The cost of such cement shall be included in the cost of the item in which the cement is used.

ITEM 15RH—RAPID HARDENING HYDRAULIC CEMENT

1. DESCRIPTION. Under this item the Contractor shall furnish a rapid hardening hydraulic cement meeting the requirements for M2RH, Rapid Hardening Hydraulic Cement.

2. MATERIAL AND CONSTRUCTION DETAILS. The material may be used in a semi-fluid state, for vertical installations, or in a plastic state, for horizontal installations.

3. METHOD OF PAYMENT. No direct payment will be made for cement under this item. The cost of such cement shall be included in the cost of the item in which the cement is used.

ITEM 16—FURNISHING AND APPLYING CALCIUM CHLORIDE

1. DESCRIPTION. Under this item the Contractor shall furnish and apply Calcium Chloride as shown on the plans or ordered by the Engineer.

2. MATERIALS. Calcium Chloride shall be delivered in water-proof paper bags of an approved type and shall meet the requirements of the specifications for M32, Calcium Chloride.

3. CONSTRUCTION DETAILS. The Contractor shall treat the highway with Calcium Chloride at such locations and at such times as the Engineer may direct. It shall be applied on the dampened surface by means of an approved lime spreader or equal. The surface may be dampened by thoroughly sprinkling with an approved sprinkler or other approved method

4. METHOD OF MEASUREMENT. The quantity of Calcium Chloride paid for under this item shall be the number of tons furnished and applied as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price bid per ton shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that furnishing water equipment and applying water will be paid for under their respective items.

ITEM 17—FURNISHING AND APPLYING SODIUM CHLORIDE (Rock Salt)

The specifications for Item 16—Furnishing and Applying Calcium Chloride shall apply in all respects except that the material shall be Sodium Chloride (rock salt) meeting the requirements of the specifications for M33.

ITEMS 18 AND 20—STRUCTURAL CONCRETE
ITEM 18—CLASS A—CONCRETE FOR STRUCTURES
ITEM 20—CLASS B—CONCRETE FOR STRUCTURES

1. DESCRIPTION. Under these items, the Contractor shall place concrete as indicated on the plans and in accordance with the specifications.

2. MATERIALS. Details of the materials permitted in these items are shown in the Table "Composition of Concrete Items" under Section 7, "Portland Cement Concrete—General Specifications".

For each particular project the plans or proposal will indicate the types of cements and kinds of aggregates which shall be used in that project.

Concrete for Item 20 may be proportioned as either Class A or Class B concrete at the Contractor's option. Alternate deliveries of different classes of concrete for a given placement will not be permitted. This materials option does not affect in any way the basis of payment for these items.

Class A and Class B Concrete shall be proportioned as specified in the Portland Cement Concrete—General Specifications.

3. CONSTRUCTION DETAILS. Concrete placed under these items shall comply in all respects to the requirements given under PART II, "Portland Cement Concrete—General Specifications" and under the subdivision thereof designated as "Structural Concrete".

4. METHOD OF MEASUREMENT. Payment for each item will be made, at the unit price bid for that item, for the number of cubic yards within the neat lines of the structure as shown on the plans or as revised by authority of the Engineer. In computing the volume of concrete for payment, no deductions will be made for the volume of joint material, embedded metal reinforcement, structural shapes, the tops of piles, or pipe with an end area of less than one square foot.

5. BASIS OF PAYMENT. The unit price bid, per cubic yard, for each item shall include the cost of furnishing all labor, materials and equipment necessary to complete the concrete work as shown on the plans or called for in the specifications except Reinforcement will be paid for separately under its appropriate item. Unless otherwise provided the unit price bid for each item shall include the cost of furnishing and placing copper flashing or other metal strips, flexible water stops, asbestos sheet packing, pipe drains, bituminous material, water for wetting, joint materials, felt, tar paper, joint sealing compounds, joint fillers and concrete curing materials.

ITEM 18M—CLASS A CONCRETE FOR STRUCTURES
(Monolithic Bridge Slabs with Integral Wearing Surfaces)

1. DESCRIPTION. The provisions of Item 18 shall apply except as hereinafter modified.

The Contractor shall place the concrete, paving between the curbs, as indicated on the plans and in accordance with the specifications. The integral wearing surface shall be finished as specified in Section 7, Structural Concrete, under the heading "Finishing Integral Wearing Surfaces on Bridge Slabs."

2. MATERIALS. The provisions of Item 18 shall apply except that coarse aggregate may be either Type A or B Crushed Stone or Crushed Gravel.

Coarse aggregate shall show no more than 3 percent loss when subjected to the 25 cycle freeze-thaw test.

3. CONSTRUCTION DETAILS. The provisions of Item 18 shall apply.

4. METHOD OF MEASUREMENT. Payment will be made for the number of cubic yards of concrete placed and finished within the payment lines indicated on the plans or as revised by the Engineer. In computing the volume of concrete for payment, no deductions will be made for the volume of joint material, embedded structural shapes or reinforcement.

5. BASIS OF PAYMENT. The provisions of Item 18 shall apply except that the cost of screed supports and other brackets or braces necessary to support finishing machines shall be included in the unit price bid for this item.

ITEM 18PI—CONCRETE PAVEMENT FOR CORRUGATED STRUCTURAL PLATE PIPE AND PIPE ARCHES

1. DESCRIPTION. Under this item the Contractor shall furnish and place a portland cement concrete pavement over the inverts of corrugated structural plate pipe where and as indicated on the plans or in the proposal, so as to provide a uniform smooth interior.

2. MATERIALS. Concrete placed under this item shall conform to the requirements of Section 7. Materials used in concrete shall comply with the requirements of Section 6. For each project the plans or proposal will indicate the types of cements and kinds of aggregates which shall be used in that project. Cement shall be a mixture of Portland Cement Type 2 and Natural cement, or Type 2 only.

Materials shall be proportioned by weight in accordance with the following table:

Specific gravity of aggregate	2.60	2.65	2.70	2.75	2.80	2.85	2.90
Pounds fine aggregate per bag of cement*	190	194	197	201	204	208	212
Pounds coarse aggregate per bag of cement	223	228	232	236	241	245	249

* Includes 3% allowance for moisture content.

Coarse aggregate shall consist of 70 to 80 per cent of No. 1 size and 30 to 20 per cent of No. 1A size.

3. CONSTRUCTION DETAILS. Pavement shall not be placed until after the embankment has been completed over the pipe, all strutting has been removed and settlement has been completed to the satisfaction of the Engineer.

The bottom 25 per cent of the inside circumference for round or elongated pipe, the bottom 30 per cent of the inside periphery for arch spans of 10 ft.-3 in. and shorter and the bottom 35 per cent of the inside periphery for arch spans longer than 10 ft.-3 in. shall be paved unless otherwise ordered by the Engineer.

The Contractor shall schedule and conduct his diversion of water operations prior to and during the placement of pavement in a manner satisfactory to the Engineer. When pavement is placed, the surfaces to be in contact with concrete shall be clean and dry to the satisfaction of the Engineer.

Concrete shall be placed at the slump ordered by the Engineer to allow the surface to be shaped and consolidated as required. However, concrete with a slump in excess of 2 inches will be rejected. Minimum cover over corrugations shall be 2 inches.

Pavement shall be reinforced with the steel fabric reinforcement conforming to the specifications for Item 25F, Steel Fabric Reinforcement. The reinforcement shall be placed on the crests of corrugations, and fastened to the pipe or pipe-arch at not more than two-foot centers by welding in a manner acceptable to the Engineer. All laps shall be six inches minimum. The reinforcement shall be four inches minimum clear from the edges of all concrete. Reinforcement shall be attached to the culvert wall in a manner acceptable to the Engineer.

Pavement shall be given a smooth wood float finish acceptable to the Engineer. Within 18 hours after completion of the finishing, the surface shall be coated with asphalt emulsion in compliance with the specifications for Item 70B, Asphalt Emulsion at the rate of 0.1 to 0.2 gallons per square yard or as ordered by the Engineer. Flow of water over the paving will not be allowed until after the paving has been cured for a minimum of 48 hours.

4. METHOD OF MEASUREMENT. The quantity of pipe pavement to be paid for shall be the number of square feet installed as shown on the plans or as ordered by the Engineer. The area shall be computed as the total area of pipe periphery covered, measured at the crests of corrugations.

5. BASIS OF PAYMENT. The unit price bid shall include the cost of all labor, materials and equipment necessary to complete the work including asphalt emulsion, except for steel fabric reinforcing which will be paid for under its respective item.

ITEM 24A—BAGGED SCREENED AGGREGATE

1. DESCRIPTION. Under this item the Contractor shall furnish and place bagged screened aggregate in back of structures as shown on the plans.

2. MATERIALS. Screened aggregate shall be No. 2 or No. 3 size or a mixture of the two sizes, and shall be placed in heavy cloth, burlap or mesh bags, each bag having the capacity of not less than one (1) cubic foot nor more than two cubic feet. Screened aggregate shall be any type acceptable to the Engineer except that shales will not be permitted.

3. CONSTRUCTION DETAILS. Bags may be stitched or sewed closed or left open.

a. Bags that are stitched or sewed closed will be filled to approximately 75-80% capacity and shall be laid in the flat position.

b. Bags with one end left open will be filled to approximately one-half capacity and shall have the open end folded under and laid in the flat position.

Bags of screened aggregate shall be laid dry against the back of the structure and shall provide a thickness not less than that shown on the plans.

4. METHOD OF MEASUREMENT. The quantity of bagged screened aggregate to be paid for under this item shall be the amount of bagged screened aggregate placed, measured in cubic yards in its final position within the payment limit lines shown on the plans.

5. BASIS OF PAYMENT. The unit price bid per cubic yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 25—METAL REINFORCEMENT FOR CONCRETE PAVEMENT

1. DESCRIPTION. Under this item the Contractor shall furnish and place sheets of steel fabric, or at the option of the Contractor assembled steel bar mats of the type shown on the Standard Structure Sheets for use in pavement lanes of ten (10) feet or more in width.

2. MATERIALS. The reinforcement shall meet the requirements given under M17A Bar Reinforcement for Cement Concrete Pavement or M17AB Wire Fabric Concrete Reinforcement.

3. CONSTRUCTION DETAILS. The reinforcement for cement concrete pavement shall, when embedded be free from mill scale, grease, injurious rust, dirt or other foreign substances. All such reinforcement shall be protected from moisture by placing in warehouses or other acceptable places.

All reinforcement shall be approved by the Engineer as to condition immediately before being placed.

All steel fabric shall be delivered in flat sheets of the size shown on the plans or the applicable Standard Structure Sheets.

4. METHOD OF MEASUREMENT. The quantity of metal reinforcement for which the Contractor will be paid will be the number of square yards of pavement reinforced in accordance with the details shown on the Standard Structure Sheets and in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid per square yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 25F—STEEL FABRIC REINFORCEMENT

1. DESCRIPTION. Under this item the Contractor shall furnish and place sheets of steel fabric as shown on the plans and in accordance with the specifications.

2. MATERIALS. Unless otherwise shown on the plans, the material furnished under this item shall consist of No. 6 gauge wire at 6" centers transversely and longitudinally which shall meet the requirements of M17AB, Wire Fabric Concrete Reinforcement as listed in Part II, Section 6.

3. CONSTRUCTION DETAILS. All fabric shall be lapped at least six inches at joints. For concrete pavement all steel fabric shall be delivered in flat sheets of widths that fit the concrete pavement slabs shown on the plans. All outside members shall be not more than 3 inches from edges of slabs.

4. METHOD OF MEASUREMENT. Payment will be made for the number of square yards of area reinforced in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid per square yard for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 25U—METAL REINFORCEMENT FOR CONCRETE PAVEMENT

The general specifications for Item 25 shall apply except that the reinforcement furnished shall be in accordance with the Standard Structure Sheet, for use in pavement lanes less than ten (10) feet in width.

ITEM 27—TRANSVERSE JOINT SUPPORTS

1. DESCRIPTION. Under this item the Contractor shall furnish and incorporate in the pavement

at his option, one of the types of transverse joint supports shown on the Standard Structure Sheets or as approved by the Chief Engineer. This item shall include transverse joint supports for construction, contraction and expansion joints. Only one type of joint support shall be used in each contract unless specified otherwise.

2. MATERIALS. Dowels shall conform to the requirements of ASTM Designation: A615 Grade 40 or Grade 60 unless otherwise indicated.

Malleable Iron Castings shall conform to all requirements of M13 Malleable Iron Castings, Grade 35018.

3. CONSTRUCTION DETAILS. The details for placing, securing and maintaining the transverse joint assemblies shall be as given in "Forming Joints" of Section 7, subdivision Pavement Concrete.

Approval of a type of support in no way relieves the Contractor of his responsibility for placing and maintaining joint supports in their proper position.

4. METHOD OF MEASUREMENT. Payment will be made for the number of linear feet of transverse joints incorporated in this work in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary for placing of all joint supports, ties, metal covers, holders, fastenings, stakes, etc. necessary for the proper completion of the work. The cost of expansion joint material will be included in the price bid for concrete pavement.

The following will appear in the proposal when required for the project:

ITEM 27S—TRANSVERSE DOWEL TYPE JOINT SUPPORTS
ITEM 27SX—CORROSION RESISTANT TRANSVERSE DOWEL TYPE JOINT SUPPORTS

ITEM 27C—LONGITUDINAL JOINT TIES (CURBING)

1. DESCRIPTION. Under this item the Contractor shall furnish and incorporate, between the curb and pavement at his option, one of the types of longitudinal joint ties of the design shown on the Standard Structure Sheets. They shall be held rigidly in place during construction, in an approved manner. They shall be of the same type used in Item 27L but as modified for use at curbs and they shall be placed in the same manner and with the same spacing.

2. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of each complete longitudinal joint tie unit placed in accordance with the plans, specifications and orders of the Engineer.

3. BASIS OF PAYMENT. The unit price bid for each unit for this item shall include the cost of furnishing all labor, materials and equipment necessary to properly complete the work.

ITEM 27L—LONGITUDINAL JOINT TIES

1. DESCRIPTION. Under this item the Contractor shall furnish and incorporate in the pavement at his option, one of the types of longitudinal joint ties of the design shown on the Standard Structure Sheets. They shall be held rigidly in place during construction, in an approved manner. Only one type of joint tie shall be used for each contract. Longitudinal joint ties shall conform to one of the currently approved types as indicated on the appropriate Standard Structure Sheet.

Where indicated on the plans or directed by the Engineer, longitudinal joint ties shall be placed in the joint between adjacent slabs of pavement midway in the depth of pavement and spaced three feet four inches apart, or as directed by the Engineer, except that joint ties shall not be placed within twelve inches of the end of the pavement slab.

In order to accomplish the location of Longitudinal Joint Ties without interfering with the form pin brackets, placement holes may be drilled non-symmetrically in the form length, or the middle hole only may be placed off-center, resulting in a slight variation of uniform spacing.

2. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of each complete longitudinal joint tie unit placed in accordance with the plans and specifications.

3. BASIS OF PAYMENT. The unit price bid for each unit for this item shall include the cost of furnishing all labor, materials and equipment necessary to properly complete the work.

The following will appear in the proposal when required for the project:

ITEM 27X—SPECIAL LONGITUDINAL JOINT TIES
ITEM 27Y—GROUT TYPE LONGITUDINAL JOINT TIES

ITEM 28—BAR REINFORCEMENT FOR STRUCTURES

1. DESCRIPTION. Under this item the Contractor shall furnish and place steel bar reinforcement as shown on the plans and in accordance with the specifications.

2. MATERIALS. Reinforcement shall be Grade 40 meeting the requirements given under M17 - BAR REINFORCEMENT FOR CEMENT CONCRETE in Part II.

Orders. Before placing orders for materials, the Contractor shall carefully check all bar lists and shall assume full responsibility for their accuracy. The additional costs in fabrication or erection necessary to rectify any errors or omissions in the bar lists shall be at the Contractor's expense.

No changes in the bar list shall be made by the Contractor unless approved by the Chief Engineer.

As soon as an order for material is placed by the Contractor, two complete copies of the order shall be furnished by the Contractor to the laboratory; all orders shall show the contract number and names of the manufacturers, the name of the structure for which the material is intended, and shall state that the material is subject to the requirements of the Suffolk County specifications. To each order shall be attached a complete copy of that part of the specifications which applies to the materials ordered thereby.

The acceptance at any time of any materials shall not be a bar to its future rejection if subsequently found to be defective or inferior in quality or uniformity to the material specified.

3. CONSTRUCTION DETAILS. Bending. When bars are heated for bending, they shall not be heated to a higher temperature than that producing a dark cherry red color. Only competent men shall be employed for cutting and bending, and proper appliances shall be provided for such work.

The reinforcement shall be bent to the shapes shown on the plans. Unless otherwise shown on the plans, the radii of bends shall be equal to or greater than three times the diameter of the bar measured from the inside of the bent bar, except for stirrups in which the bends shall be equal to or less than the diameter of the bar.

Placing and Fastening. Steel reinforcement shall be placed in the exact position shown on the plans and held securely during the placing of the concrete. In general all reinforcement shall be placed and securely wired and supported before concrete is placed in any section. All abrupt bends shall be avoided except where one steel member is bent around another. Vertical stirrups shall always pass around the main tension members. All reinforcing steel shall be kept in its proper location by means of approved metal chairs or other approved devices. Chairs or other metal devices in contact with exposed concrete surfaces shall be equipped with snug fitting, high density, polyethylene tips which provide at least 1/4 inch between the metal and any exposed surface. Stainless Steel chairs or stainless steel devices may be used without polyethylene tips and shall meet the requirements of ASTM A276 Type 430.

Splices. All reinforcement shall be furnished in the full lengths indicated upon the plans.

Samples may be taken by the inspector from the ends of full length bars. When this occurs, bars of a length equal to that of the sample plus 30 diameters shall be spliced to those bars from which samples are taken. No other splicing of bars, except where shown on the plans, will be permitted without the written approval of the Chief Engineer.

Splices for bars #11 or smaller, preferably shall be made by placing the bars in contact and wiring them together for the full length of the splice. When spliced bars are not wired together and not in contact, they shall be spaced to provide a minimum clearance of two inches between adjacent bars.

Splices for bars larger than #11 shall be made by arc welding or other types of positive connections. Arc welded splices shall be made in accordance with the requirements for welding of Structural Steel, except that radiographic inspection will not be required. Other types of positive connections shall develop, in tension at least 90% of the specified minimum tensile strength of the reinforcing bar. Proposed methods and details of splices shall be submitted to the Chief Engineer for his approval.

Final Inspection. No concrete shall be placed until the Engineer has inspected the reinforcement for conformance with these specifications. The reinforcement shall be free of excessive mill scale, injurious rust, grease, dirt, mortar or any other foreign substance when the concrete is placed.

Concreting shall not begin until permission is given by the Engineer. All concrete placed in violation of this provision shall be rejected and removed.

4. METHOD OF MEASUREMENT. Payment will be made for the number of pounds of bar reinforcement exclusive of chairs, fastenings and supports, which are incorporated in the work as shown on the plans or as ordered by the Engineer. The cost of furnishing and placing chairs, fastenings and supports shall be included in the price bid for this item. The weight of bar reinforcement will be computed by the Engineer utilizing the unit weight for each size bar given in ASTM Designation A615. If the Engineer allows the substitution of larger bars than have been specified, or splices not shown on the plans or specifically ordered by him, payment will be made only for the amount of steel which would have been required if the specified size and length of bar had been used.

5. BASIS OF PAYMENT. The unit price bid, per pound, for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 28A—SPIRAL BAR SHEAR CONNECTORS

1. DESCRIPTION. Under this item the Contractor shall furnish and weld spiral bar shear connectors to the steel beams as shown on the plans and as specified herein. The welding may be performed either in the field or in the shop.

2. MATERIAL. The spiral bars shall conform to the requirements of M17B, Spiral Bar Shear Connectors and shall be furnished in the diameter shown on the plans. The Contractor will be required to furnish the Chief Engineer two certified copies of the records of the chemical analysis of the steel to be furnished. The spiral bars shall be bent cold to conform to the details shown on the plans and shall not deviate from the dimensions specified for either diameter of spiral or pitch by more than one-half inch plus or minus.

3. CONSTRUCTION DETAILS. The spirals shall be free from excessive rust, scale, rust pits and oil at the time of welding and immediately before the concrete is placed. The beam surface to which the spirals are welded shall be thoroughly cleaned of excessive mill scale, rust, dirt, paint, grease or any other material which might impair the quality of the weld.

The spirals shall be welded to beam flanges as shown on the plans and the end welds of each spiral unit shall not deviate from the plan position by more than one-half inch.

Welding shall conform to the requirements for welding as listed in section b, paragraph 32 of Item 29.

Adequate provision shall be made in the fabrication of structural members to compensate for loss of camber due to welding of the shear connectors.

Spiral bars shall be spliced at locations shown on the plans or approved by the Chief Engineer. The details for splicing spiral bars are indicated on the plans.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of pounds of spiral bar shear connectors, exclusive of weld metal, incorporated in the work as specified or as shown on the plans.

The weight will be computed by the Engineer, using the unit weight given for each bar size as shown in ASTM Designation A615.

5. BASIS OF PAYMENT. The unit price bid, per pound, for this item shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work.

ITEM 28B—STUD SHEAR CONNECTORS

1. DESCRIPTION. Under this item the Contractor shall furnish and weld stud shear connectors to the steel beams as shown on the plans and as specified herein. The welding may be performed either in the shop or in the field.

2. MATERIALS. The studs shall conform to the requirements of M17C, Stud Shear Connectors. The studs shall be furnished in the dimensions shown on the plans.

The Contractor will be required to furnish the Chief Engineer two certified copies of the records of the chemical analysis of the steel to be furnished.

3. CONSTRUCTION DETAILS. The stud shear connectors shall be welded to the steel beams at locations shown on the plans. A maximum variation of one inch from the location shown will be accepted provided the adjacent studs are not closer than 2-1/2 inches center-to-center. The studs shall be free from rust, scale, rust pits and oil at the time of welding and immediately before the concrete is placed. The beam surface to which the studs are welded shall be free of excessive mill scale, rust, dirt, paint, grease or any other material which might impair the quality of the weld.

After the studs have been welded to the beams they shall be inspected visually and shall be given a light blow with a hammer. Any stud which does not have a complete end weld and any stud which does not emit a ringing sound when given a light blow with a hammer, shall be struck and bent 30° in the direction that will place the defective portion of the weld in the greatest tension. If a crack is observed to form in the stud or weld under this test, the stud shall be replaced. Studs bent in testing may be left bent unless otherwise directed by the Engineer.

Adequate provision shall be made in the fabrication of structural members to compensate for loss of camber due to welding of the shear connectors.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of stud shear connectors acceptably attached to the beams as shown on the plans and specifications herein.

5. BASIS OF PAYMENT. The unit price bid, per stud, shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work. If the use

of any stud shear connector requires the payment of a royalty to the manufacturer, the royalty shall be included in the unit price bid for this item.

ITEM 28C—SHEAR CONNECTORS

1. DESCRIPTION. Under this item the Contractor may, at his option, furnish spiral bar shear connectors conforming to the requirements of Item 28A or stud shear connectors conforming to the requirements of Item 28B, except that the requirements for measurement and payment shall be modified as follows:

2. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the length of flange, in feet, to which shear connectors are attached as shown on the plans and in accordance with the specifications, unless the payment length is specifically indicated on the plans.

3. BASIS OF PAYMENT. The unit price bid, per foot, shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work. If the use of any stud shear connector requires the payment of a royalty to the manufacturer, the royalty shall be included in the unit price bid for this item.

ITEM 29—STRUCTURAL STEEL

1. DESCRIPTION. Under this item the Contractor shall furnish and erect structural steel and other metal parts, as shown on the plans and in accordance with the specifications.

2. MATERIALS. All materials paid for under this item shall meet the respective requirements for the various materials as given under Part II, Section 6 of these specifications

Painting. All metal not embedded in concrete shall, unless otherwise provided upon the plans or in the contract, be painted three coats of paint in accordance with the specifications for Painting of Metal Structures as listed in Section 8a.

3. CONSTRUCTION DETAILS.

a. Drawings

(1) Contract Drawings. The drawings which accompany these specifications hereinafter designated as the "Contract Drawings" are not intended to be "Shop" or "Working" drawings.

(2) Shop Drawings Required. The Contractor shall make, as soon as possible after the contract is signed, complete and accurate shop drawings of all structural steel, machinery and other details, and the connections thereof to the masonry.

Any details not sufficiently shown on the contract drawings will be furnished to the Contractor by the Chief Engineer upon request.

All detailing for bridges carrying highways shall be done in accordance with the provisions for design and workmanship in the current American Association of State Highway Officials, "Standard Specifications for Highway Bridges", except as modified on the plans or as modified herein.

All detailing for bridges carrying railroad tracks shall be done in accordance with the provisions for design and workmanship of the current American Railway Engineering Association Specifications for "Steel Railway Bridges", except as modified on the plans or as modified herein.

The computed weight of each shipping unit shall be clearly marked on the shop drawings on which this unit is detailed.

The contract number and name, together with the location in which the work is to be performed shall be clearly indicated on each sheet.

(3) Disagreement of Scale Dimensions. In case of disagreement on any drawing between scale dimensions and figures, the figures shall be followed.

(4) Size of Shop Drawings. Shop drawings shall be neatly drawn in ink or pencil on paper or cloth. Such drawings shall be capable of producing microfilm negatives which will reproduce copies of the original drawing satisfactory to the Department. Drawings shall be cut to a standard size of 22 x 36 inches and arranged in general to conform to the contract drawings. Failure to submit drawings of the required size will be cause for their return without examination. The margin line shall be drawn 1/2 inch from the top, bottom and right hand edges and 2 inches from the left hand edge to permit binding. The working space on these drawings will therefore be 21 inches by 33-1/2 inches. A space 3 inches by 11 inches, the 11-inch dimension being parallel to the length of the sheet, shall be reserved in the lower right hand corner for title and approval signature. The sheets shall be arranged so that as far as possible the notes will appear above each other near the right edge of the sheet.

These drawings shall be arranged in systematic order and numbered consecutively in the lower right hand corner.

(5) Errors on Contract Drawings. The Contractor shall carefully verify and shall become responsible for the correctness of all other than the principal controlling dimensions shown on the contract drawings, and shall call the attention of the Chief Engineer to any errors or discrepancies that he may discover therein. He shall have no claim for damages which may result from following an error in any other than the principal controlling dimensions on these drawings.

(6) Approval of Shop Drawings. Shop drawings for beam bridges not requiring fabrication need not be submitted for approval. When the shop drawings prepared by the Contractor as above specified (except those for beam bridges not requiring fabrication) are completed, triplicate blueprints shall be submitted to the Chief Engineer, who will indicate thereon such corrections as may be necessary to secure the completion of the contract in accordance with the intent of the contract drawings and specifications.

On contracts involving one or more railroads, the Contractor shall furnish each railroad with duplicate blueprints at the same time that triplicate blueprints are submitted to the Chief Engineer.

One set of blueprints, with desired corrections, indicated thereon in colored crayon, will be returned to the Contractor. When the revision has been completed to the satisfaction of the Chief Engineer, the tracings shall be forwarded to him for his written approval, after which they will be returned to the Contractor who shall carry out the construction in strict accordance therewith and who shall make no further changes therein except upon written instructions from the Chief Engineer. The approval above referred to shall not, however, be held in any case to relieve the Contractor from the responsibility for errors that may exist in the shop drawings.

(7) Commencement of Shop Work. No shop work shall be done until after the shop drawings have been approved.

(8) Ordering of Materials. The Contractor shall bear all costs or damages which may result from the ordering of any materials prior to the approval of the shop drawings.

(9) Detention of Drawings. The Chief Engineer shall be allowed, for the examination of a set of more than five shop drawings, two working days for each drawing in the set. If there are five or less shop drawings in a set, the Chief Engineer shall be allowed ten working days.

If the shop drawings are detained for examination for a longer period than above stated, such detention will be taken into account in considering any application of the Contractor for an extension of the date of completion of the contract.

(10) Disposal of Tracings. After the completion of the contract and before the acceptance thereof, the Contractor shall deliver to the Chief Engineer all approved tracings which shall thereafter remain the property of the County.

(11) Reproductions of Drawings. The Contractor shall distribute prints of the approved shop drawings as described in the following tabulation:

2—Sets to the Chief Engineer
2—Sets to the General Contractor
2—Sets to the Designated Inspection Agency

One (1) set of reproducible tracings, on vellum, shall be sent to the Chief Engineer.

For every Railroad or Public Agency involved in the contract, the Contractor shall furnish three (3) additional sets of prints, on paper, and in addition, one (1) reproducible set of approved shop drawings made on mylar base material by an acceptable process if required by the Department.

The prints and reproducibles above specified shall be furnished without charge. Any other prints and reproducibles which may be required shall be furnished by the Contractor at cost.

(12) Cost of Shop Drawings, Prints and Reproducibles. The cost of all shop drawings, prints and reproducibles shall be included in the unit price bid for the payment item requiring the drawings.

(13) Field Splices in Stringers and Girders. When the plans do not detail a bolted or welded field splice at a specific location in stringers and girders which cannot be fabricated, transported or erected in a single piece, the Contractor will be permitted to introduce splices at a location or locations of his choice provided these splices meet the following requirements:

1. The Contractor will have the option of providing either welded or bolted splices unless welded splices are specifically required by the Contract Documents.

2. When the Contractor informs the Chief Engineer of his selection for proposed splice locations, the County will supply the maximum and minimum shear and moment design values at each location. The Contractor shall design the splice and

submit his calculations and details to the Chief Engineer for approval. The design shall be based upon the provisions of the current American Association of State Highway Officials (AASHO) Specifications for Highway Bridges.

3. Fill plates will not be permitted. Web and flange shop butt welds may be moved to extend the thicker plate so that bolted connections are made in materials of the same thickness.

4. The Chief Engineer reserves the right to order, at no extra cost, a welded splice at any location where a bolted splice design will require high strength bolts in excess of six inches long. Welded field splices in stringers and girders will be made by complete penetration butt welds which shall be radiographed as required by the Specifications.

5. Bolted designs shall use ASTM A325 high strength bolts only. The design shall be based upon the allowable shear for a friction-type connection. Bolt length shall be such that threads are excluded from shear planes in the connection.

6. When the Contract Plans do not detail a bolted splice at a specific location, no payment will be made for splice plates, bolts, nuts, washers or any increase in thickness of webs or flanges made necessary by the bolted splice requested by the Contractor.

b. Fabrication

The New York State Specification for Heat-Curving and Cambering of Rolled Beams and Welded Plate Girders is a part of the Contract Documents for all projects. This specification will be found in the proposal. Whenever adjustments are to be made in the camber or sweep of structural steel by the application of heat, or whenever the Engineer or Inspector has approved the straightening of bent material by the controlled application of heat, the work shall be done as described therein.

Section 3 of that specification entitled "Camber Increase for Dead Load Deflection Caused by Residual Stresses" shall not apply unless the Contract Plans have been prepared to indicate the amount of camber increase designed into the structure because of the provisions of that section.

When the Contract Plans have not been prepared to show camber increases to compensate for dead load deflections caused by residual stresses resulting from Heat-Curving operations, the Contractor will be required to flame cut all flanges of stringers and girders to the required radius when the radius called for is less than 600 feet unless acceptable camber modifications are agreed to prior to shop drawing approval.

(1) Storage of Materials. Structural material shall be stored above the surface of the ground upon platforms, skids, or other supports, and shall be protected as far as practicable from surface deterioration by exposure to conditions producing rust. It shall be kept free from accumulations of dirt, oil or other foreign matter.

(2) Straightening Material. All deformed structural material shall be properly straightened by methods which are noninjurious prior to being laid off, punched or otherwise worked in the shop. Sharp kinks and bends shall be cause for rejection.

(3) Workmanship and Finish. The workmanship and finish shall be first class and equal to the best practice in modern bridge shops. Shearing, chipping, flame cutting and arc-air gauging shall be carefully and accurately done. All flame cut surfaces shall be produced using a mechanically guided torch unless otherwise approved by the Engineer. Flame cut surfaces shall accurately conform to the lines shown on the plans and the surface roughness produced by flame cutting shall not exceed 1,000 microinches. Flame cut surfaces produced by a manually guided torch, when allowed, shall be smoothed by machining, chipping or grinding. Reentrant cuts shall be filleted to a radius of at least 3/4 inch.

When surface roughness is specified in microinches the value specified shall be as defined in the American Standard ASA-B46.1, Surface Texture.

(4) Rivet Holes. When reaming is not required, holes may be punched full size under the following conditions:

a. When the metal has a specified yield point of less than 40,000 psi and a thickness of 3/4 inch or less

b. When the metal has a specified yield point of 40,000 psi or more and a thickness of 5/8 inch or less.

Holes in all other metal shall be sub-punched and reamed, subdrilled and reamed or drilled from the solid.

(5) Punched Holes. Full-size holes shall be one-sixteenth inch larger than the nominal diameter of the rivet. The diameter of the die shall not exceed the diameter of the punch by more than three thirty-seconds inch. Holes must be clean cut, without torn or ragged edges. If any holes must be enlarged to admit the rivets, they shall be reamed.

(6) Accuracy of Punched Holes. The punching of holes shall be so accurately done that, after assembling the component parts of a member, a cylindrical pin 1/8 inch smaller than the nominal diameter of the punched hole may be passed through at least 75 of any group of 100 contiguous holes in the same surface or in like proportion for any group of holes. If this requirement is not fulfilled the badly punched pieces shall be rejected. If any holes will not pass a pin 3/16 inch smaller than the nominal diameter of the punched hole, this shall be cause for rejection.

(7) Drilled Holes. Drilled holes shall be 1/16 inch larger than the nominal diameter of the rivet. Burrs on the outside surfaces shall be removed by a method which leaves the hole free of burrs inside and out. The method should not dish out the metal in the vicinity of the hole.

(8) Sub-Punched and Reamed Holes. Sub-punched and reamed holes for rivets having diameters greater than 3/4 inch shall be punched 3/16 inch smaller than the nominal diameter of the rivet, and for rivets having diameters 3/4 inch or less the holes shall be punched 1/16 inch less than the nominal diameter of the rivet. The punch and die shall have the same relative sizes as specified for full-size punched holes. After punching, the holes shall be reamed to a diameter of the rivet. Burrs resulting from reaming shall be removed as stated in subsection (7) Drilled Holes.

Reaming of rivet holes shall be done with twist drills or with short taper reamers. Reamers preferably shall not be directed by hand. No oil or grease shall be used as a lubricant.

(9) Accuracy of Reamed and Drilled Holes. Holes drilled from the solid shall be accurately placed, perpendicular to the faying surface, cylindrical and shall show no offset between adjacent plies. Holes which are to be reamed shall have been accurately sub-punched or sub-drilled and the assembled parts before reaming shall conform to the requirements specified for (6) Accuracy of Punched Holes.

After reaming, holes shall be perpendicular to the faying surface, and 85 of any group of 100 contiguous holes in the same surface or a like proportion of any group of holes shall show no offset between plies or elongation of the hole greater than 1/32 inch. The remainder of the holes shall not be elongated or show an offset between plies greater than 1/16 inch. No interchange of reamed or drilled parts will be permitted.

(10) Drifting of Holes. The drifting done during assembling shall be only such as to bring the parts into position, and not sufficient to enlarge the holes or distort the metal.

(11) General Reaming. General reaming may be required, in which case a definite provision to this effect will be included elsewhere in the contract.

When general reaming is required, all rivet or bolt holes in main members shall be sub-punched and reamed, or drilled from the solid. This requirement shall not apply to holes in top and bottom chord lateral members, lateral hangers, truss and girder sway bracings, and to the lateral plates, connection angles, etc., connecting these members to the main members of the structure. Connection plates or other parts acting both as main member material and secondary (lateral, sway bracing, etc.) member material shall generally have sub-punched and reamed holes in locations engaging similar holes in main members.

Reaming shall be done after the pieces forming a built member are assembled and firmly bolted together. No interchange of reamed parts will be permitted.

(12) Preparation of Field Connections for Riveting or Bolting. Rivet and bolt holes in all field connections, except those in lateral and sway bracing, shall be sub-punched and reamed or drilled from the solid. This work shall be done with the connecting members assembled, or through a steel template not less than one inch thick. Care shall be exercised so that the finished holes conform to the requirements of the Contract Documents and are aligned so as to insure the proper camber in the completed assembly.

(13) Shop Assembling. No surfaces of metal to be in contact when assembled shall be painted.

The component parts of a built member shall be assembled, drift pinned to prevent lateral movement, and firmly bolted to draw the parts into close contact before reaming, drilling or riveting is begun. Assembled parts shall be taken apart, if necessary, for the removal of burrs and shavings produced by the reaming operation.

The members shall be free from twists, bends or other deformations.

Preparatory to shop riveting full-size punched material, the rivet holes shall be cleared for the admission of the rivets by reaming.

End connection angles, stiffener angles, etc., shall be carefully adjusted to correct location and rigidly bolted, clamped or otherwise firmly held in place until riveted.

Pieces to be connected by rivets or bolts shall not be subject to any welding unless such welding is shown on the plans or ordered by the Engineer.

(14) Match-Marking. Connecting parts assembled in the shop for the purpose of reaming or drilling holes in field connections shall be match-marked, and a diagram showing such marks shall be furnished to the Engineer.

(15) Rivets. The diameters of rivets indicated upon the plans shall be understood to mean their diameters before heating.

Heads of driven rivets shall be of approved shape, concentric with the shanks, true to size, full, neatly formed, free from fins and in full contact with the surface of the member.

(16) Field Rivets. Field rivets, for each size and length, shall be supplied in excess of the actual number to be driven to provide for losses due to misuse, improper driving or other contingencies. Rivets shall be free from furnace scale on the shanks and from fins on the under side of the machine formed heads.

(17) Bolts and Bolted Connections. (a) General. Where the use of bolts is indicated in the Contract Documents, the bolts furnished shall be unfinished bolts (ordinary rough or machine bolts), turned bolts, or high strength bolts, as specified.

(b) Unfinished and Turned Bolts. Unfinished bolts shall be standard bolts with hexagonal heads and nuts. The use of "button" head bolts will not be permitted. Bolts transmitting shear shall be threaded to such a length that not more than one thread will be within the grip of the metal. The bolts shall be of lengths which will extend entirely through their nuts but not more than 1/4 inch beyond them. The diameter of the bolt holes shall be 1/16 inch greater than the diameter of the bolts used.

Holes for turned bolts shall be carefully reamed or drilled and the bolts turned to a driving fit by being given a finishing cut. The threads shall be entirely outside of the holes and the heads and nuts shall be hexagonal. One quarter inch washers shall be used with all turned bolts. Approved nut-locks shall be used on all turned bolts unless permission to the contrary is secured from the Chief Engineer. Washers shall be provided for all bolts passing through slotted holes. Unless otherwise noted, these washers shall completely cover the slotted holes.

(c) Connections Using High Strength Bolts. This specification covers the assembly of structural joints using ASTM Designation A325 high strength carbon steel bolts, or other approved fasteners, tightened to a specified tension. The bolts are used in holes having a nominal diameter slightly larger than the nominal bolt size. The hole size shall not exceed the nominal bolt size by more than 1/16 inch.

1. Bolts, Nuts, Washers and Other Approved Fasteners.

   (a) The bolts, nuts and washers used shall conform to the provisions of ASTM Designation A325.

   (b) Except as provided in paragraph (d) of this section, bolt dimensions shall conform to the current requirements of the American Standards Association for heavy hexagon structural bolts, ASA Standard B18.2. Bolt lengths shall provide for two flat washers on each bolt or beveled washers as required such that the minimum stick-through of the bolt (beyond the nut) is 1/16 inch. Bolt length shall be such that the nut in the fully tightened position does not encounter the thread runout.

   (c) Except as provided in paragraph (d) of this section, nut dimensions shall conform to current requirements of the American Standards Association for heavy semi-finished hexagon nuts. ASA Standard B18.2.

   (d) Other fasteners which meet the chemical compositon requirements of ASTM Specification A325 and which meet the mechanical property requirements of the same specification in full-size tests and which have body diameter and bearing areas under the head and nut, or their equivalent, not less than those provided by a bolt and nut of the same nominal dimensions prescribed by paragraphs 1b and 1c may be used if approved by the Chief Engineer. Such alternate fasteners may differ in other dimensions from those of the specified bolts and nuts.

   (e) Circular washers shall be flat and smooth and their nominal dimensions, except washer thickness shall conform to the current requirements of the American Standards Association (ASA B27.2) for the Type A washers given in Table 1. Washer thickness shall conform to the dimensions given in Table 1.

Beveled washers for American standard beams and channels shall be square or rectangular, shall taper in thickness, and shall conform to the dimensions given in Table 1.
Where necessary, washers may be clipped on one side to a point not closer than 7/8 of the bolt diameter from the center of the washer.

TABLE 1—WASHER DIMENSIONS[a]

	Circular Washers				Square or Rectangular Beveled Washers for American Standard Beams and Channels		
Bolt Size D	Nominal Outside Diameter[b]	Nominal Diameter of Hole	Thickness Min.	Thickness Max.	Minimum Side Dimension	Mean Thickness	Slope or Taper in Thickness
1/2	1 1/16	17/32	.097	.177	1 3/4	5/16	1:6
5/8	1 5/16	21/32	.122	.177	1 3/4	5/16	1:6
3/4	1 15/32	13/16	.122	.177	1 3/4	5/16	1:6
7/8	1 3/4	15/16	.136	.177	1 3/4	5/16	1:6
1	2	1 1/16	.136	.177	1 3/4	5/16	1:6
1 1/8	2 1/4	1 1/4	.136	.177	2 1/4	5/16	1:6
1 1/4	2 1/2	1 3/8	.136	.177	2 1/4	5/16	1:6
1 3/8	2 3/4	1 1/2	.136	.177	2 1/4	5/16	1:6
1 1/2	3	1 5/8	.136	.177	2 1/4	5/16	1:6
1 3/4	3 3/8	1 7/8	.178[c]	.28[c]	—	—	—
2	3 3/4	2 1/8	.178	.28	—	—	—
over 2 to 4 incl.	2D 1/2	D + 1/8	.24[d]	.34[d]	—	—	—

a Dimensions in inches.
b May be exceeded by 1/4 in.
c 3/16 in. nominal.
d 1/4 in. nominal.

2. Bolted Parts

(a) The slope of surfaces of bolted parts in contact with the bolt head and nut shall not exceed 1:20 with respect to a plane normal to the bolt axis. Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible material. Holes may be punched, sub-punched and reamed, or drilled, as required by the applicable code or specification and shall be a nominal diameter not more than 1/16 in. in excess of the nominal bolt diameter.

(b) When assembled, all joint surfaces, including those adjacent to the bolt heads, nuts or washers, shall be free of scale, except tight mill scale, and shall also be free of burrs, dirt and other foreign material that would prevent solid seating of the parts.

(c) Contact surfaces within joints shall be free of oil, paint, lacquer or galvanizing unless otherwise specified.

3. Installation

(a) Bolt Tension. Each bolt shall be tightened to provide, when all bolts in the joint are tight at least the minimum bolt tension shown in Table 2 for the size of bolt used.

TABLE 2—BOLT TENSION

Bolt Size, in inches	Minimum Bolt Tension[a] in Pounds A325 Bolts
1/2	12,050
5/8	19,200
3/4	28,400
7/8	36,050
1	47,250
1 1/8	56,450
1 1/4	71,700
1 3/8	85,450
1 1/2	104,000
1 3/4	———
2	———

[a] Equal to the proof load (length measurement method) given in ASTM A325.

Threaded bolts shall be tightened with properly calibrated wrenches or by the turn-of-nut method. If required because of bolt entering and wrench operation clearances, tightening by either procedure may be done by turning the bolt while the nut is prevented from rotating.
Impact wrenches, if used, shall be of adequate capacity and sufficiently supplied with air to perform the required tightening of each bolt in approximately ten seconds.

(b) Washers. Connections shall be assembled with a hardened washer under the bolt head and nut except when interference-body bolts or similar button head fasteners are specified in the Contract Documents. When a button head fastener is specified the washer may be omitted under the head. Where an outer face of the bolted parts has a slope of more than 1:20 with respect to a plane normal to the bolt axis, a smooth beveled washer shall be used to compensate for the lack of parallelism.

(c) Calibrated Wrench Tightening. When calibrated wrenches are used to provide the bolt tension specified in paragraphs 3(a) their setting shall be such as to induce a bolt tension 5% to 10% in excess of this value. These wrenches shall be calibrated at least once each working day by tightening, in a device capable of indicating actual bolt tension, not less than three typical bolts of each diameter from the bolts to be installed. Power wrenches shall be adjusted to stall or cut-out at the selected tension. If manual torque wrenches are used the torque indication corresponding to the calibrating tension shall be noted and used in the installation of all bolts of the tested lot. Nuts shall be in tightening motion when torque is measured. When using calibrated wrenches to install several bolts in a single joint, the wrench shall be returned to "touch up" bolts previously tightened, which may have been loosened by the tightening of subsequent bolts, until all are tightened to the prescribed amount.

(d) Turn-of-Nut Tightening. When the turn-of-nut method is used to provide the bolt tension specified in paragraph 3(a), there shall first be enough bolts brought to a "snug tight" condition to insure that the parts of the joint are brought into full contact with each other. Snug tight shall be defined as the tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench. Following this initial operation, bolts shall be placed in any remaining holes in the connection and brought to snug tightness. All bolts in the joint shall then be tightened additionally by the applicable amount of nut rotation specified in Table 3, with

tightening progressing systematically from the most rigid part of the joint to its free edges. During this operation there shall be no rotation of the part not turned by the wrench.

TABLE 3—NUT ROTATION[a] FROM SNUG TIGHT CONDITION

Disposition of Outer Faces of Bolted Parts		
Both faces normal to bolt axis, or one face normal to axis and other face sloped 1:20 (bevel washer not used)		Both faces sloped 1:20 from normal to bolt axis (bevel washers not used)
Bolt length[b] not exceeding 8 diameters or 8 inches	Bolt length[b] exceeding 8 diameters or 8 inches	For all lengths of bolts
1/2 turn	2/3 turn	3/4 turn

[a] Nut rotation is rotation relative to bolt regardless of the element (nut or bolt) being turned. Tolerance on rotation; 1/6 turn (60°) over and nothing under.

For coarse thread heavy hexagon structural bolts of all sizes and length and heavy hexagon semi-finished nuts.

[b] Bolt length is measured from underside of head to extreme end of point.

(18) Riveting. Rivets shall be heated uniformly to a light cherry red color and shall be driven while hot. The heating of the points of rivets more than the remainder will not be permitted. When ready for driving they shall be free from slag, scale and other adhering matter and when driven they shall completely fill the holes. Burned, burred or otherwise defective rivets, or rivets which throw off sparks when taken from the furnace or forge shall not be driven.

Loose, burned, badly formed or otherwise defective rivets shall be cut out. Caulking and re-cupping of rivet heads will not be allowed. In cutting out defective rivets, care shall be taken not to injure the adjacent metal and, if necessary, the rivet shanks shall be removed by drilling.

Countersinking shall be neatly done and countersunk rivets shall completely fill the holes.

Shop rivets shall be driven by direct-acting riveters where practicable. The riveting machine shall retain the pressure for a short time after the upsetting is complete.

Pneumatic hammers shall be used for field riveting except when the use of other hand tools for riveting is permitted by the Engineer.

(19) Edge Preparation. Sheared edges of plates thicker than 5/8 inch shall be removed to a depth of 1/4 inch beyond the original edge or beyond any re-entrant cut produced in shearing. Unless otherwise specified this may be accomplished by edge planing or flame cutting.

(20) Machining of Bearing Surfaces. Bearing Surfaces shall be machined so that the surface produced does not exceed the maximum surface roughness tabulated below:

Steel slabs or places in contact with a concrete surface.	2000 microinches
Heavy plates in contact as part of bearing assemblies which are welded	1000 microinches
Ends of compression members, bearing stiffeners and fillers in compression	500 microinches
Rollers and Rockers	250 microinches
Pins and Pin Holes	125 microinches
Sliding Bearings	125 microinches

Sliding bearings shall be machined so that the lay of the cut is parallel to direction of movement.

Machine surfaces shall be plane and true conforming accurately to the dimensions shown on the plans.

Parts in bearing shall have uniform even contact with the adjacent bearing surface when assembled.

Base and sole plates which are plane and true and which have a surface roughness not exceeding the above tabulated values need not be machined.

Surfaces of fabricated members shall not be machined until all fabrication on that particular assembly or sub-assembly is complete.

(21) Abutting Joints. Abutting compression members shall be machined as specified above. Ends of abutting tension members shall be machined to a surface roughness of 1000 microinches to secure close and neat but not contact fitting joints.

(22) End Connection Angles. End connection angles of floor beams and stringers shall be flush with each other and accurately set as to position and length of member. In general, end connection angles shall not be finished unless required by the terms of the contract. However, faulty assembling and riveting may be cause for requiring them to be milled, in which case their thickness shall be reduced not to exceed 1/16 inch, nor shall their rivet bearing value be reduced below design requirements.

(23) Riveted Members. The several pieces forming one riveted member shall be straight or properly cambered. Pieces shall be close fitting before riveting is begun. Riveted members shall be free from twists, bends, open or misaligned joints and other defects resulting from faulty workmanship.

(24) Lacing Bars. The ends of lacing bars shall be neatly rounded unless otherwise indicated.

(25) Riveted Plate Girders. Web Plates of girders having no cover plates shall be detailed with the top edge of the web flush with the backs of the flange angles. Any portion of the plate projecting beyond the angles shall be chipped flush with the backs of the angles. Web plates of girders having cover plates may be 1/2 inch less in width than the distance back to back of flange angles. At web splices, the clearance between the ends of the web plates shall not exceed 3/8 inch.

End stiffener angles or girders and stiffener angles intended as supports for concentrated loads shall be milled or ground to secure a uniform even bearing against the flange angles. Intermediate stiffener angles shall fit sufficiently tight to exclude water after being painted.

Web splice plates and fillers under stiffeners shall fit within 1/4 inch at each end.

(26) Pins and Rollers. The material furnished for pins and rollers shall conform to the following requirements:

Pins: When pins are designed for the stresses of A36 Steel the material furnished shall conform to ASTM Designation A235 Class E. When such pins are seven inches or less in diameter ASTM Designation A108, Grade 1022 to 1030 Steel may also be furnished provided the Rockwell Hardness of the A108 Steel is not less than 85 (B-Scale) or test results indicate a minimum tensile and yield strength of 75,000 psi and 37,500 psi respectively.

When pins are designed for the stresses of A242, A440 or A441 Steel, the material furnished shall conform to the requirements of ASTM Designation A235, Class G.

Rollers: When rollers are designed for the stresses of A36 Steel, the material furnished shall conform to the requirements of ASTM Designation A235 Class E or ASTM Designation A108, Grade 1022 to 1030 provided the Rockwell Hardness of the A108 Steel is not less than 85 (B-Scale).

When rollers are designed for the stresses of A242, A440 or A441 Steel, the material furnished shall conform to the requirements of ASTM Designation A235 Class G or ASTM Designation A108, Grade 1025 to 1030 provided the Rockwell Hardness of the A108 Steel is not less than 90 (B-Scale).

Pins and Rollers shall be accurately manufactured to the dimensions shown on the plans. The surface finish shall be as required by the specifications. Pins larger than 9 inches in diameter shall have a hole not less than 2 inches in diameter bored longitudinally through their centers. The hole shall be bored before the pin is subjected to heat treatment. Boring shall be conducted in a manner that will prevent injury to the pin. Pins which contain interior defects shall be rejected.

(27) Boring Pin Holes. Pin holes shall be bored true to detailed dimensions, smooth and straight, at right angles with the axis of the member and parallel with each other unless otherwise required. A finishing cut shall always be made.

The length outside to outside of holes in tension members and inside to inside of holes in compression members shall not vary from detailed dimensions more than 1/32 inch. Boring of holes in fabricated members shall be done after the riveting or welding is completed.

(28) Pin Clearances. The diameter of the pin hole shall not exceed that of the pin by more than .020 inch for pins 5 inches or less in diameter, or .035 inch for larger pins.

(29) Screw Threads. Screw threads shall make close fits in the nuts and shall be U.S. Standard, except that for diameters greater than 1-1/2 inches, they shall be made with 6 threads to the inch.

(30) Pilot and Driving Nuts. Two pilot nuts and two driving nuts shall be furnished for each size of pin, unless otherwise specified.

(31) Dimensional Tolerances. All members whether fabricated by welding or riveting shall conform to the dimensional tolerances of the current American Welding Society Specifications for Welded Highway and Railway Bridges. Camber shall be measured with the member laying on its side.

(32) Welding. All welding shall conform to the requirements of the current "Specifications for Welded Highway and Railway Bridges" of the American Welding Society, subject to modifications which may be imposed by the Contract Documents.

Manual shielded metal-arc welding and submerged arc welding with a single electrode shall be performed as described in A.W.S. D2.0. Submerged arc welding which utilizes two electrodes shall be performed as described for single electrode welding except as modified by the procedure qualification test. The County may at its descretion accept the results of previous submerged arc qualification tests or require that new tests be run depending upon the method of welding, the joint type or detail and the acceptability of the records of qualification tests run by others.

No welding process other than manual shielded metal-arc or submerged arc welding shall be permitted without prequalification and approval of the Chief Engineer.

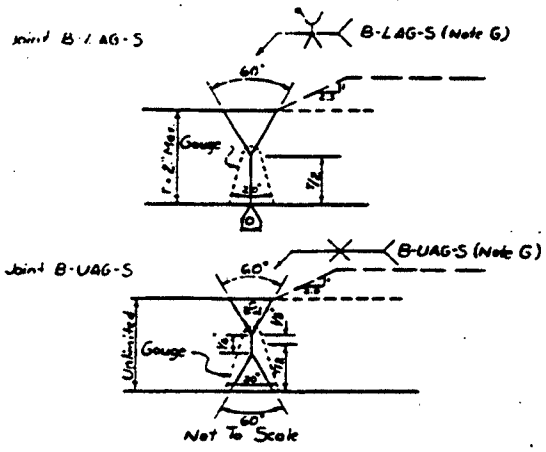
Welding procedures other than those above listed, shall be prequalified as directed by the Chief Engineer. The cost of such tests shall be included in the unit price bid for the steel with the exception that the County will witness tests and perform Charpy V-notch impact tests without cost to the Contractor.

Low hydrogen electrodes, conforming to AWS-ASTM Specification for Mild Steel Arc-Welding Electrodes, Classification No. E7016, E7018 or E7028 shall be used for all manual shielded metal-arc welding, including tack welding. These electrodes shall be properly dried and stored as specified in AWS D2.0. Electrodes which are removed from drying or storage ovens and not used in the work within the time prescribed by AWS D2.0 shall be discarded. Redrying of electrodes will not be permitted.

When a particular type of weld joint preparation is not shown on the plans by symbol or otherwise, the following joints may be considered prequalified without further qualification tests.

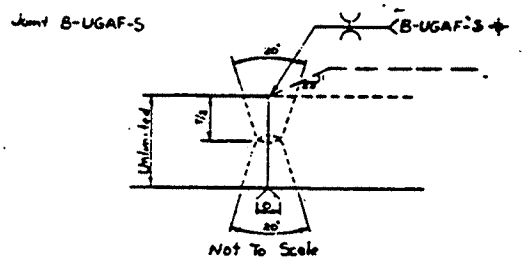
1. All joints considered prequalified under the provisions of paragraph 213 of A.W.S. D2.0-63.

2. Joints designated B-LAG-S; B-UAG-S; B-UGAF-S as detailed below



Note G:

Air Carbon-arc gouge to sound weld metal as indicated before welding the second side. The minimum radius of the gouge should be 1/4 inch. The sides of the gouge area should slope back with a total included angle of 20°.



* Gouge After-Fitting Welds shall be prepared by butting two plates together, full thickness, with zero root opening. The joint shall then be prepared for welding by air carbon-arc gouging to one half the depth of the thinner plate. After welding the groove thus prepared, the joint shall be back-gouged from the second side into sound weld metal and then welded. All grooves prepared by this method shall have a minimum radius of 1/4 inch and the sides of the groove shall slope back with a total included angle of 20°.

Backing strips or plates, when used on butt welds, shall be removed after welding and the joint ground smooth. Backing plates may be left in place on Tee and Corner joints unless otherwise specified.

Radiographic inspection shall be used to establish the soundness of tension butt welds, and may be used to examine other welds as directed by the Inspector. Radiographic Inspection shall conform to the requirements of the New York State Specification for Radiographic Inspection. Joints to be radiographed are described therein. Butt welded field splices in structural members shall be subject to 100 percent coverage by radiographic inspection unless otherwise provided. The cost of such inspection, of preparation for radiography, of providing access, and of furnishing adequate facilities for the review of radiographs in the shop or field shall be included in the unit price bid for Structural Steel. The requirements for radiographic inspection shall only apply to steel paid for under Item 29 unless otherwise specified.

All welded joints which are to be radiographed shall be ground smooth four sides before being radiographed. Welds in plate 3/4 inch or less in thickness shall be ground flush. Other welds may be finished leaving some reinforcement provided all surface lines have been removed by grinding.

Special care shall be taken to insure that shapes and plates are not ground below the ordered thickness. Small localized reductions in section thickness will be permitted provided the reduction is not more than 5% of the thickness of the thinner piece. General under grinding shall not exceed 0.010 inches. Sections ground below these limits shall be rewelded and reradiographed.

Radiographic Inspection of shop and field welds shall be performed by the Contractor and witnessed by the Inspector. One radiograph from each exposure shall be furnished to the Inspector for review and transmittal to the Chief Engineer.

A suitable variable intensity viewer shall be furnished by the Contractor for the use of the Inspector when reviewing radiographs. The viewer shall be available whenever radiography is being performed and shall remain available for one week after radiographic inspection has been completed.

When stringers or girders are to be spliced in the field, a detailed welding procedure shall be submitted to the Chief Engineer for his approval. This procedure shall be submitted with the shop drawings prior to the fabrication of the structural steel.

Stringers and girders which are to be joined by field welding shall be carefully shop assembled so that the complete assembly may be checked to insure that the proper joint alignment and fit-up is present at each joint when the correct camber is in the assembled pieces.

Welders shall be provided firm footing at all times. When it is necessary to weld from platforms above the ground, such platforms shall be rigidly braced to prevent movement of the platform during the welding operation.

(33) Bronze Surfaced Expansion Bearings. These shall be fabricated in accordance with the following:

The bronze surfacing shall be deposited on the steel base plate by the oxy-acetylene or arc welding process.

Bronze electrodes and filler metal shall be of a size and type approved by the Chief Engineer.

A suitable flux shall be used when the oxy-acetylene welding process is utilized. The type of flux shall be approved by the Chief Engineer.

The surface of the steel base plate that is to receive the bronze deposit shall be thoroughly cleaned of all dirt, oil, grease, scale and oxides by grinding or sandblasting prior to making the deposit.

A sufficient thickness of bronze shall be deposited to allow machining to the minimum thickness of 1/16". Upon completion of machining and polishing, the finished surface of the bronze shall show no evidence of cracks, blowholes or porosity exceeding the limits specified below. Un-machined low spots and blowholes not to exceed .05" in diameter will be allowed in the finished surface provided that the total area of such defect does not exceed .05% of the total area of bronze on any one plate and further provided that the total area of such defects in any square inch of the finished surface shall not exceed 1.0% per square inch. Low spots and blowholes larger or more numerous than stated above may be repaired by depositing additional bronze in the defects and remachining to the required dimensions.

Warping of the plate shall be counteracted by bending the steel plate in the opposite direction to which warping will take place prior to making the deposit. Any warp remaining in the piece after welding and cooling shall be removed prior to machining.

A plus or minus tolerance of 1/16" will be allowed in the finished combined thickness of steel and bronze expansion bearings as shown or called for on the contract plans.

c. Mill and Shop Inspection

(1) Stock Steel. No mill inspection will be required for stock steel. Stock steel will be accepted for miscellaneous parts not subject to stress. Stock steel will be accepted on the basis of the results of chemical and physical tests performed by the manufacturer. Certified copies of the results of chemical analysis and physical tests shall be furnished to the Chief Engineer as required under the heading "Sampling, Testing and Inspection" of Material Specification M-6.

(2) Type of Inspection. All steel to be furnished under this item shall be subject to shop inspection unless otherwise specified. Steel not furnished as stock steel under the conditions set forth above shall be subject to mill inspection.

(3) Visual Inspection and Nondestructive Tests. Welds shall be radiographed as described in Section b, paragraph (32) of this item. Welds, base metal, fasteners and other structural components shall be subjected to a thorough visual examination. Structural materials incorporating cracks, seams, inclusions, lamination or other defects discovered during visual examination shall be acceptably repaired or replaced. In general, defects in the base metal shall be repaired if and as required by ASTM Designation A6. The limits of all defects in welds and base metal shall be determined before a repair is approved. To determine the limits of defects the Chief Engineer may require such nondestructive tests as radiographic inspection, ultrasonic inspection, magnetic particle inspection or dye penetrant inspection to be performed upon the defective piece. The cost of such tests, when required, shall be included in the unit price bid for the steel.

(4) Notice of Rolling and Fabrication. The Contractor shall furnish the Department with two copies of the mill order and give ample notice to the Department of the beginning of the work at the mill and shop so that inspection may be provided. No material shall be rolled or fabricated before the Department has been notified where the orders have been placed.

(5) Facilities for Inspection. The Contractor shall provide all facilities for the inspection of material and workmanship in both the mill and shop. The Inspector shall be allowed free access to all parts of the premises concerned with the work. Work done while the inspector has been refused access shall be automatically rejected.

(6) Inspector's Authority. The Inspector shall have the authority to reject materials and workmanship which do not conform to the requirements of the Contract Documents. Inspections shall be made of materials and workmanship before, during and after fabrication. Materials and Workmanship which are inspected in process (while being fabricated) and which are found to contain defects or to have been subjected to abusive fabrication procedures shall be rejected while still in process.

The Inspector shall have the right to perform nondestructive tests of the materials and workmanship at the expense of the County.

Inspection at the mill and shop is intended as a means of facilitating the work and avoiding errors. It is expressly understood that it will not relieve the Contractor from any responsibility in regard to unacceptable material or workmanship and the necessity for replacing the same.

(7) Cost of Testing. The Contractor shall furnish all labor, materials and equipment necessary to perform chemical and physical tests on stock steel when such tests are required.

Nondestructive tests shall be performed at the Contractor's expense, if required by the provisions of subsection (3) above.

(8) Rejection. The acceptance of any materials or finished members by the Inspector shall not be a bar to their subsequent rejection, if found defective. Any material which is discovered to incorporate rejectable discontinuities or to deviate from the requirements of the Contract Documents in other respects shall be rejected. It shall then be repaired or replaced as determined by the Chief Engineer. The cost of replacement or repair shall be the responsibility of the Contractor.

(9) Marking and Shipping. Members with computed weights exceeding 3 tons shall have the weight marked thereon. Bolts and rivets of one length and diameter and loose nuts or washers of each size, shall be packed separately. Pins, small parts and small packages of bolts, rivets, washers and nuts shall be shipped in boxes, crates, kegs or barrels, but the gross weight of any package shall not exceed 300 pounds. A list and description of the contained material shall be plainly marked on the outside of each shipping container.

The weight of all tools and erection material shall be kept separate.

Anchor-bolts, washers and other anchorage or grillage materials, shall be shipped to suit the requirements of the masonry construction.

The loading, transportation, unloading and piling of structural material shall be so conducted that the metal will be kept clean and free from injury by rough handling. Structural members shall be suitably supported and braced so that they will not be subjected to stresses substantially in excess of those provided for in the design.

d. Erection

(1) Field Inspection. All work of erection shall be subject to the inspection of the Engineer who shall be given all facilities required for a thorough inspection of workmanship.

Materials and Workmanship not previously inspected will be inspected after delivery of the materials to the site of the work.

(2) Handling and Storing Materials. All materials shall be handled and stored in a manner that will cause no danger of permanent deflection or other injury, and in a manner approved by the Engineer. In unloading girders or other heavy members and in moving the same preparatory to erecting the steel, skids or rollers shall be employed and no material shall at any time be dropped, thrown or dragged over the ground. Any bends, sags or kinks in material will be sufficient cause for its rejection. Material to be stored shall be placed on skids above the ground. It shall be kept clean and properly drained. Girders and beams shall be placed upright and shored. Long members, such as columns and chords, shall be supported on skids placed in such a manner as to prevent injury from deflection.

(3) Falsework. All trusses shall be erected upon falsework unless otherwise permitted in writing by the Chief Engineer. The falsework shall be properly designed and substantially constructed and maintained for the loads which will come upon it. The Contractor, if required, shall prepare and submit to the Chief Engineer for approval, plans for falsework or for changes in an existing structure necessary for maintaining traffic. Approval of the Contractor's plans shall not be considered as relieving the Contractor of any responsibility.

(4) Methods and Equipment. Before starting work, the Contractor shall inform the Chief Engineer fully as to the method of erection he proposes to follow, and the amount and character of equipment he proposes to use, which shall be subject to the approval of the Chief Engineer. The approval of the Chief Engineer shall not be considered as relieving the Contractor of the responsibility for the safety of his method or equipment or from carrying out the work in full accordance with the plans and specifications. No work shall be done without the approval of the Chief Engineer.

(5) Preparation of Bearing Area. Column bases, truss and girder pedestals and shoes and bearings for beam spans shall have a full and uniform bearing upon the substructure masonry. Masonry bearing plates shall not be placed upon bridge seat areas on piers or abutments which are improperly finished, deformed or irregular.

The shoes and pedestals of truss and girder spans, the bearings of beam spans, the bases of columns and the center and end bearings of swing spans shall be rigidly and permanently located to correct alignment and elevations.

Unless otherwise provided, the above shoes, pedestals, bases and bearings shall be placed on layers of canvas and red lead, a 1/8 inch thick lead sheet, or on bearing pads as described herein.

The canvas and red lead shall be installed by thoroughly swabbing the top surface of the bridge seat bearing area with red lead paint or MBCA dull orange primer and placing upon it three layers of 12 ounce to 14 ounce duck, each layer being thoroughly swabbed on its top surface with paint. The bearing plate shall be placed while the paint is plastic.

Bearing pads shall be 1/8 inch thick and may be comprised of cotton duck impregnated with rubber or may be comprised of a high quality elastomer containing a random distribution of synthetic fibers. Bearing pads of cotton duck impregnated with rubber shall be manufactured using 8 ounce duck and high quality natural rubber in 7 plies. The breakdown stress for compression perpendicular to the plane of lamination shall not be less than 11,000 pounds per square inch.

Bearing pads with a random distribution of synthetic fibers shall consist of a fabric and rubber body with the fabric consisting of unused fabric fibers in random distribution in proper proportion to maintain strength and stability. The ultimate breakdown limit of the pad under compressive loading shall be no less than 7,000 pounds per square inch without extrusion or detrimental reduction in thickness.

All bearing pads shall be the same size as the bearing or masonry plate it is to support. The holes to accommodate the anchor bolts shall be cleanly and accurately prepared before the sheet is placed.

(6) Setting Anchor Bolts for Arch, Girder and Truss Bridges. Anchor bolts for arch, girder and truss bridges shall be as detailed on the contract drawings. They shall be carefully set to proper location and elevation using templates or other suitable means of holding the bolts in place.

Pipe sleeves, when called for on the plans, shall be kept filled with sand and sealed at the top with Bituminous Material during the time between the setting of the sleeve and the placing of the bearing. When the Contractor is ready to set the bearing, he shall clean out the pipe sleeve and after the bearing is in its final position shall fill the pipe sleeve with 1:2 grout of a creamy consistency to within one inch of the top of the masonry. The cement and sand used shall conform to the requirements of material specifications M1, Type 2 or 2A and M3 respectively. The top shall be sealed with one inch of Item 71B, Asphalt Filler. The pipe sleeves, washers and anchor bolts will be paid for as structural steel. Payment for all other work required to furnish, set and seal the anchor bolts will be included in the price bid for Structural Steel, Item 29. When the Contractor elects to set anchor bolts by Template, the template shall be of sufficient strength to support and hold the bolts in their proper position and not displace when the concrete is placed.

When the Contractor elects to drill the finished concrete to set anchor bolts, it will be his responsibility to place the reinforcing steel in the bridge seat or pedestals in such a manner as to prevent damage to the reinforcing steel during the drilling operation.

Anchor bolts shall be set and grouted immediately after holes are drilled.

(7) Setting Anchor Bolts for Beam Bridges. Anchor bolt holes for beam bridges may be drilled and the anchor bolts set in cement mortar therein. The mortar shall consist of one part Portland Cement to two parts of Mortar Sand mixed to a high slump consistency. The cement and sand shall meet the respective requirements of material specifications M1, Type 2 or 2A and M3.

Anchor bolts shall first be dropped into the dry holes to assure their proper fit after setting. They shall then be set as follows: Fill the hole about two-thirds full of mortar and by a uniform, even pressure or by light blows with a hammer (flogging and ramming will not be permitted) force the bolt down until the mortar rises to the top of the hole and the anchor bolt nut rests firmly against the metal shoe or pedestal. In case the mortar does not fill the hole, additional mortar shall be added. Remove all excess mortar which may have flushed out of the hole, to permit proper field painting of the metal surfaces.

The location of the anchor bolts in relation to the slotted holes in expansion shoes shall be varied with the prevailing temperature. The nuts on anchor bolts at the expansion ends of spans shall permit the free movement of the span.

Anchor bolts which are to be set in the masonry prior to erection of the superstructure shall be carefully set to proper location and elevation with templates or by other suitable means.

When the Contractor elects to set anchor bolts by Template, the template shall be of sufficient strength to support and hold the bolts in their proper position and not displace when the concrete is placed.

When the Contractor elects to drill the finished concrete to set anchor bolts, it will be his responsibility to place the reinforcing steel in the bridge seat or pedestals in such a manner as to prevent damage to the reinforcing steel during the drilling operation.

Anchor bolts shall be set and grouted immediately after holes are drilled.

(8) Expansion Bearings. Bearings are to be set with proper regard to the effect of stress deformation in the structure, and of temperature changes. The axes of rockers and segmental roller bearings should be substantially vertical under dead load at a temperature of 68° Fahrenheit. For this reason the rockers or rollers shall be tilted when placed to compensate for Dead Load deflection and the expansion or contraction caused by the temperature of the steel at the time the bearing is set. For the guidance of the erector a sketch shall be placed on the erection diagram showing the tilt of the rockers on expansion bearings as erected, so that they will be vertical under full dead load at 68° Fahrenheit.

(9) Handling Members. The field assembling of the component parts of a structure shall involve the use of methods and appliances not likely to produce injury by twisting, bending or

otherwise deforming the metal. No member slightly bent or twisted shall be put in place until its defects are corrected, and members seriously damaged in handling shall be rejected.

(10) Alignment. Before beginning the field bolting, riveting or field welding the structure shall be adjusted to correct grade and alignment and the elevations of panel points (ends of floor-beams) properly regulated. For truss spans a slight excess camber will be permitted while the bottom chords are being riveted, bolted or welded, but the correct camber and relative elevations of panel points shall be secured before riveting, bolting or welding the top chord joints, top lateral system and sway bracing.

(11) Straightening Bent Material and Correcting Camber Deficiencies. Bent Material shall be straightened by methods not likely to produce cracks or other defects. Steel which is heated to facilitate bending or for any other purpose shall not be heated to a temperature higher than 1200° F. This temperature will produce a dark cherry or blood red color in the steel.

After heating, the steel shall be allowed to cool slowly in air. No quenching will be permitted.

Materials other than steel may only be heated with the permission of the Chief Engineer.

The camber of rolled beams with or without cover plates may be reduced in the field by the process of heat shrinking. Welded plate girders with excessive or insufficient camber and rolled beams with insufficient camber may be corrected in the field by the process of heat shrinking provided approval is obtained from the Chief Engineer.

Upon the completion of straightening and camber operations, the surface of the metal shall be carefully inspected for incipient cracks or other signs of destress.

All members requiring straightening or camber corrections shall be considered rejected material until the corrective procedure has been completed and accepted. The method of repair shall be approved by the Chief Engineer. However, this shall not relieve the Contractor of the responsibility for the successful completion of the work. Such corrective work, when allowed, shall be performed at no additional cost to the County.

(12) Assembling and Riveting. Unless erected by the cantilever method, truss spans shall be erected on blocking so placed as to give the trusses proper camber. The blocking shall be left in place until the tension chord splices are fully riveted, bolted or welded and all other truss connections pinned and bolted. Rivets and high strength bolts in splices of butt joints of compression members and in railings shall not be installed until the span has been swung. Splices and field connections shall have one-half of the holes filled with bolts and cylindrical erection pins (half bolts and half pins) before riveting. Splices and connections carrying traffic during erection shall have three-fourths of the holes so filled.

Fitting up bolts shall be of the same nominal diameter as the rivets, and cylindrical erection pins shall be 1/32 inch larger.

Railings shall not be riveted, bolted or welded until the falsework has been removed.

(13) Adjustment of Pin Nuts. All nuts on pins shall be thoroughly tightened and the pins so located in the holes that the members shall take full and even bearings upon them.

(14) Removal of Rust and Stains from Concrete. All rust and other stains shall be removed from concrete surfaces in accordance with the requirements of Section 7, Structural Concrete, under the heading "Finishing Surfaces Exposed to View". This requirement shall apply for cleaning all new concrete placed by the Contractor. The requirement shall also apply for cleaning all existing concrete stained or damaged by the Contractor's operations.

4. METHOD OF MEASUREMENT. a. General. Payment will be made on a pound-price basis. For the purpose of payment, such items as bearing plates, castings, anchor bolts, forgings, fasteners, cable and other metal parts used in the construction of bridges shall, unless otherwise provided, be considered as structural steel even if made of other materials.

Metal Scuppers will be paid for as structural steel unless otherwise noted on the plans.

b. Weight Paid For. The payment will be based on the computed weight of metal including rivets, permanent bolts and welds, in the structure as erected. The weight of all erection materials and bolts, pilot and driving nuts, field paint and all boxes, crates or other containers used for packing, together with sills, struts and rods used for supporting members during transportation, shall be excluded.

The weight of all required rivet heads or bolt heads, nuts and washers, will be estimated, making no allowance for waste and included in the weight for which payment will be made.

The weight of all required welds will be estimated and included in the weight for which payment will be made.

c. Computed Weight. The weight of steel shall be assumed as 490 pounds per cubic foot. The weight of cast iron shall be assumed as 450 pounds per cubic foot.

The weights of rolled shapes, and of plates up to and including 36 inches in width, shall be computed on the basis of their nominal weights and dimensions, as shown on the approved shop drawings, deducting for copes, cuts and all holes.

The weights of plates wider than 36 inches shall be computed on the basis of their dimensions, as shown on the approved shop drawings, deducting for cuts and all holes. To this shall be added one-half of the allowed percentages of over-run in weight given in the General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural use. ASTM Designation: A6.

The weight of heads of shop and field driven rivets shall be assumed as follows:

Diameter of Rivet	Weight for 100 Heads
3/8"	2.15 lbs.
1/2"	4.5 lbs.
5/8"	8.6 lbs.
3/4"	14.25 lbs.
7/8"	21.25 lbs.
1"	31.00 lbs.

The weight of fillet welds shall be computed from the following table:

POUNDS OF DEPOSITED METAL PER LIN. FT. OF FILLET WELD

Size of Fillet (in.)	Deposited Metal (lb./ft.)
3/16	0.086
1/4	0.152
5/16	0.239
3/8	0.289
1/2	0.514
5/8	0.731
3/4	1.060

The weight of high strength bolts, nuts and washers, exclusive of grip, shall be computed from the following table:

HIGH STRENGTH BOLTS

Bolt Diameter (in.)	Weight of 100 Bolts with nut & 2 Washers exclusive of grip (lbs.)
1/2	22
5/8	36
3/4	57
7/8	87
1	127
1 1/8	177
1 1/4	227
1 3/8	298
1 1/2	362

The weights of castings shall be computed from the dimensions shown on the approved shop drawings, with an addition of 10 per cent for fillets and overrun.

To the total computed weight of metal shall be added an allowance of 0.4 of one per cent for shop paint.

5. BASIS OF PAYMENT. The unit price bid per pound shall include the cost of furnishing all labor, materials and equipment necessary to successfully complete the work as described in the Contract Documents. This shall include but need not be limited to: transportation, storage, lubricants, anchor bolt hole drilling and mortar, red lead and duck, lead plates, cotton duck impregnated with rubber, bolting, welding and painting both in the shop and in the field and removal of rust and stains from concrete.

Partial payment may be made for structural steel which has been delivered at the bridge site, provided the Contractor files with the Department a receipted bill of sale covering the material and also shows satisfactory proof that he has obtained a legal right for occupancy of any private property upon which the material is stored.

ITEM 30—MISCELLANEOUS METALS

1. DESCRIPTION. Under this item the Contractor shall furnish and place all metal not included in other items, as shown on the plans and in accordance with the specifications.

2. MATERIALS. All metals paid for under this item shall meet the respective requirements for the various metals listed in Section 6 of these specifications. The Contractor shall furnish the Department with two certified copies of the records of physical tests and chemical analysis of the metals used.

3. CONSTRUCTION DETAILS. Welding. Welding shall conform to the requirements specified under Item 29, section "b", paragraph 32.

Galvanizing. When materials paid for under this item are to be galvanized the process and spelter coating shall conform to the requirements of M-19, Galvanizing and Galvanized Sheets.

Painting. All unembedded metal except castings and galvanized material shall be painted three coats of paint as specified under "Painting of Metal Structures" in Section 8a.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of pounds of metal furnished and placed in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid, per pound, shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 30C—FRAMES AND GRATES—CASTINGS

1. DESCRIPTION. Under this item the Contractor shall furnish and place frame and grate castings as shown on the plans and or the applicable Standard Structure Sheets and in accordance with the specifications.

2. MATERIALS. All gratings, manhole covers, frames and curb boxes shall meet the requirements for castings M6A - Steel Castings, Grade N-1; or M8 Iron Castings, Class No. 30; or M 13 - Malleable Iron Castings, Grade 32501 at the Contractor's option.
Frames, grates and covers that are warped or rock in the opinion of the Engineer will be rejected and removed from the site of work.

3. CONSTRUCTION DETAILS. The castings shall be placed true to line and grade and shall make full and even bearing on the underlying construction surface.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of pounds of metal furnished and placed in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid, per pound, shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 30F—FRAMES AND GRATES—FABRICATED

1. DESCRIPTION. Under this Item, the Contractor shall furnish and install fabricated type frames and gratings as shown on the plans and or the applicable Standard Structure Sheets and in accordance with the specifications.

2. MATERIALS. The frames, gratings and appurtenant parts shall be fabricated from steel conforming to ASTM Designation A7 or A36 at the Contractor's option and galvanized in accordance with M19, Type I unless otherwise indicated.
Welding shall conform to the requirements of Item 29, section b, paragraph 32 except that radiographic inspection will not be required.
These units shall be supplied with approved locking devices that will securely fasten the grating to the frame and permit easy removal of the grating with a type of master key or tool. Frames and grates that are warped or grates that rock in the opinion of the Engineer will be rejected and removed from the site of work.

3. CONSTRUCTION DETAILS. The frames and gratings shall be placed true to line and grade and shall have full and even bearing on the underlying construction surface.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of pounds of metal furnished and placed in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid, per pound, shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 31—PILE SHOES

1. DESCRIPTION. Under this item the Contractor shall furnish and place pile shoes as shown on the contract plans and in accordance with the specifications.

2. MATERIALS. The pile shoes furnished under this item shall be of steel and must be approved by the Chief Engineer.

3. CONSTRUCTION DETAILS. Welding shall conform to the requirements for "Welding" as listed in section b, paragraph 32, of Item 29.

4. METHOD OF MEASUREMENT. Payment will be made for the number of shoes actually placed on the piles driven.

5. BASIS OF PAYMENT. The unit price bid for each shoe shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 32A—CABLE GUIDE RAILING (WOOD POSTS)

1. DESCRIPTION. Under this item the Contractor shall furnish and place cable guide railing with wood posts in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. Materials shall conform to the requirements of M14S, Cable Guide Rail and to the requirements for wood posts of M14R, Galvanized Beam Guide Rail.

3. CONSTRUCTION DETAILS. Wood posts shall be set as shown on the plans or as ordered by the Engineer, true to line and grade, on a firmly tamped base. The space around the posts shall be backfilled and machine tamped in 4" layers. The cost of adding water to moisten the material for backfill shall be included in the price bid, unless Items 1W and 1WA are included in the proposal.

After being set, wood posts shall be primed one coat and painted two coats of M18E, Stain Resistant White Paint. Primer and painting shall conform to the requirements of Section 8a under "Painting Timber and Lumber".

Lengths of cable guide railing in excess of 500 feet shall have two intermediate anchors for each 500 foot length or fraction thereof.

When posts for guide railing are to be installed adjacent to a stabilized shoulder course, extreme care shall be taken when installing the posts so that the stabilized shoulder material is not disturbed in any manner.

4. METHOD OF MEASUREMENT. The quantity of guide railing to be paid for will be the number of linear feet center to center of end posts (plus a 20-foot allowance for each anchor unit) completed in place as shown on the plans or as directed by the Engineer. If the guide railing is anchored to a structure instead of a dead man, payment will be made for the measured length up to the structure.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of all lumber inspection expenses and furnishing all labor, materials and equipment necessary to satisfactorily complete the work.

ITEM 32D—CABLE GUIDE RAILING (I BEAM POSTS)

1. DESCRIPTION. The general specifications for Item 32A will apply except as follows:

2. MATERIALS. Materials shall conform to the requirements of M14S, Cable Guide Rail and to the requirements for I beam posts of M14R, Galvanized Beam Guide Rail.

3. CONSTRUCTION DETAILS. I beam posts may be driven by approved methods and equipment that will provide the posts in their final position free of any distortion and burring or any other damage.

ITEM 32R—RESETTING GUIDE RAILING

1. DESCRIPTION. Under this item, the Contractor, shall remove, store, clean, reset and paint railing as shown on the plans or as directed by the Engineer. Wood posts shall be treated with hot bituminous material, Item 71, to a point six inches above the ground surface and primed one coat as specified in Section 8a under "Painting Timber and Lumber". Metal Posts and Beam Railing shall be cleaned of all dirt, scale and loose paint and then painted with one brush coat of M18K, Zinc Chromate Primer.

2. CONSTRUCTION DETAILS. The Contractor shall replace at his own expense any railing damaged by him in handling and placing.

After erection, all surfaces above the ground, except cables, shall receive two coats of M18E, Stain Resistant White Paint.

3. METHOD OF MEASUREMENT. The quantity of railing to be paid for will be the number of linear feet center to center of end posts reset in place as shown on the plans or as directed by the Engineer. If the guide railing is anchored to a structure instead of a dead man, payment will be made for the measured length up to the structure. An additional 20-foot allowance will be paid for each anchor unit actually reset.

4. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of replacing parts damaged by the Contractor, excavating, backfilling, painting and furnishing all labor, materials and equipment necessary to complete the work.

ITEM 32S—REMOVING AND STORING GUIDE RAILING

1. DESCRIPTION. Under this item the Contractor shall carefully remove existing guide railing as shown on the plans or directed by the Engineer and store it on the site at designated locations.

2. CONSTRUCTION DETAILS. The Contractor shall remove the existing guide railing and neatly store its component parts in separate piles at locations designated for future pick up by Department forces. The work shall be done in a workmanlike manner so as to salvage all usable parts. Unusable material shall be disposed of by the Contractor. Proper precautions shall be taken to protect traffic at all times.

3. METHOD OF MEASUREMENT. The quantity to be paid for will be the number of linear feet center to center of end posts removed and stored as herein specified or ordered by the Engineer. An additional 20-foot allowance will be paid for each anchor unit removed. If the guide rail is anchored to a structure, payment will be made for the measured length up to the structure.

4. BASIS OF PAYMENT. The price bid per linear foot shall include the cost of all labor, materials and equipment necessary to properly complete the work as specified or ordered by the Engineer.

ITEM 33A—GALVANIZED STEEL BEAM TYPE GUIDE RAILING (WOOD POSTS)

1. DESCRIPTION. Under this item the Contractor shall furnish and place galvanized steel beam guide railing with wood posts in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. The materials shall conform to the requirements of M14R, Galvanized Beam Guide Rail.

3. CONSTRUCTION DETAILS. Wood posts shall be set as shown on the plans or as ordered by the Engineer, true to line and grade, on a firmly tamped base. The space around the posts shall be backfilled and machine tamped in 4" layers. The cost of adding water to moisten the material for backfill shall be included in the price bid, unless Items 1W and 1WA are included in the proposal.

After being set, wood posts shall be primed one coat and painted two coats of M18E, Stain Resistant White Paint Primer and painting shall conform to the requirements of Section 8a under "Painting Timber and Lumber".

When posts for guide railing are to be installed adjacent to a stabilized shoulder course, extreme care shall be taken when installing the posts so that the stabilized shoulder material is not disturbed in any manner.

4. METHOD OF MEASUREMENT. The quantity of Galvanized Steel Beam Type Guide Railing to be paid for under this item shall be the number of linear feet center to center of end posts plus an allowance of 4 linear feet for each end terminal section. Where curved beam type guide railing is specifically called for on the contract plans or ordered in writing by the Engineer and no special item for such curved beam type guide railing is included in the contract proposal, the quantity of guide railing to be paid for will be as described above plus an additional allowance of 33-1/3% of the curved lengths measured along the horizontal center line of "valley" of the beam. Curved Beam Type Guide Railing is defined as that which will require shop working to attain the required curvature. Railing curved by springing in the field is not to be considered as Curved Beam Type Guide Railing.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of all labor, equipment and material necessary to properly complete the work including the inspection and testing information specified as well as excavating and backfilling.

ITEM 33D—GALVANIZED STEEL BEAM TYPE GUIDE RAILING (I BEAM POSTS)

1. DESCRIPTION. The general specifications for Item 33A will apply except as follows:

2. CONSTRUCTION DETAILS. I beam posts may be driven by approved methods and equipment that will provide the posts in their final position free of any distortion and burring or any other damage.

ITEM 33MB—GALVANIZED STEEL BEAM TYPE MALL BARRIER (WF POSTS)

1. DESCRIPTION. Under this item the Contractor shall furnish and place galvanized beam type mall barrier with WF posts in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. The materials shall conform to the requirements of M14R, Galvanized Beam Guide Rail.

Before erection is started, the Contractor shall prepare and submit for approval, working drawings showing details of the proposed arrangement of beam sections and posts, based upon field measurements and other pertinent data needed to establish the method of installation on both structures and roadway mall. These working drawings must be approved by the Chief Engineer and all differences and discrepancies in measurements, materials and methods settled with the Engineer before installation commences.

3. CONSTRUCTION DETAILS. WF posts may be driven by approved methods and equipment that will provide the posts in their final position free of any distortion and burring or any other damage.

4. METHOD OF MEASUREMENT. The quantity of galvanized beam type mall barrier to be paid for under this item shall be the number of linear feet center to center of end posts plus an allowance of 6 linear feet for each mall barrier terminal section.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of all labor, equipment and material necessary to complete the work.

ITEM 33PC—PRE-CAST CONCRETE GUIDE RAILING

1. DESCRIPTION. Under this item the Contractor shall furnish and erect Pre-Cast Concrete Guide Railing where and as shown on the plans and/or the applicable Standard Structure Sheet, or as otherwise directed by the Engineer.

2. MATERIALS. The guide railing and posts shall be precast of reinforced concrete meeting the requirements of Portland Cement Concrete Section 7 and the reinforcement shall comply with M17.

All fittings and other materials used under this item shall meet the requirements for the respective materials given under Part II, Section 6 of the specifications.

All exposed surfaces shall be finished true to line and surface. No plastering of any surface will be permitted. The precast concrete shall have a compressive strength of 4,000 p.s.i. at 28 days. A Department representative shall be present at the plant at the time of manufacture of the posts and members. A report of the results of tests made to satisfy the above provision shall be furnished to the Chief Engineer.

3. CONSTRUCTION DETAILS. Posts shall be set as shown on the plans or ordered by the Engineer true to line and grade, on a firmly tamped base. Backfill for post-hole shall be satisfactorily tamped in 6" layers as backfilling proceeds.

4. METHOD OF MEASUREMENT. The quantity of guide railing to be paid for will be the number of linear feet installed as shown on the plans or as directed by the Engineer, and measured outside to outside of end panels.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of all labor, equipment and materials, including excavation, backfilling and such testing as may be ordered to satisfactorily complete the work.

ITEM 34A—GUIDE POSTS (WOOD)

1. DESCRIPTION. Under this item the Contractor shall furnish and place wood guide posts in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. The posts shall conform to the requirements for wood posts with M14R, Galvanized Beam Guide Rail and the Standard Structure Sheet for Beam Type Guide Railing and Mall Barrier except holes will not be required.

3. CONSTRUCTION DETAILS. The construction details of Item 32A shall apply except that cable, hardware and intermediate anchors will not be required.

4. METHOD OF MEASUREMENT. The number of guide posts to be measured for payment under this item will be the number erected in accordance with the plans or as directed by the Engineer.

5. BASIS OF PAYMENT. The unit price bid per each post shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 34D—GUIDE POSTS (I BEAM)

1. DESCRIPTION. Under this item the Contractor shall furnish and place I beam guide posts in accordance with the plans, specifications and as ordered by the Engineer.

2. MATERIALS. The posts shall conform to the requirements for I beam posts of M14R, Galvanized Beam Guide Railing and the Standard Structure Sheet for Beam Type Guide Railing and Mall Barrier except holes will not be required.

3. CONSTRUCTION DETAILS. The construction details of Item 32D shall apply.

4. METHOD OF MEASUREMENT AND BASIS OF PAYMENT. The method of measurement and basis of payment of Item 34A shall apply.

ITEM 34R—RESETTING GUIDE POSTS

1. DESCRIPTION. Under this item, the Contractor shall remove, store, reset and paint guide posts as directed by the Engineer. Wood posts shall be treated with hot bituminous material, Item 71, to a point six inches above the ground surface. Metal Posts shall be cleaned of all dirt, scale and loose paint and then painted with one brush coat of M18K Zinc Chromate Primer.

The Contractor shall replace at his own expense any posts damaged by him in handling and placing.

After erection, wood posts shall be primed one coat and painted two coats of M18E, Stain Resistant White Paint. Primer and painting shall conform to the requirements of Section 8a under "Painting Timber and Lumber".

After erection, the metal posts shall receive two coats of M18E, Stain Resistant White Paint, which may be applied by means of an approved spraying apparatus.

2. METHOD OF MEASUREMENT. The number of guide posts to be paid for under this item will be the number erected in accordance with the plans or as directed by the Engineer.

3. BASIS OF PAYMENT. The unit price bid for each post shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 34S—REMOVING AND STORING GUIDE POSTS

1. DESCRIPTION. Under this item the Contractor shall remove and store guide posts as shown on the plans or ordered by the Engineer.

2. CONSTRUCTION DETAILS. The work shall be performed in the manner specified under Item 32S Removing and Storing Guide Railing.

3. METHOD OF MEASUREMENT. The quantity to be paid for will be the number of guide posts removed and stored in accordance with these specifications and the orders of the Engineer.

4. BASIS OF PAYMENT. The price bid for each post shall include the cost of all labor, materials and equipment necessary to properly complete the work as specified or ordered by the Engineer.

ITEM 35—BOULDER GUIDE RAILING

1. DESCRIPTION. Under this item the Contractor shall furnish and erect boulder guide railing as directed by the Engineer.

2. MATERIALS. Boulders shall be of approved selected stone of suitable shape for the purpose and shall be set with a clearance of two feet. The height above the finished shoulder surface shall be not less than 2-1/2 or more than 3-1/2 feet and the depth below at least six inches. The minimum thickness of each boulder at right angles to the highway center line shall be not less than two feet. The minimum width of each boulder along the line of the highway shall be not less than three feet and the best side shall face the pavement.

The shoulders shall be fully compacted before boulders are placed and small stone or spalls placed in the excavated depressions in shoulders so as to form a secure foundation.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet set completely in place as shown on the plans or directed by the Engineer.

4. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 36—TIMBER GUIDE RAILING

1. DESCRIPTION. Under this item the Contractor shall furnish and erect Timber Guide Railing as shown on the plans and in the proposal.

2. MATERIALS. Lumber for Posts and Rails shall be as specified for Wood Posts in Item 32A, Cable Guide Railing (Wood Posts).

The part of untreated posts set underground shall be given one coat of creosote oil before being erected. No oil shall be applied to wood timber during freezing weather. Creosote oil shall meet the specification requirements of Federal Specification TT-C-655(1) and shall be delivered to the contract in the original container.

After erection of the railing, one coat of brown "Woodlife", Cabots Stain No. 248 or an approved equal shall be applied to the rails and posts.

The dimensions of rails and posts and details of assembling and erection shall be as indicated on the plans.

3. METHOD OF MEASUREMENT. The quantity of Timber Guide Railing to be paid for will be the number of linear feet completed in place as shown on the plans or as ordered by the Engineer.

4. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of all materials, labor and equipment necessary to complete the work.

ITEM 37—METAL RAILING

1. DESCRIPTION. Under this item the Contractor shall furnish and place metal railing as shown on the plans and in accordance with the specifications.

2. MATERIALS. Pipe posts, pipe railing and rectangular tubing shall conform to the specifications given under "M14, Pipe and Rectangular Tubing for Railings".

The manufacturer shall furnish the Department with two certified copies of the physical tests and chemical analyses of the metal used in the manufacture of the pipe and rectangular tubing. Check analyses may be made by the Department from delivered material.

Metal Shims and Anchor Bolts with their nuts, washers and anchor bolt templates shall conform to the requirements of M6, Structural Steel.

3. CONSTRUCTION DETAILS. Shop Drawings. The provisions of Section "a", Item 29 will apply except that it will not be necessary to deliver the approved tracings to the Chief Engineer as required in paragraph 10.

Welding. Welding shall conform to the specifications for "Welding" as listed in section b, paragraph 32, of Item 29.

Painting. Painting shall conform to the requirements of "Painting of Metal Structures" as listed in Section 8a, except the bottom of base plates shall be painted with one coat of M18CA, Dull Orange Primer and two coats of M18G, Gray Paint.

Shop Inspection. The manufacture of metal railing will be subject to shop inspection by a representative of the Department.

Erection. Where railing posts rest on a preformed surface, shims may be required to properly align the posts. Pads may be used in lieu of shims if the required thickness of pad does not exceed 3/8 inch. Pads, if used, shall conform to the shape of the bottom of the posts and shall be of the type and quality listed on the plans.

4. METHOD OF MEASUREMENT. Unless otherwise noted on the plans, the quantity of metal railing to be paid for under this item will be the number of linear feet measured horizontally between the extreme outer limits of railing furnished and placed as shown on the plans and in accordance with the specifications except that stair and pedestrian ramp railing shall be measured along the axis of the railing.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment, including the furnishing and installing of all pads and/or shims necessary to complete the work.

The cost of furnishing and placing anchor bolts, nuts and washers and metal templates will be paid for as shown on the plans.

ITEM 37AL—ALUMINUM RAILING

1. DESCRIPTION. Under this item, the Contractor shall furnish and place aluminum railing as shown on the plans and in accordance with the Specifications.

2. MATERIALS. Aluminum railing components shall conform to the material specifications, and be furnished in the alloy and temper, listed below:

Component	Specification	Aluminum Association Alloy and Temper
Posts	M 7A	356 (Modified)
Rail End Caps	M 7A	43-F
Cast Shims	M 7A	43-F
Wrought Shims	M 7B	1100-0
Rails	M 7B	6062-T6
Set Screws	M 7B	2024-T4

Set screws shall be given an anodic coating conforming to the requirements of M19A, Aluminum Anodic Coatings, Type 205. Threads shall conform to the American Standard Association Specification B1.1, Class 2A and 2B.

Anchor bolts, nuts and washers, unless otherwise indicated on the plans, shall be made of steel conforming to the Materials Specification M6, Structural Steel as listed in Part II, Section 6, of the Specifications. All nuts and washers not embedded in the concrete and that portion of the anchor bolts indicated on the contract plans shall be Aluminum Coated by the Hot Dip process as specified in Material Specification M20, Aluminum Coating (Hot Dip).

Where an aluminum railing is to be erected on a steel surface, a 1/8" thick pad shall be placed on the steel surface separating the aluminum and the steel. The pads shall be of the type and quality shown on the plans.

3. CONSTRUCTION DETAILS. Shop Drawings. The provisions of Section "a", Item 29, shall apply except that it will not be necessary to deliver the approved tracings to the Chief Engineer as required in Paragraph 10.

Shop Inspection. The manufacture of aluminum railing will be subject to shop inspection by a representative of the Department.

Fabrication and Erection. Welding will not be permitted unless directly called for on the contract plans. Flame cutting will not be permitted.

Material 1/2" thick or less may be sheared, sawed or milled.

Material over 1/2" thick shall be sawed or milled only. Cut edges shall be true and smooth and free from excessive burrs or ragged breaks.

Rails may be heated to a temperature not exceeding 400°F. for a period not exceeding 30 minutes to facilitate bending.

The railing shall not be painted except as follows: Where aluminum railing rests on a preformed surface (except steel) the contacting aluminum surface shall be thoroughly coated with an aluminum impregnated caulking compound.

Where concrete is to be poured against an aluminum surface, the contacting aluminum surface shall be thoroughly coated with Zinc Chromate Primer conforming to Material Specification M18K. The primer shall be allowed to dry before the concrete is poured.

Where aluminum railing rests on a preformed surface, pads or shims may be required to properly align the posts. Pads may be used in lieu of shims if the required thickness does not exceed 3/8". Pads, if used, shall be of the type and quality shown on the plans and shall conform to the shape of the bottom of the post. Pads or shims do not have to be placed under the coupon extending from the base of the post.

4. METHOD OF MEASUREMENT. Unless otherwise indicated on the plans, the quantity of aluminum railing to be paid for under this item will be the number of linear feet measured horizontally, along the centerline of railing, between the extreme outer limits of railing furnished and placed as shown on the plans and in accordance with the Specifications.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, equipment and materials (including pads and shims) necessary to complete the work. The cost of furnishing and placing anchor bolts, nuts, washers and metal templates will be paid for as shown on the plans.

ITEM 37B—METAL RAILING, TYPE B

1. DESCRIPTION. Under this item the Contractor shall furnish and place metal railing as shown on the plans and in accordance with the specifications.

2. MATERIALS. Posts and wedges shall conform to the requirements of M13, Malleable Iron Castings, Grade 35018. Shims used to align the posts shall be malleable iron as specified above or may be steel conforming to the requirements of Material Specification M6.

Posts, wedges and shims shall be galvanized as specified in M19-Type II. Attention is directed to the galvanizing note in Material Specification M13.

Tubular rails, inserts and end caps shall conform to the requirements of ASTM Designation A245, Grade C and shall be galvanized as specified in M19, Galvanizing and Galvanized Sheets Type I.

Nuts and washers for wedges, anchor bolts with their nuts and washers and anchor bolt templates shall conform to the requirements of M6, Structural Steel. All bolts, nuts and washers shall be galvanized as specified in M19, Galvanizing and Galvanized Sheets Type II.

The Contractor shall furnish the Department with certified copies of the records of physical tests and chemical analysis of the metal used as specified under Item 29, Structural Steel; c. Mill and Shop Inspection, 1. Stock Steel.

3. CONSTRUCTION DETAILS. Shop Drawings. The provisions of Section "a", Item 29 will apply, except that it will not be necessary to deliver the approved tracings to the Chief Engineer as required in Paragraph 10.

Shop Inspection. The manufacture of metal railing will be subject to shop inspection by a representative of the Department.

Field Galvanizing. All abrasions of the galvanized surfaces due to handling, shipment, erection, etc. shall be repaired by field galvanizing as herein described. The area to be galvanized shall be cleaned to expose a bright metal surface. The surface shall then be heated with a torch to a temperature sufficient to melt all the metallics in the galvanizing alloy which subsequently shall be applied in either stick or paste form. The paste or stick galvanizing alloy shall be approved by the Engineer. Pastes, when used, shall consist of zinc powder and flux mixed with the minimum amount of water necessary to produce a paste.

Care shall be taken not to damage adjacent galvanized surfaces by overheating. Residues of fluxes and surface smudges shall be wiped off with waste or washed off with water.

Erection. When railing posts rest on a preformed surface, shims may be required to properly align the posts. Pads may be used in lieu of shims if the required thickness of pad does not exceed 3/8 inch. Pads, if used, shall conform to the shape of the bottom of the posts and shall be of the type and quality listed on the plans.

Painting. The railing shall not be painted except as called for on the plans or as ordered by the Engineer.

4. METHOD OF MEASUREMENT. Unless otherwise noted on the plans, the quantity of metal railing to be paid for under this item will be the number of linear feet measured horizontally, along the centerline of railing, between the extreme outer limits of railing furnished and placed as shown on the plans and in accordance with the Specifications.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, equipment and materials necessary to complete the work except that the cost of furnishing and placing anchor bolts, including nuts, washers and anchor bolt templates will be paid for as listed on the plans.

ITEM 38—SUBBASE COURSE—OLD ROAD METAL

1. DESCRIPTION. Under this item the Contractor shall place a subbase course of old road metal as shown on the plans or as ordered by the Engineer.

Drainage. Subbase course shall not be placed until culverts are completed, proper drainage provided and subgrade shaped and rolled.

2. MATERIALS AND CONSTRUCTION DETAILS. The maximum depth and width of any stone shall not be greater than the depth of the course and the maximum length of any stone shall not be greater than one and one-third times the depth or more than twelve inches.

The distribution of the old road metal shall be uniform. In cases where the finished thickness of the course is more than nine inches, the subbase course shall be laid in two courses and the first course completely filled and rolled before constructing the second. All fragments having a dimension over six inches shall be roughly placed by hand on their broadest edge with their longest dimensions cross wise of the road and in as close contact as possible. The smaller particles shall then be shoveled or forked upon the surface of the course.

Care shall be exercised in removing old road metal to prevent its being mixed with earth or other objectionable material. After laying, this course shall be thoroughly rolled with an approved self-propelled roller weighing not less than ten tons. After rolling, the course shall be true to grade and cross section and any depressions shall be eliminated by the use of broken stone. The course shall then be thoroughly rolled after which course sand or screenings shall be uniformly spread, either by hand labor or by an approved mechanical device, upon the surface and swept in by means of a gang drag broom of an approved type and rolled dry. In all cases the subbase course shall be so thoroughly compacted that it will not weave under the roller. This course shall not be laid in excess of five hundred linear feet without being rolled and thoroughly filled so as to render it water proof and thereby prevent the softening of the subgrade. Should the subgrade material become churned up into or mixed with the subbase course through any reason whatsoever, the Contractor shall at his own expense, remove such mixture of subgrade material and stone and replace the subbase course.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of cubic yards of compacted material placed as shown on the plans or ordered by the Engineer.

No deduction will be made from the items of excavation for any pavements, within the maximum payment lines, used in this course.

4. BASIS OF PAYMENT. The unit price bid per cubic yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 42—BASE COURSE—GRANULAR MATERIAL

1. DESCRIPTION. Under this item, the Contractor shall furnish and place a base course of Gravel, Broken Stone or Slag of the depth and in the places called for on the plans and in accordance with the specifications.

2. MATERIALS. All gravel or broken stone shall meet the quality requirements for types A, B or C crushed stone or crushed gravel and slag shall meet the quality requirements of crushed slag as designated in M4, Coarse Aggregates. Of the particles retained on the 1/2 inch square sieve, not more than 10% by weight shall consist of flat or elongated pieces. A flat or elongated piece is defined herein, as one, the greatest dimension of which is more than 3 times the least dimension.

The particles shall be well graded from coarse to fine and of such size as will all pass a 2 inch square sieve, 30 percent to 65 percent, by weight, shall pass the 1/4 inch square sieve and not more than 5 percent, by weight, shall pass a No. 200 sieve. Particles passing a No. 40 mesh sieve shall have a Plasticity Index=0.

No segregation of large or fine particles will be allowed, but the material as spread shall be well graded with no pockets of fine material.

3. CONSTRUCTION DETAILS. Loose material shall be spread to a depth sufficient to result in compacted layers of the specified thickness.

Water shall be added in such amounts as the Engineer may consider necessary to secure satisfactory compaction. When the moisture content of the layer is within the limits for proper compaction, the entire surface shall be rolled with a smooth wheel roller having a minimum weight of 10 tons. Each portion of the layer shall be covered by a minimum of 8 passes of the roller.

In lieu of the preceding method of rolling, the Contractor at his option may use approved mechanical tampers as specified under paragraph "vibratory compaction" of Item 43, to compact the material. After compaction, the top surface of this course shall not extend above the theoretical elevation for this course, and when tested with a straightedge 16 feet in length, any depression over 1/4 inch below the theoretical grade line shall be eliminated by the use of this same material and the surface shall be rerolled. In all cases, this course must be so thoroughly compacted that it will not weave under the roller.

After completion of the rolling, no traffic shall be permitted over this course, and no hauling other than that necessary for bringing material for the next course will be allowed over the rolled material.

This course shall not be laid in excess of 500 linear feet without being compacted. Should the subgrade or subbase course material become churned up into or mixed with the base course through any reason whatsoever, the Contractor shall, at his own expense, remove such mixture of subgrade or subbase course material and replace with base course material acceptable for this item.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of cubic yards of compacted material in place as shown on the plans and in accordance with the specifications.

5. BASIS OF PAYMENT. The unit price bid per cubic yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work. The cost of adding water shall be included in the price bid, unless Items 1W and 1WA are included in the proposal.

ITEM 42G—BASE COURSE—GRANULAR MATERIAL—GRAVEL

ITEM 42Q—BASE COURSE—GRANULAR MATERIAL—BROKEN STONE

The specifications for Item 42 shall apply in all respects, except that under Item 42G only Gravel will be permitted, under Item 42Q only Broken Stone will be permitted.

ITEM 43—BASE COURSE—SCREENED GRAVEL

ITEM 45—BASE COURSE—BROKEN STONE

1. DESCRIPTION. Under these items the Contractor shall furnish and place Stone or Gravel, conforming to the requirements in the following paragraph, either upon the properly prepared

subgrade or upon the subbase course. This Stone or Gravel shall be of sizes specified below.

2. MATERIALS. All gravel or broken stone shall meet the quality requirements for types A, B or C crushed stone or crushed gravel as designated in M4, Coarse Aggregates. Of the particles retained on the 1/2" square sieve, not more than 10% by weight shall consist of flat or elongated pieces. A flat or elongated piece is defined herein, as one, the greatest dimension of which is more than 3 times the least dimension.

3. CONSTRUCTION DETAILS. After the subgrade or subbase course shall have been properly prepared and proper drainage provided, a course of Broken Stone or Screened Gravel shall be spread evenly so that it will have after rolling, the required thickness. Stone and Gravel shall be a uniform mixture of No. 3 and No. 4A sizes.

In cases where the finished thickness of the base course is to be more than five inches, the Broken Stone or Gravel shall be spread, rolled and filled in two separate layers neither of which shall be of a greater depth than six inches measured loose.

Spreading. The spreading of any layer or course of broken stone, gravel or filler, shall be done with approved spreader equipment. No material shall be spread from piles dumped along the road except as directed by the Engineer.

No segregation of large or fine particles will be allowed but the stone, or gravel as spread shall be well graded with no pockets of fine material.

Rolling and Filling. After the base course of stone or gravel has been laid loose it shall be thoroughly rolled with an approved roller weighing not less than ten tons.

This rolling must begin at the sides and continue toward the center and shall continue until there is no movement of the course ahead of the roller. After the course is thoroughly compacted, No. 1 stone or gravel and screenings or sand, or a mixture of these, shall be uniformly spread, either by hand labor or by an approved mechanical device, upon the surface and swept in by means of a gang drag broom of an approved type or by hand broomings and rolled dry. The process of filling and brooming shall be continued until the course is thoroughly filled.

After compaction, the top surface of this course shall not extend above the theorectical elevation for this course and when tested with a straightedge 16 feet in length any depression over 1/4 inch, below the theoretical grade line, shall be satisfactorily eliminated.

After the completion of the rolling, no hauling other than that necessary for bringing material for the next course will be allowed over the rolled material. It is the intention to bind this course with the small stone or gravel but no surplus of filler will be allowed on this course. This course shall not be laid in excess of 500 linear feet without being rolled and thoroughly filled so as to render it waterproof and thereby prevent the softening up of the subgrade or subbase.

Vibratory Compaction. In lieu of the above method of rolling, the Contractor may at his option use a vibratory method as follows:

After the broken stone course is spread evenly so that it will have the required thickness, after compaction, it shall be compacted over the entire area by an approved vibratory compactor. Vibration shall continue until the stone is keyed sufficiently to permit rolling with an approved roller without displacement of the stone. The entire area of the base course shall then be thoroughly rolled with an approved roller weighing not less than ten tons. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement of the course ahead of the roller. After the course is thoroughly compacted, No. 1 size stone or gravel and screenings or sand, or a mixture of these, in an amount approximately equal to 50% of that required to fill the voids, shall be uniformly spread upon the surface either by hand labor or by an approved mechanical device. The stone and screenings shall then be vibrated into the voids of the stone by a single pass of the vibrator over the entire area. This shall be followed by a second application of No. 1 size stone or gravel and screenings or sand, or a mixture of these, spread as specified above in an amount equal to twenty-five percent of that required to fill the original voids in the stone course. This stone and screenings shall then be vibrated into the voids by a single pass of the vibrator over the entire area. The amount of stone and screenings required to fill the remaining voids in the base course shall then be applied, and shall be vibrated into the voids by a single passing over the entire area by the vibrator. No further mechanical vibration shall be applied. Any areas not completely filled by the above operations shall be filled by hand spreading and brooming.

Care shall be exercised to see that the voids in the stone base are completely filled, but the quantity of stone and screenings used and the operation of filling shall not be such as to cause floating of the coarse aggregate.

The entire area shall then be rolled until free from visible voids, ruts, loose stone and surplus filler that hides the top of the coarse aggregates.

In the event the compacted material is so graded that voids are filled without the necessity of adding filler material and additional vibrating and compacting as described above, such parts of the requirements of this specification as are not necessary may be deleted if approved in writing by the Engineer.

After compaction the top surface of this course shall not extend above the theoretical elevation for this course and when tested with a straightedge 16 feet in length, any depression over 1/4 inch, below the theoretical grade line, shall be satisfactorily eliminated.

Replacing. If the subgrade or subbase material shall become churned up into or mixed with the base course through any reason whatsoever, the Contractor shall, at his own expense, remove such mixture of subgrade material and broken stone or gravel and replace it with clean broken stone or gravel or the proper size and shall roll or otherwise compact the material so as to produce a uniform, firm and even base course.

Piles of Filler. If hand spreading is used, all filler shall be delivered and piled alongside the road before the course is placed.

4. METHOD OF MEASUREMENT. The quantity to be paid for under these items respectively will be the number of cubic yards of compacted material in place as shown on the plans and in accordance with the specifications.

5. BASIS OF PAYMENT. The unit price bid per cubic yard for the respective items shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 45S—BASE COURSE—BITUMINOUS MACADAM PENETRATION METHOD ASPHALT (Cubic Yards)

1. DESCRIPTION. Under this item the Contractor shall furnish and lay crushed stone, types A, B or C, or approved crushed slag base course, composed of fragments of the sizes specified below, and incorporate therewith bituminous material applied by means of a pressure distributor of an approved type. The laying of this course will not be allowed on a base containing frost or when the temperature is below 50°F. in the shade except with the written permission of the Chief Engineer.

2. MATERIALS. The crushed stone and crushed slag shall conform to the quality requirements of M4, Coarse Aggregates and the bituminous material shall conform to the requirements of M5, Bituminous Materials of Section 6.

3. CONSTRUCTION DETAILS. After the lower courses shall have been completed to the satisfaction of the Engineer, a course of clean approved No. 3 and 4A stone uniformly mixed shall be evenly spread thereon with an approved mechanical spreader in such quantity that after being compacted with a 10 ton roller the thickness of the course shall be as called for on the plans.

It is imperative that this course conform accurately to the line and grade specified. When ordered by the Engineer the Contractor shall provide and set up pins and string lines or other control devices in the manner directed to attain the desired accuracy.

After proper compaction, Bituminous Material "A" of the kind specified in the proposal, heated to a temperature specified by the Engineer, between the limits of 275°F. and 350°F., shall be evenly spread over the surface by the use of an approved pressure distributor, operating under a pressure of 50 pounds per square inch or more as the Engineer may direct. The quantity of bituminous material to be used shall be at the rate of 1/2 gallons per square yard per inch of finished thickness of the course.

In order to insure uniformity at junction point of two applications, it will be required that the distributor should, in starting, lap back on the previous application, covering the lap with building paper, to avoid either an excess or an insufficient quantity at the junction point. The paper shall then be removed and destroyed.

The surface shall then be immediately filled with clean No. 2 and No. 1 broken stone in a combination as determined by the Engineer that will best fill the voids in the 3 and 4 A stone course, after which it shall be compacted with a self-propelled roller weighing approximately 10 tons. During the rolling process, No. 1 crushed stone shall be applied and broomed about until the course is entirely filled. The rolling shall be continued until the course of stone is thoroughly compacted and its surface is true and even to the established grade, after which sand or screenings shall be uniformly spread, either by hand labor or by an approved mechanical device, upon the surface and thoroughly swept in and rolled until the voids are completely filled.

No stone with dust coating will be permitted for use in this course. If any stone spread in this course becomes wet or dirty, it must be allowed to dry to the full depth of the course and dirty stones removed and replaced with clean stone before the pouring of bituminous material proceeds.

If hand spreading is used, all filler for the course shall be delivered and piled alongside the road where the base course is laid.

During construction, where traffic is maintained, not more than 500 linear feet of this course shall be spread before it has been penetrated with the bituminous material.

After compaction, the top surface of this course shall not extend above the theoretical elevation for this course and when tested with a straightedge 15 feet in length any depression over 1/4 inch below the theoretical grade line shall be satisfactorily eliminated.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of cubic yards of compacted material placed in accordance with the plans and specifications measured in place in the completed course, making no deduction for catch basins and manholes.

5. BASIS OF PAYMENT. The unit price bid per cubic yard shall include the cost of furnishing

all labor, materials and equipment necessary to complete the course, except that bituminous material will be paid for under the item for such material.

ITEM 45SA—SAND ASPHALT BASE COURSE

1. DESCRIPTION. Under this item the Contractor shall construct a bituminous concrete course laid to conform to the required grade, thickness and cross-section shown on the plans and in accordance with the specifications for Bituminous Concrete Part II, Section 8 of the Public Works specifications and amendments thereto, except as herein modified.

2. MATERIALS AND CONSTRUCTION DETAILS. The aggregates to be used shall be a local bank run gravel and limestone filler or a combination of sand, stone and limestone filler. All aggregate except the limestone filler shall be passed through a dryer and the properly graded aggregates shall be introduced into the pugmill at a temperature specified by the Engineer, between the limits of 275°F. and 325°F.

Asphalt Cement. The asphalt cement used in the mix shall be a paving grade asphalt meeting the requirements of Item 65 and shall be introduced into the pugmill at a temperature specified by the Engineer between the limits of 275°F. and 350°F.

Proportioning. All materials used in the mix including the Bituminous material shall be proportioned as specified under table "Composition of Mixture" of this specification.

COMPOSITION OF MIXTURE

Passing 2" screen	100%
Passing 1/2" screen	76- 95%
Passing 1/8" screen	67- 87%
Passing #40 sieve	23- 43%
Passing #200 sieve	2- 10%
Asphalt Cement	6- 9.5%

The submission of a job mix formula as required in the general specifications will not be required for this item. The plan formula and the proportion of the mixture will be specified by the Engineer within the limits stated in the table "Composition of Mixture". Material passing the 200 mesh sieve will be considered as filler and will be deducted from the amount of pulverized limestone needed to meet the requirements of the #200 mesh sieve.

MIXING

Aggregates. The aggregates shall be introduced into the mixer at the temperature specified by the Engineer and dry mixed for a period of at least 15 seconds before the asphalt is added.

Asphalt Cement. The asphalt cement shall be introduced into the mixer at the temperature specified by the Engineer and the mixing period after the introduction of the asphalt cement shall be at least one minute or as long as may be necessary to completely and uniformly coat all aggregate particles with the asphalt cement.

The maximum thickness of any one compacted course shall be 3 inches and the mixture shall not be of a temperature less than 250°F. at the time of placing. Where typical sections of greater than three inches are called for on the plans or in the itemized proposal, this course shall be placed and compacted in equal depths and in no case shall any course be less than the 2 inches in compacted thickness.

When hand spreading is permitted, the use of dumping sheets outside of the area in which the material is to be spread will not be required.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of tons of compacted material placed in accordance with the plans and specifications.

4. BASIS OF PAYMENT. The unit price bid per ton for this item shall include the cost of furnishing all materials including the bitumen, the mixing, transporting, placing, rolling and all labor and equipment necessary to complete the work except the payment for any surface treatment with an approved aggregate where required will be made under its respective item.

ITEM 45SP—BASE COURSE ASPHALT CONCRETE TYPE 1A

1. DESCRIPTION. Under this item, the Contractor shall furnish and construct a Bituminous Concrete Base Course to conform with the details as shown in the typical sections on the Contract plans, and in accordance with the General Specications for Bituminous Concrete, Part II, Section 8.

2. MATERIALS AND CONSTRUCTION DETAILS.

Preparation of the Aggregates. The properly sized aggregates shall be introduced into the pugmill at a temperature specified by the Engineer, between the limits of 225°F. and 300°F.

Asphalt Cement. The asphalt cement used in the mix shall be a paving grade asphalt meeting the requirements of Item 64 and shall be introduced into the pugmill at a temperature compatible with the aggregates, as determined by the Engineer, between the limits of 225°F. and 350°F.

Proportioning. All materials used in the mix, including the bituminous material, shall be proportioned as specified for Type 1A, Base Course under the table "Composition of Bituminous Plant Mixtures" in the General Specifications.

Placing. The depth of any one layer shall not be greater than necessary to produce a compacted thickness of 4 inches.

Equipment. The material shall be placed using a paver equipped as specified under "Placing" in Part II, Section 8 – Bituminous Concrete, General Specifications.
The automatic screed controller will not be required for shoulders, in back of curbs and in other areas where, in the opinion of the Engineer, its use would be impractible.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of tons of material placed and compacted in accordance with the plans and specifications and orders of the Engineer.

4. BASIS OF PAYMENT. The unit price bid per ton for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, including bitumen, mixing, transporting, placing and rolling.

ITEM 45ST—BASE COURSE—BITUMINOUS MACADAM PENETRATION METHOD ASPHALT (Tons)

1. DESCRIPTION. The specifications for Item 45S will apply except as follows:
The quantity to be paid for will be the number of tons of stone incorporated in the work as shown on the plans.

2. BASIS OF PAYMENT. No direct payment will be made for sand or screenings filler.
The unit price bid per ton shall include the cost of furnishing all labor, materials and equipment necessary to complete the course, except that Bituminous Material will be paid for under its respective item.

ITEM 46—CONCRETE FOUNDATION FOR PAVEMENT

1. DESCRIPTION. Under this item the Contractor shall furnish and place, upon a properly prepared grade, Concrete Foundation for Pavement of the dimensions shown on the plans and in accordance with the specifications.

2. MATERIALS AND CONSTRUCTION DETAILS. Concrete placed under this item shall comply in all respects to the requirements given under Section 7, "Portland Cement Concrete—General Specifications" and the subdivision thereof designated as "Pavement Concrete".
Details of materials permitted in this item are shown in the table "Composition of Concrete Items" under "Portland Cement Concrete—General Specifications". The Contractor may elect to use concrete proportioned as Class A or Class B concrete. The same class of concrete shall be used throughout the entire contract unless otherwise approved by the Chief Engineer.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of cubic yards computed in accordance with the plans and specifications. No deduction shall be made for catch basins and manholes.

4. BASIS OF PAYMENT. Test cores will be taken as indicated in Section 7, under Test Cores. The unit price bid per cubic yard shall include the cost of furnishing and laying forms; the mixing, placing, screeding, finishing and curing of the concrete; cross-overs, joint material and all labor, material and equipment necessary to satisfactorily complete the work except reinforcement and joint supports will be paid for under their respective items.

ITEM 47—CEMENT CONCRETE PAVEMENT

1. DESCRIPTION. Under this item the Contractor shall construct a concrete pavement upon a properly prepared grade conforming to the lines, grades and typical sections shown on the plans and in accordance with the specifications.

2. MATERIALS AND CONSTRUCTION DETAILS. Concrete placed under this item shall comply in all respects to the requirements given under Section 7, "Portland Cement Concrete—General Specifications" and the subdivision thereof designated as "Pavement Concrete".

Details of materials permitted in this item are shown in the table "Composition of Concrete Items" under "Portland Cement Concrete—General Specifications". The Contractor may elect to use concrete proportioned as Class A or Class C concrete. The same class of concrete shall be used throughout the entire contract unless otherwise approved by the Chief Engineer.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of cubic yards computed in accordance with the plans and specifications. No deduction shall be made for catch basins and manholes.

4. BASIS OF PAYMENT. Test cores will be taken as indicated in Section 7, under Test Cores. The unit price bid per cubic yard shall include the cost of furnishing and laying of forms; the mixing, placing, screeding, finishing and curing of the concrete; cross-overs, joint material and all labor, material and equipment necessary to satisfactorily complete the work except that reinforcement and joint supports will be paid for under their respective items.

ITEM 47A—CEMENT CONCRETE PAVEMENT

1. DESCRIPTION. The specifications for Item 47 shall apply except that the Contractor shall have the option of placing two lanes of pavement full width (24') at one time in the following manner:

The longitudinal joint between the two lanes poured full width shall be made by sawing or forming. If sawing is used, the following provision shall be observed:

(1) All longitudinal joints shall be sawed within six days after the concrete has been placed.

(2) Adequate lighting operations shall be provided to facilitate sawing operations performed during the night.

The longitudinal joint shall be sawed or formed halfway between the outside edges of the poured double lane and centered over the longitudinal joint supports. If forming is used, the method of forming shall be approved by the Chief Engineer.

The crowned pavement section may be of a parabolic shape approximating the typical section as approved by the Engineer.

The Contractor shall maintain an average rate of production of at least 150 linear feet per hour if two lanes are poured at once.

ITEM 47B—CEMENT CONCRETE PAVEMENT

1. DESCRIPTION. The specifications for Item 47 will apply with the following modifications:

The concrete furnished under this item shall be proportioned as Class A Concrete in accordance with the requirements of Section 7, Portland Cement Concrete—General Specifications. The details of the materials permitted in this item are shown in the table "Composition of Concrete Items".

Curing shall be in accordance with the requirements of "Portland Cement Concrete—General Specifications" subdivision "Structural Concrete".

Equipment for mixing and placing the concrete shall be subject to the approval of the Chief Engineer.

ITEM 47C—CEMENT CONCRETE PAVEMENT WITH CARBON BLACK

1. DESCRIPTION. The specifications for Item 47 will apply except as herein modified. The concrete placed above the reinforcement shall be colored by adding to the mix an amount of Emulsified Carbon Black equal to two percent by weight of the Cement used in the mix.

2. MATERIALS. The carbon black shall conform to the requirements of M31, Emulsified Carbon Black.

An approved air-entraining agent, M21, Admixtures, shall be added to the mix as required to maintain the specified air content that would be obtained without the emulsified carbon black. The quantity of emulsified carbon black shall be compensated by reducing the amount of mixing water to maintain the specified slump.

3. CONSTRUCTION DETAILS. The mixer shall be thoroughly washed to the satisfaction of the Engineer before mixing the colored top course, unless a mixer is used exclusively for this course.

4. METHOD OF MEASUREMENT AND BASIS OF PAYMENT. The cost of furnishing all labor, material and equipment necessary to incorporate the emulsified carbon black into the work shall be included in the price bid for the Item Emulsified Carbon Black.

ITEM 47U—UNREINFORCED CEMENT CONCRETE PAVEMENT

1. DESCRIPTION. The specifications for Item 47 shall apply except contraction joints shall be constructed at approximately twenty feet (20') intervals. No reinforcement shall be required in this concrete. Construction joints shall be formed as directed by the Engineer. Joint supports shall be placed transversely and longitudinally as indicated on the applicable Standard Structure Sheets or on the plans and in the proposal.

ITEM 51-F—ASPHALT CONCRETE—TYPE 1A
(Mixing Method—Hot Mix—Two Course)

1. DESCRIPTION. Under this item the Contractor shall construct a two-course bituminous concrete pavement laid to conform to the required grade, thickness and cross-section shown on the plans and in accordance with the general specifications for "Bituminous Concrete—Part II—Section 8".

2. MATERIALS AND CONSTRUCTION DETAILS.

Aggregates. Coarse aggregates used in Top Course shall be from approved sources and shall meet one of the following requirements:

1. Crushed limestone and dolomite that has an acid insoluble content not less than 10 percent (excluding particles of chert or similar silicious rocks). Where more than one geologic stratum is quarried, each stratum shall meet this requirement.
2. Crushed sandstone, granite, chert, trap rock, ore tailings, slag and other similar material.
3. Crushed hardheads, crushed gravel (where permitted) and blends of two or more of the following types of materials—crushed hardheads, gravel, limestone, dolomite, sandstone, granite, chert, trap rock, ore tailings, slag or other similar materials. These aggregates shall meet the following requirements:

Total Coarse Aggregate (plus 1/8" materials)
Not less than 20 percent (by weight with adjustments to equivalent volumes for materials of different specific gravities) of the aggrevate particles shall be non-carbonate (Non-Carbonate—Acid insoluble content not less than 80 percent)

Plus 1/4" Material
Not less than 20 percent (by weight with adjustments to equivalent volumes for materials of different specific gravities) of the aggregate particles shall be non-carbonate (Non-Carbonate—Acid insoluble content not less than 80 percent)

Where coarse aggregates for Top Course are from more than one source or of more than one type of material, they shall be proportioned and blended to provide a uniform mixture.

Preparation of the Aggregates. The properly sized aggregates shall be introduced into the pugmill at a temperature specified by the Engineer, between the limits of 225°F. and 300°F.

Asphalt Cement. The asphalt cement used in the mix shall be a paving grade asphalt meeting the requirements of Item 64. The asphalt cement shall be introduced into the pugmill at a temperature compatible with that of the aggregates as determined by the Engineer, between the limits of 225°F. and 350°F.

Proportioning. All materials used in the mix, including the bituminous material, shall be proportioned as specified for Type 1A top or binder under the table COMPOSITION OF BITUMINOUS PLANT MIXTURES in the General Specifications.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of tons of compacted material placed in accordance with the plans and specifications.

4. BASIS OF PAYMENT. The unit price bid per ton for this item shall include the cost of furnishing all materials, including the bitumen, the mixing, transporting, placing and rolling and all labor and equipment necessary to complete the work except that payment for surface dusting with an approved aggregate when required will be made under its respective item.

ITEM 51AC-F—ASPHALT CONCRETE—TYPE 1AC (ARMOR COAT) (Mixing Method—Hot Mix—One Course)

The specifications for this item will appear in the proposal if and when it is to be included in the work items of the contract.

ITEM 51D—ASPHALT CONCRETE DRIVEWAYS

1. DESCRIPTION. Under this item the Contractor shall construct driveways at locations designated on the plans or by the Engineer and in accordance with the specifications for the asphalt concrete item designated in the proposal for the roadway pavement.

2. METHOD OF MEASUREMENT AND BASIS OF PAYMENT. The provisions of Method of Measurement and Basis of Payment of Item 51F shall apply and the number of tons of asphalt concrete to be measured for payment under this item shall begin at the near edge of highway pavement and extend to the end of the driveways as designated by the Engineer.

ITEM 51FZ—ASPHALT CONCRETE, TYPE 1A (TOP COURSE)

The specifications for Item 51-F shall apply except that under this Item the Contractor shall construct a one course layer of top course-mix laid to the required thickness as shown on the plans.

ITEM 51S—COLORED SYNTHETIC BINDER CONCRETE

1. DESCRIPTION. Under this item, the Contractor shall construct a one-course colored synthetic binder concrete course laid to conform to the required grade, thickness, cross-section and color shown on the plans or as ordered by the Engineer. The general specifications as modified of "Bituminous Concrete" shall apply except as modified herein.

2. MATERIALS.

Aggregates. The specifications for M3, Fine Aggregates shall apply except that the gradation shall be as necessary to meet the general mix gradation limits herein. In addition, when wet, the aggregate shall be white and shall have a lightness index of at least 40 on the Gardner color scale.

Binder. The synthetic binder shall conform to the requirements of Item 64C – Synthetic Resin Binder.

Pigment. The pigment shall conform to the requirements of Item 64CP – Pigment for Synthetic Resin Binder.

Samples of the aggregates, binder and pigments along with a job mix formula for the mixture shall be submitted to the Laboratory at least 30 days prior to intended use for initial approval. Sample size shall be as follows:

Aggregates – 50 lbs. of each size
Binder – 2 gallons
Pigment – 2 lbs. (Information as to manufacturer's packaging units shall be included with the pigment sample)

These samples will be in addition to the Department's routine sampling and acceptance program.

Composition of Mixture. The gradation, binder content, percentage of pigment and mixture temperature shall be as shown below. Approval of the job mix formula shall depend on Laboratory test results on the aggregate, pigment, binder and mixture. If the gradation and aggregate color are approved by the Chief Engineer, he shall also set the synthetic binder content and percent of pigment used in the mix.

Sieve Size	General Limits % Pass	Job Mix % Tolerance
1/8	100	
20	38 – 72	±4
40	21 – 54	±4
80	10 – 30	±3
200*	3 – 15	±2
Synthetic Binder Content	7.0 – 9.0	±0.4
Pigment*	0.20 – 2.50	—

Mixture, aggregate and binder temperature range: 260°F. – 325°F.

*Note that the percent pigment added to the mix is defined as percentage of total aggregate weight and shall be considered as mineral filler passing the #200 sieve.

Preparation of Mixture. Before the pugmill is allowed to receive the synthetic binder, it shall be thoroughly cleaned by charging a minimum of two successive batches of hot dry aggregate into the pugmill and mixing each for a minimum of four minutes. In addition, the first batch of synthetic binder concrete produced after a change from normal asphalt production shall not be incorporated into the work. Such batches shall be of at least 50% of the rated pugmill capacity.

After introduction of the binder into the pugmill, the pigment shall be added in whole bags or packages as delivered by the manufacturer. The percentage of pigment as determined by the Laboratory may be increased as ordered by the Engineer to increase brilliance, but in no case shall pigment be added by partial bags or packages.

3. CONSTRUCTION DETAILS. All surfaces to be paved shall be thoroughly cleaned of all foreign material prior to the placing of the pavement. A prime coat consisting of a uniform application of RC-70 Synthetic Cutback (Item 69S) shall be applied at a uniform rate of between 0.07 and 0.17 gallons per square yard over existing concrete or brick pavements. Existing bituminous pavements and new base or leveling courses shall be primed only when indicated on the drawings or as ordered by the Engineer.

The trucks, paving machines, rollers and tools which come in contact with the synthetic binder concrete shall be thoroughly cleaned before use. In addition, the paving machine shall be cleaned of excess asphalt by spraying with solvent, followed by the passage of two or more tons of clean hot aggregate through the paver, followed by the passage and subsequent wastage of at least one ton of synthetic binder concrete through the paver. This synthetic binder concrete may be from the same batch used to clean the pugmill.

The acceptable thickness tolerance on this course shall be ±1/8" from the nominal thickness as shown on the plans or ordered by the Engineer.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of tons of compacted material placed in accordance with the plans and specifications.

5. BASIS OF PAYMENT. The unit price bid per ton shall include the cost of furnishing all labor, materials and equipment necessary to complete the course except that synthetic resin binder, pigment for synthetic resin binder, and synthetic resin rapid curing cutback prime coat shall be paid for under their respective items.

ITEM 51TL—ASPHALT CONCRETE TRUING AND LEVELING COURSE

1. DESCRIPTION. The specifications for Item 51, Asphalt Concrete, shall apply except as noted. Under this item the Contractor shall furnish and place a truing-up or leveling course over the existing pavement or over any surface on which it is proposed to lay a wearing course. This course shall be the minimum variable thickness of proper plant mix necessary to bring the surface of the existing pavement to the same transverse slope and longitudinal grade required for the finished pavement surface.

2. MATERIALS. The material used in this course shall be prepared in accordance with the specifications for either the Surface or Binder Course material or a combination of both as ordered by the Engineer, using the asphalt concrete as required in the proposal.

3. CONSTRUCTION DETAILS. The work shall consist of removing irregularities in the old pavement, filling and patching holes, correcting variations in banked pavement, establishing pavement crowns, etc. The bituminous material shall be placed in a manner which will produce the desired result and be satisfactory to the Engineer.

The provisions of the General Specifications for Bituminous Concrete shall apply. Under the heading "Compacting the Course" special attention shall be paid to compacting the thin sections before cooling.

For compacted thicknesses up to 1-1/2 inches the Fine Mix shall be used. For compacted thicknesses in excess of 1-1/2 inches the Coarse or Binder Mix shall be used.

The surface of the truing-up course shall be tested in the same manner as provided in the General Specifications for placing bituminous concrete except that the allowable variation from the true surface after compaction shall not exceed 3/8 of an inch. This course shall be placed at least 24 hours in advance of the time of placing any portion of the finished wearing surface.

ITEM 51Y—ASPHALTIC CONCRETE FOR SHOULDERS

1. DESCRIPTION. Under this item the Contractor shall construct a bituminous concrete course laid to conform to the required grade, thickness and cross-section shown on the plans and in accordance with the specifications for Bituminous Concrete Part II, Section 8 of the Public Works Specifications and amendments thereto, except as herein modified.

2. MATERIALS AND CONSTRUCTION DETAILS. The aggregates to be used shall be a local bank run gravel and limestone filler or a combination of sand, stone and limestone filler. All aggregate except the limestone filler shall be passed through a dryer and the properly graded aggregates shall be introduced into the pugmill at a temperature specified by the Engineer, between the limits of 250°F. and 325°F.

Asphalt Cement. The asphalt cement used in the mix shall be a paving grade asphalt meeting the requirement of Item 64 and shall be introduced into the pugmill at a temperature specified by the Engineer between the limits of 225°F. and 300°F.

Proportioning. All materials used in the mix including the Bituminous material shall be proportioned as specified under table "Composition of Mixture" of this specification.

COMPOSITION OF MIXTURE

Passing 1" screen	100%
" 1/2" screen	78–100%
" 1/4" screen	64– 90%
Passing #10 sieve	41– 70%
" #40 "	17– 38%
" #80 "	8– 21%
" #200 "	4– 12%
Asphalt Cement	6– 8%

The submission of a job mix formula as required in the general specifications will not be required for this item. The plan formula and the proportion of the mixture will be specified by the Engineer within the limits stated in the table "Composition of Mixture". Material passing the 200 mesh sieve will be considered as filler and will be deducted from the amount of pulverized limestone needed to meet the requirements of the #200 mesh sieve.

MIXING

Aggregates. The aggregates shall be introduced into the mixer at the temperature specified by the Engineer and dry mixed for a period of at least 15 seconds before the asphalt is added.

Asphalt Cement. The asphalt cement shall be introduced into the mixer at the temperature specified by the Engineer and the mixing period after the introduction of the asphalt cement shall be at least 45 seconds or as long as may be necessary to completely and uniformly coat all aggregate particles with the asphalt cement.

The maximum thickness of any one compacted course shall be 3 inches and the mixture shall not be of a temperature less than 225°F. at the time of placing. Where typical sections of greater than three inches is called for on the plans or in the itemized proposal this course shall be placed and compacted in equal depths and in no case shall any course be less than the 1-1/4 inches in compacted thickness.

The use of an automatic screed will not be required.

When hand spreading is permitted, the use of dumping sheets outside of the area in which the material is to be spread will not be required.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of tons of compacted material placed in accordance with the plans and specifications.

4. BASIS OF PAYMENT. The unit price bid per ton for this item shall include the cost of furnishing all materials including the bitumen, the mixing, transporting, placing, rolling and all labor and equipment necessary to complete the work except the payment for any surface treatment with an approved aggregate where required will be made under its respective item.

ITEM 52—ASPHALT CONCRETE—TYPE 2A
(Stone Filled Sheet Asphalt)
(Mixing Method—Hot Mix—Two Course)

1. DESCRIPTION. Under this item the Contractor shall construct a two-course bituminous concrete pavement laid to conform to the required grade, thickness and cross-section shown on the plans and in accordance with the general specifications for Bituminous Concrete, Part II, Section 8.

2. MATERIALS AND CONSTRUCTION DETAILS.

Preparation of the Aggregates. The properly sized aggregates shall be introduced into the pugmill at a temperature specified by the Engineer between the limits of 275°F. and 350°F.

'71

The asphalt cement used in the mix shall be a paving grade asphalt meeting the requirements of Item 65 or a combination of 85% asphalt cement meeting the requirements of Item 64 and 15% of powdered gilsonite or M5P powdered asphalt, by weight. The method of adding the gilsonite or powdered asphalt shall be subject to the approval of the Engineer. The asphalt cement shall be introduced into the pugmill at a temperature compatible with that of the aggregates as determined by the Engineer, between the limits of 250°F. and 350°F.

Proportioning. All materials used in the mix, including the bituminous material, shall be proportioned as specified for Type 2A top or binder under the table COMPOSITION OF BITUMINOUS PLANT MIXTURES in the general specifications.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of tons of compacted material in place.

4. BASIS OF PAYMENT. The unit price bid per ton for this item shall include the cost of furnishing all materials including the asphalt cement and gilsonite, the mixing, transporting, placing, rolling and all labor and equipment necessary to complete the work except that payment for surface dusting with an approved aggregate where required shall be made under its respective item.

ITEM 52B—ASPHALT CONCRETE—TYPE 2B
(Stone Filled Sheet Asphalt)
(Mixing Method—Hot Mix—Two Course)

1. DESCRIPTION. Under this item the Contractor shall construct a two-course bituminous concrete pavement in accordance with the Specifications for Item 52—Asphalt Concrete—Type 2A except as modified herein.

All materials used in the mix shall conform with the requirements for Type 2B top or binder in the general specifications for "Bituminous Concrete—Part II—Section 8" and the gradations shall conform to the table COMPOSITION OF BITUMINOUS PLANT MIXTURES therein.

Regardless of the amount of work under this item in the contract, each course shall be laid with a finishing machine of an approved type.

ITEM 52PI—MASTIC PAVING FOR CORRUGATED STRUCTURAL PLATE PIPE AND PIPE ARCHES

1. DESCRIPTION. Under this item the Contractor shall furnish and place a bituminous mastic pavement with bituminous primer over the inverts of corrugated structural plate pipe where and as indicated on the plans or in the proposal, so as to provide a uniform smooth interior.

2. MATERIALS. Composition by weight of the bituminous mastic shall be as follows:

50% Mortar sand conforming to M3A, Mortar Sand
30% Portland cement conforming to M1, Portland Cement
20% Bituminous material conforming to the requirements for bituminous material for pipe coating and paving of M23A

3. CONSTRUCTION DETAILS. Pavement shall not be placed until after the embankment has been completed over the pipe, all strutting has been removed and settlement has been completed to the satisfaction of the Engineer. Priming or paving shall not be commenced until the interior of the pipe is completely dry, and the pipe shall be kept in a dry condition until paving has been completed for the full length of the pipe.

The bottom 25 percent of the inside circumference for round or elongated pipe, the bottom 30 percent of the inside periphery for arch spans of 10 ft.-3 in. and shorter and the bottom 35 percent of the inside periphery for arch spans longer than 10 ft.-3 in. shall be paved unless otherwise ordered by the Engineer.

Surfaces to be paved shall be uniformly coated with the bituminous primer at the rate of 0.10 to 0.15 gal. per sq. yard of metal surface coated.

The dry materials shall be heated to a temperature between 375°F. and 400°F. and mixed dry until uniformly blended. The coating asphalt, heated to a temperature between 375°F. and 400°F. shall be added to the mineral aggregate and mixed until uniformly blended, as determined by the Engineer, a minimum of ten minutes. The mixture shall be removed from the mixer at a temperature between 375°F. and 400°F. and immediately placed and troweled to a depth of 1/4 inch to 1/2 inch above the crests of corrugations.

4. METHOD OF MEASUREMENT. The quantity of pipe pavement to be paid for shall be the number of square feet installed as shown on the plans or as ordered by the Engineer. The area shall be computed as the total area of pipe periphery covered, measured at the crests or corrugations.

5. BASIS OF PAYMENT. The unit price bid per square foot shall include the cost of all labor, materials and equipment necessary to complete the work including asphalt primer.

ITEM 55B—SURFACE COURSE BROKEN STONE
(Bituminous Double Surface Treatment)

ITEM 56—SURFACE COURSE BITUMINOUS MACADAM
—TYPE 1
(Penetration Method—Hot Asphalt)

ITEM 57—SURFACE COURSE BITUMINOUS MACADAM
—TYPE 2
(Penetration Method—Asphalt Emulsion)

ITEM 58C—SURFACE COURSE BITUMINOUS MACADAM
—OPTIONAL
(Asphalt Cutback—Road Mix)

ITEM 58E—SURFACE COURSE BITUMINOUS MACADAM
—OPTIONAL
(Asphalt Emulsion—Road Mix)

ITEM 59W—BITUMINOUS STABILIZED COURSE
(Including Shoulders)

ITEM 59Y—SOIL CEMENT COURSE (Including Shoulders)

The specifications for the above items will appear in the proposal if and when they are to be included in the work items of the contract.

ITEM 60—TREATMENT WITH BITUMINOUS MATERIAL

1. DESCRIPTION. Under this item the Contractor shall furnish, heat if necessary, unload, haul and apply bituminous material of the kind specified.

2. CONSTRUCTION DETAILS. After the pavement has been cleaned for surface application or stone prepared for penetration application and when dry, the bituminous material shall be uniformly sprayed over the surface by means of an approved pressure distributor. Each machine used for applying the bitumen shall be required to operate under and maintain a pressure of at least 20 pounds per square inch for surface application and 50 pounds per square inch for penetration work. The machine must be so constructed that, at all times under any condition, it will distribute the material evenly and uniformly.

The amount of bituminous material to be used at any one application per square yard shall depend upon the character of the pavement, the materials and the local conditions. The Contractor shall, therefore, be subject entirely to the direction of the Engineer in this respect.

The application of the bituminous material for surface application shall be confined to one side of the pavement for any continuous length of highway treated under this contract. The opposite side shall then be treated, starting at the same end of the highway as in the treatment of the first side. The application of bituminous material for penetration work shall be as directed by the Engineer.

It is intended that the bituminous material for cold application will not require heating before applying; but should the temperature of the air fall below 60°F. and when required by the Engineer, the material must be heated sufficiently to be properly applied, at no additional expense to the County.

The bituminous material for hot application shall be heated to a temperature specified by the Engineer between the limits of 200°F. and 300°F. as required, if asphalt is used.

3. METHOD OF MEASUREMENT. Under this item the Contractor will be paid for the number of gallons of bituminous material furnished and incorporated in the work in accordance with the plans and specifications and the orders of the Engineer. Bituminous material that has been wasted or that has been rendered unfit for use by overheating or long continuous heating will not be paid for.

4. BASIS OF PAYMENT. The unit price bid per gallon shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 60A—SUBSEALING CEMENT CONCRETE PAVEMENT

The specifications for this item will appear in the proposal if and when it is to be included in the work items of the contract.

ITEM 60C—COLOR CONTRAST FOR PAVEMENT

The specifications for this item will appear in the proposal if and when it is to be included in the work items of the contract.

ITEM 60CW—WHITE COLOR CONTRAST FOR PAVEMENT

1. DESCRIPTION. Under this item the Contractor shall furnish Bituminous Materials and surface treat the pavement or shoulder areas at locations shown on the plans or ordered by the Engineer. No work shall be performed under this item when the air temperature in the shade is below 70°F.

2. CONSTRUCTION DETAILS. After the top course Asphalt Concrete has been completed, the Contractor shall locate and mark all areas to be treated. An application of Rapid Curing Asphalt Cut Back Grade RC-70 or as indicated in the proposal shall then be applied to those areas at the rate of 0.2 to 0.3 gallons per square yard by means of an approved pressure distributor.

Immediately after the Bituminous Material has been applied, No. 1A size washed calcite stone chips shall be spread on the treated areas at the rate of 20 to 25 pounds per square yard and rolled once using a smooth wheeled roller in order to set the stone chips firmly into the base. This shall be immediately followed by a minimum of 4 passes with an approved pneumatic tired roller.

The whiteness of the calcite aggregate shall be such that when pulverized so that 100 percent passes the No. 200 sieve it shall show a 70 percent reflection when tested with the Gardiner Reflection Meter.

The quantity of Bituminous Material and stone chips may be varied as directed by the Engineer to provide as rough a surface as possible and the rolling must be regulated so that the top of the chips remain uncoated with Bituminous Material in order to provide as great a color contrast as possible with the adjacent Asphalt Pavement.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of square yards of pavement treated in accordance with these specifications.

4. BASIS OF PAYMENT. The unit price bid per square yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 60D—DRILLING SUBSEALING HOLES

The specifications for this item will appear in the proposal if and when it is to be included in the work items of the contract.

ITEM 61—BITUMINOUS MATERIAL

1. DESCRIPTION. Under this item the Contractor shall furnish and place bituminous material as shown on the plans and in accordance with the specifications.

2. MATERIALS. Material furnished for use under this item shall conform to the specifications for Item 69MA or 69MB Bituminous Material A, Cut Back or Asphalt Emulsion, RS-2 (Item 70B, Grade C).

3. CONSTRUCTION DETAILS. Bituminous material shall be applied in an even coating by mopping. It shall be applied to dry surfaces in two equal coats at right angles to each other so that the final coverage shall total not less than four gallons per 100 square feet. A small area shall be coated with the bituminous material and approved by the Engineer before the remainer of the work, which shall be equal to the approved area, is performed.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of gallons of Bituminous Material incorporated in the work as shown on the plans and in accordance with the specifications.

5. BASIS OF PAYMENT. The unit price bid per gallon shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 62—MEMBRANE WATERPROOFING

ITEM 63—PROTECTION COURSE FOR MEMBRANE WATERPROOFING

The specifications for these items will appear in the proposal if and when they are to be included in the work items of the contract.

ITEM 64C—SYNTHETIC RESIN BINDER

1. DESCRIPTION. This item is to be used in connection with Item 51S. Under this item, the Contractor shall furnish and incorporate in the work a synthetic resin binder. The supplier shall furnish the Engineer with data on the temperature-viscosity relationship for each lot of binder to be used on a project. This data shall take the form of a graph as approved by the Laboratory and shall cover the ranges of temperatures and viscosities within which the binder may be used.

2. MATERIALS. The binder shall comply with the following specifications:

% Water	0.0
Homogeneous	Yes
Pen @ 77° F. 100 g 5 sec.	85-100
Pen @ 39.2° F. 200 g 60 sec.	———
Pen ratio (39.2° F/77° F. x 100)Min.	30
% Loss @ 325° F. Max	1.0
Thin Film Oven Test % Min.	47
% Sol. in CCl_4 Min.	99.5
Flash Point °F. Min.	400
Ductility @ 77°F. Min.	100

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of gallons measured at a temperature of 60°F. incorporated into the work as directed by the Engineer.

4. BASIS OF PAYMENT. The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to incorporate the synthetic binder material into the work.

ITEM 64CP—PIGMENT FOR SYNTHETIC RESIN BINDER

1. DESCRIPTION. This item is to be used in connection with Item 51S. Under this item, the Contractor shall furnish and incorporate in the work a pigment yielding the desired mix color.

2. MATERIALS. The pigment shall be compatible with the synthetic binder to be used and shall produce a non-fading heat stable color in the synthetic binder concrete. The pigments shall be of approved types or their demonstrated equivalent as shown in the following schedule:

(a) White Titanium Dioxide - 50 lbs. per ton of mix TiO_2 (Rutile)
OR - 450 - American Cyanamid
(or) R-722 - New Jersey Zinc
(or) R-44 - Glidden
(or) RL-5-DB-C. Worthington, Inc.

(b) Yellow - 34 lbs. per ton of mix
CP Chrome Yellow Medium No. 2343 - Harshaw Chemical Company
(or) Ready Dispersed Chrome Yellow R-1238 - Mineral Pigments Corp.

(c) Orange - 46.8 lbs. per ton of mix as follows:
33.3% Ming Orange No. 2522 - Harshaw Chemical Company and
66.7% CP Chrome Yellow Medium No. 2343 Harshaw Chemical Co.
(or) Ready Dispersed Chrome Yellow R-1238 - Mineral Pigments Corp.

(d) Traffic Red - 20 lbs. per ton of mix as follows:
90% Ming Orange No. 2522 - Harshaw Chemical Co.
10% Permanent Red 2B-1051S - Harshaw Chemical Co.

(e) Green - 10 lbs. per ton of mix as follows:
25.0% Zulu Green No. 3820 - Harshaw Chemical Co.
71.0% TiO_2 (Rutile - see under White)
4.0% Blue Toner NC-4851 (non-crystallizing) - Harshaw Chemical Co.

(f) Blue - 8.5 lbs. per ton of mix as follows:
40.0% Blue Toner NC-4851 (non-crystallizing) -
Harshaw Chemical Co. 60.0% TiO_2 (Rutile - see under White)

3. METHOD OF MEASUREMENT. The quantity to be paid for will be the number of pounds of pigment incorporated into the mix.

4. BASIS OF PAYMENT. The price bid per pound shall include the cost of all labor, materials and equipment necessary to incorporate the pigment into the work.

ITEM 69S—SYNTHETIC RESIN RAPID CURING CUTBACK

1. DESCRIPTION. This item is to be used in connection with Item 51S. Under this item, the Contractor shall furnish and incorporate in the work synthetic binder material meeting the requirements of this item.
The supplier shall furnish the Engineer with data on the temperature-viscosity relationship for each lot of binder to be used on a project. This data shall take the form of a graph as approved by the Laboratory and shall cover the ranges of temperatures and viscosities within which the binder may be used.

2. MATERIALS. The cutback shall conform to the following requirements with the addition that it shall be a light colored synthetic resin compatible with the colored synthetic binder concrete course laid over it:

Water, Max. (%)	0.2
Kinematic Viscosity @ 140°F. Centistokes	8-18
Distillation: % Total distillate	
to 680°F., by Vol.	
to 374°F., Min.	10
to 437°F., Min.	50
to 500°F., Min.	70
to 600°F., Min.	90
Residue from distillation to 680°F.	
% Volume by difference Min.	43
Specific Gravity @ 60°F.	0.890 - 0.905

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of gallons measured at a temperature of 60°F. incorporated into the work as directed by the Engineer.

4. BASIS OF PAYMENT. The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to incorporate the cutback into the work.

ITEM 69X—BITUMINOUS MATERIAL "A" CUTBACK

ITEM 70X—BITUMINOUS MATERIAL "A" EMULSION

The specifications for these items will appear in the proposal if and when they are to be included in the work items of the contract.

ITEM 64—BITUMINOUS MATERIAL A, PAVING

ITEM 64P—BITUMINOUS MATERIAL A, PAVING

ITEM 65—BITUMINOUS MATERIAL A, PAVING

ITEM 66B—BITUMINOUS MATERIAL A, CATIONIC EMULSION

ITEM 66D—BITUMINOUS MATERIAL A, CATIONIC EMULSION

ITEM 67B—BITUMINOUS MATERIAL A, LIQUID MEDIUM CURING

ITEM 67C—BITUMINOUS MATERIAL A, LIQUID MEDIUM CURING

ITEM 67D—BITUMINOUS MATERIAL A, LIQUID MEDIUM CURING

ITEM 67DX—BITUMINOUS MATERIAL A, LIQUID MEDIUM CURING

ITEM 67E—BITUMINOUS MATERIAL A, LIQUID MEDIUM CURING

ITEM 67F—BITUMINOUS MATERIAL A, LIQUID MEDIUM CURING

ITEM 67G—BITUMINOUS MATERIAL A, LIQUID MEDIUM CURING

ITEM 69—BITUMINOUS MATERIAL A, CUTBACK RAPID CURING

ITEM 69C—BITUMINOUS MATERIAL A, CUTBACK RAPID CURING

ITEM 69MA—BITUMINOUS MATERIAL A, CUTBACK RAPID CURING

ITEM 69MB—BITUMINOUS MATERIAL A, CUTBACK RAPID CURING

ITEM 69R—BITUMINOUS MATERIAL A, CUTBACK RAPID CURING

ITEM 70—BITUMINOUS MATERIAL A, EMULSION

ITEM 70B—BITUMINOUS MATERIAL A, EMULSION

ITEM 70C—BITUMINOUS MATERIAL A, EMULSION

ITEM 70M—BITUMINOUS MATERIAL A, EMULSION

ITEM 70MS—BITUMINOUS MATERIAL A, EMULSION

ITEM 71—BITUMINOUS MATERIAL A, FILLER

ITEM 71B—BITUMINOUS MATERIAL A, FILLER

ITEM 71C—BITUMINOUS MATERIAL A, SUBSEALING

1. DESCRIPTION. Under these items the Contractor shall furnish and incorporate in the work bituminous material of the kind and quality designated on the plans or in the specifications meeting the requirements of M5, Bituminous Materials.

Application or Mixing Temperatures. Under Items 64 through 65, and Items 67B through 69MB, the supplier shall furnish the Engineer with data on the temperature-viscosity relation for each lot of asphalt to be used on a project. These data shall take the form of a graph as

approved by the Laboratory and shall cover the range of temperatures and viscosities within which the asphalts may be used.

2. METHOD OF MEASUREMENT. The quantity to be paid for under these items will be the number of gallons measured at a temperature of 60°F. incorporated in the work as directed by the Engineer.

3. BASIS OF PAYMENT. The unit price bid shall include the cost of furnishing all labor, materials and equipment necessary to incorporate the bituminous materials in the work.

ITEM 76—MAINTENANCE AND PROTECTION OF TRAFFIC (Requirement A, B or C)

1. DESCRIPTION. Under this item the Contractor shall maintain traffic and protect the public from damage to person and property, within the limits of and for the duration of the Contract. Traffic shall be maintained over a reasonably smooth traveled way which shall be so marked by signs, delineation, guiding devices and/or other methods that a person who has no knowledge of conditions can safely, and with a minimum of discomfort and inconvenience, ride, drive or walk over all or any portion of the highway under construction where traffic is to be maintained. Under this item the words "delineation" and "guiding devices" include but are not limited to delineators, barrels, flashers, flares, railing, temporary curb of any kind, pavement markings (paint, tape or other) and other similar materials or methods acceptable to the Engineer. Pavement markings shall be understood to mean their application and removal when so ordered. All work under this item shall be in accordance with the plans and/or as ordered by the Engineer.

All signs, delineation and guiding devices used to maintain, protect and control traffic shall comply with the NEW YORK STATE MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES.

The Contractor is placed on notice that the Maintenance and Protection of Traffic over this highway during construction is considered as important and necessary an item of work as is the actual construction itself. The Contractor shall at all times conduct his operation in a manner to insure the safety of not only the motorist but also the pedestrian and his own employees.

The Contractor shall protect the user from damage to person and property by reason of any construction operation (for example—painting, paving, blasting, tree work, demolition, etc.) by such protective screens, devices or methods as are approved by the Engineer.

Unless otherwise specified in the Proposal or on the plans the Contractor shall under this item be responsible for the maintenance within the limits of the Contract of the entire pavement, drainage facilities and other highway elements, both old and new, beginning within ten days after the date the Contract is awarded and ending on the date the Contract is officially accepted. In the event that the Contractor is authorized in writing by the Chief Engineer to delay the start of the work beyond the 10 day period provided in the specifications, the following exception is made relative to the start of Watchman service and responsibility for physical maintenance of the highway or contract site: Watchman service and responsibility for physical maintenance of the highway or contract site called for in the proposal shall begin on the day that work on any item of the contract (including any preparatory work or moving of equipment on the site) is started and shall continue until the date of acceptance of the contract. He shall not be responsible for the plowing of snow or the control of ice on the pavement, or on the travel way, as the case may be.

The Contractor shall so schedule his work as to keep to a minimum, the amount of the old traveled way that is destroyed or substantially damaged at any one time. Any such length in excess of one mile shall be considered excessive unless the Contractor shall have submitted and the Engineer approved a detailed schedule of operations which reflects to the contrary.

2. MATERIALS. All materials used shall comply with the requirements for the various items or materials as established in these specifications or on the plans. Existing pavements shall be kept in repair by using suitable plant-mix bituminous materials for concrete or bituminous pavements. Earth or gravel traveled ways shall be repaired and maintained by the use of the basic material or other suitable material approved by the Engineer. The Contractor may at his own expense and if approved by the Engineer, utilize a stabilizing agent in the material used for maintaining or patching gravel or earth traveled ways.

All temporary signs, delineators and other warning and guiding devices shall be as specified in the plans or as approved by the Engineer and, except as otherwise specified will remain the property of the Contractor.

Reflective sheet material shall conform to the minimum requirements as set forth on the Standard Structure Sheets for construction signs. Material meeting the more rigid requirements of M71 - REFLECTORIZED SIGN BACKGROUND as included in the latest edition of the New York State Department of Transportation "Public Works Specifications" may be used at the Contractor's option. Reflective paints shall conform to M200 - REFLECTIVE LIQUID COATING - EXPOSED LENS as included in the latest edition of the New York State Department of Transportation "Public Works Specifications".

3. CONSTRUCTION DETAILS. (a) The Contractor shall generally provide a traveled way suitable for two or more lanes of traffic. This travel way shall be kept well drained and reasonably smooth and hard at all times and free of potholes, bumps, irregularities and depressions that hold or retain water. He shall conduct his operations to insure a minimum of delay to traffic. Stopping traffic for more than approximately 5 minutes is considered unsatisfactory. Traveled ways on which the posted speed cannot be reasonably, comfortably and safely maintained are considered unsatisfactory. The necessary equipment and personnel to attain and maintain a satisfactory riding surface shall be available and used as needed at all times, both when the work is under way and when the work is temporarily suspended for any period of time. Special attention shall be given to maintenance of a satisfactory traveled way over weekends, holidays and during the winter season.

(b) The Contractor shall keep the traveled way free of foreign objects such as rocks, timber and other items that may fall from transporting vehicles. Spillage of material carried by or dropped from the under-carriage of any carrying vehicle resulting from the Contractor's hauling operations along or across any public traveled way shall be removed immediately and such traveled way, both within and outside of the contract limits shall be kept free of such spillage by the Contractor. Whenever dusty conditions resulting from the Contractor's operations occur they shall be corrected by the use of calcium chloride and/or water. Where water is used it shall be distributed uniformly over a minimum width of 8 feet by the use of suitable spray heads or spray bar. Whenever it becomes necessary to maintain traffic on one lane the Contractor shall provide adequate traffic controls on the section of highway on which vehicle operation is maintained. He shall employ a sufficient number of competent flagmen and/or temporary traffic lights operating continuously during the time traffic is so maintained. In the event the length of the one lane operation is extremely short and conditions are favorable to safe operation, the Engineer may, in writing, authorize the Contractor to dispense with flagmen or traffic control signals. The Contractor shall also provide a sufficient number of competent flagmen in areas where traffic is congested, particularly where construction equipment is operating.

Flagmen shall be equipped with approved yellow or red-orange caps and vests in conformance with the New York State Manual of Uniform Traffic Control Devices.

(c) The Contractor shall maintain all elements of the Highway, both old and new, beginning within ten days after the date the Contract is awarded and ending on the date the Contract is accepted by the Commissioner unless otherwise designated on the plans or in the proposal. He shall provide an adequate traveled way as specified. He shall devote particular attention to all drainage facilities, keeping them fully operative at all times. Ditches shall be provided at all times, even during grading operations, to adequately drain the traveled way and the remainder of the right of way. The Contractor will not be required to plow snow or control ice on the traveled way.

He shall however keep the entire contract in such condition that snowplows and related equipment may safely traverse the area to plow snow and/or control ice on the traveled way. He shall be responsible for the moving of any plowed snow that may be necessary to adequately maintain any element of the highway, except that he will not be responsible for the moving of any plowed snow from driveways or entrances.

Any damage to any portion of the work occasioned by lack of adequate maintenance shall be repaired by the Contractor at his own expense.

Separate payment will be made to the Contractor for the repair or replacement of the following permanent completed elements of the highway, for which the Contractor is responsible, that may be damaged by public traffic other than the Contractor's:

Guide Rail, Guide Posts, Bridge Railing, Median Barrier, Curbs, Permanent Barricades, Fencing, Light Poles and Appurtenances, Delineators, Route Mile Markers, Signs and Sign Structures, and Traffic Signal Equipment.

Work for which there is a bid item will be paid for at the unit price for that item. Work for which there is no bid item will be paid for at an agreed price or by means of force account.

(d) The Contractor shall provide and maintain at all times a safe and adequate ingress and egress to and from intersecting highways, homes, businesses and commercial establishments at existing or at new access points, consistent with the work, unless otherwise authorized by the Engineer. The Contractor will not be responsible for snow removal from driveways or entrances. On highways on which motor bus service is maintained, he shall provide suitable areas or locations for the loading and unloading of passengers. The existing pavement at improved intersecting streets shall not be disturbed without prior consent of the Engineer.

(e) The Contractor shall furnish and erect, as required and as directed by the Engineer, reflectorized signs for the information of the motorist and to adequately and legally post the highway under construction as to its status.

All signs shall be kept clean, mounted at the indicated height and so placed as to be effective both day and night. Signs, warnings, delineators and barricades shall be used to adequately inform the motorist of any unusual or unsafe condition and to safely and clearly guide him through the contract area. Such signs, warnings or devices shall be so placed as to give timely warning and permit the motorist to take the necessary action to traverse the area safely.

The Contractor shall delineate areas where there is a drop-off near the edge of the traveled lanes and areas on which it is unsafe to travel. Where the drop-off is less than six inches, and where soft or unsafe areas occur, an approved delineator shall be placed along the edge of the traveled way at intervals of not more than 200 feet. Where the drop-off is between 6 inches and 18 inches, the spacing shall be reduced to 100 feet maximum. Where the drop-off is greater than 18 inches, a continuous delineation consisting of a properly painted or reflectorized board or band shall be used in addition to individual delineators. 30 to 55 gallon drums or containers set on end may be used as delineators, provided they are properly painted or reflectorized and kept clean at all times. Other markers or delineators may be circular or rectangular in shape and shall be constructed of reflective sheeting having a minimum area of 20 square inches or of reflective buttons having a minimum diameter of 3 inches. All reflective delineators or markers shall be yellow or amber in color except that at entrances to commercial establishments the Contractor shall place a green reflective marker on each side of the designated safe entrance to the establishment. The entire entrance area between adjacent green markers shall be kept safe and smooth for convenient ingress and egress. Delineators shall be substantially mounted so that the bottom of the reflective unit is 4 feet above the elevation of the traveled way. Any area judged by the Engineer to be particularly hazardous shall be marked by the use of oil burning flares or signal flashers with large reflectorized orange lens in addition to the reflective markings.

All signs and markers shall indicate actual conditions existing and shall be moved, removed or changed immediately, as conditions require. Sign sizes, details and mounting heights are shown on Standard Structure Sheets and/or approved sign manuals as indicated in the plans. These are minimum requirements and the Contractor shall have an adequate quantity of each of these signs available for use as required. The Engineer may, if conditions exist, require additional signs. In that event they shall be consistent with the arrangement, material and details of those shown on the Standard Structure Sheets.

(f) All existing highway signs, markers, delineators and their supports (authorized by the State Traffic Commission) within the contract limits are to remain under the control and jurisdiction of the Engineer and are to be maintained for the duration of the contract by the Contractor as directed by the Engineer. Any signs not authorized by the State Traffic Commission shall be removed from the right of way as ordered by the Engineer.

The Contractor shall, when ordered, remove these existing signs, markers and delineators and their supports; store, protect and keep them clean; and replace them on the contract as directed by the Engineer. Signs, markers and delineators not to be replaced shall be cleaned and delivered to the Engineer as directed by him.

Signs, markers and delineators lost or damaged because of negligence on the part of the Contractor shall be replaced at the Contractor's expense.

Route marker signs shall be maintained by the Contractor during construction. Should relocations be necessary at various stages of construction they shall be placed in locations visible to traffic as directed.

(g) The Contractor shall provide watchmen for the continuous patrol of the contract whenever his operations are closed down, and when his operations are curtailed to the point where he is substantially closed down as follows:

Requirement "A". On contracts where traffic is heavy the Contractor shall provide a watchman or watchmen who shall patrol the entire job at least once every hour while the Contractor's operations are closed down or substantially closed down.

Requirement "B". On contracts where traffic is moderately heavy the Contractor shall provide a watchman or watchmen who shall patrol the entire job at least once every three hours while the Contractor's operations are closed down or substantially closed down.

Requirement "C". On contracts where traffic is relatively light the Contractor shall provide a watchman or watchmen who shall patrol the entire job at least once before dark and once between 11 P.M. and midnight on days that the Contractor is working. On weekends or days when the Contractor is not working the watchman shall patrol the entire job at least once between 7 A.M. and 8 A.M., once before dark, and once between 11 P.M. and midnight.

The watchmen will be responsible for making sure all signs, barricades, delineators, flares and markers are up and in good condition and that the traveled way is in a safe and reasonable condition.

In the event that the watchmen cannot physically take care of a hazardous condition, the Contractor shall make arrangements for emergency assistance to the watchmen on notice from them.

Every watchman shall be furnished with a recording time clock of a type satisfactory to the Engineer and shall "punch in" at designated points approved by the Engineer. Distinctive keys for "punching in" shall be securely fastened to a substantial object and all keys that open the

recording element of the clock or clocks shall be kept by the Engineer. The clock or clocks shall be delivered to the Engineer for the removal of the record at times designated by him.

The extent of watchman service required shall be indicated on the plans or in the proposal under Requirement A, B or C. Whenever Requirement "A" or "B" is designated, the Chief Engineer may, in writing, authorize the Contractor to substitute Requirement "B" or "C" whenever work is substantially suspended or substantially completed provided that the entire job site is, in the opinion of the Chief Engineer, in such a condition as to justify this reduction in watchman service.

In the event all work on the contract is suspended due to unavailability of materials, seasonal nature of work or other valid reason, or in the event all work on the contract is completed (except for the removal of construction signs) and it is requested in writing by the Contractor, the Chief Engineer may authorize further reduction or elimination of watchman service for the period during which work is suspended or during the time between the actual physical completion of the work as defined above and the official acceptance of the work by the Commissioner provided that during any such period the Contractor maintains the highway in a satisfactory and safe condition.

The Contractor's attention is directed to the fact that watchman service required under this item does not relieve the Contractor of any of his responsibilities under the item of Uniformed Watchmen Service when the item for Uniformed Watchmen Service is indicated in the Contract documents.

(h) On postal routes, mailboxes serviced from motor vehicles shall be maintained by the Contractor in a usable location during construction. The Contractor should not move any mailbox which contains mail. He will advise the owner to remove such mail before he moves the box. Before acceptance of the work, any mailbox which has been disturbed or removed shall be replaced by the Contractor in a location as directed by the Engineer.

In the event, the original mounting post has been lost, damaged or is unusable, the Contractor shall furnish a 1-1/2" galvanized pipe mounting post with flanged top fitting and will firmly install the new mounting and mailbox at the designated location and at the proper height to the satisfaction of the Engineer.

(i) When directed by the Chief Engineer, the Contractor shall open to traffic any portions of new pavement or structure before final acceptance of the Contract.

Inclement weather or other factors may prevent the installation of permanent pavement markings either by the Contractor or others in time for the opening to traffic of such pavement or structure. The Contractor, in such cases, shall install temporary pavement markings as approved and at the locations ordered by the Engineer. In order not to inhibit bonding of permanent pavement markings, said locations shall be offset an appropriate distance from the location of permanent pavement markings. The cost of such temporary pavement markings will be included in the bid price for Maintenance and Protection of Traffic.

4. METHOD OF MEASUREMENT. The work of maintenance and protection of traffic shall be paid for on a lump sum basis. In the event that, in the judgment of the Engineer, traffic is not maintained adequately and/or safely on any part of the contract, on any day, no payment for maintenance and protection of traffic will be made for that day. The amount of such daily non-payment will be determined by dividing the lump sum amount bid for this item by the number of calendar days between the date of award and the date of completion as designated in the proposal without regard to any extension of time with a minimum of:

$75 per day where Requirement "A" for Watchman Service is called for
$50 per day where Requirement "B" for Watchman Service is called for
$30 per day where Requirement "C" for Watchman Service is called for

These amounts may be deducted from any monies due the Contractor on this Contract.

If the Contractor fails to maintain and protect traffic adequately and safely for a period of 24 hours, the Engineer may correct the adverse conditions by the use of County forces, augmented if necessary by such other equipment and personnel as it may be necessary to hire, and the entire cost of this work by said forces shall be deducted from any monies due the Contractor on this contract. The cost of this work shall be in addition to the daily non-payment deductions listed above.

5. BASIS OF PAYMENT. Maintenance and protection of traffic shall be paid for on the lump sum price bid for this item, less any deductions for unsatisfactory accomplishment as determined under Method of Measurement. The price bid shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work.

If, in the judgment of the Commissioner, the amount bid for this item is not adequate for the Maintenance and Protection of Traffic in accordance with this specification, he may determine that the bid is unbalanced and may for this reason reject any such bid.

The price bid shall also include the cost of any detour, temporary pavement or temporary structure not shown on the plans or in the proposal. The items for Furnishing Water Equipment, Applying Water, Furnishing and Applying Calcium Chloride for dust control within the right of way

and bituminous plant mixed material for patching existing pavement or where specifically ordered by the Engineer, or as shown on the plans shall be paid for under their respective items. Separate payment shall be made to the Contractor for the repair or replacement of certain permanent completed highway elements damaged by public traffic. (See Construction Details, paragraph c.) During the period when plant mixed bituminous material is available the material used for patching or other uses specifically ordered by the Engineer, shall meet the requirements of Item 51F or such other applicable item in the contract as is ordered by the Engineer. When bituminous plants are closed down for the season the material used for patching shall be a suitable "winter mix" approved by the Chief Engineer. The materials used and the method of mixing, storing and applying this "winter mix" shall be as directed by the Chief Engineer. In either case payment for the material used will be made under Item 51F or such other applicable item in the contract as is ordered by the Engineer. Monthly payments will be made for this item in proportion to the total amount of work completed, less any amounts deducted for unsatisfactory accomplishment.

ITEM 77—TEMPORARY STRUCTURES AND APPROACHES

1. DESCRIPTION. Under this item the Contractor shall construct and remove temporary structures and approaches thereto in accordance with the lines, grades and details shown on the plans. In this connection the Contractor may be required to move existing structures to temporary locations as shown on the plans and maintain the structure for the period that traffic operates thereon.

2. MATERIALS. When specific details are shown on the plans, substitutions and alterations of materials will be permitted only when approved by the Chief Engineer. When specific details are not shown on the plans, the Contractor will be required to construct approaches and structures capable of supporting loads at least equivalent to the H15-44 live loading in accordance with the design requirements given by the current edition of the Standard Specifications for Highway Bridges of the American Association of State Highway Officials. Prior to beginning construction of any structure designed by the Contractor, or his agents, the detail plans shall be submitted to the Chief Engineer, for review. The Contractor shall assume all liability and responsibility for the materials and workmanship required to provide adequate and safe structures and approaches.

3. CONSTRUCTION DETAILS. Temporary structures shall be constructed or existing structures moved and temporary approaches shall be constructed in such sequence and manner that interference with and inconvenience to the traveling public is kept at a minimum.
Welding shall conform to the requirements specified under Item 29, Section b, paragraph 32.

4. METHOD OF MEASUREMENT. Payment will be made at the lump sum price bid for this item as follows: Seventy-five percent (75%) of the amount bid will be paid when the Temporary Structures and Approaches are complete and operative. The remaining 25% will be paid when the temporary structures and pertinent approaches or appurtenances are removed.
In the event there is more than one structure the Engineer shall equitably apportion the lump sum bid to each such structure and apply the above procedure to each such structure.

5. BASIS OF PAYMENT. Payment will be made at the lump sum price bid for this item. The price bid shall include the cost of furnishing all labor, materials and equipment necessary to complete the work as shown on the plans and in accordance with the specifications. Payment for maintenance of such temporary structures and approaches thereto shall be included in Item 76, Maintenance and Protection of Traffic.

ITEM 78A—STONE FILLING

ITEM 78B—MEDIUM STONE FILLING

ITEM 78C—HEAVY STONE FILLING

The specifications for these items will appear in the proposal if and when they are to be included in the work items of the contract.

ITEM 79—DRY STONE PAVING

ITEM 79A—GROUTED STONE PAVING

ITEM 79B—CONCRETE BLOCK PAVING

The specifications for these items will appear in the proposal if and when they are to be included in the work items of the contract.

ITEM 80—DRY RIP-RAP

The specifications for this item will appear in the proposal if and when it is to be included in the work items of the contract.

ITEM 80A—GROUTED RIP-RAP

1. DESCRIPTION. Under this item the Contractor shall furnish and place grouted rip-rap as shown on the plans or as ordered by the Engineer.

2. MATERIALS. Rip-rap shall consist of durable field or quarry stone each shaped as nearly as practicable in the form of a right rectangular prism. At least fifty per cent of the stones shall weigh in excess of 300 pounds each, and the remainder of the stones shall weigh from 100 to 300 pounds each.

One dimension of each of the stones furnished shall be the thickness of the grouted rip-rap as shown on the plans and the stones shall be so laid that this dimension is perpendicular to the prepared bed. The grout shall consist of one part Cement and three parts of Fine Aggregates. Cement shall conform to M1 Portland Cement, Type 2 or 2A. Sand shall conform to M3, Fine Aggregates.

3. CONSTRUCTION DETAILS. The stones shall be placed so that the weight of the stones is carried by the underlying material and not by the adjacent stones. On slopes, the largest stones shall be placed at the bottom. All grouted rip-rap shall be properly aligned and in close contact, and shall rest on a 6 inch bed of stone chips, crushed stone, crushed slag or gravel unless the material in the underlying natural slope or embankment is suitable granular material as determined by the Engineer. No material upon which the grouted rip-rap is laid will be allowed to fill the spaces between the stones. When the stones are in place, the spaces between them shall be completely filled with grout and the surface swept with a stiff push broom. No rip-rap shall be grouted in freezing weather. The grouted rip-rap shall be kept moist for four days after grouting.

4. METHOD OF MEASUREMENT. The quantity of grouted rip-rap paid for under this item will be the number of cubic yards measured in the final position. The porous bed placed under the grouted rip-rap will be included in the quantity of grouted rip-rap and will be paid for as such.

5. BASIS OF PAYMENT. The unit price bid, per cubic yard, for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that necessary excavation will be paid for under its appropriate item.

ITEM 81—DISMANTLING AND STORING EXISTING SUPERSTRUCTURES

ITEM 81A—REMOVING EXISTING SUPERSTRUCTURES

ITEM 81B—DISMANTLING AND REMOVING EXISTING SUPERSTRUCTURES

The specifications for these items will appear in the proposal if and when they are to be included in the work items of the contract.

ITEM 82—COFFERDAMS

1. DESCRIPTION. Under this item the Contractor shall furnish, place, maintain and remove cofferdams and unwatering equipment at the locations indicated on the plans or called for in the proposal.

2. MATERIALS. Cofferdams may be constructed of earth, earthfilled bags, sheet piling or any other materials which the Contractor may elect to use.

3. CONSTRUCTION DETAILS. Cofferdams shall be constructed so as to keep the excavations free from earth, water, ice or snow and to permit the excavations to be carried to depths up to 3 feet below the foundation elevations shown on the plans.

The foundations shall be placed with the cofferdams in an unwatered condition unless otherwise indicated on the plans. Unwatering equipment and any necessary bracing shall be of adequate quality and capacity and shall be so arranged as to permit their proper functioning in connection with the cofferdams.

Any and all damage caused by the failure of a cofferdam or the inability of the cofferdam to perform its proper functions from any cause whatsoever shall be the responsibility of the Contractor. It shall also be his responsibility to protect any and all stream banks from erosion

by reason of restriction of the channel caused by the erection of the cofferdams. Any material which erodes from the banks during the time that the cofferdams are in place shall be replaced by the Contractor at his own expense.

The cofferdam system shall be of sufficient size and strength to meet the requirements of the Industrial Code Rule 23.

4. METHOD OF MEASUREMENT. The quantity of cofferdams to be paid for under this item shall be the number of square feet obtained by multiplying the distance, from the elevation of the base of the permanent concrete structure, exclusive of any piles or backfill material placed underneath such base, to an elevation 2 feet higher than the highest water elevation recorded at the site during any period in which the cofferdams are in use in an unwatered condition, by the horizontal length of the cofferdams actually installed. The horizontal length shall be measured along the payment lines shown on the contract plans. Unless otherwise shown on the plans or authorized by the Chief Engineer, the horizontal payment lines for cofferdams shall be established along a line 3 feet beyond the limits of the substructure footing and parallel to the sides of the footings.

In the event that the stream is dry when the cofferdam or cofferdams are established and remains dry during the entire use of the cofferdam or cofferdams, the bed of the stream will be taken as the highest water elevation. The length shall be measured along the driving line of the sheeting in the case of sheet pile cofferdams and along the top surface at the gravity axis of the section in the case of earth or earthfilled bag cofferdams unless the limits are otherwise indicated on the plans or determined by the Engineer.

5. BASIS OF PAYMENT. The unit price bid, per square foot, for this item shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work.

The cost of constructing any necessary cofferdam system above the upper payment elevation described in the Method of Measurement due to the requirements of Industrial Code Rule 23 shall be included in the unit price bid for this item and no direct payment will be made for this additional work.

In the event that the Contractor is required to lower a foundation in excess of 3 feet below the elevations shown on the plans, changes to the respective cofferdam will be classified as extra work and will be paid for at cost based on the Engineers force account records plus a percentage for overhead and profit in accordance with the procedure used by the Department for "Contingencies, Extra Work, Deductions". Additional quantities of other items of this contract made necessary by the lowering of a foundation will be paid for at the unit price bid for the respective items involved.

ITEM 83C—CORRUGATED METAL PILING

ITEM 83S—STEEL SHEET PILING

ITEM 83T—TIMBER SHEET PILING

1. DESCRIPTION. Under this item the Contractor shall furnish and place sheet piling of the type and at the locations shown on the plans or ordered by the Engineer. Sheet piling shall include all necessary waling and bracing. Sheet piling placed under this item will be left in place as a part of the finished structure.

2. MATERIALS. Corrugated Metal Piling. Corrugated metal shall be new and unused conforming to the requirements of ASTM Designation A245 Grade C or D.

The Contractor shall furnish certified copies of test results as required under the heading "Sampling, Testing and Inspection" of Material Specification M-6. Stock Steel which conforms to the above requirements may be used.

Timber Sheet Piling. Unless otherwise indicated on the plans, timber sheet piling shall consist of any acceptable species which can be placed satisfactorily. The timber shall be free from any defects which might impair its strength or tightness.

Steel Sheet Piling. Steel sheet piling shall be new and unused conforming to the requirements of ASTM Designation A328. Stock steel may be used. The Contractor shall furnish certified copies of test results as required under the heading "Sampling, Testing and Inspection" of Material Specification M-6.

3. CONSTRUCTION DETAILS. Steam or pneumatic hammers shall be used to drive all piling. Any material which stops the driving of sheet piling shall be removed by the Contractor. Payment for the removal of such material will be made under an appropriate item.

4. METHOD OF MEASUREMENT. The quantity of piling to be paid for under this item shall be the number of square feet obtained by multiplying the vertical length of piling, measured between the payment lines herein described, by the horizontal length of piling actually installed. The horizontal length shall be measured along a projection of the piling on a plane parallel to and midway between the front and rear face of the piling wall.

The upper payment line, unless otherwise specified on the plans or by the Engineer, shall be the actual intersected grade or ground line whichever is lower. The lower payment line shall be established at the bottom of the piling driven to the penetration shown on the plans or ordered by the Engineer.

When the depth of penetration below the planned bottom of excavation is not specified or ordered by the Engineer, the lower payment line shall be established four (4) feet below the planned bottom of excavation regardless of the depth driven to assure stability.

Additional sheet piling driven only to provide support for the sheeting shown on the plans or ordered by the Engineer shall be considered part of the bracing system and shall not be paid for as sheet piling. Its cost shall be included in the unit price bid for the ordered quantity.

5. BASIS OF PAYMENT. The unit price bid per square foot for these items shall include the cost of furnishing all labor, material and equipment necessary to complete the work.

ITEM 83CT—TEMPORARY CORRUGATED METAL PILING

ITEM 83ST—TEMPORARY STEEL SHEET PILING

ITEM 83TT—TEMPORARY TIMBER SHEET PILING

1. DESCRIPTION. Under this item the Contractor shall furnish, place, maintain and remove temporary corrugated metal, timber or steel sheet piling and necessary waling and bracing, all of the type and at the locations shown on the plans or when and as ordered by the Engineer.

2. MATERIALS. Temporary Timber Sheet Piling. Unless otherwise indicated on the plans, timber sheet piling shall consist of any acceptable species which can be placed satisfactorily. The timber shall be free from any defects which might impair its strength or tightness.

Temporary Corrugated Metal or Steel Sheet Piling. Temporary Corrugated Metal or Steel Sheet Piling need not be new, but the section modulus and the web thickness of the piling used shall be not less than that shown on the plans.

3. CONSTRUCTION DETAILS. Steam or pneumatic hammers shall be used to drive all piling. Any material which stops the driving of sheet piling shall be removed by the Contractor. Payment for the removal of such material will be made under an appropriate item. Unless otherwise shown on the plans, upon completion of the structure, the Contractor may, at his option, remove the corrugated metal or steel sheet piling placed under this item or leave the same in place after cutting off the tops at the elevation ordered by the Engineer.

4. METHOD OF MEASUREMENT. The quantity of piling to be paid for under this item shall be the number of square feet obtained by multiplying the vertical length of piling, measured between the payment lines herein described, by the horizontal length of piling actually installed. The horizontal length shall be measured along a projection of the piling on a plane parallel to and midway between the front and rear face of the piling wall.

The upper payment line, unless otherwise specified on the plans or by the Engineer, shall be the actual intersected grade or ground line whichever is lower. The lower payment line shall be established at the bottom of the piling driven to the penetration shown on the plans or ordered by the Engineer.

When the depth of penetration below the planned bottom of excavation is not specified or ordered by the Engineer, the lower payment line shall be established four (4) feet below the planned bottom of excavation regardless of the depth driven to assure stability.

Additional sheet piling driven only to provide support for the sheeting shown on the plans or ordered by the Engineer shall be considered part of the bracing system and shall not be paid for as sheet piling. Its cost shall be included in the unit price bid for the ordered quantity.

5. BASIS OF PAYMENT. The unit price bid, per square foot, for these items shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

ITEM 83TX—TEMPORARY SHEET PILING

1. DESCRIPTION. Under this item the Contractor shall furnish, place, maintain and remove temporary sheet piling including the necessary waling and bracing, at locations as shown on the plans or as ordered by the Engineer.

2. MATERIALS. Sheet piling for this item shall be of adequate cross section and shall be adequately braced to protect workers against the hazard of falling or sliding material. The selection of materials, their arrangement and details shall be the Contractor's option and responsibility, but subject to the approval of the Engineer.

3. CONSTRUCTION DETAILS. Sheet piling shall be installed where indicated on the plans and directed by the Engineer. Any material which stops the driving of the sheet piling shall be removed by the Contractor, and payment included under the appropriate excavation item. Sheet piling installed under this item shall be tight or continuous, except where skeleton sheet piling is permitted under Industrial Code Rule No. 23 of the New York State Department of Labor, Board of Standards and Appeals. Skeleton sheeting shall be considered as any sheeting other than tight or continuous sheeting.

4. METHOD OF MEASUREMENT. The quantity of tight or continuous temporary sheet piling to be paid for under this item shall be the number of square feet obtained by multiplying the vertical length of piling, measured between the payment lines herein described, by the horizontal length of piling actually installed. The horizontal length shall be measured along the payment lines shown on the contract plans. Unless otherwise shown on the plans or authorized by the Chief Engineer, the horizontal payment lines for temporary sheet piling shall be established along a line 3 feet beyond the limits of the substructure footings and parallel to the sides of the footings.

The quantity of temporary skeleton sheet piling to be measured under this item, when skeleton sheet piling is used, will be the number of square feet of piling measured as if continuous or tight sheet piling was used divided by two (2).

Unless indicated otherwise on the plans or in the proposal, the lower payment line shall be the base of the permanent structure, exclusive of any piles or backfill material placed underneath such base. The upper payment line shall be the subgrade of the roadway when under a cut section or the ground surface existing at the site prior to beginning the work of this item or the finished grade (whichever is lower), or as ordered, in writing, by the Engineer.

Additional sheet piling driven only to provide support for the sheeting shown on the plans or ordered by the Engineer shall be considered part of the bracing system and shall not be paid for as sheet piling. Its cost shall be included in the unit price bid for the ordered quantity.

5. BASIS OF PAYMENT. The unit price bid per square foot for this item shall include the cost of furnishing all labor, material and equipment necessary to complete the work, including all necessary sheeting and bracing. The cost of maintaining the excavated area free from earth, water, ice and snow will be included in the price bid for the appropriate excavation item.

ITEM 84TC—CREOSOTED TIMBER PILES

1. DESCRIPTION. Under this item the Contractor shall furnish and place creosoted timber piles at locations indicated on the plans or as directed by the Engineer. The provisions of the specifications for the item Untreated Timber Piles will apply except as noted herein.

2. MATERIALS. a. General. Piles shall be Southern Pine or Douglas Fir containing, preferably, as much sapwood as possible. The thickness of the sapwood in Southern Yellow Pine and Douglas Fir shall be not less than one and one-half inches and one inch, respectively, on the butt end.

The creosote used in the treatment of the piles shall conform to the requirements of M28A, Wood Preservative Creosote Oil, Type I.

Piles shall be peeled of bark, including the inner skin, soon after cutting, so that the piles are smooth and clean. Care shall be taken to remove as little sapwood as possible while peeling the bark.

b. Conditioning and Treatment. The conditioning before treatment and the preservative treatment shall conform to the requirements of Federal Specification TT-W-571 "Wood Preservative; Recommended Treating Practice", except as modified herein.

c. Retention of Wood Preservative. The minimum amount of creosote finally retained per cubic foot of piles shall be as follows: Piles to be used on land or in fresh water; Douglas Fir and Southern Yellow Pine—12 pounds by the full cell or empty cell process. Piles to be used in salt water; Douglas Fir—16 pounds by the full cell process, and Southern Yellow Pine—20 pounds by the full cell process.

d. Inspection of Piles. The Contractor shall give the Department ample notice relative to the location of, and time when, creosoting operations will take place. Inspection of piles will be made by inspectors designated by the Department before, during and after the piles are creosoted at the creosoting plant. No piles shall be shipped which do not bear, in legible form, the inspector's stamp of approval.

The piles shall be subject to inspection by the Engineer after arrival at the site and no previous approval at the plant shall bar rejection in the field for injury, breakage or defects discovered after the piles have left the creosoting plant.

Piles shall be free from damage or defects which would impair their usefulness or durability for the purpose intended. The use of "S" irons for repairing or preventing checks, splits, or other defects will not be permitted.

e. Storage and Handling of Piles. All creosoted timber piles shall be carefully handled and properly stored. Any surface breaks which do not warrant the rejection of the pile shall be given three coats of hot creosote oil.

f. Treatment of Pile Heads and Bolt Holes. The heads of piles shall be treated as follows: The sawed surface shall be thoroughly brush coated with 3 successive applications of hot creosote, followed by a thick application of a mixture of 30% creosote and 70% pitch. The application of the pitch coat shall not apply to pile heads encased in concrete. All bolt holes bored subsequent to treatment shall be treated with creosote oil by means of an approved pressure bolt hole treater. Any unfilled holes, after being treated with creosote oil, shall be plugged with creosoted plugs.

3. METHOD OF MEASUREMENT AND BASIS OF PAYMENT. The provisions of the specifications for the item Untreated Timber Piles will apply to this item and will in addition include the cost of the creosote, the creosoting process and the cost of furnishing all labor, materials and equipment necessary to complete the work, except that Pile Shoes and Furnishing Equipment for Driving Piles will be paid for under their respective items.

ITEM 84CP—PRECAST CONCRETE TEST PILES

ITEM 84SB—STEEL BEARING TEST PILES

ITEM 84TU—UNTREATED TIMBER TEST PILES

1. DESCRIPTION. Under these items the Contractor shall furnish and place untreated timber test piles, precast concrete test piles or steel bearing test piles, as shown on the plans or as ordered by the Engineer.

2. MATERIALS AND CONSTRUCTION DETAILS. The provisions of the specifications for the item Untreated Timber Piles, the item Precast Concrete Piles, and the item Steel Bearing Piles will apply as therein noted.

Test piles are driven to determine the lengths of bearing piles to be used. The Contractor's attention is directed to the fact that the location, number, lengths and methods of driving test piles may be changed as directed by the Chief Engineer at any time during the progress of the work. Test piles may be completely driven in one operation or may be partially driven and allowed to set from 2 to 24 hours before driving is resumed, all as directed by the Chief Engineer.

Test piles that are driven within the structure limits will be used as bearing piles. Test piles shall be similar in shape and section to those that are to be used subsequently for bearing piles.

3. METHOD OF MEASUREMENT. The quantity of untreated timber test piles, precast concrete test piles or steel bearing test piles to be paid for under these items will be the number of linear feet of test piles ordered placed in the leads by the Engineer.

4. BASIS OF PAYMENT. The unit price bid, per linear foot, shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that Pile Shoes and Furnishing Equipment for Driving Piles will be paid for under their respective items.

ITEM 84T—UNTREATED TIMBER PILES

1. DESCRIPTION. Under this item the Contractor shall furnish and place untreated timber piles at locations indicated on the plans or as directed by the Engineer. Piles placed under this item for any temporary use shall be furnished, placed, maintained and removed as ordered by the Engineer.

2. MATERIALS. Timber piling shall be of any species of wood that will satisfactorily withstand driving except white or gray birch, poplar or basswood. Piles shall be free from any defects which may impair their strength or durability.

Piles shall be peeled by removing all of the rough bark and at least 80 per cent of the inner bark.

Piles shall be cut above the ground swell and shall taper from butt to tip. A line drawn from the center of the tip to the center of the butt shall lie wholly within the body of the pile and shall not fall outside of the center of the pile at any point more than 1 per cent of the length of the pile. All knots shall be trimmed close to the body of the pile.

Size. All measurements for piles shall be taken under the bark. The diameter of piles at the tip and at a section 3 feet from the butt shall be as follows:

DOUGLAS FIR, HEMLOCK, LARCH, PINE, SPRUCE
OR TAMARACK

Length of Pile in feet	Tip Diameter in inches Min.	Tip Diameter in inches Max.	Butt Diameter in inches Min.	Butt Diameter in inches Max.
Under 40	8	11	12	20
40 to 50	7	10	12	20
51 to 70	7	10	13	20
71 to 90	6	9	13	20
Over 90	5	8	13	20

OAK, CYPRESS AND OTHER HARDWOODS

Length of Pile in feet	Tip Diameter in inches Min.	Tip Diameter in inches Max.	Butt Diameter in inches Min.	Butt Diameter in inches Max.
Under 30	8	11	12	18
30 to 40	7	11	13	20
Over 40	6	10	13	20

The diameter of the pile at the butt shall not exceed 20 inches

3. CONSTRUCTION DETAILS. a. Preparation for Driving. Piles shall not be driven until after the excavation is carried to the finished grade at the bottom of the footing. Any material forced up between the piles shall be removed to the correct elevation before concrete for the foundation is placed, and payment for excavation of this material will be made under the item Structure Excavation.

The butts shall be sawed square, and the tips shall be sawed square or tapered to a point not less than 4" in diameter where soil conditions require it. When necessary, the piles shall be shod with metal shoes of a design satisfactory to the Chief Engineer, the points of the piles shall be carefully shaped to secure an even and uniform bearing on the shoes.

Full length piles shall always be used where practicable, but, if splices cannot be avoided, an approved method of splicing shall be used. Piles shall not be spliced except by permission of the Chief Engineer.

b. Methods of Driving. Piles shall be driven with a steam, diesel or pneumatic hammer in the order determined by the Engineer and shall in general either start at the center of the foundation and work each way or at the outside row and work progressively across the foundation.

c. Equipment for Driving. The rated striking energy of the hammer used shall be not less than 7000 ft. lbs. nor more than 13,500 foot pounds per blow.

Sufficient boiler or compressor capacity must be provided at all times to maintain the rated speed of hammer during the full time of driving a pile. The valve mechanism and other parts of the hammer shall be maintained in first class condition so that the length of stroke, for a single acting hammer, and the number of blows per minute for a double acting hammer, for which the hammer is designed, will be obtained. Any double acting hammer not operating at the rated speed of hammer specified in the manufacturer's catalogue, for the particular hammer being used, shall be deemed unsatisfactory and shall be removed from the site. Each hammer shall be equipped with an anvil to fit the type of pile to be driven.

Pile driver leads shall be constructed in such a manner as to afford freedom of movement of the hammer, and they shall be held in position by guys or stiff braces to give the required support to the pile during driving.

Except where piles are driven through water, the leads preferably shall be of sufficient length so that the use of a follower will not be necessary. The driving of piling with followers shall be avoided if practicable and shall be done only with written permission and direction of the Chief Engineer. When directed by the Engineer, either approved steel or wooden spuds shall be used to penetrate the upper strata in order to assist in driving the piles to the required depth and resistance. Augers may be used for this purpose provided written permission is obtained from the Chief Engineer. Payment for furnishing and using a follower, augers or spuds will be considered as included in the unit price bid for piles.

Water jets shall not be used in driving any pile unless permitted in writing by the Chief Engineer.

When water jets are used, the number of jets, and the volume and pressure of water at the jet nozzles shall be sufficient to freely erode the material adjacent to the pile. The plant shall have sufficient capacity to deliver at all times at least 100 pounds per square inch pressure at two 3/4 inch jet nozzles. Before the desired penetration is reached, the jets shall be withdrawn and the piles shall be driven with the manner to secure the final penetration.

d. Defective Piles. The procedure incident to the driving of piles shall not subject them to excessive and undue abuse, producing injurious splitting, splintering and brooming of the wood. Any pile broken by reason of internal defects (even though the Engineer permitted it to be placed in the leads), or by improper driving or driven out of its proper location shall be removed, or at the option of the Engineer, a seoond pile may be driven adjacent thereto, if this can be done without impairing the structure. All piles so driven shall be at the expense of the Contractor.

Piles shall be driven with a variation of not more than one-quarter inch per foot from the vertical or from the batter shown on the plans or as determined by the Engineer. If the tops of wooden piles are driven below the elevation fixed by the plans or as established by the Engineer, the piles shall be withdrawn and replaced by new and, if necessary, longer piles at the expense of the Contractor.

All piles pushed up by any cause shall be driven down again as directed by the Engineer and the cost shall be included in the unit price bid for this item.

e. Determination of Bearing Values. When required, the lengths and number of the piles will be determined by actual loading tests, which will be paid for under the item Load Tests for Piles.

All piles shall be driven to the elevation shown on the plans, or to the resistance ordered by the Chief Engineer at the time of driving.

f. Order Lists for Piles. After piles have been placed in accordance with the specifications for Untreated Timber Test Piles the Engineer will furnish the Contractor with an itemized list showing the number and lengths of all piles to be placed under this item and the Contractor shall furnish piles in accordance with such itemized list.

g. Storage and Handling of Timber Piles. The method of storing and handling shall be such as to avoid injury to the piles. Special care shall be taken to avoid breaking the surface of piles.

h. Cutting Off Timber Piles. The tops of all piling shall be cut to a true plane, as shown on the plans, and at the elevation fixed by the Engineer.

i. Inspection of Piles. No inspection will be made by the Department of untreated timber piles prior to their shipment to the site of the work. Upon arrival at the site, the piles will be inspected by the Engineer and any piles which do not comply with the specifications will be rejected and shall be removed from the site by the Contractor.

4. METHOD OF MEASUREMENT. The quantity of untreated timber piles to be paid for under this item will be the number of linear feet of piles which are placed in the leads, in accordance with the order list as established under this specification.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that Furnishing Equipment for Driving Piles and Pile Shoes will be paid for under their appropriate items.

Piles that are delivered at the site of the work in accordance with the itemized list furnished the Contractor by the Engineer, and that for any reason are not used in the work shall be the Contractor's property if he so elects. In the event that the Contractor does not desire to retain these piles for his own use, the Department will purchase the same at the cost of the piles delivered at the site of the work.

The estimated length of piles is indicated on the plans for each pier, abutment, wall or other structure.

Timber piles will be paid for at the unit price bid per linear foot unless the lengths of piles indicated in the order list exceed 30 feet, and also exceed the estimated lengths by amounts indicated in the following table. In such cases payment will be made for the total lengths of piles at the bid price plus the amount indicated in this table.

ADDITIONAL PAYMENT PER LINEAR FOOT OF PILE

Ordered Lengths of Piles

Estimated Length of Piles	31' to 35'	36' to 39'	40' to 45'	45' to 49'	50' to 55'	56' to 59'	60' to 65'	66' to 69'	70' to 75'	76' to 79'	80' to 85'	86' to 89'	90' to 95'	96' and over
10' to 30'	$.00	$.05	$.08	$.13	$.23	$.23	$.25	$.25	$.33	$.33	$.63	$.73	$.83	$.93
31' to 39'	....	....	....	.05	.15	.15	.18	.18	.25	.25	.55	.65	.75	.85
40' to 49'	....	....	....	....	....	.10	.13	.13	.20	.20	.50	.60	.70	.80
50' to 59'	....	....	....	....	....	....	....	.03	.10	.10	.40	.50	.60	.70
60' to 69'	....	....	....	....	....	....	....	....	....	.08	.38	.48	.58	.68
70' to 79'	....	....	....	....	....	....	....	....	....	....	.28	.28	.40	.53
80' to 89'	....	....	....	....	....	....	....	....	....	....	....	....	.10	.20
90' and over	....	....	....	....	....	....	....	....	....	....	....	....	....	.10

The lengths of piles indicated on the plans for each particular pier, abutment, wall or other structure will be used as a basis in determining the price to be used for payment.

ITEM 85—STEEL BEARING PILES

1. DESCRIPTION. Under this item the Contractor shall furnish and place steel bearing piles of the size and type and at locations indicated on the plans. All piles shall be driven to rock or to a resistance required by the Chief Engineer at the time of driving.

2. MATERIALS. Steel for bearing piles shall be new and unused conforming to the requirements of M6, Structural Steel. Stock steel may be used.

3. CONSTRUCTION DETAILS. a. Driving. The driving shall be done with a steam, diesel or pneumatic hammer in the order to be determined by the Engineer and shall in general either start at the center of the foundation and proceed in both directions from this point or start at the outside row and work progressively across the foundation. All piles forced up by any cause shall be driven down again as directed by the Engineer and the cost shall be included in the unit price bid for the piles. Piles in excavated foundations shall not be placed until after the excavation is carried to the finished grade at the bottom of the footing. Any material forced up by the driving shall be removed and the correct elevation of foundation established before any concrete is placed. Payment for this material removed will be made at the unit price bid for Structure Excavation.

b. Equipment for Driving and Determination of Bearing Values. The provisions of paragraph (c) "Equipment for Driving" and (e) "Determination of Bearing Values" of the specifications for Item 84T will apply except as noted herein. The rated striking energy per blow of the hammer used shall not be less than 13,000 foot pounds.

However, if in the opinion of the Chief Engineer, satisfactory results are not obtained with the hammer furnished by the Contractor, a hammer meeting his approval shall be furnished and used. The payment for any such replacement is included in the price bid for furnishing Equipment for Driving Piles.

c. Lengths of Piles. The Contractor shall furnish and place in the leads piles of the estimated lengths indicated on the plans or of the lengths shown on an itemized list furnished by the Engineer if test piles are used. If the Contractor is permitted to use splices to furnish piles of the ordered lengths, the cost of making the splices shall be at the Contractor's expense.

If the ordered length of pile, when driven, does not reach a resistance satisfactory to the Chief Engineer, the Engineer will order an additional length of pile placed in the leads and spliced onto the driven pile. This splice will be paid for under the Item, Splices for Steel Bearing Piles.

d. Allowable Variation in Driving. Where piles are to be exposed in the finished work they shall be truly vertical or accurately battered as indicated on the plans and the pile, at the top, shall not vary from the plan location more than one inch. Other piles as finally placed may have a variation of not more than 1/4 inch per foot from the vertical or from the batter shown on the plans or ordered by the Chief Engineer.

e. Cutting Off of Piles. The tops of all piles shall be cut off as shown on the plans or to the elevation fixed by the Engineer. All cut off lengths shall become the property of the Contractor and shall be removed by him from the site of the work.

f. Splices. Splices shall be avoided if practicable, but if necessary, their number, locations and details shall be subject to the approval of the Chief Engineer.

Welding of splices shall conform to the specifications for "Welding" as listed in section b, paragraph 32, of Item 29.

g. Painting Exposed Piles. All exposed pile surfaces not embedded in concrete shall, unless otherwise specified, be painted with three coats of paint as described under "Painting of Metal Structures" in Part II, Section 8a with the exception that the first coat shall also be applied in the field.

4. METHOD OF MEASUREMENT. The quantity of Steel Bearing Piles to be paid for under this item will be the number of linear feet of piles placed in the leads in accordance with paragraph c.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, including the furnishing and placing of steel pile points and steel caps, necessary welding or riveting or both, the cutting off of all surplus length of piles, painting and the furnishing of all labor, materials and equipment necessary to splice the piles in accordance with Paragraph c. Lengths of Piles, when allowed. Furnishing Equipment for Driving Piles and ordered pile splices will be paid for under their respective items.

ITEM 85A—SPLICES FOR STEEL BEARING PILES

1. DESCRIPTION. Under this item the Contractor shall, when ordered by the Engineer, splice additional length or lengths of steel bearing piles onto steel bearing piles already driven. Any splice shall be constructed as shown on the plans or as approved by the Chief Engineer. This is a contingent item and shall apply only when the Engineer has directed an ordered length to be increased.

2. MATERIALS. The provisions for Item 85 shall apply.

3. CONSTRUCTION DETAILS. Welding of Splices shall conform to the specifications for "Welding" as listed in section b, paragraph 32, of Item 29.

4. METHOD OF MEASUREMENT. Payment will be for the number of pile splices ordered by the Engineer in accordance with this specification.

5. BASIS OF PAYMENT. The price bid for each pile splice shall include the cost of all labor, materials and equipment necessary to complete the work.

ITEM 85C—CAST-IN-PLACE CONCRETE PILES

1. DESCRIPTION. Under this item the Contractor shall construct cast in place concrete piles at locations shown on the plans or as directed by the Engineer.

Cast-in-place concrete piles shall be constructed by filling, with concrete, steel pile casings which have been driven to a predetermined depth, approved resistance or to rock, to the satisfaction of the Chief Engineer.

a. Description of Terms.

(1) Pile Casings. Pile casings may be formed of steel shells, pipes or a composite of the two unless otherwise stated on the plans or in the proposal.

(2) Pipes. Pipes shall be considered as smooth hollow cylindrical casings each of such diameter and thickness that they may be directly driven without the use of a mandrel.

(3) Shells. Shells shall be considered as any casing which requires the use of a mandrel to properly drive the casing or any casing which utilizes deformations to develop the strength necessary to permit driving without a mandrel. Shells which do not maintain a constant diameter from tip to butt may utilize either the uniform taper or the step taper form.

(4) Composite Pile Casings. Composite pile casings may be formed of a combination of shell and pipe in which the pipe forms the lower portion of the casing.

b. Pile Dimensions.

Shells of the uniform taper or step taper type shall have a minimum tip diameter of 8 inches and a minimum butt diameter, at point of cut off, of 12 inches regardless of pile length. Shells which taper shall increase in diameter, starting at the tip, at the rate of not less than 1 inch for each 12 feet of length until a diameter of 12 inches is reached. From this point the shell may be extended at a constant 12 inch diameter to the butt.

The minimum outside diameter of pipes and of shells of constant diameter, shall be 12 inches except in the case of composite pile casings where the lower 50 percent of the casing may be formed of 10-3/4 inch O.D. pipe.

2. MATERIALS. Unless otherwise indicated on the plans the Contractor will be obliged to furnish the particular type of shell or pipe which may be satisfactorily placed without distortion. The Contractor shall submit a description of the type and size of pile casing to be used for the approval of the Chief Engineer. No used pipe or shell will be permitted. All pipe furnished under this item shall be uncoated pipe.

Pile casings which do not hold their original form during driving or while adjacent piles are being driven or which fracture or fail during driving or while adjacent piles are being driven shall, unless otherwise directed, be withdrawn and immediately removed from the site at the Contractor's expense. If at any time during the driving or placing of the pile casings, the Chief Engineer determines from the results of the driving at the site that the pile casings of the type or thickness being used cannot be satisfactorily placed, the Contractor shall remove same from the site and furnish casings of a different type or greater thickness as determined by the Chief Engineer at no additional expense to the County.

The provisions of the foregoing paragraph will not apply where the type, diameter and thickness of pile casings are specifically called for on the plans.

The metal of shells which are directly driven shall have a thickness sufficient to withstand the driving without fracture or failure but in no case shall the thickness be less than 0.1053 inches. Shells driven with a mandrel shall have a thickness not less than 0.0538 inches.

Pipes shall have a thickness sufficient to withstand driving without fracture or failure but in no case shall the thickness of pipes be less than 3/16 inches unless otherwise shown on the plans.

When the diameter and thickness of pipes are shown on the plans, the material used shall conform to the requirements of A.S.T.M. Designation A252, Grade 2 unless otherwise specified. The Contractor shall furnish certified copies of test results as required under the heading, Sampling, Testing and Inspection of Material Specification M-6. Reinforcement shall meet the requirements of M17, Reinforcement for Cement Concrete.

3. CONSTRUCTION DETAILS. a. Points. All pile casings shall be equipped with an approved point unless otherwise indicated on the plans. However, the Chief Engineer may require that pipes be driven open ended any time the results of driving piles with points at the site indicate that, in his opinion, better results can be obtained by omitting the points. Pipes which are driven with open ends shall have the material in the pipes removed after the completion of the driving operation unless it is otherwise indicated on the plans or in the special notes. The ends of the pipes shall be faced perpendicular to the axes of the tubes.

b. Splices. Splices in pipes and shells shall be avoided if practicable, but if necessary, such splices shall be welded in conformance to the requirements for "Welding" as listed in Section b, paragraph 32 of Item 29. Where design considerations and soil characteristics permit, the Contractor may, at the discretion of the Chief Engineer, substitute a suitable mechanical splice. Such mechanical devices shall be subject to the provisions of Material Specification M6. If, in the opinion of the Engineer, these mechanical devices fail to provide a satisfactory splice permission for their use may be withdrawn and they shall be removed from the job site at the Contractor's expense. All splices shall be watertight and their number, location and details shall be subject to the approval of the Chief Engineer.

c. Reinforcement. The piles shall be reinforced as shown on the plans and the reinforcement secured in such a manner as to insure its proper location in the finished piles.

d. Concrete. Concrete shall not be placed in any pile casing until such adjacent casings as the Engineer may direct, have been satisfactorily placed. Before placing concrete in the casing, the casing shall be inspected. When it is found to be free from water and in satisfactory condition, it shall be filled with Class A concrete, mixed and placed in accordance with the specifications for Class A Concrete for Structures. The slump of the concrete shall not exceed 3 inches. Concrete shall be placed continuously in each pile.

Special care shall be exercised in filling the piles to prevent honeycomb and air pockets from forming in the concrete. Internal vibrators and other means shall be used to the maximum depth practicable, as determined by the Engineer, to consolidate the concrete. The concrete as finally placed and consolidated in the pile casing shall be of sound structural quality throughout the entire length of the pile.

e. Driving. The driving shall be done with a steam, diesel or pneumatic hammer in the order to be determined by the Engineer and shall in general either start at the center of the foundation and proceed in both directions from this point or start at the outside row and work progressively across the foundation. All piles forced up by any cause shall be driven down again as directed by the Engineer and the cost therefor shall be included in the unit price bid for the piles. Piles in an excavated foundation shall not be driven until after the excavation is carried to the finished grade at the bottom of the footing. Any material forced up by the driving shall be removed and the correct elevation of foundation established before any concrete is placed. Payment for the removal of this material will be made at the unit price bid for the Item Structure Excavation.

f. Equipment for Driving and Determination of Bearing Values. The provisions of paragraph c. "Equipment for Driving" and e. "Determination of Bearing Values" of the specification for Item 84T will apply except as noted herein. The rated striking energy per blow of the hammer used shall be not less than 13,000 ft. lbs.

However, if in the opinion of the Chief Engineer, satisfactory results are not obtained with the hammer furnished by the Contractor, a hammer meeting his approval shall be furnished and used. The cost for any replacement shall be included in the price bid for the item "Furnishing Equipment for Driving Piles".

g. Lengths of Piles. The lengths of piles indicated on the plans are for estimating purposes only. The actual lengths of piles necessary will be determined in the field by driving the pile casings to the resistance required by the Chief Engineer at the time of driving.

h. Allowable Variation in Driving. Where piles are to be exposed in the finished work they shall be truly vertical or accurately battered as indicated on the plans and the pile at the top shall not vary from the plan location more than one inch. Other piles as finally placed may have a variation of not more than one quarter (1/4) inch per foot from the vertical or from the batter shown on the plans or ordered by the Chief Engineer.

i. Cutting Off Pile Casings. Pile casings shall be cut off at the elevations indicated on the plans or ordered by the Chief Engineer.

j. Painting Exposed Pile Casings. All exposed casing surfaces not embedded in concrete shall, unless otherwise specified, be painted with three coats of paint as described under "Painting of Metal Structures" in Part II, Section 8a with the exception that the first coat shall also be applied in the field.

4. METHOD OF MEASUREMENT. The quantity of Cast-in-Place Concrete Piles to be paid for under this item will be the number of linear feet of piles remaining in the finished structure.

5. BASIS OF PAYMENT. The unit price bid, per linear foot, shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, including the furnishing and placing of pile points, the cutting off of surplus lengths of pile casings, splicing, the removing of material from the casings and the furnishing and placing of concrete in the casings. Bar Reinforcement and Furnishing Equipment for Driving Piles will be paid for under their respective items.

ITEM 85T—TUBULAR CAST-IN-PLACE CONCRETE PILES

1. DESCRIPTION. Under this item the Contractor shall furnish and construct open ended tubular piles filled with concrete at locations indicated on the plans or as directed by the Engineer. The piles shall be constructed by filling with concrete, steel tubes which are left in the ground after having been placed to the satisfaction of the Chief Engineer. All tubes shall be established in rock as detailed on the plans, or in material which upon inspection is considered satisfactory by the Chief Engineer. Completed piles shall be truly vertical and the pile at the cap shall not vary from plan location more than one inch. The diameter and thickness of the tubes to be furnished and placed are shown on the contract plans.

2. MATERIALS. The material in the tubes shall conform to the requirements of A.S.T.M. Designation A252, Grade 2 unless otherwise shown on the plans. No used pipe will be permitted.

The Contractor will be required to furnish the Chief Engineer with two certified copies of the records of the physical tests performed on the newly manufacturered pipe in accordance with the above A.S.T.M. requirements before any driving is progressed.

Reinforcement shall meet the requirements of M17, Reinforcement for Cement Concrete.

All exposed surfaces not embedded in concrete shall, unless otherwise specified, be painted with three coats of paint as described under "Painting of Metal Structures" in Part II, Section 8a with the exception that the first coat shall also be applied in the field.

3. CONSTRUCTION DETAILS. a. Splices. Splices shall at all times be avoided but if they are necessary, a detail with the location of the splices and the method of their accomplishment shall be submitted to the Chief Engineer. No splices shall be made until approval has been obtained.

b. Welding. Welding of splices, if allowed, shall conform to the specification for "Welding" as listed in Section b, paragraph 32, of Item 29.

c. Reinforcement. The piles shall be reinforced as indicated on the plans and the reinforcement shall be secured so that it will occupy its proper place in the finished concrete in the tube.

The method of placing the reinforcement and holding it in its proper position and alignment shall be approved by the Engineer before any concrete is poured in the tube.

d. Placement of the Tube. The methods and equipment to be used in establishing the tube in rock or in satisfactory material is the responsibility of the Contractor.

It is intended that these tubes shall be established in position by being driven with an impact hammer. This driving shall be accomplished with a steam, diesel or pneumatic hammer and shall be progressed so as to avoid all distortion of the tube.

The Contractor may, if he so elects, after a study of the underlying material, use any or any combination of the following procedures:

(1) Previously drill the soil or other unsuitable bearing material at the location of the pile to a diameter not greater than 2" less than the outside diameter of the tube itself.

(2) Drive and not clean the tube until it is near its anticipated final position. In this instance, the sole responsibility for deformation of the pile shall rest with the Contractor. If any distortion of the pile occurs it shall be removed and a new pile or tube driven in its place.

(3) Drive the tube and remove obstructions which are found as the tube is driven below the surface to its final location. In all instances the tube in its final location shall be cleaned from its tip to its top.

All piles to be founded in rock shall be seated to the depth, and in the manner shown on the plans.

When all tubes in one footing have been driven and have been approved they shall be filled with concrete mixed and placed in accordance with the specifications for Class A Concrete for Structures. The slump of the concrete shall not exceed 3 inches. Concrete shall be lowered into each tube with a bucket whenever it is practicable to do so. Under no circumstances will concrete be permitted to be dumped freely into the tube. If it is not practicable to use a bucket then baffles or a tremie must be used to avoid segregation.

Special care shall be exercised in filling the tube to prevent honeycomb and air pockets from forming in the concrete. Internal vibrators and other means shall be used to the maximum depth practicable, as determined by the Engineer, to consolidate the concrete.

4. METHOD OF MEASUREMENT. The quantity of tubular piles to be paid for under this item will be the number of linear feet of piles remaining in the finished structure.

5. BASIS OF PAYMENT. The unit price bid, per linear foot, shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, including the furnishing and using of well driving equipment, or any other type of equipment necessary to satisfactorily complete the work. The unit price bid shall also include the cutting off of surplus lengths of tubes, splicing, the removing of the material from the tube and the placing of concrete in the tube.

The bar reinforcement and the furnishing of equipment for the driving of the piles will be paid for under their respective items.

ITEM 86C—PRECAST CONCRETE PILES

1. DESCRIPTION. Under this item the Contractor shall furnish and place precast concrete piles of the size, shape and at locations indicated on the plans or ordered by the Engineer.

2. MATERIALS. Concrete used for casting precast concrete piles shall be Class A Concrete for Structures except as noted below.

Reinforcement shall meet the requirements of M17, Reinforcement for Cement Concrete.

3. CONSTRUCTION DETAILS. a. Reinforcement. Piles shall be reinforced as indicated on the plans and the reinforcement shall be placed and held to true position in the forms by means of suitable devices.

b. Form Work. Forms for piles shall conform to the shape, line and dimensions of the piles as called for on the plans, and shall be accessible for tamping, vibrating and consolidating the concrete. Piles that are to be exposed to view in the completed structure shall have a surface finish in accordance with the specifications for structural concrete as listed in Part II, Section 7.

c. Casting. The piles shall be made in a properly equipped and organized plant and shall be cast in a horizontal position. The slump of the concrete shall be not greater than 2 inches.

The concrete shall be placed continuously in each pile and compacted by vibrating, supplemented by spading and tamping the concrete in a manner acceptable to the Engineer. The forms shall be overfilled, the surplus concrete screeded off and the top surfaces finished to a uniform even texture similar to that produced by the forms. Special care shall be exercised in tamping and vibrating the concrete so as not to displace the reinforcement.

d. Removal of Forms. Side forms may be removed at any time not less than 12 hours subsequent to placing the concrete, provided the concrete has hardened sufficiently. The entire pile shall be supported for at least 2 days and not subjected to any handling stress until the concrete has set for at least 21 days and for a longer period in cold weather; the additional time to be determined by the Engineer. If test cylinders of the concrete, used in the piles, are made and such test cylinders are cured in the same manner as the piles, the piles may be handled when the test cylinders indicate the concrete has attained a strength of at least 3000 pounds per square inch.

e. Finish. As soon as the forms are removed, any cavities or irregularities in the surface of the piles shall be filled with 1 to 2 mortar and the exposed surfaces of the cavities or irregularities rubbed smooth with a wooden float.

f. Curing. Piles cured indoors shall be moist cured for at least 7 days and if cured in

the open, the piles shall be covered with burlap or other suitable absorbent material and kept wet for the same period. The piles shall be maintained at a temperature of 50°F. or above for at least 7 days. Curing shall start as soon as possible after completion of the pouring.

g. Storage and Handling of Piles. The method of storing and handling piles shall be such as to eliminate the danger of fracture by impact or undue bending stresses, in curing or transporting the piles from the molds and into the leads. Piles shall be stored on a firm bed and, if piled in tiers, they shall be arranged to permit proper hydration. In general, concrete piles shall be lifted by means of a suitable bridle or sling attached to the pile at the pick-up points indicated on the plans and marked on the piles. Care shall be exercised to avoid injury to the surfaces of the piles.

h. Time and Method of Driving. Unless otherwise permitted by the Chief Engineer, piles shall not be driven until a period of 30 days has elapsed after the piles have been cast. Piles shall be driven with a steam, diesel or pneumatic hammer in the order to be determined by the Engineer and shall in general either start at the center of the foundation and work each way or at the outside row and work progressively across the foundation.

i. Preparation for Driving, Equipment for Driving, Determination of Bearing Values and Allowable Variation in Driving. The provisions of the specifications for "Preparation for Driving", "Equipment for Driving" and "Determination of Bearing Values" of the item Untreated Timber Piles and for "Allowable Variation in Driving" of the item Cast-in-place Concrete Piles shall apply except as noted herein. The rated striking energy per blow of the hammer used shall not be less than 19,000 ft. lbs. unless otherwise indicated on the plans.

The weight of the striking parts of the hammer shall be not less than one-third the weight of the pile.

A suitable driving head shall be provided to fit the top of the pile, and to hold the cushion for the pile head. The cushion used should provide enough protection to prevent damage to the piles but should not absorb too much of the energy of the blow.

j. Order Lists for Piling. The provisions of the specifications for "Order Lists for Piling" for the item Untreated Timber Piles will apply.

k. Extensions or "Build Ups". Extensions, splices or "build ups" on piles shall not be made unless ordered by the Engineer; but when permitted they shall be made as follows:

After the driving is completed, the concrete at the end of the pile shall be cut away, leaving the reinforcing steel exposed for a length of forty diameters. The final cut of the concrete shall be perpendicular to the axis of the pile. Reinforcement similar to that used in the pile shall be securely fastened to the projecting steel and the necessary form work shall be placed, care being taken to prevent leakage along the pile. The concrete shall be of the same quality and the cement shall be of the same brand as that used originally in the pile. Just prior to placing concrete, the top of the pile shall be thoroughly wetted and covered with a thin coating of neat cement, or other suitable bonding material. The forms shall remain in placed not less than 7 days and shall then be carefully removed and the entire exposed surface of the pile finished as ordered by the Engineer.

l. Cutting Off Tops of Piles. The tops of piles, where necessary, shall be cut off to true planes perpendicular to the longitudinal axis of the pile at the elevation shown on the plans or fixed by the Engineer.

m. Defective Piles. Piles which are not straight or are cracked, damaged or in any respect defective, when about to be driven, will be rejected and shall be replaced by the Contractor.

n. Special Cement. In order to minimize the time between the casting and driving of the piles, the Contractor, subject to the approval of the Chief Engineer, may use an accelerating method or material, at no additional cost to the Department. When such method or material is used, the interval between casting and driving will be determined by the Chief Engineer.

o. Inspection. If the piles are not cast at the site, the Contractor shall notify the Engineer, sufficiently in advance, where and when the piles are to be manufactured so that he may have ample time to arrange for their inspection.

4. METHOD OF MEASUREMENT. The quantity of Precast Concrete Piles to be paid for under this item will be the number of linear feet of piles which are placed in the leads, in accordance with the order list as established under this specification. In case "build ups" are necessary, the built up length will be paid for at the contract price per linear foot for piles in place. No payment will be made for "build ups" which are made necessary by damage to the piles during driving operations.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that the cost

of Furnishing Equipment for Driving Piles will be paid for under a separate item.

ITEM 87—FURNISHING EQUIPMENT FOR DRIVING PILES

1. DESCRIPTION. Under this item the Contractor shall furnish equipment for driving piles at all structures where piles are to be placed. The equipment shall be capable of driving piles 20 feet longer than the estimated lengths shown on the plans. In case the ordered lengths exceed the estimated lengths by more than 20 feet the use of spuds will be permitted in order to satisfactorily drive the required lengths of piles. All unsatisfactory equipment shall be removed from the site and be replaced with equipment which is satisfactory to the Chief Engineer. The furnishing of equipment for driving sheet piling is not included in this item, but is included in the unit price bid for sheet piling.

2. METHOD OF MEASUREMENT. Payment will be made at the lump sum price bid for this item as follows: Seventy-five percent (75%) of the amount bid will be paid when the equipment for driving piles is furnished and operative. The remaining 25% will be paid when the work of driving piles is completed.

3. BASIS OF PAYMENT. Payment will be made by lump sum. The price bid shall include the cost of furnishing all labor, materials and equipment necessary for transporting, erecting, maintaining, making any ordered equipment replacement, dismantling and removing the entire pile driving equipment. The cost of all labor, including the manipulation of the pile driving equipment and materials in connection with driving piles shall be included in the unit price bid per linear foot for the piles to be driven.

ITEM 88—LOAD TESTS FOR SOILS

1. DESCRIPTION. Under this item the Contractor shall make load tests to determine the bearing power of soils. He shall provide facilities for these tests either in accordance with the equipment and methods recommended by the "Special Committee of the American Society of Civil Engineers to Codify Present Practice on the Bearing Value of Soils for Foundations" Proceedings No. XLVI No. 6 August 1920 pages 905 to 915 Plate XI and XII or by a method recommended by the Contractor in writing and approved by the Chief Engineer. Load tests shall be made where shown on the contract plans.

2. BASIS OF PAYMENT. Payment will be by lump sum for each loading test. The price bid shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work and shall include the removal and disposal of equipment and loading materials. Excavation necessary to carry out loading tests will be paid for under the item Structure Excavation.

ITEM 88P—LOAD TESTS FOR PILES

1. DESCRIPTION. Under this item the Contractor shall load a test pile or piles in a manner shown or indicated on the plans or ordered by the Engineer.

2. CONSTRUCTION DETAILS. In general, each test shall consist of the application of a load to a single pile or a group of piles. The test load shall be supported by a suitable platform adequately braced against lateral movement. The load shall be applied in increments as called for on the plans or ordered by the Chief Engineer and suitable apparatus shall be provided for accurately determining both the superimposed weight and the settlement of the pile or pile group under each increment of load. Interpretations of the records of each test and determinations therefrom will be made by the Chief Engineer.

3. BASIS OF PAYMENT. Payment for this item will be made by lump sum for each test made. The lump sum price bid for each load test shall include the cost of furnishing all labor, equipment (except pile driving equipment) and materials necessary to (1) place the pile or piles, (2) construct the loading platform, (3) place the loading material, (4) place the recording apparatus and (5) remove any or all of the foregoing, subsequent to the tests. Piles included for payment in this item will not be paid for under any other item.

ITEM 89—REMOVING OLD BITUMINOUS CARPET

ITEM 90M—CLEANING EXISTING PAVEMENT (Per Mile)

ITEM 90Y—CLEANING EXISTING PAVEMENT (Per Square Yard)

The specifications for these items will appear in the proposal if and when they are to be included in the work items of the contract.

ITEM 92—SCREENED GRAVEL—LOOSE MEASURE

ITEM 93—BROKEN STONE—LOOSE MEASURE

1. DESCRIPTION. Under these items the Contractor shall furnish and place as directed by the Engineer, Screened Gravel or Broken Stone for miscellaneous work.

2. MATERIALS. The gravel or stone shall be approved material meeting the requirements for Type A, B or C. It shall be furnished in the sizes or combination of sizes indicated on the plans or ordered by the Engineer.

3. METHOD OF MEASUREMENT. The quantity to be paid for shall be either the number of tons, loose measure or the number of cubic yards, loose measure, as indicated in the itemized proposal.

4. BASIS OF PAYMENT. The unit price bid shall include the cost of all labor, materials and equipment necessary to properly complete the work.

ITEM 94—STONE CURB
(Types "A", "B", "C" and/or as Indicated)

ITEM 94D—STONE CURB—TYPE D

ITEM 95—STONE CURB (Granite)

ITEM 96—RESETTING OLD CURB

The specifications for these items will appear in the proposal if and when they are to be included in the work items of the contract.

ITEM 97—CONCRETE CURB
(Types "AB", "AC", "BB", "BC" and/or as Indicated)

1. DESCRIPTION. Under this item the Contractor shall place concrete curb, of the type shown on the plans and/or the Standard Structure Sheet, where shown on the plans or ordered by the Engineer.

2. MATERIALS. Concrete shall conform to all of the requirements specified for Item 97 in the table, "Composition of Concrete Items" and Portland Cement Concrete, General Specifications of Section 7.

3. CONSTRUCTION DETAILS. Curb shall be cast in place in sections approximately 20 feet long and provision made at each joint for expansion of 1/4 inch, except that when joint supports are used between curb and reinforced concrete pavement, construction joints shall be located at approximately 20' intervals and/or opposite each pavement contraction joint. Expansion joints 3/4" in thickness shall be located opposite each pavement expansion joint.

All forms shall be set true to line and grade and held rigidly in position. They shall be either of metal or of acceptable planed and matched lumber, and of such construction that there will be no interference to inspection of grade and alignment and that a smooth surface will be provided.

The forms shall be left in place at least 24 hours or until the concrete has set sufficiently so that, in the opinion of the Engineer, they can be removed without injury to the curb. Upon removal of the forms, the curb shall be immediately rubbed down to a smooth and uniform surface, but no plastering will be permitted. For this work, competent and skillful finishers shall be employed.

The concrete shall be compacted by means of an approved immersion type, mechanical vibrator of a size and weight sufficient to thoroughly vibrate the entire concrete mass without damaging or mis-aligning the forms. The vibrator shall be introduced into the concrete at one foot intervals for a period not to exceed two seconds for each immersion and shall vibrate at not less than 5000 impulses per minute.

Expansion joint material shall be premoulded bituminous as specified under M-36 cut to conform with the cross-section of the curb.

Curing. At the Contractor's option either M39 Waterproof Paper Blankets, M40 Quilted Covers, M40A Polyethylene Coated Burlap Blankets or M40B Polyethylene Curing Covers shall be used in curing concrete curb. Other methods of curing may be used only when so indicated on the plans or in the itemized proposal. The method of curing shall comply with the requirements given under Section 7, "Pavement Concrete".

Protection. The Contractor shall protect the curb and keep it in alignment and first class condition until the completion of the contract. Any curb which is damaged at any time previous to the final acceptance of the work shall be removed and replaced with satisfactory curb at the Contractor's expense.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item shall be the number of linear feet of curb placed in accordance with the plans, specifications and orders of the Engineer.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work, including any excavation, except that joint supports and foundation course will be paid for under their respective items.

ITEM 97AI—CONCRETE CURB—TYPE AI (Integral)

The specifications for Item 97, Concrete Curb, shall apply except as follows:

Vibration may be eliminated if the concrete flows under the face curb form onto the pavement providing other satisfactory means is provided to insure a dense, smooth surface concrete free from honeycomb.

The curb forms must be placed and filled with concrete before the initial set occurs in the pavement concrete and within the time limit necessary to insure positive bond between pavement and curb.

ITEM 97G—CONCRETE CURB AND GUTTER
(Types "BB", "BC", "C" and/or as Indicated)

Under these items the Contractor shall place concrete curb and gutter, of the type shown on the plans and/or the Standard Structure Sheet, where shown on the plans or ordered by the Engineer.

The requirements specified under Item 97 Concrete Curb shall apply in all respects.

ITEM 97M—REFLECTING CONCRETE MALL

ITEM 97R—REFLECTING CONCRETE CURB
(Types "ABR," "ACR", and/or as Indicated)

1. DESCRIPTION. Under these items the Contractor shall place reflecting concrete curb or mall of the type shown on the plans and/or the Standard Structure Sheet, where shown on the plans or ordered by the Engineer.

2. MATERIALS. The requirements of Item 97 shall apply and in addition: The reflecting surface of the curb or mall, approximately 1 inch thick, shall be a mortar mix consisting of one part White Portland Cement to 1-3/4 parts sand. White Portland Cement shall conform to the requirements of M1, Portland Cement, Type 6, and sand mixed with this cement shall conform to the requirements of M3C, White Fine Aggregate.

3. CONSTRUCTION DETAILS. All of the requirements of Item 97, Type AB shall apply and in addition:

The reflecting surface shall be placed immediately after placing the base concrete and not more than twenty minutes shall elapse between the pouring of the base concrete and the reflecting surface.

Scoring and finish of the reflecting surface shall conform with the sketch shown on the plans and/or the Standard Structure Sheet or as modified by the Engineer.

Curing. The concrete shall be cured in accordance with the requirements of Item 97, Curing.

Protection. All of the requirements of Item 97 shall apply.

4. METHOD OF MEASUREMENT AND BASIS OF PAYMENT. All of the requirements of Item 97 shall apply.

ITEM 97S—ASPHALT CONCRETE CURB

1. DESCRIPTION. Under this item the Contractor shall furnish and place asphalt curbs of the dimensions and at the locations shown on the plans or as ordered by the Engineer.

2. MATERIALS. The curb shall be formed of material meeting the requirements of Item 51F with the following exceptions:

a. The amount of asphalt cement based on the total weight of the mix shall be between 6.0% and 9.0%; and,

b. The asphalt cement used in the mix shall be a paving asphalt having a penetration from 85–100;

c. Gradation of aggregate shall be as follows:

Sieve Size	% Passing*	Job Mix Limits*
1/2"	100	0
1/4"	95–100	±5
1/8"	80–100	±4
20	30– 70	±4
40	15– 45	±3
80	5– 23	±2
200	2– 10	±2
Asphalt Cement**	6– 9	±0.4

* Based on total aggregate weight
** Based on total weight of mix

d. The above gradation shall include 1/2–2% by weight of total aggregate, asbestos fibers added separately into the mix.

3. CONSTRUCTION DETAILS. The machine used for placing the curb shall be of a type approved by the Chief Engineer and shall be a self-propelled automatic curber capable of producing a smooth well compacted finished curb by extrusion through a worm gear into the curb mold under pressure. No side forms will be required, but where the curb is to be laid on an existing pavement that does not have a smooth grade, the Engineer may require 2" by 2" angle iron to be used as a track so that the finished curb will have a smooth and true line and grade.

The density of the curb in place shall be not less than 90% of the maximum theoretical density. The mix should be adjusted to obtain the densest possible composition. On grades greater than 3% the curbing shall be laid uphill. The machine shall have a sufficiently large hopper capacity to insure a steady flow of material to the extrusion screw.

The complete automatic curber assembly shall weigh approximately 700# and have a uniform weight distribution to assure sufficient compaction to produce maximum density and prevent material from oozing out underneath the form as well as to eliminate excess cleanup and trimming of finished curb and loss of material.

Where curb is to abut an existing structure-wall or is placed at the extreme edge of pavement, a machine shall be used that is capable of placing the curb to within one inch of the structure-wall or edge of pavement.

If the base consists of a fresh laid bituminous surface the curb may be laid directly on this course after proper cleaning. In other case, a tack coat consisting of 0.10 to 0.15 gallon per square yard of surface of either Bituminous Material Item 70B or Item 69 must be applied to the thoroughly dried foundation.

The mixture shall be so maintained that when deposited the temperature shall be not more than 15°F. lower than when it left the mixing plant.

After a curing period of not less than 72 hours, exposed surfaces of the curbing shall be sprayed or hand brushed with two (2) coats of White Curb Paint, Item M18M. Each coat of paint shall be applied to the curb at the rate of one (1) gallon per 200 linear feet of curb.

The curb shall be clean and free of all foreign matter before painting. Paint shall be applied only when air temperature is above 50°F. or at 50°F. and raising. No paint shall be applied when there is a reasonable expectation of rain. At least eighteen (18) hours shall elapse between application of the two coats.

The one inch space between the back of the curb and a structure-wall shall be sealed with approved bituminous material for the full depth of the curb.

4. METHOD OF MEASUREMENT. The quantity to be paid for will be the number of linear feet of Asphalt Concrete Curb furnished and placed in accordance with the plans and specifications and the orders of the Engineer.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, equipment and materials (including paint and bituminous materials) necessary to properly complete the work.

ITEM 98—CONCRETE GUTTERS
(Types "BB", "BC", "C", "D" and/or as Indicated)

1. DESCRIPTION. Under this item the Contractor shall furnish and place concrete gutters of the type indicated where shown on the plans or ordered by the Engineer.

2. MATERIALS. Concrete shall conform to all of the requirements specified for Item 98 in the table—Composition of Concrete Items and Section 7, Portland Cement Concrete, General Specifications.

3. CONSTRUCTION DETAILS. Unless otherwise indicated, concrete gutters shall be constructed in 8-foot sections of the shapes and types shown on the plans and/or Standard Structure Sheet and to the line and grade directed. A steel separating plate 1/8 inch thick and cut to fit the section shall be used in each joint and removed when concrete hardens, or the gutter may be constructed in alternate sections, 24 hours to elapse before the construction of the intermediate sections. A straight-edge shall be laid parallel to the line of the gutter to strike off the surface to conform accurately to the gutter section.

All construction joints shall be poured full with material meeting the requirements of Item 71.

Curing. The requirements of curing of Item 97 shall apply.

Protection. The Contractor shall protect the gutters and keep them in first class condition until the completion of the contract. Any gutters damaged previous to the final acceptance of the work shall be removed and replaced with satisfactory gutters at the Contractor's expense.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of square yards of exposed surface of Concrete Gutters placed in accordance with the plans or as ordered by the Engineer.

5. BASIS OF PAYMENT. The unit price bid per square yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work except that the necessary excavation will be paid for under the item Trench and Culvert Excavation.

ITEM 98G—ASPHALT CONCRETE GUTTERS

1. DESCRIPTION. Under this item the Contractor shall furnish and place Asphalt Concrete Gutters of the width, shape and thickness and at the locations shown on the plans or ordered by the Engineer.

2. MATERIALS AND CONSTRUCTION DETAILS. The gutter shall be formed and constructed of Asphalt Concrete, meeting the requirements of Item 51Y. It shall be placed so as to conform to the cross-section, depth, line and grade shown on the plans. The gutter shall be constructed using wood or metal side forms of a size and type acceptable to the Engineer, and the material, after placing, shall be compacted to the contour shown on the plans and to the satisfaction of the Engineer. If an approved type of mechanical paver is used to place, form and compact the material, no side forms of metal or wood will be required.

After compaction, the finished surface of the gutter shall be sealed by an application of bituminous material, 70B, in the quantity and manner directed by the Engineer.

3. METHOD OF MEASUREMENT. The quantity to be paid for will be the number of tons of Asphalt Concrete, furnished and placed in accordance with the plans and specifications and the orders of the Engineer.

4. BASIS OF PAYMENT. The cost of the sealing material and the application shall be included in the unit price bid for this item.

The unit price bid per ton shall include the cost of all labor, materials and equipment necessary to properly complete the work except that necessary excavation will be paid for under Trench and Culvert Excavation.

ITEM 99—COBBLE GUTTERS

1. DESCRIPTION. Under this item the Contractor shall furnish and place cobble gutters where shown on the plans or ordered by the Engineer.

2. MATERIALS AND CONSTRUCTION DETAILS. Cobble gutters shall be made of rounded "hardheads", quarry or field stone, set on edge. If "hardheads" are used they shall be 6 inches to 10 inches in diameter. The largest stones shall be selected and set along the inner edge and the center of the gutter. All stones shall be embedded in mortar composed of one part Type 2 cement, M1, and two parts of M3 Fine Aggregates. All stone shall be laid to line and grade with close joints by skilled workmen using regular paving tools. The stones shall then be thoroughly rammed in place and brough to a uniform surface.

The joints shall be made of the same mortar as described above. The mortar shall completely fill the joints after being tamped.

3. METHOD OF MEASUREMENT. The quantity of cobble gutters to be paid for under this item will be the number of square yards of exposed surface laid in accordance with the plans or as directed by the Engineer.

4. BASIS OF PAYMENT. The unit price bid per square yard shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except the excavation necessary will be paid for under the Item, Trench and Culvert Excavation.

ITEM 100—LEACHING BASINS

1. DESCRIPTION. Under this item the Contractor shall build leaching basins of a type shown on the detail plans or Standard Structure Sheets at places indicated on the plans or ordered by the Engineer. They shall be built of Class A Concrete, Common Brick, Solid Concrete Block or Reinforced Concrete Pipe. The specific material used in their construction shall be as indicated on the plans.

2. MATERIALS. The requirements for Materials of Item 102 shall apply.
Porous material for filling shall be broken stone or screened gravel of the sizes indicated on the plans or ordered by the Engineer.

3. METHOD OF MEASUREMENT. For each basin completed in accordance with the plans, the Contractor shall receive the price bid.

4. BASIS OF PAYMENT. The unit price bid for each basin shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that the excavation will be paid for under the Item, Trench and Culvert Excavation and the frames and gratings and step irons will be paid for under their respective items.

ITEM 102AR—CATCH BASINS

ITEM 102BR—FIELD INLETS

ITEM 102CR—MANHOLES

ITEM 102DR—DROP INLETS

1. DESCRIPTION. Under these items, the Contractor shall build catch basins, field inlets, manholes and drop inlets as shown on the plans or as directed by the Engineer. They shall be built of either Class A Concrete, Concrete Manhole Blocks, Concrete Blocks, Common Brick, Reinforced Concrete Pipe or Precast Reinforced Concrete Units. Unless specifically designated on the plans and/or the proposal, the material used shall be at the option of the Contractor.

2. MATERIALS. Concrete shall be in accordance with the requirements of Section 7, "Portland Cement Concrete, General Specifications" and the subdivision thereof designated as "Structural Concrete". Details of materials permitted in the concrete for these items are shown in the table "Composition of Concrete Items". Concrete block shall conform to the requirements of M44 Concrete Block. Concrete Manhole Blocks for round structures shall be so designed and laid that the interior surfaces of the drainage facilities are cylindrical for the straight sides and conical for the top four courses with no offsets. Corner units for rectangular basins or inlets must be "L" shaped with an inside return side equal to half the length of the normal unit. Units for both manholes and basins must be so designed that only full length units are required to lay any one course. Inside and outside joints must not exceed one-half inch.

Mortar. Portland Cement Type II shall conform to the requirements of M1, Portland Cement. Masonry Cement shall conform to ASTM C91, except that the provisions pertaining to inspection, sampling and acceptance shall be as directed by the Department. Sand shall conform to the requirements of M3A, Mortar Sand.
The mortar shall be proportioned as follows:

Portland Cement Type II (parts)	Masonry Cement (parts)	Mortar Sand (parts)
1	1	4-1/2 to 6

All cementitious materials and aggregate shall be mixed for at least 3 minutes with the maximum amount of water to produce a workable consistency in a mechanical batch mixer. Hand mixing of the mortar may be permitted only for small quantities as approved by the Engineer. Mortars that have stiffened because of evaporation of water from the mortar may be re-tempered

by adding water as needed to restore the required consistency. Mortars shall be used and placed in final position within 2-1/2 hours after mixing.

All block shall be laid in full mortar beds. Mortar used for filling vertical or inclined joints shall be of such consistency that it will require rodding. The mortar shall be rodded until it rises to the top and completely fills the joints.

Cement shall conform to the requirements of M1, Portland Cement Type 2. Common Brick shall conform to the requirements of M43.

Reinforced Concrete Pipe and Precast Reinforced Concrete Units shall conform to the requirements of M25A, Reinforced Concrete Pipe, except that the three edge bearing test will not be required, and those provisions of ASTM Designation C478 Precast Reinforced Concrete Manhole Risers and Tops covering "Design" shall apply except as modified below.

Manhole steps shall be one of the following materials:

Cast Iron	- M-8, except that Class 25A will be required
Malleable Iron Castings	- M-13 Grade 35018
Wrought Iron	- M-10
Cast Aluminum	- M-7A, Alloy 356-T6
Wrought Aluminum	- M-7B, 6061-T6 or 6005
Reinforced Plastic	- M-137

Manhole steps may be cast in place, bolted or mortared in place after fabrication. Manhole steps affixed to the manhole wall after fabrication of the manhole section shall be affixed to the wall with a rapid hardening hydraulic cement meeting the requirements of M2RH.

3. METHOD OF MEASUREMENT AND BASIS OF PAYMENT. The unit of quantity to be paid for will be the number of linear feet of height measured from the bottom of the base to the top of the masonry, measured to the nearest tenth of a foot.

4. BASIS OF PAYMENT. For payment purposes, precast reinforced concrete units are defined as those cast in other than their final positions.

The price bid shall include the cost of all labor, equipment and materials including manhole steps necessary to complete the work, except as follows:

1. Necessary excavation for catch basins, manholes, drop inlets and field inlets will be paid for under the item for Trench and Culvert Excavation.

2. Frames, covers, gratings, bar reinforcement (except in reinforced concrete pipe or precast reinforced concrete units), etc. will be paid for under their respective items.

ITEM 102X—EXTRA DEPTH OF CATCH BASINS, MANHOLES, FIELD INLETS AND DROP INLETS

1. DESCRIPTION. Under this item the Contractor shall build the catch basins, drop inlets, field inlets and manholes to the depth shown on the plans or directed by the Engineer.

2. MATERIALS. The specific material for the extra depth construction shall be as indicated on the plans.

3. METHOD OF MEASUREMENT. For such increase in depth in excess of 6 feet as shown on plans or directed by the Engineer, the Contractor shall be paid the price bid for each foot of such extra depth.

4. BASIS OF PAYMENT. The price bid per each foot of extra depth, shall be understood to include the cost of all labor, equipment, materials and incidentals necessary to complete the work, except as follows:

1. Necessary excavation for this extra depth will be paid for under the Item, "Trench and Culvert Excavation".

2. Bar reinforcement and step irons will be paid for under their respective items.

ITEM 103—ALTERING CATCH BASINS, FIELD INLETS, MANHOLES AND DROP INLETS

1. DESCRIPTION. Under this item the Contractor shall alter each catch basin, field inlet and manhole and drop inlet as indicated on the plans or as directed by the Engineer.

2. MATERIALS. All changes shall be made with the same type of material as used in the original construction unless otherwise indicated on the plans or orders of the Engineer.

3. CONSTRUCTION DETAILS. All work shall be done in a workmanlike manner by competent masons.

4. METHOD OF MEASUREMENT. For each manhole or catch basin altered as directed by the Engineer, the Contractor shall receive the unit price bid.

5. BASIS OF PAYMENT. The unit price bid for each shall include the cost of furnishing all labor, materials and equipment necessary to complete the work. If any manhole or catch basin heads or covers are broken through carelessness on the part of the Contractor, they shall be replaced at his expense.

ITEM 105—CONCRETE SIDEWALK

1. DESCRIPTION. Under this item the Contractor shall build sidewalks upon properly prepared subgrades as indicated on the plans or ordered by the Engineer.

2. MATERIALS. Concrete shall conform to all of the requirements specified for Item 105 in the table—"Composition of Concrete Items" and Section 7.

3. CONSTRUCTION DETAILS. The concrete shall be worked and floated so as to produce a smooth and uniform surface. The concrete shall be laid in one course with steel fabric reinforcement conforming to the requirements of Item 25F embedded midway between the upper and lower surfaces.

Sidewalks shall be of the depth shown on the plans and have transverse construction joints to the full depth of the concrete spaced 20 to 25 feet apart and the edges of such joints finished with an edging tool of 1/4" radius. The top surface shall be scored at intervals of three to five feet so that the finished walk will be marked in squares both longitudinally and transversely.

Premoulded Bituminous Joint Filler, M36 shall be placed between sidewalks and curb, pavement, buildings, etc.

Curing. The specifications for Item 98, Concrete Gutters will apply for curing.

4. METHOD OF MEASUREMENT. The unit price bid per cubic yard for this item shall include the cost of preparing subgrades and of furnishing all equipment, materials and labor necessary to complete the work.

5. BASIS OF PAYMENT. Payment will be made for the actual number of cubic yards of sidewalk laid as called for on the plans or as ordered by the Engineer.

ITEM 106G—FENCE GATES

1. DESCRIPTION. Under this item the Contractor shall furnish and erect metal fence gates of the type and size as indicated on the plans or the applicable Standard Structure Sheet and in the location shown or ordered by the Engineer.

2. MATERIALS. Gate frames shall be composed of tubing braced with rods, bars or angles and filled with wire mesh meeting the requirements of the specifications for the type of fencing with which the gate is to be used, all as detailed on the plans or Standard Structure Sheet. Gate posts shall likewise be made of tubing and bracing as shown on the plans. All steel and iron parts shall have a continuous coating of pure zinc meeting the requirements specified for the item of fencing with which the gate is to be used. Each gate shall be supplied with a lock and triplicate keys. Use of old or reconditioned materials will not be permitted.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of complete gates furnished and erected in accordance with the specifications, plans and orders of the Engineer.

4. BASIS OF PAYMENT. The unit price bid for each size gate shall cover furnishing and installation of the gates, gate posts, locks, bracing and necessary appurtenances, excavation, backfilling, clearing and grubbing, cement and all labor and incidental expenses necessary to satisfactorily complete the work.

ITEM 106L—CHAIN LINK FENCING

1. DESCRIPTION. Under this item the Contractor shall furnish and erect Chain Link Fencing of the type and size indicated on the plans or applicable Standard Structure Sheet and in the location shown on the plans or ordered by the Engineer.

2. MATERIALS. Fabric shall conform to the specifications for M6F, Galvanized Fence Fabric.

Posts, top rails and braces shall be of the type and size and shape indicated on the plans or approved equivalent. They shall be standard full weight steel shapes or approved equivalent. Tubing shall have longitudinally welded seams. All materials shall be new and first class and shall not include reconditioned thin wall pipe, or re-rolled or open seam pipe. All materials shall be thoroughly galvanized on the inside and outside surface in accordance with M19, Type I.

Fittings shall be Malleable Iron conforming to M13, Cast Steel conforming to M6A or Cast Iron conforming to M8. All fittings shall be galvanized in accordance with M19, Type II.

Samples of fabric and other materials will be taken by the Engineer, inspector or other agent of the County authorized for that purpose and submitted to the Laboratory in accordance with the Department's instructions. Materials must be approved before being used in the work.

3. CONSTRUCTION DETAILS. All line posts shall be spaced equidistant in the fence line on a maximum of 10 feet centers. Posts shall be set plumb in concrete bases of the depth and diameter indicated on the plans or ordered by the Engineer. The top of the posts shall be brought to a smooth grade line. The concrete for the post holes shall be Class B concrete. It shall be cast rough in the ground around the posts and the top surface shall be domed to shed water and provide a neat, workmanlike appearance when completed.

Intermediate posts shall be placed at the following locations: corners; changes in direction; abrupt changes in grade; intervals no greater than 500 feet in the fence line; or as directed by the Engineer.

Each end or gate post shall have one brace assembly and each corner or intermediate post to have two brace assemblies. When the fence is on a long curve, the intermediate posts shall be evenly spaced so that the strain of the fence will not bend the line posts.

All top rails shall pass through the base of the post caps and shall form a continuous brace from end to end of each stretch of fence. Top rail lengths shall be joined with sleeve couplings with expansion sleeves provided at 100 feet intervals. Top rails shall be securely fastened to terminal posts by means of approved rail end connectors. Horizontal braces shall be provided at all terminal posts, corner posts and intermediate posts, midway between top rail and ground and shall extend from the above mentioned posts to the first adjacent line post. Braces shall be securely fastened to the line posts by brace ends and brace bands, and to the terminal posts by approved rail end connectors. Diagonal brace rods shall be trussed from the brace end on the line post back to the terminal post, corner post or intermediate post and fastened to it by an approved connector.

Fence fabric shall be installed 2"± above ground level and securely fastened along the bottom and to all braces, top rails and intermediate posts, at the intervals indicated on the Standard Structure Sheet, by approved methods. The fabric shall be secured to all end, corner and gate posts with stretcher bars fastened to the posts in a manner that will permit adjustment of the fabric tension.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet of Chain Link Fencing measured along the top of fencing center to center of end posts, properly furnished and installed in accordance with the requirements of the plans, specifications, Standard Structure Sheet and orders of the Engineer. An allowance of 10 linear feet will be added for each end post, corner post and intermediate post installed in accordance with the specifications.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials, tools and equipment necessary to satisfactorily complete the work and shall include the transportation, clearing and grubbing, excavation, fill, cement, concrete, line posts, hardware, fencing and all other necessary materials or work.

ITEM 106T—TEMPORARY WIRE FENCE

1. DESCRIPTION. Under this item the Contractor shall completely enclose by temporary fences all excavations having side slopes greater than 1:1 and depths greater than 8 feet; steep embankments and all other potentially hazardous locations as soon as a hazardous condition is apparent and as ordered by the Engineer.

Temporary wire fence shall be omitted where the Engineer in charge orders slopes to be flattened to not more than a 1 on 1 or where temporary sheeting is extended to a minimum of three (3) feet above the working ground surface. The Engineer in charge may limit, extend, include or exclude areas to be fenced, as conditions warrant.

The provisions for this fencing are in addition to any provisions that the Contractor would normally make to safeguard his work operations and in no way diminish his obligations in this respect under the Contract.

2. MATERIALS. Fencing shall be not less than five (5) feet in height, mounted on steel angles, wood or other satisfactory means of support spaced at intervals of not more than ten (10) feet. Fabric shall be .083" diameter(No. 14 B.W.G.) iron wire both directions of an electrically welded rectangular mesh, with openings no greater than two (2) inches wide by four (4) inches high.

3. CONSTRUCTION DETAILS. The Contractor shall furnish, erect, relocate, maintain and remove all temporary fence and warning signs required under this item.

The Contractor will be permitted to remove such portions of the fencing as may be required for his operations during working hours, providing that the public is continuously safeguarded by other satisfactory means during these operations. In all such cases the fence must be restored at the end of each work day.

Warning signs reading "DANGER—KEEP OUT" shall be mounted on the fence as required by the Engineer in charge, but at no more than one hundred (100) foot intervals. Signs shall be 16" x 24" with five (5) inch black letters on a white background.

4. METHOD OF MEASUREMENT. The quantity of temporary wire fence to be paid for shall be the number of linear feet of fence furnished and erected or re-erected complete, including posts and warning signs, in accordance with these specifications.

5. BASIS OF PAYMENT. The price bid shall be the unit price per linear foot of temporary wire fence (measured along the top of the fence) and shall include the cost of all labor, materials, equipment and incidentals required to furnish and erect or re-erect, maintain and remove the fence. The cost of furnishing, erecting or re-erecting, maintaining and removing warning signs shall be included in the unit price bid for fence.

No direct payment will be made for fence removed and replaced by the Contractor for his own convenience during his daily operations, but payment therefor will be included in the price bid for fence furnished and erected or removed under this item.

ITEM 107—TIMBER AND LUMBER

1. DESCRIPTION. Under this item the Contractor shall furnish and place timber and lumber of various sizes as may be ordered for sills or platforms beneath the road, for culverts, bridges, reinforcing existing structures and for other similar purposes as ordered by the Engineer.

2. MATERIALS. Timber and lumber shall conform to the requirements of M26, Timber and Lumber.

3. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of thousand board feet placed in the completed work. In measuring dressed timber and lumber, the cross-section of any piece will be taken as the minimum nominal commercial size of undressed material from which the piece could have been cut. When round timber is used, it shall be estimated as square timber of the largest undressed commerical size which can be inscribed in the small end of the log. The length of any piece will be taken as the actual length in the finished work, making no deductions for bevels, notches or splices.

4. BASIS OF PAYMENT. The unit price bid per thousand board feet shall include the cost of furnishing all spikes, nails, screws, hardware, labor, materials and equipment necessary to complete the work, except that all plates, nuts, bolts and washers will be paid for as Structural Steel.

Work Not Included. No payment will be made under this item for timber or lumber for forms, moulds, or centers; or for sheeting, bracing, scaffolds, fences, guide rails or any part of the Contractor's temporary bridges, roads or plant. Payment for timber and lumber used in the above cases shall be included under the appropriate items covering the same.

ITEM 107S—STRESS GRADED TIMBER AND LUMBER

1. DESCRIPTION. Under this item the Contractor shall furnish and place stress graded timber and lumber as shown on the plans or as ordered by the Engineer.

2. MATERIALS. All timber and lumber shall conform to the requirements of M27, Stress Graded Timber and Lumber. Stress grades shall be as shown on the plans.

Approval of Order. The Contractor shall submit for approval a detailed statement of his proposed order for timber and lumber to the Chief Engineer. No material shall be ordered until this statement has been approved.

Paint. Paint and painting materials shall conform to Material Specification M18A.

3. CONSTRUCTION DETAILS. Stress graded timber and lumber shall be placed or erected as shown on the plans or ordered by the Engineer.

Where painting is specified, paint shall be applied as required under Painting Timber and Lumber in Section 8a.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of thousand board feet placed in the completed work. In measuring dressed timber and lumber, the cross section of any piece will be taken as the minimum nominal commercial size of undressed material from which the piece could have been cut. When round timber is used it shall be estimated as square timber of the largest undressed commercial size which can be inscribed in the small end of the log. The length of any piece will be taken as the actual length of the finished work, making no deductions for bevels, notches or splices.

5. BASIS OF PAYMENT. The unit price bid per thousand board feet shall include the cost of furnishing all spikes, nails, screws, timber connectors, hardware, labor, materials and equipment necessary to complete the work, except that all plates, nuts, bolts and washers will be paid for as Structural Steel.

ITEM 108—TREATED TIMBER AND LUMBER

1. DESCRIPTION. Under this item the Contractor shall furnish and place treated timber and lumber as shown on the plans or as ordered by the Engineer.

2. MATERIALS. a. General. Timber and lumber shall conform to the requirements of M27, Stress Graded Timber and Lumber. Preservatives shall conform to the requirements of either M28A, Wood Preservative—Creosote Oil, Type I, or M28C, Wood Preservative—Oil Borne (Pentachlorophenal Solution).

b. Approval of Order. The provisions of Item 107S shall apply.

c. Preservative Treatment. The preservative treatment of timber and lumber shall conform to requirements of Federal Specification TT-W-571 "Wood Preservative; Recommended Treating Practice", with the following additions and modifications:

Creosote oil shall be the only preservative allowed for treatment of timber and lumber that is to be used in water. In other applications, either creosote oil or pentachlorophenal may be used at the option of the Contractor.

With the exception of southern pine, all timber and lumber 3 inches and more in thickness shall be incised. Incising shall be done so as to obtain a uniform depth of penetration of preservative with a minimum loss of structural strength.

All timber and lumber treated with Creosote Oil shall finally retain not less than 12 pounds of wood preservative per cubic foot of wood.

Timber and lumber subject to damage by marine borers shall be treated to produce the final retention specified under the heading Coastal Waters in Table 1 of Federal Specification TT-W-571.

When "Wood Preservative—Oil Borne" is used, the final retention of preservative shall be not less than 0.40 lbs. of pentrachlorophenal or 8.0 lbs. of 5% pentachlorophenal solution per cu. ft. of wood.

d. Sampling and Inspection. Sampling and inspection will be done by an accredited representative of the Department. The inspector shall have the power to take samples of the material for analysis and to reject those materials which do not fulfill the requirements of these specifications as to either quality or workmanship. The acceptance of any materials by the Inspector shall not be a bar to their subsequent rejection if found defective. The Contractor shall furnish all facilities and equipment for the inspection and testing of materials and workmanship and the Inspector shall be allowed free access to all premises where inspections can be made.

The Contractor shall give the Department and Department's Inspection Agents ample notice relative to the location of, and time when, treating operations will take place. Inspection of all timber and lumber will be made by the Department's Inspection Agents before, during and after pressure treatment at the treating plant. No treated timber and lumber shall be shipped which does not bear, in legible form, the Inspector's stamp of approval.

3. CONSTRUCTION DETAILS. All cutting, framing and boring of timber and lumber shall be done before treatment whenever practicable. Cutting and boring below high water shall be particularly avoided in material which is to be used in waters infested with marine borers.

All cut surfaces shall be thoroughly brush coated with 3 successive applications of hot

creosote, followed by a thick application of a mixture of 30% creosote and 70% pitch.

Bolt holes which have been bored subsequent to treatment shall be treated with creosote oil by means of an approved pressure bolt hole treater. Any unfilled holes, after being treated with creosote oil shall be plugged with creosoted plugs.

All treated timber and lumber shall be carefully handled and properly stored. Any surface breaks which do not warrant the rejection of the timber and lumber shall be thoroughly brush coated with three successive applications of hot creosote oil, followed by a thick application of a mixture of 30% creosote and 70% pitch.

4. METHOD OF MEASUREMENT. The provisions of Item 107S will apply.

5. BASIS OF PAYMENT. The provisions of Item 107S will apply.

ITEM 109—RELAYING PIPE

The specifications for this item will appear in the proposal if and when it is to be included in the work items of the contract.

ITEM 110—CONCRETE CRIBBING

1. DESCRIPTION. Under this item the Contractor shall furnish and place concrete cribbing as shown on the Standard Structure Sheet or other types approved by the Chief Engineer. Concrete cribbing shall be placed on a suitable foundation as determined by the Engineer.

2. MATERIALS. The concrete in the crib members shall conform to the specifications for Class A Concrete for Structures (modified in accordance with the requirements for Item 110 in the table—Composition of Concrete Items).

Reinforcement in the crib members shall conform to the specification for M17, Reinforcement for Cement Concrete in Part II, Section 6.

3. CONSTRUCTION DETAILS. Concrete cribbing shall be constructed and backfilled as shown on the Standard Structure Sheet. While the cribbing is being placed it shall be filled with stone. The largest dimension of each of the stones shall be less than twelve inches.

4. METHOD OF MEASUREMENT. The quantity of Concrete Cribbing to be paid for under this item will be the number of square feet of face of cribbing completed in place.

5. BASIS OF PAYMENT. The unit price bid per square foot for this item shall include the cost of furnishing all labor, materials and equipment necessary to complete the work, except that all necessary excavation will be paid for under the item Structure Excavation and stone filling will be paid for under the item Stone Filling.

ITEM 110M—METAL BIN TYPE RETAINING WALL

ITEM 111—PNEUMATICALLY PROJECTED CONCRETE

ITEM 112—EMULSIFIED CARBON BLACK

The specifications for these items will appear in the proposal if and when they are to be included in the work items of the contract.

ITEM 113—HIGHWAY-RAILROAD BARRICADE

1. DESCRIPTION. Under this item the Contractor shall furnish and erect barricades as shown on the Standard Structure Sheet at the places shown on the plans or as directed by the Engineer.

2. MATERIALS. The posts shall be of seasoned white oak, cedar, locust, tamarack or chestnut. Rails shall be of seasoned spruce, douglas fir, or southern pine lumber, dressed four sides. Posts and rails shall be sound and clear.

Black Paint shall conform to the requirements of M18D, Black Paint.

White Paint shall conform to the requirements of M18E, Stain Resistant White Paint.

3. CONSTRUCTION DETAILS. The lower 3-1/2 feet of the posts shall be dipped while dry in bituminous material conforming to the requirements of Item 71, heated to a temperature

of 300°F. The posts shall be thoroughly dry before being set in the ground. The joints of the rails and posts shall be given one coat of White Paint before assembling. The entire surface above the ground shall be given three coats of White Paint and stripes shall be formed with one coat of Black Paint. No paint shall be applied in wet or freezing weather.

Painting shall conform to the requirements for Painting Timber and Lumber as specified in Part II, Section 8a.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of linear feet of barricade completed in place.

5. BASIS OF PAYMENT. The unit price bid per linear foot shall include the cost of furnishing all labor, materials and equipment necessary to complete the work.

The reflecting sign is not included in this item.

ITEM 113HB—HIGHWAY BARRICADE (——TYPE POSTS)

The specifications for this item will appear in the proposal if and when it is to be included in the work items of the contract.

ITEM 114—RAILROAD PROTECTION

1. DESCRIPTION. Under this item the Contractor shall reimburse the railroad company or companies for the service of all flagmen, switch tenders, pilots, conductors, watchmen and similar protective labor as required by the railroad company or companies involved in the project to protect the operation and safety of its equipment during the Contractor's operations on the project.

2. BASIS OF PAYMENT. Payment will be made at the lump sum price bid for this item after the railroad or railroads have acknowledged receipt of payment of their costs from the Contractor. Monthly payments will be made for this item in proportion to the amount of work completed provided the railroad or railroads have been previously reimbursed.

The lump sum price bid shall cover the service of all flagmen, switch tenders, pilots, conductors, watchmen and similar protective labor as required by the railroad company or companies involved in the project to protect the operation and safety of its equipment during the Contractor's operations on the project.

No payment will be made under this item for protection caused by the Contractor electing to use railroad equipment or tracks in the performance of his contract. Protective measures required by the railroad under those conditions will be paid for by the Contractor to the railroad directly and must be included in his bid for other items in the contract as part of the construction costs.

ITEM 115—BRIDGE BEARING PADS

1. DESCRIPTION. Under this item the Contractor shall furnish and install pads under the bearing plates, to reduce impact shock and vibration as shown on the plans and in accordance with the specifications.

2. MATERIALS. The bearing pads shall consist of material that will retain its elasticity under all weather conditions with no absorption of moisture and shall be either one of the following:

a. An approved impregnated compressible fabric composed of layers of cotton duck weighing 8 ounces per square yard impregnated with a high quality natural rubber. Warp and filling yarn shall be 2 ply with warp count 50 threads and filling count 40 threads. The finished material shall contain 64 plies per inch of thickness.

b. An approved compressible material composed of brass wire inserted asbestos yarn cloth weighing between 2.75 and 3.00 pounds per square yard, treated with an asphaltic base impregnation and compounded with a thermo-setting elastimer to provide conformity and elasticity. The untreated cloth shall consist of 14 ends per inch and 9 picks per inch. The finished material shall contain approximately 16 plies per inch of thickness.

A test pad 1/2 inch thick shall not compress less than 1/64 inch nor more than 1/16 inch under a load of 1,000 pounds per square inch and the test pad shall return to its original thickness after this load is removed.

The bearing pads shall be of the same length and width as the bearing plates under which they are to be placed. The thickness shall be as noted on the plans. Samples of the pads, of the thickness to be used, shall be submitted to the Chief Engineer and his approval obtained before the pads are incorporated in the work. Tolerance on specifications shall be plus or minus 5%.

3. CONSTRUCTION DETAILS. When the bearing pads are to be placed on concrete, the surface of the concrete shall be finished as specified under Structural Concrete in paragraph "Finishing Bearing Surfaces" of the specifications. The bearing pads shall be placed at the same time that the bearing plates are set.

4. METHOD OF MEASUREMENT. The quantity to be paid for under this item will be the number of square feet measured to the nearest tenth, of bridge bearing pads remaining in the finished structure, furnished and installed as shown on the plans and in accordance with the specifications.

5. BASIS OF PAYMENT. The unit price bid per square foot shall include the cost of furnishing all labor, materials and equipment necessary to satisfactorily complete the work.

ITEM 116—PROJECT SURVEY AND STAKE-OUT

1. DESCRIPTION. Under this item the Contractor shall do all necessary surveying required to construct all elements of the project as shown on the plans and specified in the proposal and specifications. This shall include but shall not be limited to stakeout, layout and elevations for the highway, structures, forms, pile layouts and appurtenances as shown and required consistent with the current practices of the Department, and shall be performed competently qualified personnel acceptable to the Chief Engineer. Where railroad relocation or alteration is done by force account by the railroad or by the Contractor, all necessary surveying is to be done as part of this item as ordered by the Engineer. The stake-out survey shall proceed immediately following the award of the contract and shall be expeditiously progressed to completion in a manner and at a rate satisfactory to the Chief Engineer. The Contractor shall keep the Engineer fully informed as to the progress of the stake-out survey.

2. MATERIALS. All instruments, equipment, stakes and any other material necessary to perform the work satisfactorily, shall be provided by the Contractor. All stakes used shall be of a type approved by the Engineer. It shall be the Contractor's responsibility to maintain these stakes in their proper position and location at all times.

3. CONSTRUCTION DETAILS. The Contractor shall trim trees, brush and other intefering objects, not inconsistent with the plans, from survey lines in advance of all survey work to permit accurate and unimpeded work by his stake-out survey crews and the Department's cross-section survey crews. The location and length shown on the plans for pipe and structural plate culverts shall be considered to be approximate. The ordered length of culverts will be determined by the Engineer after the Contractor accurately stakes the proposed culvert in the planned location as approved by the Engineer and after appropriate and necessary engineering study. The exact position of all work shall be established from control points, base line transit points or other points of similar nature and/or modified by the Engineer. Any error, apparent discrepancy or absence in or of data shown or required for accurately accomplishing the stake-out survey shall be referred to the Engineer for interpretation or furnishing when such is observed or required.

The Contractor shall place two offset stakes or references at each center line station, or as ordered by the Engineer and at such intermediate locations as the Engineer may direct. From computations and measurements made by the Contractor, these stakes shall be clearly and legibly marked with the correct center line, station number, offset and cut or fill so as to permit the establishment of the exact center line location and elevation during construction. If markings become faded or blurred for any reason the markings shall be restored by the Contractor at the request of the Engineer. He shall locate and place all cut, fill, slope, fine grade or other stakes and points, as the Engineer may direct for the proper progress of the work. All control points shall be properly guarded and flagged for easy identification.

Drainage structures shall be staked out by the Contractor at the locations and elevations shown on the plans or ordered by the Engineer. The Contractor shall also accurately establish the center line of bearings for bridge abutments and piers, by setting special hubs or reference points as directed by the Engineer, so located and protected to insure their remaining undisturbed until such time as they are no longer needed. The Contractor shall accurately mark the location of anchor bolts to be installed, establish the elevations of bearing surfaces and check bearing plates to insure installation at their exact elevation. Before the erection of structural steel is started the Contractor shall verify by accurate field measurements the locations, both vertically and horizontally, of all bearings and shall assume

full responsibility for the fabricated structural steel fitting the substructure as constructed.

All required Rights-of-Way and easement limits shall be established, staked and referenced by the Contractor concurrent with the construction stake-out survey.

Reference points, base lines, stakes and bench marks for borrow pits shall be established by the Contractor.

Permanent Survey Marker locations shall be established and referenced by the Contractor.

The Contractor shall be responsible for the accuracy of his work and shall maintain all reference points, stakes, etc. throughout the life of the contract. Damaged or destroyed points, bench marks or stakes, or any reference points made inaccessible by the progress of the construction shall be replaced or transferred by the Contractor. Any of the above points, which may be destroyed or damaged shall be transferred by the Contractor before they are damaged or destroyed. All control points shall be referenced by ties to acceptable objects and recorded. Any alterations or revisions in the ties shall be so noted and the information furnished to the Engineer immediately. All stake-out survey work shall be referenced to the center line shown on the plans. All computations necessary to establish the exact position of the work from control points, shall be made and preserved by the Contractor. All computations, survey notes and other records necessary to accomplish the work shall be neatly made. Such computations, survey notes and other records shall be made available to the Engineer upon request and shall become the property of the County and delivered to the Engineer not later than the date of the acceptance of the Contract.

The Engineer may check all or any portion of the stake-out survey work or notes made by the Contractor. Any necessary correction to the work shall be made immediately by the Contractor. Such checking by the Engineer shall not relieve the Contractor of any responsibilites for the accuracy or completeness of his work.

Prior to the final cross-section survey of the project by the Engineer, the Contractor shall re-establish center line or base line points and stationing as required by the Engineer.

Prior to the final cross-section survey or any borrow pits by the Engineer, the Contractor shall re-establish base line points and stationing, as well as any necessary bench marks as required by the Engineer.

The Contractor will not be required or permitted to take the preconstruction or final cross-sections that are used for payment purposes.

During the progress of the construction work, the Contractor will be required to furnish all of the surveying and stake-out incidental to the proper location by line and grade for each phase of the work. For paving and any other operation requiring extreme accuracy, the Contractor will re-stake with pins or other acceptable hubs located directly adjacent to the work at a spacing directed by the Engineer.

Any existing stakes, iron pins, survey monuments or other markers defining property lines which may be disturbed during construction, shall be properly tied in to fixed reference points before being disturbed and accurately reset in their proper position upon completion of the work.

Just prior to completion of the contract, the Contractor shall re-establish if necessary and retie all control points as permanently as possible and to the satisfaction of the Engineer.

4. METHOD OF MEASUREMENT AND BASIS OF PAYMENT. Payment will be made at the lump sum price bid for this item. The price bid shall include the cost of furnishing all labor, equipment, instruments and other material necessary to satisfactorily complete the project surveying and stake-out.

Monthly payments will be made under this item in proportion to the amount of work done on this item as determined by the Engineer.

ITEM 117—SURFACE DUSTING WITH FINE AGGREGATE

ITEM 118—CONCRETE RIP-RAP IN BAGS

ITEM 120—REFLECTORIZED HIGHWAY-RAILROAD CROSSING SIGNS

ITEM 120A—RAILROAD APPROACH WARNING SIGNS, REFLECTING TYPE

The specifications for these items will appear in the proposal if and when they are to be included in the work items of the contract.

ITEM 120D—DISPOSAL OF BUILDINGS

1. DESCRIPTION. Under this item the Contractor shall be required , if ordered by the Engineer, to dispose of any or all buildings within the right of way as shown on the plans and itemized proposal. Any building ordered disposed of by the Engineer shall become the property of the Contractor and shall be demolished, removed or otherwise disposed of at his

option. The Contractor shall dispose of the buildings and remove from the site all materials resulting therefrom. He shall remove the foundation to a depth of not less than four feet below the finished surface of the roadway prism, shall break up any paved cellar floor and grade the site. Disposal of all waste materials shall be subject to the approval of the Engineer. All salvage materials shall be removed from the site of the work prior to the final acceptance of the project. If any building is removed to a new location or any salvage material placed on private lands, satisfactory written permission from the owner or owners of such property shall be furnished to the Engineer prior to such undertaking. The Contractor shall provide for the discontinuance of all utility services and will be held strictly responsible for any claim arising from his failure to do so. The Contractor shall progress the work under this item as one of the first operations of his work schedule unless directed otherwise by the Engineer.

County Options. Under this item the County reserves the right to clear the site of the project of buildings by removal from the site of the work by the owner thereof.

In clearing the site of the work, however, if a property owner agrees with the Department to remove the building, no payment will be made the Contractor under Item 120D. But the Contractor shall demolish foundation, cellar floors, walks and other facilities required to properly complete the work, and no direct payment will be made therefor. If the Contractor disposes of a building under Item 120D, he will be paid his bid price.

2. METHOD OF MEASUREMENT. The Contractor will be paid the lump sum price bid for the disposal of each building disposed of in accordance with the provisions of these specifications.

3. BASIS OF PAYMENT. The lump sum price bid shall cover all labor, tools, machinery, including all excavation and incidentals necessary to satisfactorily complete the work.