UNIFORM STANDARD SPECIFICATIONS for PUBLIC WORKS CONSTRUCTION

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MARICOPA ASSOCIATION of GOVERNMENTS

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(Includes revisions through 2011)

FOREWORD

Publication of these Uniform Standard Specifications and Details for Public Works Construction fulfills the goal of a group of agencies who joined forces in 1966 to produce such a set of documents. Subsequently, in the interest of promoting county-wide acceptance and use of these standards and details, the Maricopa Association of Governments accepted their sponsorship and the responsibility of keeping them current and viable.

These specifications and details, representing the best professional thinking of representatives of several Public Works Departments, reviewed and refined by members of the construction industry, were written to fulfill the need for uniform rules governing public works construction performed for Maricopa County and the various cities and public agencies in the county. It further fulfills the need for adequate standards by the smaller communities and agencies who could not afford to promulgate such standards for themselves.

A uniform set of specifications and details, updated and embracing the most modern materials and construction techniques will redound to the benefit of the public and the private contracting industry. Uniform specifications and details will eliminate conflicts and confusion, lower construction costs, and encourage more competitive bidding by private contractors.

The Uniform Standard Specifications and Details for Public Works Construction will be revised periodically and reprinted to reflect advanced thinking and the changing technology of the construction industry. To this end a Specifications and Details Committee has been established as a permanent organization to continually study and recommend changes to the Specifications and Details. Interested parties may address suggested changes and questions to:

Standard Specifications & Details Committee
c/o Maricopa Association of Governments
302 North First Avenue, Suite 300
Phoenix, Arizona, 85003.

These suggestions will be reviewed by the committee and appropriate segments of the industry and cumulative annual revisions will be published the first of each year. A copy of this publication is available for review on the internet at the website listed below. Please follow the links to the publications page and look for *Uniform Standard Specifications for Public Works Construction and/or Uniform Standard Details for Public Works Construction*:

www.mag.maricopa.gov

While in the interest of uniformity, it is hoped that all using agencies will adopt these standards with as few changes as possible, it is recognized that because of charter requirements and for other reasons, some agencies will find it necessary to modify or supplement certain requirements.

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(B) Fails to perform the work with sufficient workmen and equipment or with sufficient materials to assure the prompt completion of said work, or

(C) Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or

(D) Discontinues the prosecution of the work, or

(E) Fails to resume work which has been discontinued within a reasonable time after notice to do so, or

(F) At any time colluded with any party or parties, or

(G) Allows any final judgment to stand against him unsatisfied for a period of 14 calendar days, or

(H) For any cause whatsoever, fails to carry on the work in an acceptable manner, the Engineer will give notice in writing to the Contractor and his surety of such delay, neglect, or default, and advise them that the work must be resumed immediately.

If the Contractor or surety, within a period of 14 calendar days after such notice, has not proceeded in accordance therewith, then the Contracting Agency will, upon written notification from the Engineer of the fact of such delay, neglect or default and the Contractor's failure to comply with such notice, have full power and authority without violating the contract, to take the prosecution of the work out of the hands of the Contractor. The Contracting Agency may appropriate or use any or all materials and equipment on the ground as may be suitable and acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the Engineer will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Contracting Agency, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due said Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Contracting Agency the amount of such excess.

***108.11 TERMINATION OF CONTRACT**

The Contracting Agency may terminate the contract or a portion thereof if conditions encountered during the progress of the work make it impossible or impracticable to proceed with the work or a local or national emergency exists.

When contracts, or any portion thereof, are terminated before completion of all work in the contract, adjustments in the amount bid for the pay items will be made on the actual quantity of work performed and accepted, or as mutually agreed for pay items of work partially completed or not started. No claim for loss of anticipated profits will be considered.

Termination of the contract or any portion thereof shall not relieve the Contractor of his responsibilities for the completed work nor the surety of its obligation for and concerning any just claims arising out of the work performed.

End of Section

*Not applicable to Improvement District Projects.

SECTION 109

MEASUREMENTS AND PAYMENTS

109.1 MEASUREMENT OF QUANTITIES:

All work completed under the contract will be measured by the Engineer according to United States standard measures. The methods of measurement and computation to be used in determination of quantities of materials furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice. A station, when used as a definition or term of measurement, will be 100 linear feet.

Unless otherwise specified, longitudinal measurements will be made along the grade line.

Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the Engineer.

The term ton will mean the short ton consisting of 2,000 pounds avoirdupois.

Unless otherwise specified, structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.

In computing volumes of excavations or fill, the average end area method or other acceptable methods as determined by the Engineer will be used.

Volumes will be computed at 60° F, using ASTM D-1250 for Asphalt or ASTM D-633 for Tars.

Lumber will be measured by the thousand board foot measure actually used in the work. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.

The term lump sum, when used as a pay item, will mean complete payment for the work described.

Sundry items which have a basis for measurement and payment herein and which are incidental to or required in the construction of the work but are not included as items in the fee schedule shall be considered an integral part of the contract, and all labor, materials, etc. required for such items shall be furnished by the Contractor and the cost of same included in the unit price.

Where the units of measurement shown on the proposal form or the methods of measurement specified in the project special provisions differ from the measurement and payment provisions of the Uniform Standard Specifications, the project documents shall have precedence.

109.2 SCOPE OF PAYMENT:

Measurement and payment for pay items in the proposal will be as indicated in the applicable standard specification or in the special provisions.

When payment is specified to be made on the basis of weight, the weighing shall be done by a licensed public weighmaster or the weighmaster's deputy on a device licensed or certified as defined by Arizona Revised Statutes Section 41-2091 and 41-2093. The Contractor shall furnish the Engineer with duplicate Weighmaster's Certificates showing the actual net weights together with the information required by the rules adopted by the Department of Weights and Measures as authorized by Arizona Revised Statutes Section 41-2065. The Contractor shall furnish the Engineer with duplicate Weighmaster's Certificates at the time of delivery unless the Engineer designates a different submittal time. The Contracting Agency will accept the certificates as evidence of the weight delivered.

Payment for the various items in the proposal will be made at the unit price in the proposal, and shall be compensation in full for furnishing all labor, materials, equipment and appurtenances necessary to complete the work in a satisfactory manner as shown on the plans and as required in the specifications, with all connections, testing, and related work completed. Each item, fixture, piece of equipment, etc., shall be complete with all necessary connections and appurtenances, for the satisfactory use and operation of said item. No additional payment will be made for work related to any item unless specifically called for in the proposal. This compensation shall also cover all risk, loss, damage or expense of whatever character arising out of the nature of the work or the prosecution thereof, subject to the provisions of Section 107.

The unit prices shall include all costs for salaries and wages, all payroll additives to cover employee benefits, allowances for vacation and sick leave, company portion of employee insurance, social and retirement benefits, all payroll taxes, contributions

(5) The Engineer may exclude individual payment requests which in the Engineer's judgement do not warrant storage and prepayment under the intent of this section.

(B) Final Payment: When the project has been accepted as provided in Section 105, and within 30 calendar days after final inspection of the work completed under the contract, the Engineer will render to the Contracting Agency and the Contractor, a final estimate which will show the amount of work performed and accepted under the contract. All prior estimates and partial payments will be subject to correction in the final estimate for payment.

Within sixty (60) calendar days after final acceptance, the Contracting Agency will pay the Contractor all amounts due him under the contract, except that before final payment will be made, the Contractor shall satisfy the Contracting Agency by affidavit that all bills for labor and materials incorporated in the work have been paid. The Contractor's Affidavit may be obtained from the Engineering Office of the Contracting Agency.

If payment will be longer than 60 days after final completion and acceptance, the owner will provide the Contractor specific written findings for reasons justifying the delay in payment.

The acceptance of the project and the making of the final payment shall not constitute a waiver by the Contracting Agency/Owner of any claims arising from faulty or defective work appearing after the completion or from failure of the Contractor to comply with the requirements of the contract documents.

109.8 PAYMENT FOR DELAY:

The procedures contained in this Section shall not be construed to void any provision of the contract which require notice of delays, provides for negotiation of other procedures for settlement or provide for liquidated damages.

109.8.1 Failure to Locate or Incorrect Location of Utilities: Arizona Revised Statutes 40-360.28 indicates that if a person (owner, operator, or agent) fails to locate or incorrectly marks the location of the underground facility in a timely manner, the person (owner, operator, or agent) becomes liable for resulting damages, costs and expense to the injured party. The Contracting Agency will deny any claims for damages or delays if another owner or operator is at fault.

109.8.2 Contracting Agency Delays: Arizona Revised Statutes 34-221 states "A contract for the procurement of construction shall include a provision which provides for negotiations between the Agent and the Contractor for the recovery of damages related to expenses incurred by the Contractor for a delay for which the Agent is responsible, which is unreasonable under the circumstances and which was not within the contemplation of the parties to the contract." In this case, if the Contractor sustains damages which could not have been avoided by the judicious handling of forces, equipment and plant or by reasonable revision in the Contractor's schedule of operation, the compensation for such damages will be negotiated. The Contractor shall notify the Engineer of the condition in writing by the next work day. Failure to notify the Engineer within this time may be just cause to reject any claims for such damages.

Compensation for such damages will be negotiated as follows:

(A) The Engineer shall be satisfied that the Contractor has made every reasonable effort to prosecute the work despite any delays encountered or revisions in the Contractor's scheduling of work.

(B) The Compensation paid to the Contractor shall be in accordance with Section 109.

109.8.3 Extension of Contract Time: For any such delays, the contract time will be adjusted in accordance with Section 108.7.

109.9 DOLLAR VALUE OF MAJOR ITEM:

TABLE 109-1	
DOLLAR VALUE OF MAJOR ITEM	
Original Contract Amount	Dollar Value of Major Item
$0.00 to $1,000,000.00	$50,000 or 10% of original contract amount, whichever is less
$1,000,000.00 to $5,000,000.00	5.0% of original contract amount
$5,000,000.00 or greater	$250,000.00 or 2.5% of original contract amount, whichever is greater

109.10 PAYMENT FOR MOBILIZATION/DEMOBILIZATION

The Agency will compensate Contractor for a single round trip mobilization/demobilization of Contractor's personnel, equipment, supplies and incidentals, including establishment of offices, buildings and other facilities required for the performance of the work on the project, as well as preparatory work and operations prior to the commencement of the work on the project site.

Mobilization/demobilization will be measured for payment by the lump sum as a single complete unit of work. Payment for mobilization/demobilization will be made at the contract lump sum price. Payment shall be made in equal one-third portions. The first payment will be paid with the Contractor's initial billing. The second payment will be made when the total payments to the Contractor for the pay items, exclusive of payments for mobilization/demobilization, equal greater than one-half of the initial contracted amount, exclusive of mobilization/demobilization. The remaining one-third will be paid as part of the final payment due to the Contractor.

When other contract items are adjusted as provided in Section 109, and if the costs applicable to such items of work include mobilization costs, such mobilization costs will be considered as recovered by Contractor in the lump sum price paid for mobilization, and will be excluded from consideration in determining compensation under Section 109.

If the Contractor performs a second or additional mobilization/demobilization of personnel, material and/or equipment at the Engineer's express written request, the Agency will compensate the Contractor for such expenses at the Contractor's actual costs. The Contractor shall provide all documentation for these costs at the request of the Engineer.

For projects that do not list mobilization/demobilization as a pay item, a single round trip mobilization/demobilization shall be considered a non-pay item for said projects, the cost of which shall be spread across other appropriate items. Should a second or additional mobilization/demobilization be required at the Engineer’s express written request, compensation for such shall be handled as detailed in the foregoing paragraph.

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SECTION 310

UNTREATED BASE

310.1 DESCRIPTION:

Untreated base, i.e., select or aggregate base course, shall comply with Subsection 702.2 unless the use of a different type of material is specifically authorized in the special provisions.

310.2 PLACING:

Untreated base 6 inches or less in compacted thickness may be placed in a single layer and those more than 6 inches in thickness shall be built up in successive layers of approximately equal compacted thickness not to exceed a maximum thickness of 6 inches. The requirements which follow are applicable to all types of material.

After distributing, the base material shall first be watered and then immediately bladed to a uniform layer that will net, after rolling, the required thickness. If the materials deposited are not uniformly blended together, the blading operation shall be continued to such extent as may be necessary to eliminate segregation. The quantity of water applied shall be that amount which will assure proper compaction resulting in a relative density of not less than 100 percent as determined under Section 301. Care shall be exercised in connection with watering operations to avoid wetting the subgrade or any lower base course to detrimental extent.

Upon completion, the base surface shall be true, even and uniform conforming to the grade and cross-section specified.

Untreated base may vary not more than ½ inch above or below required grade and cross-section.

310.3 DEFICIENCY:

When in the opinion of the Engineer there is reason to believe that a deficiency in thickness, or an excess of plasticity exists, measurements or samples will be taken in the same pattern as that defined in Section 321. If the base has been covered or it is otherwise impractical to correct the deficiency, the corrective measures in Table 310-1 shall be taken by the Contractor at no additional cost to the Contracting Agency.

TABLE 310-1

THICKNESS AND PLASTICITY DEFICIENCY

Type	Deficiency	Corrective Measure
I	½ inch or more but less than 1inch thickness	Place asphalt chip seal using precoated chips in accordance with Section 330 for the full roadway width over the area involved but for not less than 660 feet or one City block in length.
II	1 inch or more in thickness	Place an additional asphalt concrete overlay, a 9.5 mm mix, of ½ the thickness of the deficiency in thickness for the full roadway width over the area involved, not less than 660 feet or one City block in length.
III	A plasticity index of 6 to 7 inclusive*	Place an asphalt concrete overlay ½ inch in thickness over the same total area as required for Type I and II.
IV	A plasticity index of over 7*	Remove deficient material from affected area and replace with material complying with the specifications.

* The plasticity index shall be in accordance with AASHTO T-146 Method A (wet preparation), T-89 and T-90.

310.4 PAYMENT:

Payment for untreated base will be made on the basis of the contract unit price per ton unless an alternate basis of payment is provided in the proposal.

SECTION 311

SOIL CEMENT BASE COURSE

311.1 DESCRIPTION:

This item shall consist of a base course composed of a mixture of local soil, portland cement, and water compacted at optimum moisture content.

311.2 MATERIALS:

Portland cement and water shall comply with Sections 725 and 225. The soil for the mixture shall consist of the material in the area to be paved. The material shall not contain more than 5 percent gravel or stone retained on a 3 inches sieve. It shall be demonstrated by laboratory tests that the plasticity and hardening characteristics of the soil will be adequately modified by the specified cement content.

311.3 EQUIPMENT:

An ample number of machines, combination of machines and equipment shall be provided and used to produce the complete soil cement base course meeting the requirements for soil pulverization, cement distribution, water application, incorporation of materials, compaction, finishing, and for application of the curing material as provided in these specifications.

Mixing shall be accomplished by means of multiple-pass soil-cement mixer, single-pass soil-cement mixer or central plant mixer.

Water may be applied through the mixer or with the water trucks equipped with pressure sprays. Water trucks providing fine fog-type sprays shall be furnished for finishing and curing. Properly adjusted garden type nozzles on a pressure bar may be used to produce fog spray if approved by the Engineer.

Cement spreader shall be a specially constructed device to distribute bulk cement uniformly at rate specified either in windrows or on the flat as determined by method of mixing.

311.4 CONSTRUCTION METHODS:

Before undertaking construction of the soil cement base course, the area to be paved shall be brought to a compacted condition, true to line and grade as directed by the Engineer or as shown on the plans. During this process any unsuitable soil or material, including excess material retained on a 3 inches sieve, shall be removed and replaced with acceptable material. The compacted surface shall be at the proper elevation as specified, shown on the plans, or as directed by the Engineer, for the top of the soil cement base. At completion of this phase, the material and surface shall be approved by the Engineer before proceeding with the next step.

The material shall be scarified, pulverized, mixed with water and cement, compacted and finished and cured in lengths permitting the full roadway width to be complete in not more than 4 hours from the time that cement is exposed to water. Such lengths will generally be not less than 600 feet or the length of one City block and preferably more. Where a gutter section exists the material shall be pulled back from the gutter face for the full depth of the course before processing.

311.4.1 Pulverizing: Before application of cement, soil to be processed shall be scarified to depth of base. The material should be damp at time of scarifying to reduce the dust to a minimum and to aid in pulverization. If the soil contains clods, it shall be pulverized until not less than 80 percent, exclusive of gravel or stone, will pass a No. 4 sieve.

311.4.2 Application of Cement: The quantity of cement shall be by weight as a percentage of the dry weight of the soil as determined by the laboratory and/or as directed by the Engineer and shall be applied uniformly on the soil in a manner satisfactory to the Engineer. The allowable deviation in uniformity shall not exceed 10 percent. The entire operation of spreading and mixing shall be conducted in such a manner as will result in a uniform soil cement and water mixture for the full design width and depth.

The percentage of moisture in the soil, at the time of cement application, shall not exceed the quantity that will permit a uniform and intimate mixture of the soil and cement during mixing operations, and it shall not exceed the specified optimum moisture content for the soil cement mixture.

SECTION 317

ASPHALT MILLING

317.1 DESCRIPTION:

The work under this Section shall consist of milling existing asphalt concrete pavement where shown on the Plans or requested by the Engineer.

317.2 CONSTRUCTION REQUIREMENTS

Contractor is responsible for locating all milling hazards on and below the surface within the areas to be milled including areas requiring special milling. Special milling is not a separate pay item and shall be paid for as Asphalt Milling.

The milling cut depth shall be the depth indicated on the Plans plus or minus 1/8 inch. The milling machine shall have electronic grade controls. Contractor shall remove the milled material and sweep the roadway clean with a power pick-up broom to the satisfaction of the Engineer.

Asphalt pavement adjacent to manholes, valve boxes, small radius curbs and other fixed objects that produce confined area shall be removed with milling equipment specifically designed to operate in constricted areas. The equipment shall be capable of removing asphalt concrete of the specified thickness without damage to, or displacement of, the adjacent object(s).

The Contractor shall be responsible for continually checking the milling operation to determine that the proper depth of milling has been achieved, that the proper profile and cross slope are achieved, and that the surface texture is (a) free from longitudinal ridges, and (b) has a uniform pattern.

The Contractor shall immediately notify the Engineer when:

- The existing pavement thickness is found to be less than anticipated and breaking of the underlying material occurs.
- Delamination of underlying material occurs.

The work shall result in a clean milled surface to the specified depth for the area indicated by the construction documents including the areas immediately around and next to any individual hazard within the area to be milled. The edge of milled area shall form a straight clean cut line.

317.3 MEASUREMENT AND PAYMENT:

Measurement for Asphalt Milling will be by the square yard and shall only include area milled to the required depth and cross section.

Payment for Asphalt Milling at the contract unit price shall be full compensation for the work, complete-in-place, including all asphalt milling, milling around structures, removal and disposal of milled materials, and sweeping.

End of Section

SECTION 320

ROAD-MIXED SURFACING

320.1 DESCRIPTION:

Road-mixed surfacing shall consist of a mixture of mineral aggregate and bituminous binder mixed on the roadbed or other area, spread and compacted on a prepared subgrade or base course in conformity with the lines, grades, and dimensions shown on the plans or typical cross-section, or as specified in the special provisions.

320.2 MATERIALS:

Materials shall conform to the requirements of Sections 710 and 712 for the type and grade specified on the special provisions.

320.3 PRIME COAT:

When a prime coat is required, it shall be applied as specified in Section 315.

320.4 SPREADING AGGREGATE:

The mineral aggregate shall be deposited in a windrow along one side of the roadbed by means of approved spreader box equipped with a readily adjustable strike off device or other suitable equipment. The maximum lift for blade mixing and laying shall not exceed 1 cubic yard per running foot. If the mineral aggregate is delivered to the roadbed in separate sizes, each size of aggregate shall be spread in a windrow of the required quantity for that size of material, after which the windrows of various sizes shall be blended into one windrow alongside of the roadbed.

The aggregate shall be so spread that the windrows will be uniform and equal in size and will contain the proper quantity of material to provide surfacing of the required width and thickness. Care shall be exercised to prevent the aggregate from becoming mixed with earth or shoulder material. Preparatory to applying the liquid asphalt, a portion of the material from the windrow shall be spread uniformly over one-half the width of the roadbed.

Unless permitted by the Engineer, no more aggregate shall be spread on any one day than can be mixed with liquid asphalt within 72 hours. If traffic conditions require, the Engineer may require spread or flattened windrows.

320.5 APPLICATION OF LIQUID ASPHALT:

The temperature of the liquid asphalt, when applied, shall be in accordance with Section 712, and 16 to 22 gallons shall be applied for each cubic yard of road-mix material, in not less than 2 approximately equal applications.

Unless otherwise approved by the Engineer, no liquid asphalt shall be spread when weather conditions are unsuitable, or when the moisture content of the mineral aggregate exceeds 3 percent by weight of the dry aggregate. When the aggregate is unusually porous, the permissible moisture content may be increased and liquid asphalt spread at the discretion of the Engineer, when laboratory tests indicate that such increased moisture content will not produce an unstable mixture.

Liquid asphalt shall be prevented from spraying upon adjacent pavements, structure, guard rails, guide posts, culvert markers, trees and shrubbery, adjacent property and improvements, and other highway improvements or facilities not specifically mentioned herein, or that portion of the traveled way being used by traffic.

320.6 MIXING:

Immediately following each successive application of liquid asphalt, the surfacing material shall be thoroughly mixed by means of a blade. After the final application, the material shall be bladed into a windrow and the windrow bladed back and forth between the center and the edge of the area to be surfaced with a heavy blade grader having a wheel base not less than 16 feet long, until a satisfactory mixture of uniform appearance is obtained.

Should the mixture show an excess or deficiency of liquid asphalt, or uneven distribution thereof, prior to spreading and compacting, the condition shall be corrected by adding mineral aggregate or liquid asphalt, as the need may be, and remixing the material to produce a satisfactory mixture. If necessary, all compressed masses of material shall be broken up.

accordance with AASHTO T312. The maximum theoretical density shall be tested in accordance with the requirements of AASHTO T209. Effective voids determined on the laboratory compacted specimens will be determined at a minimum of once per lot in accordance with the requirements of AASHTO T269. Should the testing for effective air voids not meet the "Full Payment" or "No Corrective Action" requirements of Table 321-5, additional testing for laboratory air voids on the remaining sublots will be performed as necessary to determine the extent of the deficiency. Acceptance testing results will be furnished to the contractor within five working days of receipt of samples by the acceptance laboratory.

The allowable deviations for acceptable production of each measured characteristic from the values established in the JMF for each sublot are as follows:

TABLE 321-3	
ACCEPTANCE LIMITS FOR ASPHALT CONCRETE	
Maximum Aggregate Size	100% passing
Nominal Maximum Aggregate Size	±7%
No. 8 Sieve to the Nominal Maximum Aggregate Size	±6%
No. 100 and No. 30 Sieves	±4%
No. 200 Sieve	±2%

If the results from a single acceptance sample fall outside of the acceptance limits in Table 321-3 a second sample shall be taken and if the second acceptance sample is also outside of the acceptance limits in Table 321-3 the Contractor shall cease production of asphalt concrete. Production shall not begin again until calibration test results verify that adjustments made to materials or proportions yield a gradation that falls within acceptance limits in Table 321-3.

The asphalt binder content shall be considered acceptable if it is within ± 0.40% of the mix design target value.

TABLE 321-4		
ASPHALT BINDER CONTENT CORRECTIVE ACTION FOR DEVIATIONS		
Deviation from that permitted	When the contracting agency is the owner: Payment Reduction ($ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
0.0 to 0.1% points	$2.00	EA (see 321.10.6)
Over 0.1 to 0.2% points	$6.00	EA (see 321.10.6)
Over 0.2% points	Removal*	Removal*

Note: Removal* refers to Section 321-10.6

TABLE 321-5		
LABORATORY VOIDS ACCEPTANCE AND PENALTIES		
Laboratory Air Voids (Measured at N_{des} or 75 blows as applicable)	When the contracting agency is the owner: Payment Reduction ($ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
Less than 1.5%	Removal*	Removal*
1.5-2.0%	$2.50	EA (see 321.10.6)
2.1-2.7%	$1.00	EA (see 321.10.6)
2.8-6.2%	Full Payment	No corrective action
6.3-6.9%	$1.00	EA (see 321.10.6)
7.0-8.0%	$2.50	EA (see 321.10.6)
Greater than 8.0%	Removal*	Removal*

Note: Removal* refers to Section 321-10.6

If an agency or Engineer is purchasing asphalt concrete directly from a commercial material supplier, the agency or Engineer will use Section 321.10 and specifically Tables 321-3, 321-4 and 321-5 from Section 321.10 when determining the acceptance of the asphalt concrete with the material supplier.

321.10.3 Surface Testing: If directed by the Engineer surface drainage test shall be performed. The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than 1/4 inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway. The straightedge shall be furnished by the contractor and shall be acceptable to the Engineer.

All streets shall be water tested for drainage in the presence of the Engineer or designated representative before final acceptance. Any areas not draining properly shall be corrected to the Engineer's satisfaction at the Contractor's expense. Water for this testing shall be provided and paid for by the Contractor.

When deviations in excess of the above tolerance are found, humps or depressions shall be corrected to meet the specified tolerance, or shall be cut out along neat straight lines and replaced with fresh hot mixture and thoroughly compacted to conform with and bond to the surrounding area. Materials and work necessary to correct such deviations shall be at no additional cost to the Contracting Agency.

321.10.4 Asphalt Pavement Thickness: Asphalt Pavement thickness will be determined from cores secured from each sublot for this purpose. Such cores will be taken and measured by the Asphalt Concrete Coring Method. This method can be found at in Section 321.14. Each core location will be patched by the party responsible for the testing.

If the pavement thickness is deficient from the target thickness by 0.25 inches or less, it will be paid for at the contract unit price. If the pavement thickness deficiency is greater than 0.25 inches and the contracting agency is not the owner (i.e. permits) the following steps will apply:

(1) If the thickness deficiency of the pavement exceeds 0.25 inch, the limits of the deficient area will be isolated by coring at maximum intervals of 100 feet from the deficient core. The thicknesses of the original deficient core will be averaged with the thicknesses of the cores taken from 100 feet on each side of it to determine compliance with the acceptance requirements.

(2) If the pavement thickness from step one above deviates from the target thickness by more than 0.25 inch but not more than 0.50 inch, corrective action will be required. This corrective action will consist of application of a Type II slurry seal coat in accordance to Section 715. The Contractor may present an engineering analysis outlining other proposed remedial measures for the consideration of the Engineer. The Engineer will review the engineering analysis and decide within 30 working days whether to accept the proposed remedial measures.

(3) If the pavement thickness from step one above deviates from the target thickness by more than 0.50 inch, corrective action will be required. The deficient area will be overlaid with no less than 1 inch thick lift, for the full width of the pavement to meet or exceed the designed thickness, with the appropriate end and edge milling, with a mixture approved by the Engineer. The Contractor may present an engineering analysis outlining other proposed remedial measures for the Engineer's consideration. The Engineer will review the engineering analysis and decide within 10 working days whether to accept the proposed remedial measures. If the Engineer chooses to reject the engineering analysis, the indicated overlay will be constructed by the Contractor at no additional cost to the Owner.

If the pavement thickness deficiency is greater than 0.25 inches and the contracting agency is the owner, Table 321-6 will apply.

SECTION 340

CONCRETE CURB, GUTTER, SIDEWALK, SIDEWALK RAMPS, DRIVEWAY AND ALLEY ENTRANCE

340.1 DESCRIPTION:

The various types of concrete curb, gutter, sidewalk, sidewalk ramps, driveways, and alley entrances shall be constructed to the dimensions indicated on the plans and standard detail drawings.

340.2 MATERIALS:

Concrete shall be class B unless otherwise noted. Concrete shall conform to the requirements of Section 725.

Expansion joint filler shall comply with Section 729.

340.2.1 Detectable Warnings Detectable warnings shall consist of raised truncated domes aligned in a square grid pattern in conformity to the Americans with Disabilities Accessibility Guidelines. Truncated domes shall have the following nominal dimensions: base diameter of 1.0 inches (0.9 inches minimum) top diameter of 50 percent of the base diameter minimum to 65 percent of the base diameter maximum, and height of 0.2 inches. Dome center-to-center spacing of 2.35 inches, measured between the most adjacent domes on the square grid. Dome center-to-center spacing for radial installations shall be 1.6 inches minimum and 2.4 inches maximum with a base-to-base spacing of 0.65 inches minimum. Detectable warnings shall contrast visually with adjoining surfaces. Visual contrast shall be obtained by color, use safety yellow or other approved color. The color shall be an integral part of the material surface. The material is to be durable with a non-slip surface not subject to spalling, chipping, delamination, or separation. All detectable warnings shall be approved by the jurisdictional agency prior to installation.

340.3 CONSTRUCTION METHODS:

Existing pavements and concrete, that are joined by new construction, shall be cut in accordance with Section 601.

The subgrade shall be constructed and compacted true to grades and lines shown on the plans and as specified in Section 301. All soft or unsuitable material shall be removed to a depth of not less than 6 inches below subgrade elevation and replaced with material satisfactory to the Engineer. When the Engineer determines that the existing subgrade consists of soils with swelling characteristics, the moisture content shall be brought as close as possible to the optimum required for compaction. This shall be done by the addition of water, by the addition and blending of dry suitable material or by the drying of existing material. The subgrade shall then be compacted to a relative density of 75% minimum to 85% maximum with 80% as ideal.

Material displaced in the construction shall not be placed on the base and/or surfacing material already in place on the roadway nor shall the excavated material be placed in such a manner as to interfere with access to property or traffic flow in the street.

Existing concrete sidewalks and driveways which abut the new sidewalks and driveway entrances shall be removed to a distance required to maintain a slope as indicated by standard details or not to exceed 1 inch per foot where sidewalks are concerned. Sawcutting is required at the match lines and payment will be made under the respective pay items as provided in the proposal.

Concrete curbs, gutters and sidewalks shall be constructed by the conventional use of forms, or may be constructed by means of an appropriate machine when approved by the Engineer.

If machines designed specifically for such work and approved by the Engineer are used, the results must be equal to or better than that produced by the use of forms. If the results are not satisfactory to the Engineer, the use of the machine shall be discontinued and the Contractor shall make necessary repairs at his own expense. All applicable requirements of construction by use of forms shall apply to the use of machines.

Forms conforming to the dimensions of the curb, gutter, sidewalk, sidewalk ramps, driveway, and alley entrance shall be carefully set to line and grade, and securely staked in position. The forms and subgrade shall be watered immediately in advance of placing concrete.

Forms shall be thoroughly cleaned each time they are used, and shall be coated with a light oil, or other releasing agent of a type which will not discolor the concrete. The concrete shall be thoroughly spaded away from the forms so that there will be no rock pockets next to the forms. The concrete may be compacted by mechanical vibrators approved by the Engineer. Tamping or vibrating shall continue until the mortar flushes to the surface, and the coarse aggregate is below the concrete surface.

Unless otherwise specified, expansion joints shall be installed at all radius points, at both sides of each driveway, at both sides of each alley entrance, at adjoining structures and at every change of depth in the concrete. The maximum distance between expansion joints shall be 50 feet. Expansion joints shall be constructed in a straight line, vertical plane and perpendicular to the longitudinal line of the sidewalk, curb and gutter, single curb, etc., except in cases of curved alignment, where they will be constructed along the radial lines of the curve. Expansion joints shall be placed to match the joints of the adjacent concrete such as sidewalk to the curb and gutter or single curb, etc. Expansion joints shall be constructed to the full depth and width of the concrete and extend one inch into the subgrade with the top of the expansion joint material one-quarter inch below the top surface as depicted in Detail 230. Expansion joint material shall be secured in place prior to placement of concrete. Unless otherwise specified, all expansion joints installed against newly placed concrete, sawcut or other smooth surfaces shall comply with Section 729.1 - Premolded Joint Filler per ASTM D-1751, ½ inch, Bituminous Type. Expansion joints installed against existing uneven surfaces shall be per Section 729.2 - Pour Type Joint Filler.

Contraction joints, unless otherwise specified, shall be constructed in accordance with the standard details, and in a straight line and vertical plane perpendicular to the longitudinal line of the sidewalk, sidewalk ramp or curb and gutter, except in cases of curved alignment when they will be constructed along the radial lines of the curb.

Sidewalk or sidewalk ramp score marks, unless otherwise specified, shall be constructed in accordance with the standard detail.

All edges shall be shaped with a suitable tool so formed as to round the edges to a radius as indicated on the standard details.

The front face form shall not be removed before the concrete has taken the initial set and has sufficient strength to carry its own weight, gutter forms and rear forms shall not be removed until concrete has hardened sufficiently to prevent damage to the edges. Special care shall be taken to prevent any damage. Any portion of concrete damaged while stripping forms shall be repaired or if the damage is severe, replaced at no additional cost to the Contracting Agency. The face, top, back, and flow line of the curb and gutter shall be tested with a 10-foot straightedge or curve template, longitudinally along the surface. Any deviation in excess of 1/4 inch shall be corrected at no additional cost to the Contracting Agency.

The surface of concrete sidewalk or sidewalk ramp shall be tested with a 5-foot straightedge. Any deviation in excess of 1/8 inch shall be corrected at no additional cost to the Contracting Agency.

When required by the Engineer, gutters having a slope of 0.8 foot per hundred feet or less, or where unusual or special conditions cast doubt on the capability of the gutters to drain, they shall be water tested. Water testing shall consist of establishing flow in the length of gutter to be tested by supplying water from a hydrant, tank truck or other source. One hour after the supply of water is shut off, the gutter shall be inspected for evidence of ponding or improper shape. In the event water is found ponded in the gutter to a depth greater than ½ inch, or on the adjacent asphalt pavement, the defect or defects shall be corrected in a manner acceptable to the Engineer without additional cost to the Contracting Agency.

Any section of the work deficient in depth or not conforming to the plans or specifications shall be removed and replaced by the Contractor at no additional cost to the Contracting Agency.

Finishing and Curing of the concrete shall be done in the manner specified in Section 505.

The Contractor shall stamp his name and year on all work done by him, on each end of the curb, gutter, sidewalk or sidewalk ramp. The letters shall not be less than 3/4 inch in height.

340.3.1 Detectable Warnings The detectable warning surface shall be located so that the edge nearest the curb line is 6 inches minimum and 8 inches maximum back from the face of curb. Detectable warning surfaces for railroads shall be located so that the edge nearest the rail crossing is 6 inches minimum and 8 inches maximum from the vehicle dynamic envelope.

Detectable warnings shall be installed perpendicular to the direction of pedestrian/wheelchair travel and have a minimum width of 24 inches measured perpendicular to the edge of the roadway or rail crossing. The base surface of detectable warnings shall be installed flush with the adjacent walkway surface, the truncated domes shall extend above the walkway surface. The boundary between detectable warnings and the adjacent walkway shall provide a flush uniform surface that will not cause ponding of water nor present a tripping hazard. Partial domes at the edge of the detectable warning shall be made flush to match the base surface of the detectable warning. Detectable warnings installed on curb ramps shall extend the full width of the ramp depression.

SECTION 350

REMOVAL OF EXISTING IMPROVEMENTS

350.1 DESCRIPTION:

This work shall consist of removal and disposal of various existing improvements, such as pavements, structures, pipes, curbs and gutters, and other items necessary for the accomplishment of the improvement.

350.2 CONSTRUCTION METHODS:

The removal of existing improvements shall be conducted in such a manner as not to injure utilities or any portion of the improvement that is to remain in place. See Section 107.

Sidewalks shall be removed to a distance required to maintain a maximum slope for the replaced portion of sidewalk, for one inch per foot and all driveways shall be removed to a distance as required by standard details.

Existing concrete driveway curbs and gutters shall be removed to the right-of-way line and the new end of curb faced.

Portland cement concrete pavements, curbs and gutters and sidewalks designated on the plans for removal shall be saw-cut at match lines, in accordance with Section 601 and removed.

Asphalt concrete pavements designated on the plans for removal shall be cut in accordance with Section 336.

Removal of trees, stumps, roots, rubbish, and other objectionable materials in the right-of-way shall be done in accordance with Section 201.

Backfill and compaction of all excavated areas shall be compacted to the densities as prescribed in Section 601.

All surplus materials shall be immediately hauled from the jobsite and disposed of in accordance with Section 205.

350.3 MISCELLANEOUS REMOVAL AND OTHER WORK:

This work shall include, but not be limited to the following, where called for on the plans:

(A) Relocate existing fence and gate.

(B) Remove and reset mail boxes.

(C) Remove signs and bases in right-of-way.

(D) Remove planter boxes, block walls, concrete walls, footings, headwalls, irrigation structures, and storm water inlets.

(E) Install plugs for pipes and remove existing plugs as necessary for new construction.

(F) Remove wooden and concrete bridges.

(G) Remove median island slabs.

(H) Remove pavements and aggregate base where called for outside the roadway prism.

350.4 PAYMENT:

Payment for removals will be made at the unit bid prices bid in the applicable proposal pay items, which price shall be full compensation for the item complete, as described herein or on the plans.

End of Section

SECTION 355

UTILITY POTHOLES-KEYHOLE METHOD

355.1 DESCRIPTION:

This specification covers the requirements for coring, vacuum excavation, backfilling, and reinstatement of the asphalt core into asphalt pavement.

355.2 EXCAVATION

Excavation requires coring a circular hole through asphalt pavement using drilling/coring equipment and removal of the intact asphalt pavement core. The vertical alignment of the coring operation shall be perpendicular to the horizon and cutting shall be extended the full depth of the existing pavement section.

Pavement cores shall not be greater than 24 inches in diameter, shall not be spaced closer than 3 feet between cores (edge to edge), shall not contain a joint or any pavement cracks greater than 1/8-inch wide, and shall only be obtained from pavements where the asphalt concrete section is at least 4 inches thick.

Contractor shall place a temporary mark (paint or chalk) on the pavement core and adjacent pavement prior to cutting to insure that the pavement core when replaced will have the same orientation as found in the original pavement.

Pavement cores shall be either removed from the work site or stored in a safe and secure on-site location. The cores shall be made readily available for reinstatement into the pavement.

Soil shall be removed by air/vacuum extraction methods to expose utilities. The zone of soil removal shall remain essentially within a vertical plane extending below the edges of the core hole.

The Contractor shall dispose of all excess materials.

355.3 BACKFILL AND COMPACTION

355.3.1 Backfill Using Mechanical Compaction: Backfill shall be aggregate base per Section 702 or native soil per Sections 601.4.3, placed in maximum 6 to 8-inch loose lifts.

Backfill compaction shall be determined by use of a compression wave amplitude monitoring device manufactured specifically for the purpose of measuring soil compaction. This device shall measure the compression wave amplitude as compaction progresses using below grade piezoelectric transducer wave sensors and an above-grade electronic monitor. The device shall signal the operator of successful compaction (the compaction wave amplitude becomes asymptotic for continued compaction effort) for each lift.

At time of compaction backfill moisture shall have sufficient available moisture to be compacted based on the physical appearance (soil ball) method as specified in USDA Soil Conservation Service Agricultural Information Bulletin 199, described as follows:

> Firmly squeeze a palm-size sample of soil into a ball by hand. Granular soils with sufficient available moisture will tend to ball under pressure, but seldom holds together for long. Cohesive soils with sufficient available moisture will form a ball that can be rolled into approximate ¼" wide ribbons between the palms of the hands without breaking apart, leaving no free water on the hand.

A compaction sensor shall be placed at the bottom of the first loose lift. A new sensor shall be placed for every 48 inches of compacted fill depth.

Pneumatic compaction equipment (pneumatic rammers or equivalent) shall be used for compaction of the backfill material. The size of the compactor shall not exceed one-half the diameter of the hole.

Mechanical compaction on each lift shall be continued until the electronic monitor signals that compaction is complete. A new lift shall not be placed until a positive signal has been received. Remove backfill soil and sensor if the monitor does not give a positive compaction signal after repeated compaction efforts. Repeat backfilling and compaction with a new sensor.

Contractor shall provide compaction documentation to the Agency upon request.

355.3.2 Slurry Backfill: If mechanical compaction is not used, the Contractor shall use ½-sack CLSM as backfill in accordance with Section 728.

355.3.3 Leveling Course: A 1-1/2-inch to 2-inch thick leveling course of compacted crushed gravel meeting the requirements of ASTM C33, No. 8 coarse aggregate shall be placed above the backfill and directly below the asphalt concrete pavement section.

355.4 PAVEMENT RESTORATION

The pavement surface shall be restored to its original condition by setting the reinstated pavement core flush with and in its original orientation.

Bonding agent meeting the requirements of Section 708 shall be used for pavement core reinstatement. Excess bonding material shall be removed from the restored pavement surface. A "patched" appearance shall be avoided in surface restoration wherever possible.

The contractor shall reinstate the pavement core within 24 hours of cutting the pavement. Holes left open longer than 24 hours after cutting shall be covered with an approved steel road plate capable of supporting traffic loads. The steel plate must be rounded with a fitted collar that, when inserted into the hole, will prevent the steel plate from tipping, tilting, bouncing or spinning out of the hole under traffic conditions. An asphalt mix shall be used to ramp pavement up to the steel plate along all edges.

355.5 SURFACE TOLERANCES

The reinstated core shall be flush and level with the adjacent pavement. Gaps attributable to the positioning of the core shall be less than 1/16-inch between the bottom of a minimum 3-foot long straightedge and the surface of the pavement in any direction on the surface of the keyhole core, except across the pavement crown or drainage gutters.

355.6 DEFICIENCIES

Where the pavement core is found to be fractured or defective upon removal, or becomes damaged after removal and prior to reinstating, the defective or damaged core shall not be used to reinstate the pavement. Pavement repair shall be performed in accordance with Detail 212, Type A Pavement Repair.

A pavement core is considered unacceptable when one of the following conditions exist:

a) The core contains any vertical cracks wider than 1/8-inch extending full depth or partial depth through the core; or

b) Any deteriorated piece of the core is larger than 10 percent of the overall area of the core.

c) Two or more successive layers of asphalt concrete in the core become horizontally delaminated and cannot be rebounded to each other with the bonding compound.

All unacceptable pavement cores shall be removed from the job site.

355.7 MEASUREMENT

Each acceptable utility pothole repair shall be counted. No distinction shall be made based on size of the utility pothole or method of repair.

355.8 PAYMENT

Payment at the contract price for utility pothole repair complete in place shall be full compensation for all labor, equipment and material required for a complete in place installation. Payment includes traffic control and disposal of all excess materials.

SECTION 360

TELECOMMUNICATIONS INSTALLATION

360.1 DESCRIPTION:

This work shall consist of the installation of underground telecommunications facilities within the public right-of-way.

360.2 TRENCHING, BACKFILL AND RESTORATION:

All work shall be done in accordance with Section 601.

360.3 CABLE INSTALLATION:

(A) "Trunk Lines" Cable providing telecommunications service by connecting regions or states or by connecting central offices within a metropolitan area. Such cable shall be installed as described below:

(1) If the cable is to be installed within an open trench, the cable shall be placed within schedule 40 PVC conduit or equal with a minimum inside diameter of 4 inches. The conduit shall be buried at a minimum depth of 48 inches below finished grade measured to the top of the conduit. A color coded plastic warning tape with a minimum thickness of 5 mil and a minimum width of 3 inches shall be installed in the trench and centered over the PVC conduit at a depth of from 18 to 30 inches below finish grade.

(2) Cable crossings under existing paved streets shall be accomplished by jacking or boring unless open trenching is authorized by the Engineer or Agency. The cable shall be placed within a schedule 40 PVC conduit or better at a minimum depth of 48 inches.

(B) Telecommunications cables other than "trunk lines" shall be installed as described below.

(1) If a cable is to be installed within the right-of-way of an arterial or collector street, it shall be placed at a minimum depth of 36 inches below finished grade. A color coded plastic warning tape as described in "A" shall be placed 18 inches below the surface.

(2) If a cable is to be installed within the right-of-way of a local/residential street it shall be placed at a minimum depth of 24 inches below finished grade.

(3) Cable crossings under existing, paved streets shall be accomplished by jacking or boring unless open trenching is authorized by the Engineer or Agency.

360.4 CABLE LOCATING (FIBER OPTIC):

If a cable which is to be installed is fiber optic a tracing or locating wire shall be installed with the cable.

360.5 PAYMENT:

Payment will be made at the contract unit price bid per lineal foot.

End of Section

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PART 500

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PART 600

WATER AND SEWER

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SECTION 604

PLACEMENT OF CONTROLLED LOW STRENGTH MATERIAL

604.1 DESCRIPTION:

The work covered by this specification consists of furnishing all materials, labor and equipment for the placement of controlled low strength material (CLSM).

The type of backfill to be used shall be as specified in the special provisions, plans or by the Engineer.

The following is a brief description of the types of CLSM and their intended uses:

1/2 SACK: General trench backfill in areas where future excavation into the backfill with conventional hand tools is anticipated or in areas of low loading such as streets, parking areas, behind retaining walls, etc.

1 SACK: General trench backfill and backfill behind retaining walls where additional strength is required above that of 1/2 sack CLSM.

1-1/2 SACK: Structural backfill under foundations and as thermal fill and/or mechanical protection of duct banks and conduits.

604.2 MATERIALS:

CLSM shall conform to the requirements of Section 728. Ready-mixed concrete shall not be used in lieu of CLSM without prior approval from the Engineer and shall be subject to rejection.

604.3 PLACEMENT:

The controlled low strength material shall be placed directly into the excavation. The CLSM shall be placed in a uniform manner that will prevent voids in or segregation of the material. Foreign material which falls into the trench prior to and during placing of the CLSM shall be immediately removed. The CLSM shall have consistency, workability, plasticity, flow characteristics and pumpability (when required) such that the material when placed is self-compacting. Mechanical compaction or vibration may be used to consolidate around structures, pipes, multiple conduits, etc., otherwise no mechanical compaction or vibration shall be required. The total elapsed time between the initial addition of water to the CLSM and the completed placement shall not exceed 90 minutes.

When CLSM is used for backfill around pipes or conduits, the CLSM shall be placed equally on both sides of pipe or conduit to prevent lateral displacement. Also, the CLSM shall be placed in lifts. The height of each lift shall not exceed the depth that will cause floating of the pipe or conduit. When placing the CLSM in greater lift depths, sufficient anchorage shall be provided so the pipe or conduit will not float.

Where CLSM is used for backfill around pipes or conduits with a depth less than 20 feet, the width of the excavation shown on the plans or in Section 601 may be reduced so that the minimum clear distance between the outside of the pipe or conduit and the side of the excavation (each side) shall be 12 inches for pipes or conduits 42 inches and larger, 6 inches for pipes or conduits between 4 inches and 42 inches and 3 inches for pipes or conduits 4 inches and smaller.

When CLSM is used behind retaining walls, the depth of each lift shall be limited so it will not induce hydraulic loads greater than the design loads.

For long trenches or installations which require a large amount of CLSM, bulkheads of wood, dirt, sand bags, etc. can be used to control the material's flowability. The bulkhead shall be removed prior to the continuation of the backfilling.

CLSM shall NOT be permitted to come in contact with any aluminum, copper or brass materials, e.g., aluminum pipes or culverts, copper water pipe, saddles, fittings, etc. Protection shall be any combination of the following: place a layer of noncorrosive material around the pipe e.g., native material, import material, etc. or provide a protective covering or wrapping such as polyethylene wrap per Section 610.5. Pipes smaller than 4 inches can be completely wrapped with tape as per Section 610.5 or approved equal.

Generally, CLSM does not resist freezing and thawing and in some cases may propagate the condition. CLSM mixes must be modified where long term freeze-thaw durability is indicated as a concern. The mix design shall have an air content of no less than six percent by volume, when tested in accordance with ASTM C-6023.

604.4 PERFORMANCE TESTING:

CLSM placed within the traveled way or otherwise to be covered by paving or embankment materials, shall not be covered until one of the following performance criteria have been met:

A) When a person of average weight and shoe size can walk on the surface of the CLSM without creating greater than 1/8-inch indents in the material, or
B) When the in-place CLSM has reached a strength of 30 psi, when tested in accordance with ASTM D-4832, or
C) When a ball drop indentation of 3-inches or less is obtained, when tested in accordance with ASTM D-6024, or
D) When a penetration resistance reading of 650 is achieved, when tested in accordance with ASTM C-403.

Additionally, CLSM shall not be covered if proof rolling by pneumatic-tired or steel wheel vibratory roller results in the bringing of free water to the surface or results in surface undulation (pumping).

When CLSM is placed in foundation excavations, the material shall be protected from foundation loading and placement of foundation concrete prior to having reached initial set per ASTM C-403, or allowed to set in place for 24 hours, whichever occurs first.

604.5 ACCEPTANCE:

CLSM shall be considered deficient and may be rejected at the discretion of the Engineer if:

A) The CLSM is outside of the limits specified in Table 728-1 and/or

B) The aggregate gradation is outside the limits specified in Section 701.3.5.

Rejected material not placed shall be immediately removed from the job site. Rejected material placed shall be removed and replaced with acceptable material. Removing and disposing of the rejected material shall be at no additional cost to the Contracting Agency.

604.6 PAYMENT:

No pay item will be included in the proposal nor direct payment made for CLSM unless specifically included in the Project Specifications and Fee Proposal. The cost for placing the material shall be included in the unit price for the specific work function (laying pipe, placing structure foundation, construction retaining wall, etc.).

SECTION 610

WATER LINE CONSTRUCTION

610.1 DESCRIPTION:

The construction of all water lines shall conform to applicable standard specifications and details, except as otherwise required on the plans or as modified in the special provisions.

610.2 GENERAL:

All pipe shall be delivered, handled and installed in accordance with the manufacturer's recommendations and/or applicable provisions of AWWA standards for installation of the various types of water mains specified, insofar as such recommendations and provisions are not in variance with the standard specifications and details.

Where water lines are to be constructed in new subdivisions or in conjunction with street repaving projects, the streets shall be pre-graded to within 6 inches of the new street subgrade prior to trenching or cut stakes shall be set for trenching.

610.3 MATERIALS:

All pipe for water lines shall be of the classes shown on the plans or as specified below.

(A) The 4 inches through 16 inches diameter pipe may be asbestos-cement or ductile iron, except where a particular material is specified. All pipe shall be minimum 150 P.S.I. design unless otherwise specified.

(B) Pipe 16 inches and larger may be either ductile iron, or concrete pressure pipe-steel cylinder type.

Ductile iron water pipe and fittings - Section 750. Asbestos-cement water pipe and fittings - Section 752. Concrete pressure pipe-steel cylinder type - Section 758.

610.4 CONSTRUCTION METHODS:

All water mains in major streets shall have a minimum cover of 48 inches over the top of the pipe. Water mains in other locations shall have a minimum cover over the top of the pipe as follows:

(A) 36 inches for mains smaller than 12 inches.

(B) 48 inches for mains 12 inches and larger.

Cover for water mains will be measured from existing or proposed finished grade of pavement or from natural ground, whichever is deeper.

No water main shall be deflected, either vertically or horizontally, in excess of that recommended by the manufacturer of the pipe or coupling, without the appropriate use of bends or offsets.

If adjustment of the position of a length of pipe is required after it has been laid, it shall be removed and rejoined as for a new pipe.

Every precaution shall be taken to prevent foreign material from entering the pipe. When on the project site, the ends of the pipe section shall be plugged, wrapped or tarped at all times when a pipe laying is not in progress, which includes storage and staging at the site. The pipe shall be stored on a pallet, blocking or other means to prevent foreign materials from entering the pipe. The pipe line shall be protected by a water-tight plug or other means approved by the Engineer when the pipe is in the trench if pipe laying is not in progress.

Where restrained joints are specified on mains sixteen (16) inches in diameter and smaller, ductile iron pipe shall be used with an approved joint restraint method.

On mains sixteen (16) inches in diameter and larger where plans specify welding joints and where ductile iron pipe is furnished, joints shall be restrained by an approved joint restraint method for the distance specified.

Except as otherwise required in this specification, the special provisions, or by the Engineer, trench excavation, backfilling and compaction shall be in accordance with the requirements of Section 601. Backfilling may be accomplished as soon as the pipe line has been installed to the satisfaction of the Engineer, subject to the requirements for testing, as contained below.

Hydrostatic testing shall be in accordance with this specification.

All corporation stops used for testing and chlorination shall be left in the pipe line with the stop closed and all connecting pipe removed.

Curb stops with flushing pipes or fire hydrants shall be installed at the ends of dead-end mains according to standard details.

Thrust blocks shall be installed in accordance with this specification.

Valve boxes and covers shall be according to standard details.

Asbestos-cement pipe shall be installed in accordance with AWWA C-603, except pipe and fittings shall be in accordance with Section 752.

Cast iron pipe shall be installed in accordance with AWWA C-600, except pipe and fittings shall be in accordance with Section 750.

Ductile iron pipe shall be installed in accordance with this specification and pipe and fittings shall be in accordance with Section 750.

610.5 SEPARATION:

610.5.1 General:

Water lines and sewer lines shall be separated to protect water lines from contamination by sewer lines.

The angle of a water line and sewer line crossing shall be limited to between (45) forty-five degrees and (90) ninety degrees. Intersection angles of less than (45) forty-five degrees shall not be allowed.

Separation distances are measured from the outside diameter of the water or sewer line, or the centerline of a manhole.

When water and sewer lines can not meet separation requirements, extra protection is required as described in 610.5.5 and shown in Standard Detail 404.

Extra protection requirements for line crossings are measured from the closest outside surfaces of the sewer and water line.

Water line service connections to individual building supply and distribution plumbing shall not be placed below sewer lines, and shall otherwise comply with the separation requirements of the applicable plumbing code as applied by the Agency (Administrative Authority). Methods described for extra protection do not apply to these service lines.

Water and sewer lines shall not be constructed parallel within a common trench.

610.5.2 Water Line Separation from Gravity Sewer Lines:

Water lines shall not be placed within two (2) feet horizontal and one (1) foot vertical above and two (2) feet vertical below gravity sewer lines.

On lines 12 inches in diameter or less, determination of the rate of flow of water into the line to be treated may be made by starting with the line full of water and measuring the rate of discharge at a hydrant located at the end of the pipe farthest away from the point of chlorine application.

For lines larger than 12 inches in diameter, the disinfection operation is generally started with the line empty.

Measurement of the flow of water into and out of all lines shall be made by means of a pitot gage, current type meter, or other approved device.

611.12 PREVENTING REVERSE FLOW:

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Check valves shall be used to accomplish this.

611.13 RETENTION PERIOD:

Treated water shall be retained in the pipe long enough to destroy all nonspore-forming bacteria. This period should be at least 24 hours and should produce no less than 10 ppm residual chlorine at the extreme end of the line at the end of the retention period.

NOTE: If the circumstances are such that less than a 24 hour retention period must be used, the chlorine concentration shall be increased to 100 ppm. Under these conditions, special care should be taken to avoid attack on pipes, valves, hydrants and other appurtenances.

611.14 CHLORINATING VALVES AND HYDRANTS:

In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent.

611.15 FINAL FLUSHING, SAMPLING AND TESTING:

Following chlorination, all treated water in the newly laid pipeline shall be thoroughly flushed until the replacement water throughout the new pipeline can be proved, by laboratory testing, comparable in quality to the water served to the public from the existing water system. Prior to sampling for laboratory testing, the residual chlorine throughout the length of the pipeline shall be reduced to 1.0 ppm or less. Once the required residual chlorine level in the pipeline is achieved, samples shall be taken as outlined below.

The Contracting Agency or its authorized representative will collect all samples for testing of the new water mains. To initiate the sampling and testing, the Contractor will present to the Contracting Agency a written request for such work no later than 24 hours prior to the time when samples are to be taken.

Samples shall be taken from a tap and riser located and installed in such a way as to prevent outside contamination. Samples shall never be taken from an unsterilized hose or fire hydrant, because such samples will seldom meet bacteriological standards. The number of sampling locations shall be as follows: Waterlines up to but less than 150 feet in length require one sampling riser installed as near the end as possible; lines 150 feet to 300 feet in length, two sampling risers, one near each end of the line; lines 300 to 3,000 feet in length, a minimum of three sampling risers. In addition, dead ends on main lines should be represented with a sampling riser.

The number of samples taken at each sampling location shall be determined by the Contracting Agency based on one of the following methods.

(A) One sample from each sampling location which is examined and analyzed in the laboratory over a three day (72 hour) period.

(B) Two samples taken on separate days from each sampling location. Satisfactory water quality of the new main shall continue for a period of at least two days (48 hours) as demonstrated by laboratory examination of these samples.

Upon completion of laboratory testing, results of all tests shall be sent by the laboratory to the Contracting Agency. Results of laboratory analysis will be interpreted by the Contracting Agency, and reported to the Contractor. Under no circumstance shall the Contractor contact the laboratory. If there is need for test results before written reports are submitted, such information shall be obtained only from the Contracting Agency or its authorized representative.

611.16 REPETITION OF CHLORINATION PROCEDURE:

Should the initial treatment fail to result in the conditions specified above, the original chlorination procedure shall be repeated until satisfactory results are obtained.

611.17 PAYMENT:

No separate pay item shall be contained in the proposal for disinfecting water mains. This operation shall be included in the price bid for the water mains, installed complete in place, as specified in the proposal.

End of Section

SECTION 618

STORM DRAIN CONSTRUCTION

618.1 DESCRIPTION:

This section covers concrete pipe line and high density polyethylene (HDPE) pipe line construction used for the conveyance of irrigation water and storm drainage in streets, easements, and alley right of ways, under low hydrostatic heads.

Installation of pipe in laterals of Salt River Valley Water Users' Association or other irrigation districts shall conform to the specifications and permit of the respective irrigation district.

Installation of pipe in State Highways shall conform to the specifications and permit of the Arizona Department of Transportation.

618.2 MATERIALS:

The concrete pipe and HDPE pipe, specials, joints, gaskets, and testing shall be according to Sections 620 or 735, 736 and 738, except as specified below or as modified by special provisions.

(A) Specials: Pipe specials such as closure pieces, wyes, tees, bends, and manhole shafts shall be provided as indicated on the plans, and such specials shall be made equal in strength, diameter, and other physical characteristics to the standard straight pipe lengths by the use of extra concrete, extra reinforcing, or steel items. Drawings of specials shall be submitted to the Engineer for approval before their fabrication.

(B) Rubber Gasket Joints: When rubber gasket pipe is used, the joint shall be sealed with a continuous ring gasket made of a special composition rubber of such size and cross section as to fill the annular space provided for it. The gasket shall be the sole element depended upon to make the joint watertight, and shall have smooth surfaces, free from pits, blisters, porosity, and other imperfections.

(1) Rubber Gaskets for RCP shall be in accordance with ASTM C-443 or AASHTO M-315.

(2) Rubber Gaskets for HDPE pipe shall be in accordance with Subsection 738.2.3.

(C) Water Stops: Water stops will be required when connecting HDPE pipe to concrete structures, manholes, etc. The water stop shall comply with Section 738 and will be installed per manufacturer recommendations.

(D) Cement Mortar Joints for RCP will be in accordance with Subsection 736.3.

618.3 CONSTRUCTION METHODS:

Excavation, bedding, backfilling, and compaction or consolidation of backfill and bedding of trenches shall be accomplished in accordance with Sections 601 and 603 for HDPE pipe, except as specified below, or as modified by special provisions.

The Contractor shall over-excavate the trench and fill with select materials in accordance with standard details.

Where the cover over the top of the pipe is less than 10 feet, the maximum trench width is unrestricted. The pay width, however, for pavement replacement shall remain in accordance with Section 336. For pipe, with 10 feet or more cover, the maximum trench width shall be as required by Sections 601 and 603 for HDPE pipe.

The laying of the pipe shall be in finished trenches free from water or debris, and shall be commenced at the lowest point, with the spigot ends pointing in the direction of the flow. Each pipe shall be laid firmly and true to line and grade, in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden off-sets of the flowline. Any adjustment to line and grade shall be made by scraping away or filling in under the body of the pipe, never by wedging or blocking under the pipe ends.

Variation from prescribed alignment and grade shall not exceed 0.10 foot and the rate of departure from or return to established grade or alignment shall be no more than 1 inch in 10 feet of pipe line unless otherwise approved by the Engineer. For closures and deflection angles greater than 10 degrees, joints shall be made by use of a bend, specially manufactured fitting, or by a concrete collar, per standard details.

Pipe shall be of the type, class and size shown on the plans or in the special provisions.

All pipe, for permit construction, shall be reinforced concrete pipe, ASTM C-76 Class III or HDPE pipe in accordance with ASTM F-894, AASHTO —252 or AASHTO —294. For reinforced concrete pipe, the minimum cover from the top of the pipe to the finished grade shall be 2 feet and the maximum cover shall be 12 feet. The minimum and maximum cover for HDPE pipe shall be as specified in the special provisions or the manufacturer's recommendations.

All pipes installed under railroad tracks shall be reinforced concrete pipe, ASTM C-76, Class V and the minimum cover over all pipes shall be as specified in the railroad permit and/or special provisions. Bedding shall be in accordance with standard details.

The allowable water loss for irrigation lines shall not exceed 2 gallons per hour per 100 feet of pipe per inch of diameter of pipe, under a minimum test head of 1 foot above the top of the pipe at the upper end when tested in accordance with the procedures of Section 615.

618.4 JACKING PIPE:

At locations where jacking is required, the storm drain line shall be installed by jacking to the lengths indicated on the plans, in accordance with the following. The methods and equipment used in jacking reinforced concrete pipe conduit shall be optional with the Contractor, provided that the proposed method is first approved in writing by the Engineer. Such approval, however, shall in no way relieve the Contractor of the responsibility for damages of any nature which might occur as a result of the methods used.

Only workmen experienced in the operation of jacking concrete conduit shall be used.

The driving ends of the conduit shall be properly protected and the conduit shall be driven true to alignment and grade. The deviation from true line and grade at any single point within the jacked portion shall be limited to 0.5 feet horizontal deviation from line and ±0.2 feet vertical deviation from grade.

Any section of conduit which may show signs of failure shall be removed and replaced with a new section of precast conduit or with a cast-in-place section, which in the opinion of the Engineer is adequate to carry the loads imposed upon it. In this respect it shall be understood that where pipe is specified on the drawings to be jacked into place the jacked pipe shall be reinforced concrete of the strength specified in these specifications and the design of such pipe is based upon superimposed loads and not upon loads which may be placed upon the pipe as a result of jacking operation. Any increase in pipe strength required in order to withstand jacking loads shall be the responsibility of the Contractor. The reinforcing shall be circular and of either single or double cage design.

Spacer blocks shall be placed in the inside circular space which will allow sufficient width for point mortaring when jacking is completed and to equalize pressures during jacking. Three grout holes per 8-foot section of pipe shall be made during manufacturing.

Double rubber gaskets and band type joints shall be provided for 36 inches diameter and larger pipe.

One hole shall be made on the top midway between the ends. Two additional holes, each approximately 1.5 feet from each end and approximately midway between the springline and top on opposite sides shall be made.

Where the nature of the soil, or the structure under which the conduit is being jacked is such that, there is increased danger of a cave-in or damage to said structure, the method of jacking the conduit shall be as specified below.

The leading section of conduit shall be equipped with a jacking head securely anchored thereto to prevent any wobble or alignment variation during jacking operations. The length and details of the jacking head shall be subject to the written approval of the Engineer. Excavation shall be carried out entirely within the jacking head and no excavation in advance thereof will be permitted. Every effort shall be made to avoid any loss of earth outside of the jacking head. Excavated material shall be removed from the conduit as excavation progresses, and no accumulation of such material within the conduit will be permitted. Upon completion of the jacking operations, all voids around the outside face of the conduit shall be filled by grouting through each of the previously constructed grout holes to the satisfaction of the Engineer. The grout shall be a mixture of one part cement to three parts sand and a mixture by volume.

Grouting equipment and material shall be on the job before jacking operations are started in order that grouting around the jacked conduit may be started immediately after the jacking operation. After grouting, the holes in the conduit shall be repaired to the satisfaction of the Engineer.

618.5 VIDEO INSPECTION OF NEW MAINLINE STORM DRAINS:

The Contractor shall provide the Engineer with an annotated video inspection record (either VHS or DVD format) of the new mainline storm drain pipeline. The video shall clearly show all joints, seals, connecting pipes, and manholes. This video shall be provided to the Engineer, and reviewed and approved by the Engineer prior to the Contractor being allowed to place the final pavement over the storm drain line. No separate payment will be made for this inspection; the cost of the video inspection shall be included in the cost of the pipe.

618.6 MEASUREMENT:

(A) Main Line Pipe: Shall be the number of linear feet of pipe laid as measured along the pipe axis.

Unless hereinafter modified, measurement shall extend through manholes when no change in pipe size occurs. When a change in pipe size occurs within a manhole, unless hereinafter modified, measurement for each size will be taken to the centerline of the manhole.

(B) Connecting Pipe: Shall be the number of linear feet of pipe installed, as measured along the pipe axis from a main line pipe, or a manhole, or a catch basin to a catch basin, or a plugged end, and shall include the portions of the connecting pipe embedded in the above structures.

(C) Jacked Pipe: Shall be made at the ground surface and shall be the number of linear feet of ground surface undisturbed by the cut and cover construction on either side of the jacked section.

618.7 PAYMENT:

(A) Main Line Pipe: Will be paid at the unit price bid per linear foot, to the nearest foot, for each size and type of pipe and shall be compensation in full for furnishing and installing the type of pipe as specified and as shown on the plans including removal of obstructions, excavation, bedding, backfilling, compacting, testing, joint materials, joining, collars, and field closures.

(B) Connecting Pipe: Will be paid at the unit price bid per linear foot, to the nearest foot for each size of pipe and shall be compensation in full for furnishing and installing complete in place as shown on the plans and as specified, the connecting pipe and specials including spur connections, removal of obstructions, excavation, bedding, backfilling, compacting, joint materials, joining, collars, field closures, and testing.

(C) Jacked Pipe: Will be paid the same as for main line pipe.

End of Section

SECTION 620

CAST-IN-PLACE CONCRETE PIPE

620.1 GENERAL:

This specification covers cast-in-place non-reinforced concrete pipe intended for use as storm sewers or irrigation lines. The abbreviated title is CIPP. CIPP is conduit made of portland cement concrete cast monolithically in a properly prepared trench, using equipment specifically designed for this purpose. The type of equipment to be used by the Contractor must be approved by the Engineer and the Contractor may be required to furnish evidence of the successful use of this equipment on prior work. CIPP will be placed only:

(A) By experienced operators. The Engineer will be the sole judge as to experience level.

(B) In the presence of the Engineer.

(C) In ground capable of standing unsupported from the bottom of the trench to the top of the pipe without sloughing.

(D) In fill when it can be demonstrated to the satisfaction of the Engineer that the fill will adequately support the pipe.

620.2 MATERIALS:

620.2.1 Cement shall be ASTM C-150, Type II, low alkali as per Section 725.

620.2.2 Sand aggregate used for concrete and mortar shall conform to Section 701. Maximum size of the aggregate shall not be greater than ⅓ of the minimum wall thickness up to and including a wall thickness of 4 ½ inches. The maximum aggregate size is 1 ½ inches.

620.2.3 Water used for concrete and for curing the pipe shall be as per Section 725.

620.2.4 Concrete shall be Class A in accordance with Section 725. Slump shall be the minimum required for satisfactory placement of the concrete by the equipment used by the Contractor. The slump shall not exceed 3 inches.

620.2.5 Bonding mortar shall consist of two (2) or more parts of cement to three (3) parts of sand by volume.

620.3 CONSTRUCTION METHODS:

620.3.1 Excavation: The trench will be neatly excavated with vertical sides and semi-circular bottom. The trench shall be shaped to form the bottom outside of the pipe on the alignment and to the grades specified in the plans. Departure from and return to established grade shall not exceed 1 inch per 10 linear feet with a maximum allowable departure of 1 ½ inches. Departure from and return to specified alignment shall not exceed 2 inches per 10 linear feet with a maximum allowable alignment departure of 4 inches. The bottom of the trench, hereinafter known as the trench form, will be shaped to provide full, firm, and uniform support by undisturbed earth or compacted fill for at least the bottom 210 degrees of the pipe. Density of the fill shall be at least five percent (5%) greater than the natural inplace soil, but in no case less than 85 percent (85%) when tested in accordance with AASHTO T-99, Method A and T-191 or ASTM D-2922 and D-3017.

When it is necessary to install the pipe in rocky areas, the rock will be removed and replaced with suitable fill material compacted to proper density. The rock will be over-excavated to leave a 6 inches minimum compacted soil cushion between the rock and the pipe. For construction accuracy, areas left void by rock removal will be completely filled with compacted material, then trenched for the pipe as though natural ground. If the rock below the pipe subgrade is fractured or fragmented or if it consists of large cobblestones or boulders, the replacement fill material will be carefully selected to insure that it is of such gradation that it will not be removed downward by fluctuation of the water table. In no case will expansive soils be used for fill. A similar procedure of over-excavation, backfill, compaction, and retrenching will be used where sloughing sand or where soft or spongy soil conditions are encountered. When expansive clays are encountered, they will be thoroughly moistened by ponding, to completely expand the soil, and the moisture maintained until the concrete is placed.

Where the pipe is to be constructed through fill materials, such fill shall have stability in the zone of the trench form equal to firm undisturbed earth, in the area adjacent to the fill.

All gaskets shall be of virgin styrene butadiene rubber (SBR), or equal, compound for water services. The complete circle gasket shall be 0.25 inch ±0.03 thick and permanently attached to the sleeve. A dielectric insulating flange insulation kit shall be installed between the stainless steel flange and the cast iron valve. The kit shall contain full faced gaskets, full length sleeves, and single insulating washers. Insulation gasket material shall be neoprene-faced phenolic, insulation sleeves shall be mylar or minlon and full length, insulation washers shall be phenolic, or approved equal. All insulation material shall be of a type designated by the manufacturer as suitable for service at the operation temperatures and pressure specified.

(B) Tapping sleeves for concrete pressure pipes shall be fabricated tapping sleeves and comply to the following.

The sleeves shall be installed in accordance with AWWA Manual M-9. They shall also meet AWWA C-301, and AWWA C-303 standards pertaining to design, manufacturing, testing and welder qualifications. When tapping AWWA C-301 pipe, additional considerations pertaining to installation, testing and tapping shall be noted in the special prevision and/or the plans.

The tapping sleeve assembly shall be designed to meet or exceed the pressure rating of the pipe using the same safety factors.

The tapping sleeve assembly shall be pressure tested to at least 5 percent over the actual working pressure in the pipeline. The main shall be pressurized to full working pressure during the test of the sleeve. The test shall occur prior to tapping of the main.

The sleeve shall be a three part design, back half, front half with draw flange and a gland as shown in Detail 342. The sleeve shall be designed to permit the cutting of the of the rods or prestressing wires of the pipe after installation of the two sleeve halves. The gland shall have a sealing gasket set in a retaining groove on the pressure plate. The sealing portion of the gasket shall be square or rectangular in shape and have minimum dimensions of ½ inch x ½ inch. The pressure plate on the gland shall be stabilized to eliminate flexing. The gland shall be equipped with load bearing set screws to protect the pipe cylinder from any excess loading caused by the valve, tapping machine, etc. The annular space between the sleeve and the gland shall be grouted through an opening in the sleeve.

Both halves of the sleeve shall be the same thickness and width. With approval from the Engineer, stainless steel strapped back sleeves will be permitted when the outside pipe diameter is irregular and can not accommodate a full back sleeve.

The sleeves shall be furnished with grout horns/openings through which the annular space between the outside pipe surface and the sleeve shall be grouted.

All interior and exterior ferrous surfaces shall be epoxy coated to a minimum dry film thickness of 12 mils. Epoxy coating shall be factory applied by a electrostatic or thermosetting process in accordance with the manufactures's instructions. The epoxy materials used shall be 100% powder epoxy or liquid epoxy that conforms to the requirements of AWWA C-550 for use in a potable water system.

All bolts shall be 304 stainless steel.

No weld-on sleeves or nozzles will be permitted.

Tapping sleeves shall be JCM #415 Type 2 ESS or approved equal.

All external surfaces of the tapping sleeve shall be covered with a minimum of two inches of mortar. The mortar shall be Type "M" per Section 776 using Type II low alkali cement. The mortar shall be held in place by use of wire mesh.

The Contractor shall obtain the necessary dimensions for ordering the sleeve from direct field measurements. Excavation may be required to obtain the measurements. If an excavation is required, the Engineer may require the Contractor to return the land to its original use until the materials are delivered.

The contractor shall provide, for approval of the Engineer, the manufacture, shop drawings, calculations, and any other technical data as required by the Engineer for the tapping sleeve. Also, the contractor shall submit the manufacture history of 6 successful production of the sleeves over the last year. The submittal shall include but not limited to the number, size, location, agency and contact person, etc.

The Contractor shall also provide, for approval by the Engineer, the name of the company/contractor/subcontractor to install the sleeve and perform the tap. The submittal shall include a history of 5 successful sleeve installations and taps per year over the last 3 years. The submittal shall include but not limited to the sizes and locations of the taps, the agencies and contact persons, the addresses and telephone numbers, etc.

630.4.3 Tapping and Associated Fees: Except for meter service connections, taps shall be made by the Agency at prevailing rates or by approved Contractors when allowed or requested by the Contracting Agency. After installation of the tapping sleeve and valve, the Contractor shall provide an excavation sufficient in size to accommodate the tapping operation.

The Contractor shall pay the established shutdown charge to the Contracting Agency every time it is necessary to shut off valves and take a section of a water main out of services.

The above charges, as well as charges for tap connections to steel cylinder and reinforced concrete pipe, are subject to change, as established by the Contracting Agency.

630.5 BUTTERFLY VALVES:

(A) 16 inches and larger:

Valves shall be in accordance with AWWA C-504 latest revision as modified herein:

(1) Valve body shall be of cast iron or ductile iron with connecting ends one of or a combination of Flanged (Short Body), mechanical joint or ACP Hub End.

(2) Valves shall be Class 150-B unless otherwise specified.

(3) When requested the manufacturer shall furnish records of tests specified in AWWA C-504.

(4) Shaft seal may be O-ring seal, V-type packing or pull down packing.

(5) The valve disc may be either cast iron or ductile iron.

(6) Valves and operators shall be for direct burial installation.

(7) Valves to be furnished with manual operators and 2 inch square operating nut. Operator torque rating shall be calculated in accordance with AWWA C-504.

(8) Valves shall open when turning the operating nut counter-clockwise.

(9) Valves shall be installed with valve shaft in a horizontal position and the operating shaft vertical.

(10) All interior ferrous surfaces exposed to fluid flow shall be epoxy coated to a minimum dry film thickness of 6 mils. Epoxy coatings shall be factory applied by an electrostatic or thermosetting process in accordance with the manufacturer's printed instructions. The epoxy materials used shall be 100% powder epoxy or liquid epoxy that conforms to the requirements of AWWA C-550, and to the prevailing requirements of the Food and Drug Administration and of the Environmental Protection Agency.

(11) All exterior ferrous surfaces, except finished or bearing surfaces, shall be factory coated with two coats of asphaltic varnish conforming to Federal Specification TT-V-51c, or shall be epoxy coated as required above for interior surfaces.

(12) A manufacturer's affidavit of compliance shall be furnished.

(13) Shop drawings shall be furnished.

(B) 3 inches through 12 inches:

SECTION 630

This specification generally describes valves and operator assemblies designed for underground service, as manufactured by Dresser Industries, B-I-F Industries Incorporated, Henry Pratt Company, Allis Chalmers Manufacturing Company, or approved equal.

Where material or equipment is designated on the plans or in this specification by a trade or manufacturer's name, it is so designated primarily to establish standards of quality, finish, appearance and performance.

All specific requirements of this specification must be adhered to, and all necessary modifications shall be made in the article specified by the trade name, type or model or manufacturer's equipment to make it conform to all specific requirements of this specification.

The valves shall be in accordance with AWWA C-504, Class 150-B, except as modified herein:

(1) Valve ends may be the thin type or wafer type to be installed between flanges drilled in conformance with ASA B 16.1-125 or may be flanged both ends or the valves may have bell ends with rubber gaskets, for cast iron pipe or asbestos cement pipe conforming to the kind of pipe being used.

(2) Valves shall be designed for buried service with the valve shaft in a horizontal position and the operating shaft vertical.

(3) Valves shall be left-hand opening, counter-clockwise unless shown otherwise on the plans.

(4) Discs shall be Ni-Resist, ASTM A-436, Type 1, or cast iron, ASTM A-48, Class 40, in accordance with the following variations:

(a) Cast iron disc may be used providing the rubber seat ring is contained on the disc with the rubber ring closing against a Type 304 stainless steel ring or a bronze ring contained in the body of the valve.

(b) Ni-Resist disc may be used where rubber seat is contained in the valve body.

(c) Valves with rubber seats in the valve body may have cast iron discs with a Type 304 stainless steel or bronze edge seating surface retained on the edge of the disc.

Shafts and disc shaft fasteners shall be constructed of Type 304, stainless steel, unless the shaft is completely sealed from the line fluid. Valve shafts completely sealed from the line fluid may be of high strength steel with all other metal parts in contact with the line fluid to be Type 304 stainless steel.

Valves with rubber seat mounted in the body shall have the rubber either bonded or mechanically retained in its final position. Rubber seats which are on the disc edge shall be retained by a clamping ring and screws. Clamping ring and screws shall be made of 18-8 stainless steel, Type 304, or bronze conforming to ASTM B-61 or ASTM B-584.

Manual operators shall have AWWA 2 inch square operating nuts and shall require at least 2 turns per inch diameter to rotate the disc 90 degrees. Operators must accept a minimum of 300 ft. lbs. input torque on stops at ends of travel without damage to valve or operator. The operator torque rating shall equal, or exceed, the valves shown in Table I of AWWA C-504 for valve class specified above.

All interior ferrous surfaces exposed to fluid flow shall be epoxy coated to a minimum dry film thickness of 6 mils.

Epoxy coatings shall be factory applied by an electrostatic or thermosetting process in accordance with the manufacturer's printed instructions.

The epoxy materials used shall be 100% powder epoxy or liquid epoxy that conforms to the requirements AWWA C550-81, and to the prevailing requirements of the Food and Drug Administration and of the Environmental Protection Agency.

All exterior ferrous surfaces, except finished or bearing surfaces, shall be factory coated with 2 coats of asphaltic varnish conforming to Federal Specification TT-V-51c, or shall be epoxy coated as required above for interior surfaces.

630.6 AIR RELEASE AND VACUUM VALVES:

Valve assemblies shall be furnished and installed where shown and as detailed on the drawings.

(A) Air release on water mains shall be controlled by the use of an air release valve assembly, of size and type as shown on the plans. Air release valves shall be of the flanged or screwed type as designated on the Agency's approved products list or in the special provisions.

(B) Vacuum and Air Relief when called for on the plans shall be controlled by a vacuum relief valve on the air release valve noted above. The valves shall be of the same manufacture or may be a combination air and vacuum valve assembly designated on the Agency's approved products list or in the special provisions.

630.7 CONSTRUCTION METHODS:

All valves, their supports, manholes, vaults, and valve boxes shall be installed in accordance with Section 610.

Valves 16 inches and larger, before being shipped from the factory, shall have the flanged ends completely covered with plywood. Plywood shall be left on the valve until just before installation in the line.

630.8 MEASUREMENT:

Measurement will be by the unit each of the various kinds and sizes of valves, manholes, vaults, or tapping sleeves and valves, including valve boxes and covers.

630.9 PAYMENT:

Payment will be made at the contract unit price and shall be compensation in full for the complete installation in place including all labor, materials, equipment, and all incidentals necessary to complete the installation. The compensation will also include the cost of necessary pavement replacement in excess of the pay widths allowed in Section 336 for pavement replacement over pipe trenches.

End of Section

PART 700

MATERIALS

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701	2010	Rock, Gravel, and Sand	701-1
702	2011	Base Materials	702-1
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705	1998	Portland Cement Treated Base	705-1
708	2011	Asphalt Pavement Core Bonding Materials	708-1
709	2009	Reclaimed Asphalt Pavement	709-1
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711	2003	Paving Asphalt	711-1
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725	2010	Portland Cement Concrete	725-1
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737	1998	Asbestos-cement Pipe and Fittings for Storm Drain and Sanitary Sewer	737-1
738	2004	High Density Polyethylene Pipe & Fittings for Storm Drain & Sanitary Sewer	738-1
741	2011	Lining for Reinforced Concrete Sanitary Sewer Pipe	741-1
743	1998	Vitrified Clay Pipe	743-1
744	1998	ABS Truss Pipe and Fittings	744-1
745	1998	PVC Sewer Pipe and Fittings	745-1
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758	2005	Concrete Pressure Pipe - Steel Cylinder Type	758-1
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760	1998	Coating Corrugated Metal Pipe and Arches	760-1
761	1998	Structural Plate Pipe, Arches, and Pipe Arches	761-1
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771	2005	Galvanizing	771-1
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790	1999	Paint	790-1
792	2010	Dust Palliative	792-1
795	1998	Landscape Material	795-1
796	2010	Geosynthetics	796-1

SECTION 702

BASE MATERIALS

702.1 GENERAL:

Materials for use as aggregate base shall be classified in the order of preference as follows:

(A) Crushed Aggregate.

(B) Processed Natural Material.

(C) Processed Steel Slag.

(D) Decomposed Granite.

When base material without further qualification is specified, the Contractor shall supply crushed aggregate. When a particular classification of base material is specified, the Contractor may substitute any higher classification of base material for the specified classification.

Except where materials are being obtained from a previously approved source, the Contractor shall give the Engineer 10 days advance notice, in writing, of the source of the base material he intends to use in order to allow sufficient time to perform the necessary tests.

702.2 CRUSHED AGGREGATE:

Crushed aggregate shall consist of crushed rock or crushed gravel or a combination thereof as defined in Section 701.

702.2.1 Soundness: The percentage of wear of crushed aggregate to be used as base will be determined as in Section 701, except that Grading B of ASTM C-131 shall be used. The percentage of wear of the material shall not exceed 40 after 500 revolutions.

702.2.2. Grading: The aggregate shall be well graded when tested in accordance with ASTM C-136 and C-117. The percentage composition by weight shall be within Table 702-1.

Table 702-1

CRUSHED AGGREGATE GRADATION

Sieve Sizes (Square Openings)	Percentage by Weight Passing Sieve		
	Select Material		Aggregate Base
	Type A	Type B	
3"	100		
1 ½		100	
1 ¼			100
No. 4	30-75	30-70	38-65
No. 8	20-60	20-60	25-60
No. 30	10-40	10-40	10-40
No. 200	0-12	0-12	3-12

702.2.3 Plasticity Index: Unless otherwise noted, the Plasticity Index as tested in accordance with AASHTO T-146 Method A (Wet Preparation), T-89 and T-90 shall not be more than 5.

702.3 PROCESSED NATURAL MATERIAL:

702.3.1 General: Processed natural material shall consist of hard, durable fragments of stone or gravel and a filler of sand or other finely divided mineral matter. It shall be free from an excess of soft or disintegrated pieces, alkali, adobe, vegetable matter, loam, or other deleterious substances.

702.3.2 Physical Requirements: When sampled and tested in accordance with standard test methods, the aggregate shall meet the following requirements:

(A) Percentage of Wear: When tested in accordance with ASTM C-131, the percentage of wear shall not exceed 40 percent after 500 revolutions.

(B) Plasticity Index: When tested in accordance with AASHTO T-146 Method A (Wet Preparation), T-89 and T-90, the plasticity index shall not be more than 5.

(C) Liquid Limit: When tested in accordance with AASHTO T-89, the liquid limit shall not be more than 25 percent.

702.3.3 Crushed Material: Crushed material is not required, but may be incorporated in the finished product.

702.3.4 Grading: The aggregate shall conform to the sieve analysis in this specification except that the least dimension of the maximum particle size shall not exceed 2/3 of the compacted thickness of the specified lift being placed.

702.4 DECOMPOSED GRANITE:

Decomposed granite shall be any granitoid igneous rock which has been weathered in place and which has as principal constituents granular fragments of quartz and feldspar. It may also contain fragments of granitic rock not yet broken down into the component minerals. This material shall remain stable when saturated with water. Particles larger than 3 inches, which will not be broken in the process of rolling and tamping during construction, shall not be used.

Decomposed granite shall conform to the following requirements:

(A) When tested in accordance with this specification, not more than 20 percent shall pass the No. 200 mesh sieve.

(B) The P.I. of material passing the No. 200 sieve prior to testing shall not be less than 3 nor greater than 10. The Plasticity Index shall be tested in accordance with AASHTO T-146 Method A (Wet Preparation), T-89 and T-90.

702.4.1 Preparation of Test Specimens: A quantity of sufficient size to have a dry weight of 15 pounds shall be selected and dried to constant weight at a temperature between 215°F. and 230°F. Fifteen pounds of this material shall then be subjected to 500 revolutions in a Los Angeles abrasion machine, as described in Section 701, except that nothing shall be placed in the drum other than the material to be tested.

The material that has been subjected to the breakdown shall be tested in accordance with ASTM C-117 to determine the percentage of material finer than a No. 200 mesh sieve by washing.

End of Section

SECTION 705

PORTLAND CEMENT TREATED BASE

705.1 GENERAL:

The cement treated base shall consist of furnishing all materials in accordance with these specifications. The estimated cement requirement is 3 ½ percent by weight of the dry aggregate. The cement shall be Type II, low alkali.

705.2 AGGREGATE FOR CEMENT TREATED BASE:

The aggregate for cement treated base shall conform to the requirements of Section 701 except the plasticity of the material passing the No. 40 sieve shall not exceed 5 and the grading shall be per Table 705-1.

TABLE 705-1	
CEMENT TREATED BASE GRADATION	
Sieve Size	**Percentage By Weight Passing Screen**
1 ½ inches	100
No. 4	40-70
No. 40	30 Max.
No. 200	38000

705.3 PORTLAND CEMENT AND WATER:

Portland cement and water shall conform to the requirements of Section 725.

705.4 COMPRESSIVE STRENGTH OF CEMENT TREATED BASE:

The minimum compressive strength at 7 days shall not be less than 500 psi when tested in accordance with ASTM D-1633.

705.5 BITUMINOUS MATERIAL FOR CURING SEAL:

Bituminous material for curing seal shall conform to the requirements of Sections 712 or 713 for the type specified.

End of Section

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SECTION 708

ASPHALT PAVEMENT CORE BONDING MATERIALS

708.1 GENERAL

This specification covers the materials required to bond asphalt pavement cores to the asphalt concrete pavement from which it was originally removed.

708.2 MATERIALS

Bonding material shall be a single component cementitious, rapid hardening, high strength, waterproof bonding agent conforming to the physical properties shown in Table 708-1.

TABLE 708-1		
Bond Material Properties		
Property	**ASTM Test Method**	**Requirements**
Bond Strength, psi	C882	20 min.
Compressive Strength, psi, (70 degrees F., 30 minute cure)	C109	200 min.

Bonding material shall be impervious to water penetration at the joint after curing.

Bonding material shall, within 30 minutes at minimum ambient temperature of 70 degrees F., allow an 18" diameter core to support a traffic load equivalent to at least three (3) times the AASHTO H-25 standard wheel load.

The bonding material is required to securely bond the asphalt concrete core to asphalt concrete pavement and to fill all voids between the core and pavement and within the core.

708.3 TEST REPORT

Specifications and test results for the bonding material shall be submitted to the Agency for review and approval before use.

SECTION 709

RECLAIMED ASPHALT PAVEMENT

709.1 DESCRIPTION:

Reclaimed Asphalt Pavement (RAP) is pavement containing RAP asphalt and RAP aggregates, which has been processed to 1 ½ inches maximum size and is free of detrimental quantities of organic, non-granular soils and deleterious materials. The stored RAP shall be uniform in appearance and well graded from fine to coarse.

709.2 STORAGE:

RAP shall be stored in such a manner to permit ready inspection and shall be protected from contamination. Any portion of the stockpile that has been consolidated so that the uniformity is affected, will require reprocessing prior to use.

709.3 TEST REQUIREMENTS:

Prior to the use of RAP in a recycled asphalt concrete mix, the reclaimed asphalt concrete supplier shall furnish the Engineer with the following test reports from the stockpiles that are to be used for recycling.

(A) Sand equivalent test of the unextracted RAP: Minimum of 80 when tested in accordance with ASTM D-2419 or AASHTO T-176.

(B) RAP asphalt content ASTM D-2172 and D-1856.

(C) "Gradation test of sample aggregate in accordance with AASHTO T-30, "Standard Method of Test for Mechanical Analysis of Extracted Aggregate," when solvent extraction or incineration methods are utilized to determine asphalt content."

End of Section

SECTION 715

SLURRY SEAL MATERIALS

715.1 GENERAL:

Slurry seal shall consist of a properly proportioned mixture of emulsified asphalt, mineral aggregate, mineral fillers, and water.

All material source must be approved prior to their use. The Contractor will submit material samples at least seven days prior to start of construction. When requested, additional samples will be furnished during the construction period at no cost to the Contracting Agency. This is a non-pay item.

715.2 AGGREGATE:

715.2.1 Mineral Filler: Mineral filler shall consist of finely divided matter, such as hydrated lime, portland cement, limestone dust or fly ash, conforming to the requirements of ASTM D-4318. Mineral filler shall be used only when needed to reduce the setting time, to improve the workability or to reduce the stripping characteristics of the aggregate emulsion mixture. The minimum amount of the required filler will be used and it will be considered as part of the blended aggregate. The expected range shall be between .25% and 2.0% by weight of aggregate.

715.2.2 Mineral Aggregate: Mineral aggregate shall consist of sound and durable sand and/or crushed stone as per MAG Section 701 combined with an approved mineral filler where it is required. The mineral filler will be considered as part of the blended aggregate. The material shall be non-plastic (ASTM D-4318) with a sand equivalent (ASTM D-2419) of at least 50. The abrasion loss (ASTM C-131) shall not exceed 35 percent. Ninety percent of the aggregate retained on the No. 50 sieve shall have at least one fractured face. The gradation of material aggregate shall conform to Table 715-1.

715.3 BITUMINOUS MATERIAL:

The emulsified asphalt used for seal coating shall be quick setting or slow setting as per Section 713.

The quick setting emulsified asphalt shall be of the anionic or cationic quick set type such as QSH or CQSH that will react to chemically active mineral fillers such as portland cement in such a way that the applied slurry mixture can support controlled traffic in 45-60 minutes after application. The amount of chemically active filler shall be determined by mix design and field performance.

Quick Set Emulsion Mix Properties	
Slurry Seal Mixing, 70-85 degree F., Sec.	120 Sec. Min.
Slurry Seal Setting text, 70-85 degree F., 1 hour cure	No Brown Stain
Slurry Seal Water Resistance Test, 70-85 degree F., 30 minute cure	No More Than Slight Discoloration

Slow setting emulsion may be used when traffic control is not a critical item.

Placement of slurry seal is temperature dependent and should be tested under field conditions.

715.4 WATER:

Water shall be potable and be compatible with the slurry ingredients used.

715.5 TEST CERTIFICATES & REPORTS:

Test certificates and reports for the bituminous material shall be furnished in accordance with Section 711.

715.6 CONVERSION OF QUANTITIES:

Volumetric conversions shall be accomplished in accordance with Section 713.

TABLE 715-1			
SLURRY SEAL AGGREGATE			
SIEVE SIZE	Type I % PASSING	Type II % PASSING	Type III % PASSING
3/8	100	100	100
No. 4	100	85/100	70/90
No. 8	90/100	65/90	45/70
No. 16	65/90	45/70	28/50
No. 30	40/60	30/50	19/34
No. 50	25/42	18/30	12/25
No. 100	15/30	10/21	7/18
No. 200	10/20	5/15	5/15
Emulsified Asphalt content as a % of Dry Wt. Of Aggregate (approx.) ASTM D-3910 (W.T.A.T. TEST)	18	16	14
Residual Asphalt Range requirements % of Dry Wt. of Aggregate ASTM D-3910 (W.T.A.T. TEST)	10-16	7.5-13	6.5-12
Pounds of Aggregate per Square Yard (approx.)	8-10	12-18	18-25

End of Section

SECTION 728

CONTROLLED LOW STRENGTH MATERIAL

728.1 GENERAL:

Controlled Low Strength Material (CLSM) is a mixture of cementitious materials, aggregates, admixtures\additives, and water that, as the cementitious materials hydrate, forms a soil replacement. CLSM is a self-compacting, flowable, cementitious material primarily used as a backfill, structural fill, or a replacement for compacted fill or unsuitable native material. Placement and usage of each type of CLSM is described in Section 604,

728.2 MATERIALS:

Cementitious materials shall conform to Section 725.2.
Coarse and fine aggregates shall conform to Section 701.3.5
Water shall conform to Section 725.4.

728.3 PROPORTIONING OF MIXTURES AND PRODUCTION TOLERANCES:

Proportioning of the mixture shall comply with Section 725.6 and Table 728-1. The CLSM shall have consistency, workability, plasticity, and flow characteristics such that the material when placed is self-compacting. A minimum of 40% coarse aggregate shall be used. A mix design shall be submitted for the Engineer's approval prior to the excavation for which the material is intended for use. Sampling shall be in accordance with ASTM D-5971. The flow consistency shall be tested in accordance with ASTM D-6103. Unit weight (when applicable) shall be obtained by ASTM D-6023. Compressive strength shall be tested in accordance with ASTM D-4832.

TABLE 728-1	
CONTROLLED LOW STRENGTH MATERIAL REQUIREMENTS	
Portland Cement Content, Sack/cu yd	Flow, inches
1/2 Sack	9±2
1 Sack	9±2
1 1/2 Sack	9±2

Note for Table 728-1:
1) CLSM mixes meeting the table requirements will not generally be placeable by means of a concrete pump or may not provide the needed workability for certain conditions. When pumpable mixes or increased workability are required, the addition of fly ash or a natural pozzolan in excess of the required Portland Cement Content may be used.

2) Ready-mixed concrete shall not be used in lieu of CLSM without prior approval from the Engineer and shall be subject to rejection.

728.4 MIXING:

CLSM mixing shall comply with Section 725.7. Mixing shall continue until the cementitious material and water are thoroughly dispersed throughout the material. Mixes shall be homogenous, readily placeable and uniformly workable.

SECTION 729

EXPANSION JOINT FILLER

729.1 PREMOLDED JOINT FILLER:

Expansion joint filler materials shall consist of premolded strips of a durable resilient compound and comply with ASTM D-1751, D-1752, or D-2628, as specified by the Contracting Agency.

729.2 POUR TYPE JOINT FILLERS:

Pour type joint fillers shall comply with ASTM D-1850, D-1190, D-1854, or with the following formulation, as specified by the Contracting Agency.

Asphalt latex joint filler shall consist of asphalt latex emulsion and sodium fluosilicate furnished in separate containers and mixed on the site. The emulsion shall consist by volume of 60 parts AR-1000 asphalt conforming to the requirements of Section 711, 40 parts of synthetic latex, GRS-Type 4, and 5 to 10 parts of sodium fluosilicate, half strength. The emulsion and sodium fluosilicate shall not be mixed until the joint is ready to be filled. The amount of sodium fluosilicate to be mixed with the emulsion shall be approximately 3 to 5 percent by weight of the emulsion. The joint to be filled shall be thoroughly cleaned and surface dry.

The sealing compound shall consist of paving asphalt, Grade AR-1000 conforming to the provisions of Section 711, emulsified with rubber latex in the presence of a suitable emulsifying agent. Rubber latex designated as GRS-Type 4, or any other approved type, containing approximately 40 percent solids.

The resulting emulsion shall consist of a minimum of 55 percent of paving asphalt and a minimum of 36 percent of rubber latex and shall conform to the requirements set forth in Table 729-1.

TABLE 729-1

ASPHALT-LATEX EMULSION JOINT SEALING COMPOUND-

SPECIFICATION DESIGNATION	TEST METHOD	LIMITS	REMARKS
Furol Viscosity at 77°F.	AASHTO T-72	50-250 seconds	Before adding gelling agent.
Sieve Test	AASHTO T-59	1% Max.	Before adding gelling agent.
Penetration at 77°F.	ASTM D-217	50-250	The penetration test is made on a specimen prepared by stirring 5% of sodium fluosilicate into the asphalt latex emulsion in a 6 ounce deep ointment can. The specimen is then allowed to stand in the air at a temperature of 77°F. ±2° for a period of 30 minutes and is then penetrated with a grease cone under a total load of 150 grams.
Elasticity		70% Min.	After addition of 5% of sodium fluosilicate and curing for 24 hours at 100°F.±2°, the specimen shall have an elastic recover of not less than 70%.
Dehydration		Loss 30% maximum	Twenty-five grams of emulsion, prior to adding the gelling agent, is placed in an 8 ounce flat ointment can and dehydrated in a suitable oven maintained at a temperature of 200°F.±2° for a period of 24 hours.
Time of Set		15-60 minutes	After mixing the emulsion with 1% to 4% by weight of powdered sodium fluosilicate the emulsion shall harden or develop a set in from 16 to 60 minutes, under field conditions.

(A) Portland Cement: Portland cement shall comply with ASTM C-150, Type II, low alkali. The pipe manufacturer shall supply a cement mill certificate in triplicate for each load of cement delivered, showing the specification, type, chemical analysis, and quantity. In lieu of the above, on stockpiled pipe the manufacturer shall certify that the type of cement used meets this specification. The pipe manufacturer shall also certify in writing that the cement content of the concrete complies with the specifications as to yield per cubic yard of concrete poured.

(B) Concrete Admixtures: The pipe manufacturer shall certify in writing that no calcium chloride or admixture containing calcium chloride has been used in the manufacture of the pipe. Other admixtures may be used if approved by the Engineer. The pipe manufacturer shall certify to the brand and chemical content of such admixtures used.

(C) Steel Reinforcement: The pipe manufacturer shall supply 3 copies of mill certificates showing heat numbers, chemical analysis, and physical tests on reinforcing steel. In lieu of the above, on stockpiled pipe the manufacturer shall certify that the type of steel used meets this specification. The number of steel wraps shall not be less than 5 percent below that shown on the shop drawing for any one pipe.

(D) Rubber gaskets shall be in accordance with ASTM C-443 or AASHTO M-315.

735.5 MANUFACTURER'S QUALIFICATIONS AND EQUIPMENT REQUIREMENTS:

The manufacturer shall be competent to manufacture the type, size and quality of pipe; in addition, he shall have satisfactory curing and storage facilities, and satisfactory financial resources.

Calibration of Cement and Aggregate Scales: The pipe manufacturer shall make whatever alterations are necessary to his equipment to enable the Contracting Agency's Sealer or State Inspector of Weights and Measures to check, calibrate, and seal the aggregate and cement scales used in the pipe production.

735.6 CURING OF PIPE:

(A) Steam Curing: The manufacturer shall provide adequate steam plant, piping, enclosures, and other facilities for curing the pipe. The enclosures shall be such that the temperature is maintained continuously between 110 and 150°F.

(B) Curing of the pipe shall not commence until the concrete has attained its initial set, but in any event not sooner than 1 hour nor later than 8 hours after placing of the concrete. Rate of rise of temperature shall not exceed 30°F per hour.

(C) Water Curing: The pipe shall be kept moist during daylight hours. The pipe, including the ends, shall be covered with burlap for the first 3 days, except that, if the pipe is kept constantly and completely wet with fog sprays during the daylight hours, the burlap covering may be omitted. If the manufacturer fails to proceed immediately with the required water curing he shall seal the surfaces of the concrete, except joint surfaces that are to be grouted, with an approved, white pigmented sealing compound in accordance with Section 726.

735.7 TESTS AND ACCEPTANCE:

(A) Basis of Acceptance: The basis of acceptance for the reinforced concrete pipe shall be in accordance with ASTM C-76 by the method stated in the special provision and as amended herein. However, the purchaser may, at his option, make concrete cylinder tests for the purpose of determining release dates for shipment of the pipe and for his information in regard to general quality of the concrete.

(B) Segregation of Material: The slump of the concrete mix shall not exceed 4 inches so as to preclude excessive segregation of the materials used and shall be proportioned so that the result shall be a homogeneous concrete mixture of such quality that the pipe will conform to the tests and design requirements of these specifications.

(C) A pipe has failed the D-load test when the opening crack exceeds .01 inch for a distance of 1 foot when measured at close intervals. These measurements are taken within the 1 foot measured span only when the crack line is more or less parallel to the axis of the pipe, as it is obvious that where the crack deviates substantially from parallel, and approaches a direction normal to the axis, that the edges of the crack tend to slip past each other, instead of opening up under load. The intent of the test is to measure the crack opening under stress.

(D) Porous or honeycomb concrete areas 6 inches or less in diameter may be removed and repaired. Pipe having defects or repairs greater than 6 inches in diameter will not be accepted.

(E) Any crack exceeding 1 foot in length that goes completely through the pipe, is not considered acceptable whether repaired or not, except that a single end crack that does not exceed the depth of the joint as measured from the end to the inside shoulder is acceptable.

(F) Any crack that is .01 inch in width for one-sixteenth inch in depth or deeper, for a length of 1 foot or more and continues as a hairline crack down to the reinforcing steel for over 1/2 the length of the pipe is not considered acceptable whether repaired or not.

(G) A single continuous hairline crack which does not extend to the reinforcing steel and not in excess of .01 inch in width for a distance of 1 foot is acceptable without repair. This type of crack, longer than 1 foot shall be repaired.

(H) Repairs shall be made by filling the defect with epoxy under pressure or by chipping out a V-section to the full depth of the defect and repairing with an approved patching compound. The composition of the patching compound shall be furnished to the Engineer for approval.

(I) The words regarding acceptability and repair ability in the above paragraphs shall also apply when the crack occurs after loading of the pipe in the trench with backfill. Cracks wider than .01 inch shall be assumed to indicate overstress of the steel. In such case, the defective portion of the installation shall be replaced or repaired in a manner acceptable to the Engineer. After structural repairs are completed, the remaining cracks shall be filled as required above. All corrective measures shall be at the expense of the Contractor.

(J) Blisters: All pipe joints having blisters involving less than 1/4 the interior surface area shall be repaired by removing all loose material and exposing all hollow area and replacing with fresh concrete properly bonded, with an acceptable bonding agent, and curing the repair with membrane coating. Blisters with larger areas are not considered to be repairable or acceptable.

(K) Painting of pipe, or portion of pipe, with grout to cover defects, minor or major, will not be permitted until approved by the Engineer.

(L) Where the modified or special design method, under ASTM C-76 is elected, acceptance on the basis of material tests and inspection of manufactured pipe for defects and imperfections shall be as stated in ASTM C-76, and as amended herein. However, one joint of each size and D-load shall be selected by the Engineer for test purposes, and shall be tested for strength by the 3 edge bearing method, ASTM C-497, with the results being used for confirmation of the submitted design for this D-load. If the pipe section tested fails in compression or shear before reaching the D-load specified, the test shall be considered a failure. Additional sections of the same diameter size and class shall be tested as specified above until the load requirements are met for the D-load strength. This test procedure shall be accomplished only once per manufacture regardless of the number of contractors he supplies. Placing of reinforcing steel in the test section of pipe to control shear cracks will not be permitted.

Requirements regarding defects shall be the same as stated above for standard pipe.

Concrete test requirements specified under compression tests of ASTM C-76 shall be amended in part to read as follows: “The average of any 5 consecutive strength tests of the laboratory-cured specimens shall be equal to or greater than the specified strength set forth in Tables III, IV, or V, and not more than 20 percent of the strength tests shall have values less than the specified strength. If more than 20 percent have values less than the specified strength, the lot represented shall be considered to be defective and not acceptable. In no case shall any cylinder tested fall below 80 percent of the specified design strength. If any one cylinder falls below 80 percent of the specified design strength, then the entire production represented by that cylinder will not be accepted for purchase by the Contracting Agency unless the Contractor can demonstrate by coring to the satisfaction of the Engineer, that the cylinder in question is not representative of the entire production, or is representative of only a portion of the entire production.”

During the fabrication of the pipe, concrete cylinders shall be made from a representative sample of the concrete. Concrete cylinders and slump tests shall be made by the Engineer or under his direct supervision. A set of cylinders shall consist of three. A minimum of one set shall be made for each day's production.

SECTION 736

NON-REINFORCED CONCRETE PIPE

736.1 GENERAL:

The size and classes of the non-reinforced concrete pipe to be furnished shall be as shown on the plans, or as specified under the item of work for the project of which the concrete pipe is a part.

Strength classes of non-reinforced concrete shall be as identified in ASTM C-14, Class 1 non-reinforced concrete pipe. Class 2 non-reinforced concrete pipe, or Class 3 non-reinforced concrete pipe.

Unless otherwise specified, Class 3 non-reinforced concrete pipe will be used.

736.2 MATERIALS:

Materials used in manufacturing the pipe shall be as specified in ASTM C-14, with the following exception:

Cement shall conform to ASTM C-150, Type II, low alkali. Samples and testing shall conform to the methods designated therein. The pipe manufacturer shall supply a cement mill certificate, in triplicate, for each load of cement delivered, showing the specification, type, chemical analysis, and quantity. On stockpiled pipe in lieu of the above, the manufacturer shall certify that the type of cement used meets this specification. Satisfactory facilities shall be provided for identifying, inspecting, and sampling cement at the mill, the warehouse, and the site of the work. The Contracting Agency shall have the right to inspect the cement and obtain samples for testing at any of these points. The cement shall be stored in a weathertight, dry, well ventilated structure approved by the Engineer. Cement salvaged by cleaning cement sacks, mechanically or otherwise, shall not be used in the work. Cement containing lumps will be rejected and shall immediately be removed from the site of the work. If the temperature of the cement exceeds 150°F., it shall be stored until cooled to that temperature.

736.3 PIPE JOINTS:

The joints may be tongue and groove mortared joints, or rubber gaskets joints. With rubber gasket joints, inside mortaring and outside grouting is not required. Tongue and groove joints shall be mortared inside and grouted outside. Grouting of outside joints shall be by the diapering method.

736.3.1 Cement Mortar Joints:

(A) The mortar or grout shall consist of 1 part portland cement and 2 parts sand, by volume. The quantity of water in the mixture shall be sufficient to produce a soft workable mortar, but shall in no case exceed a water-cement weight ratio of 0.53. Where outside joints are made by the diaper method, the grout shall be composed of 1 part cement to 3 parts sand, and shall be mixed to the consistency of thick cream. The sand shall conform to Section 701, and the cement shall conform to Section 725.

(B) The pipe ends shall be thoroughly cleaned and wetted with water before the mortar or grout is placed. No backfilling around the joints shall be done until the joints have been fully inspected and approved.

(C) Mortar joints shall be cured by keeping them wet for 3 days or by using a curing compound.

736.3.2 Rubber Gasket Joints: Rubber gaskets shall be in accordance with ASTM C-443 or AASHTO M-315.

736.4 CURVES, BENDS AND CLOSURES:

Horizontal and vertical long-radius curves shall be formed by slight deflection at the joints, provided that the maximum joint opening caused by such deflection shall not exceed 3/4 inch. Short radius curves shall be formed by straight pipe in which the joints are beveled. The bevel of the pipe shall not exceed 5 degrees, and the total angular deflection for beveled pipe shall not exceed 10 degrees at any joint.

736.5 CARE OF PIPE AND MATERIALS:

All pipe and materials shall be manufactured, handled, loaded, shipped and unloaded in such manner as to be undamaged and in sound condition, in the completed work. Particular effort shall be exercised to protect the ends of pipe. Repairs on damaged pipe shall be made to the satisfaction of the Engineer, otherwise they shall not be used in the work and shall be replaced with an equal pipe or special in an acceptable condition. At all times rubber gaskets shall be stored in a cool, dark place until ready for use.

736.6 TESTS:

Before pipe is delivered to the job site for use in any work under the contract, test pipes shall meet the requirements of the hydrostatic pressure test and the loading test described in ASTM C-14. The test shall be made at the point of manufacturer and shall be made under the presence of the Engineer.

End of Section

SECTION 741

LINING FOR REINFORCED CONCRETE SANITARY SEWER PIPE

741.1 GENERAL:

The interior area of the reinforced concrete pipe as indicated on the plans, shall be sealed and protected with lining, as specified below.

The installation and application of the pipe lining shall be accomplished by the supplier of the reinforced concrete pipe.

All work for and in connection with the installation of lining in concrete pipe and the field sealing of joints shall be done in strict conformance with all applicable published specifications, instructions and recommendations of the approved lining manufacturer. The pipe supplier shall furnish all labor, material and equipment to successfully accomplish the lining.

741.2 MATERIALS:

741.2.1 Material Composition: The material shall be a liner plate which is a combination of inert, synthetic resins, pigments, and plasticizers, compounded to make permanently flexible sheets.

The liner plate shall be resistant to the following: Oxidizing agents, sulfuric, phosphoric, nitric, chromic, oleic, and stearic acids; sodium and calcium hydroxides; ammonia, sodium, calcium, magnesium, and ferric chlorides; ferric sulfate, petroleum oils and greases; vegetable and animal oils, fats, greases and soaps.

Liner plate shall be impermeable to sewage gasses and liquids and shall be non-conducive to bacterial or fungus growth. All liner plates shall be factory checked electrically to insure freedom from any porosity with a high voltage holiday detector set at a minimum of 20,000 volts.

Joint strips and welding strips shall have the same composition and corrosion resistance as liner plate, but shall not have locking extensions.

The lining shall have good impact resistance, shall be flexible and shall have an elongation sufficient to bridge up to 1/4 inch setting crack which may take place in the pipe or in the joint after installation, without damage to the lining.

Once cast into the pipe, the lining shall be permanently and physically attached to the concrete by a locking extension and shall not rely on an adhesive bond.

741.2.2 Material Details and Dimensions: The liner plate shall not be less than 0.065 inches in thickness. Locking extension shall be of the same material as the liner and shall be integrally extruded with the sheets. If steel bands are used to secure the liner plate to the forms transversely, strap channels shall be integrally molded into the sheet.

Liner plate shall be supplied as pipe size sheets fabricated by shop welding together the basic size sheets.

Joint straps shall be 4 inches ± 0.25 inches in width and shall have each edge beveled prior to application.

Welding strips shall be 1 inch ± 0.125 inch in width and shall have the edges beveled at time of manufacture.

The Contractor shall submit a shop drawing showing liner plate details for approval by the Engineer, prior to fabrication of the pipe.

741.3 Installation of Liner Plate: The installation of liner plate, including the welding of all joints, shall be done in accordance with the manufacturer's recommendations. Nailing through the plate will not be tolerated. Liner plate shall be installed with locking extensions parallel with the longitudinal axis of the sewer, unless otherwise shown on the plans. All joints between individual sheets or sections of liner plates shall be continuously heat-welded by the use of welding strips of the same kind and equivalent thickness of material as the liner plates (with the exception of the integral extension ribs).

Liner plate shall be held snugly in place against inner forms by means of light gage steel wire, light steel banding straps or other suitable means. If steel banding straps are used, they shall be applied in strap channels provided for this purpose.

Locking extensions (T-shaped) shall be integrally extruded to all lower, terminal or longitudinal edges of liner plate as applied to concrete pipe. If banding straps are used, a steel rod 1/4 inch in diameter may be inserted in each locking extension along the longitudinal edges of each sheet of liner plate for concrete pipe or some other approved method for holding the lower edge of the liner plate snugly against the form shall be provided.

Concrete poured against liner plate shall be compacted in a careful manner so as to protect the liner plate and to produce a dense, homogeneous concrete securely anchoring the lock extensions into the concrete.

In removing forms, care shall be taken to protect liner plate from damage. Sharp instruments shall not be used to pry forms from lined surfaces. All holes and cut, torn or seriously abraded areas in the liner plate shall be patched. Patches made entirely with welding strip shall be fused to the liner plate over the entire patch. Larger patches may consist of smooth liner plate applied over the damaged area with adhesive. All edges must be covered with welding strip fused to the patch and the sound liner plate adjoining the damaged area.

The Contractor shall take all necessary measures to prevent damage to installed liner plate from equipment and materials used in or taken through the work.

The applied lining shall be free from bubbles due to poor workmanship, and the Contractor shall cut out said bubbles and weld a similar sheet in place of the bubble, unless otherwise directed by the Engineer.

Application on Concrete Pipe-Special Requirements: Liner plate shall be set flush with the inner edge of the bell or groove end of a pipe section and shall extend to the spigot or tongue end or to approximately 3 inches beyond the tongue end, depending upon the type of liner plate to be made with the adjoining concrete pipe.

Wherever concrete pipe, which are protected with liner plate, join structures not so lined, such as brick structures, concrete pipe, cast-in-place structures or clay pipe, the liner plate shall be extended over and around the end of the pipe and back into the structure for not less than 4 inches.

Where a pipe spur, not of plastic lined concrete, is installed through lined concrete pipe, the liner plate shall be returned 4 inches at the surface of contact. The seal between the liner plate and the spur shall be made using an approved adhesive material and strapped in place.

If the joint space is too wide or the joint space surface too rough to allow satisfactory sealing with this adhesive, the joint space shall be filled with 2 inches of densely caulked lead wool or other approved caulking material.

Lined concrete pipe may be cured by standard curing methods. Care shall be exercised, in handling, transporting and placing lined pipe to prevent damage to the liner plate. No interior hooks or slings shall be used in lifting pipe. All handling operations shall be done with an exterior sling or with a suitable fork lift.

No pipe with damaged lining will be accepted until and unless the damage has been repaired to the satisfaction of the Engineer.

741.4 Field Joints: The Contractor shall obtain the services of qualified personnel to weld the liner plate field joints. Pipe joints must be dry before the liner plate joints are made. All mortar and other foreign material shall be removed from liner plate surfaces adjacent to the pipe joint, leaving them clean and dry.

No liner plate joints shall be made until the trench has been backfilled.

Field joints in the liner plate at pipe joints may be either of the following described types:

Type P-1- The joint shall be made with a separate 4 inch joint strip and 2 welding strips. The 4 inch strip shall be centered over the joint, secured to the liner plate with an approved adhesive, or other approved means, and welded along each edge to adjacent liner plate with a 1 inch weld strip. The width of the space between adjacent liner plate sheets shall not exceed 2 inches. The 4 inch joint strip shall lap over each liner plate a maximum of 1 inch.

SECTION 765

This Section is Deleted.

SECTION 770

STRUCTURAL AND RIVET STEEL, RIVETS, BOLTS, PINS, AND ANCHOR BOLTS

770.1 GENERAL:

All steel, unless otherwise designated on the plans or in the special provisions, shall conform to the requirements of ASTM A-36.

Report of Tests: Before fabrication, the Contractor shall furnish to the Engineer a certified mill report in triplicate, for each identifiable melt of steel or iron from which the material is to be fabricated. The report shall include the chemical and physical tests required by the ASTM specifications.

Additional Tests: The Contracting Agency reserves the right to require and to make additional mill and laboratory tests. The number of such additional tests will be limited as follows, except that in the case of failure of the material to comply with the ASTM requirements, more tests will be made:

Structural steel, 1 complete test for each heat or each 10 tons of identifiable stock. Rivets, 1 complete test for each size. Bolts, 1 complete test for each lot.

Identifiable stock is material for which authentic records of the chemical and physical properties are available.

Test specimens shall be furnished, cut, and machined in accordance with the ASTM specification, for the material to be tested, as referred to herein. Test specimens shall be furnished and machined by the Contractor at no additional cost to the Contracting Agency.

Mill Tolerances: Rolling and cutting tolerances, permissible variations in weight and dimensions, defects and imperfections shall not exceed the limits for structural steel contained in ASTM A-6.

Stock Material: When the Contractor proposes to use material already in stock, he shall notify the Engineer of such intention at least 10 days in advance of beginning fabrication, to permit sampling and testing.

770.2 STRUCTURAL STEEL:

Stock Materials: The Contractor shall select the material he wishes to use from stock. The Contractor shall furnish 3 certified mill reports for each of the heat numbers. Two samples shall be taken by a representative of the Engineer from each heat number, one for the tension test and one for the coldbend test. If the heat numbers cannot be identified, the representative of the Engineer shall select random test specimens from the unidentifiable heats. The number of such test specimens shall be at the discretion of the Engineer. The cost of all tests on stock material shall be borne by the Contractor.

High Strength Low-Alloy Structural Steel: The material shall conform to the requirements of ASTM A-242, A-572/A-572M, A-606, A-607 or A-653 Grades C, D, or E as specified in the special provisions.

Copper Bearing Structural Steel: Copper bearing structural steel shall conform to the requirements of ASTM A-36, A-570, A-611, or A-653 as specified in the special provisions.

770.3 RIVETS:

Stock Material: Rivets taken from identifiable stock shall be accepted by the Engineer in accordance with this specification.

Rivets from unidentifiable stock, for which authentic records of the chemical and physical properties are not available, shall not be used except where shown on the plans or when approved by the Engineer.

High-Strength Structural Rivet Steel: The material shall conform to the requirements of ASTM A-502.

Structural Rivet Steel: The material shall conform to the requirements of ASTM A-502, except that the test specimen shall be bent upon itself when performing the bend test.

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