UNIFORM STANDARD SPECIFICATIONS for PUBLIC WORKS CONSTRUCTION

SPONSORED and DISTRIBUTED by the

MARICOPA ASSOCIATION of GOVERNMENTS

1998
ARIZONA
(Includes revisions through 2010)

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.

TABLE OF CONTENTS

SAMPLE FORMS

	Page
Bond Issue or Budget Project	I
Improvement District Project	iii
Surety Bond	iv
Bond Issue or Budget Project	v
Contract	v
Improvement District Project	vii
Contract	vii
Contract Performance Bond	ix
Labor and Materials Payment Bond	x
Engineering Department Certificate of Insurance	xi
Contractor's Affidavit Regarding Settlement of Claims	xiii
Change Order Request	xiv
Authorized Signature Form	xv

PART 100 - GENERAL CONDITIONS

Section	Title	Page
101	Abbreviations and Definitions	101-1
102	Bidding Requirements and Conditions	102-1
103	Award and Execution of Contract	103-1
104	Scope of Work	104-1
105	Control of Work	105-1
106	Control of Materials	106-1
107	Legal Regulations and Responsibility to Public	107-1
108	Commencement, Prosecution and Progress	108-1
109	Measurements and Payments	109-1
110	Notification of Changed Conditions and Dispute Resolution	110-1

PART 200 - EARTHWORK

Section	Title	Page
201	Clearing and Grubbing	201-1
205	Roadway Excavation	205-1
206	Structure Excavation and Backfill	206-1
210	Borrow Excavation	210-1
211	Fill Construction	211-1
215	Earthwork for Open Channels	215-1
220	Riprap Construction	220-1
225	Watering	225-1
230	Dust Palliative Application	230-1

PART 300 - STREETS AND RELATED WORK

Section	Title	Page
301	Subgrade Preparation	301-1
306	Mechanically Stabilized Subgrade-Geogrid Reinforcement	306-1
309	Lime Slurry Stabilization	309-1
310	Untreated Base	310-1
311	Soil Cement Base Course	311-2
312	Cement Treated Base	312-1
313	Bituminous Treated Base Course	313-1
315	Bituminous Prime Coat	315-1
317	Asphalt Milling	317-1
320	Road-mixed Surfacing	320-1
321	Asphalt Concrete Pavement	321-1
323	Heater Remix Resurfacing	323-1
324	Portland Cement Concrete Street Pavement	324-1
325	Asphalt-Rubber Concrete Overlay, GAP Graded	325-1

327 Hot in-Place Recycling 327-1
329 Tack Coat 329-1
330 Asphalt Chip Seal 330-1
331 Microsurfacing Specifications 331-1
332 Asphalt Emulsion Slurry Seal Coat 332-1
333 Fog Seal Coats 333-1
334 Preservative Seal for Asphalt Concrete 334-1
335 Hot Asphalt-rubber Seal 335-1
336 Pavement Matching and Surfacing Replacement 336-1
340 Concrete Curb, Gutter, Sidewalk, Sidewalk Ramps, Driveway and Alley Entrance 340-1
341 Terrazzo Sidewalks 341-1
342 Decorative Pavement Concrete Paving Stone or Brick 342-1
343 Exposed Aggregate Paving 343-1
345 Adjusting Frames, Covers, Valve Boxes and Water Meter Boxes 345-1
350 Removal of Existing Improvements 350-1
360 Telecommunications Installation 360-1

PART 400 - RIGHT-OF-WAY AND TRAFFIC CONTROL

Section Title Page
401 Traffic Control 401-1
405 Monuments 405-1
410 Precast Safety Curbs 410-1
415 Flexible Metal Guardrail 415-1
420 Chain Link Fences 420-1
424 Parkway Grading 424-1
425 Topsoils 425-1
430 Landscaping and Planting 430-1
440 Sprinkler Irrigation System Installation 440-1

PART 500 - STRUCTURES

Section Title Page
501 Driving Piles 501-1
505 Concrete Structures 505-1
506 Precast Prestressed Concrete Members 506-1
510 Concrete Block Masonry 510-1
511 Brick Masonry 511-1
515 Steel Structures 515-1
520 Steel and Aluminum Handrails 520-1
525 Pneumatically Placed Mortar 525-1
530 Painting 530-1

PART 600 - WATER AND SEWER

Section Title Page
601 Trench Excavation, Backfilling and Compaction 601-1
602 Encasement of Water or Sewer Pipe by Jacking or Tunneling Operation 602-1
603 Installation for High Density Polyethylene Pipe 603-1
604 Placement of Controlled Low Strength Material 604-1
605 Subdrainage 605-1
610 Water Line Construction 610-1
611 Disinfecting Water Mains 611-1
615 Sewer Line Construction 615-1
616 Reclaimed Water Line Construction 616-1
618 Storm Drain Construction 618-1
620 Cast-in-place Concrete Pipe 620-1
621 Corrugated Metal Pipe and Arches 621-1
625 Manhole Construction and Drop Sewer Connections 625-1

630 Tapping Sleeves, Valves and Valve Boxes on Water Lines 630-1
631 Water Taps and Meter Service Connections 631-1

PART 700 - MATERIALS

Section	Title	Page
701	Rock, Gravel, and Sand	701-1
702	Base Materials	702-1
703	Riprap	703-1
705	Portland Cement Treated Base	705-1
709	Reclaimed Asphalt Pavement	709-1
710	Asphalt Concrete	710-1
711	Paving Asphalt	711-1
712	Liquid Asphalt	712-1
713	Emulsified Asphalts	713-1
714	Microsurfacing Materials	714-1
715	Slurry Seal Materials	715-1
716	Cover Material	716-1
717	Asphalt-rubber	717-1
718	Preservative Seal for Asphalt Concrete	718-1
719	Recycled Asphalt Concrete Hot Mixed	719-1
725	Portland Cement Concrete	725-1
726	Concrete Curing Materials	726-1
727	Steel Reinforcement	727-1
728	Controlled Low Strength Material	728-1
729	Expansion Joint Filler	729-1
735	Reinforced Concrete Pipe	735-1
736	Non-Reinforced Concrete Pipe	736-1
737	Asbestos-Cement Pipe and Fittings for Storm Drain and Sanitary Sewer	737-1
738	High Density Polyethylene Pipe & Fittings for Storm Drain & Sanitary Sewer	738-1
741	Lining for Reinforced Concrete Sanitary Sewer Pipe	741-1
743	Vitrified Clay Pipe	743-1
744	ABS Truss Pipe and Fittings	744-1
745	PVC Sewer Pipe and Fittings	745-1
750	Iron Water Pipe and Fittings	750-1
752	Asbestos-Cement Water Pipe and Fittings	752-1
753	Galvanized Pipe and Fittings	753-1
754	Copper Pipe, Tubing and Fittings	754-1
755	Polyethylene Pipe for Water Distribution	755-1
756	Fire Hydrants	756-1
757	Sprinkler Irrigation System	757-1
758	Concrete Pressure Pipe - Steel Cylinder Type	758-1
759	Steel Pipe	759-1
760	Coating Corrugated Metal Pipe and Arches	760-1
761	Structural Plate Pipe, Arches, and Pipe Arches	761-1
765	Rubber Gaskets for Concrete Pipe	765-1
770	Structural and Rivet Steel, Rivets, Bolts, Pins, and Anchor Bolts	770-1
771	Galvanizing	771-1
772	Chain Link Fence	772-2
775	Brick and Concrete Masonry Units (Blocks)	775-1
776	Masonry Mortar and Grout	776-1
778	Lumber	778-1
779	Wood Preservatives	779-1
780	Timber Piles	780-1
781	Steel Piles	781-1
782	Concrete Piles	782-1
785	Steel Castings	785-1
786	Bronze Castings	786-1
787	Gray Iron Castings	787-1
790	Paint	790-1

792 Dust Palliative 792-1
795 Landscape Material 795-1
796 Geosynthetics 796-1
Index Index-1

PART 200

EARTHWORK

Section	Title	
201	Clearing and Grubbing	201-1
205	Roadway Excavation	205-1
206	Structure Excavation and Backfill	206-1
210	Borrow Excavation	210-1
211	Fill Construction	211-1
215	Earthwork for Open Channels	215-1
220	Riprap Construction	220-1
225	Watering	225-1
230	Dust Palliative Application	230-1

This Page is Reserved for Future Use

Materials used or work performed by the Contractor, to stabilize the subgrade so it will withstand loads which may be placed upon it by his equipment shall be accomplished by the Contractor at no additional cost to the Contracting Agency.

215.4 FILL AND BACKFILL:

Unless otherwise specified in the special provisions, material obtained from the project excavations may be presumed to be suitable for use as fill or backfill provided that all organic material, rubbish, debris, and other objectionable material is first removed. However, stone, broken portland cement concrete and bituminous type pavement obtained from the project excavations will be permitted in the backfill or fill with the limitations as specified in Section 211.

Unless otherwise specified in the special provisions, the density of fills and backfills shall be at least 90 percent.

215.5 GRADING:

Grading of unlined channels, levees and access roads shall conform to the following tolerances:

(A) A vertical tolerance of none above and 3 inches below the specified grade will be allowed on:

(1) Channel bottom

(2) Channel side slopes in both cut and fill

(3) Levee and access road side slopes in cut

(B) A vertical tolerance of none below and 3 inches above the specified grade will be allowed on:

(1) Top surface of levee and access road in both cut and fill

(2) Levee and access road side slopes in fill

Regardless of the construction tolerances specified, excavation and grading shall be performed so that finished surfaces are in uniform planes with no abrupt breaks in the surface.

Construction tolerances specified above for grading are solely for purposes of field control.

215.6 TESTS:

Density tests shall be made in accordance with Section 211.

215.7 MEASUREMENT:

If compensation for stripping is included in the price paid for other items of work the Contractor shall notify the Engineer sufficiently in advance of excavation or other work so that cross section elevations and measurements of the ground surface may be taken upon completion of stripping.

The Engineer will compute the quantity of excavation by a method which in his opinion is best suited to obtain an accurate determination.

215.8 PAYMENT:

Earthwork for open channels will be paid for on a lump sum basis or at the contract unit price per cubic yard of excavation as stipulated in the proposal. Such price shall include clearing, stripping, excavation, fill, backfill, compaction, grading, hauling, removal and disposal of excess excavated material and debris unless an alternate method of payment is stipulated in the proposal.

End of Section

SECTION 220

RIPRAP CONSTRUCTION

220.1 DESCRIPTION:

Riprap construction shall consist of furnishing and placing stone, with or without grout, and underlain with filter material of granular filter blankets or erosion control geosynthetic fabric. The depth and type of riprap shall be as shown on the plans or in the special provisions.

220.2 MATERIALS

Riprap shall conform to the requirements of Section 703.

Erosion control geosynthetic fabric shall conform to the requirements of Table 796-3 in Section 796.

Waste or sacked concrete shall not be permitted for use as riprap.

The Contractor, at no additional cost, shall provide mechanical equipment, a sorting site, and labor needed to assist in checking riprap gradation.

Granular filter blankets shall consist of processed natural material conforming to the requirements of Section 702.3, with the gradation and thicknesses as specified on the plans or in the special provisions.

220.3 PREPARATION OF GROUND SURFACES

The bed for placement of riprap shall be shaped and trimmed to provide even surfaces.

220.4 PLACEMENT OF EROSION CONTROL GEOSYNTHETIC FABRIC:

Fabric shall be placed at the locations shown on the project plans. The Contractor shall provide a surface free of obstructions, depressions, debris, and soft yielding surfaces prior to the placement of fabric. The fabric shall be loosely laid (not in a stretched condition), aligned and placed with no fold over wrinkles.

The fabric shall be placed to provide a minimum 24-inch of overlap for each joint. On horizontal joints, the uphill fabric shall overlap the downhill fabric. On vertical joints, the upstream fabric shall overlap the downstream fabric.

Bedding material shall be placed uniformly on the fabric to the depth specified on the plans and shall be free of mounds, dips, and windrows. Bedding material shall not be compacted.

220.5 RIPRAP PLACEMENT:

Riprap shall be carefully placed on filter material consisting of a granular filter blanket or the bedding material on erosion control geosynthetic fabric. Placement shall not damage the underlying filter blanket or geosynthetic fabric. If the Engineer determines that the placement of stone has damaged or displaced the filter material to the extent that it cannot function as intended, the Contractor, at his expense, shall remove the placed riprap stone and properly correct the damage to, and/or the displacement of, the filter material. Such correction may include the removal of the filter material, re-grading the affected area, and subsequent replacement of the filter material and riprap stone as required by the Engineer.

Riprap shall be placed in a manner which will produce a dense, reasonably well-graded mass without segregation and with a minimum amount of voids. The larger stone shall be evenly distributed through the riprap mass. The individual placement of larger riprap stones may be required to obtain a uniform distribution of stone size. The riprap placement shall be supplemented by such hand methods as are required to obtain a uniform finished surface. Allowable tolerance from the slope lines and grades shown for the finished riprap surfaces shall not exceed a distance equal to 1/3 of the nominal D_{50} size above or below the design surfaces. The final surface elevations shall be lower than any adjacent apron or pipe invert elevations and shall not obstruct the operation of adjacent structures. The flow line within riprap shall provide positive drainage with minimal ponding. Individual stones shall

depress below the finished grades no lower than a distance equal to 1/2 of the nominal D_{50} size. Special care shall be exercised in placing riprap within 3 feet of structures to avoid damage to such structures.

220.6 GROUTED RIPRAP:

Place riprap as specified in Section 220.5, excluding the use of filter material, then grout in place with portland cement mortar. Place grout to the depth as shown on the plan but in no case less than 70 percent of the depth of riprap. Consolidate grout into place with suitable spades, trowels or other approved means to provide a dense stone and mortar layer with all voids and interstices filled. After grout has been placed, the rocks shall be thoroughly brushed so that their top surfaces are exposed. If required, use water pressure to clean stone faces after the mortar has achieved sufficient strength. The outer rocks shall project 1/3 to 1/4 their diameter above the grouted surface.

The grout shall consist of 1 part cement and 3 parts by volume of aggregate. The portland cement shall be Type II as specified in Section 725 and the aggregate shall be 2 parts sand and 1 part gravel passing a 3/8 inch square mesh screen. The quality of the sand and gravel shall be as specified in Section 701.

The amount of water shall be such as to permit gravity flow into the interstices with limited spading and brooming. The consistency of the grout shall be as approved by the Engineer.

Except when hand mixing is permitted by the Engineer, grout shall be mixed in an approved machine mixer for not less than 1 1/2 minutes. Should hand mixing be permitted, the cement and aggregate shall be thoroughly mixed in a clean, tight mortar box until the mixture is of uniform color after which clean water shall be added in such quantity as to provide a grout of the required consistency.

220.7 MEASUREMENT:

The completed, in place riprap construction within the limits of the dimensions shown on the plans shall be measured. Measurement will be in cubic yards rounded to the nearest cubic yard.

No separate measurement will be made for erosion control geosynthetic fabric, bedding material, or grout.

220.8 PAYMENT:

Payment for riprap will be made for the accepted complete in-place riprap construction at the contract unit price. Riprap construction shall include excavation, ground surface preparation, erosion control geosynthetic fabric (if used for the project), bedding material, riprap stone, grout (if used for the project) and backfilling.

Payment for riprap shall be full compensation for furnishing all material, labor and equipment for riprap construction.

SECTION 225

WATERING

225.1 DESCRIPTION:

Water for compacting embankments, constructing subgrade, placement of screened gravel and crushed surfacing, and for laying dust caused from grading operations or public travel, shall be applied in the amounts and places as directed by the Engineer.

225.2 WATER SUPPLY:

Water shall consist of providing a water supply sufficient for the needs of the project and the hauling and applying of all water required.

The Contractor shall make arrangements for and provide all necessary water for his construction operation and domestic use at his own expense.

If the Contractor purchases water from a water utility at a fire hydrant on or near the project, all arrangements shall be made by him at his own expense and payment made direct to the water utility as agreed upon.

The Contractor shall use only those hydrants designated by the water utility in charge of water distribution and in strict accordance with its requirements for hydrant use.

The Contractor shall furnish all connections, wrenches, valves and small tools that may be necessary to meet the requirements of the water utility pertaining to hydrant use.

225.3 CONSTRUCTION EQUIPMENT:

The tank truck and/or trailer shall meet all safety and licensing regulations and the water shall be applied by sprinkling with tank trucks equipped with spray bars and suitable apparatus.

225.4 MEASUREMENT:

No measurement will be made of water, unless otherwise provided for in the special provisions or proposal.

225.5 PAYMENT:

The cost of watering will be included in the price bid for the construction operation to which such watering is incidental or appurtenant, unless otherwise provided for in the special provisions or proposal.

End of Section

SECTION 230

DUST PALLIATIVE APPLICATION

230.1 DESCRIPTION:

This section shall govern the application of dust control palliatives (agents) on unpaved roads, traffic surfaces, vacant lots, construction sites and road shoulders. Dust palliatives may also be used to protect erosion of slopes, embankments, sediment control and re-vegetated areas.

Dust palliatives may be applied as topical treatments to penetrate an undisturbed surface, or may be applied to larger areas using mixing methods that blend the product with surface material and then compact the mixture to provide a stabilized, dust resistant, surface course.

230.2 MATERIALS:

Materials to be used as dust palliatives shall conform to the requirements of Section 792. The specific dust palliative to be used shall be as shown on the plans or as directed by the Engineer.

Water used for diluting dust palliatives and for pre-wetting of treated subgrade shall be either potable or from a source compatible with dust palliative ingredients.

230.2.1 Product Verification:

The Contractor, in the presence of the Engineer or his designee, shall obtain samples of the bulk, undiluted liquid dust palliative/stabilizer product as it is delivered to the job site. Samples shall be taken from each bulk tanker that delivers the liquid dust palliative/stabilizer for product verification testing purposes. If the bulk undiluted liquid dust palliative/stabilizer is delivered in containers, a sample must be taken from each container delivered to the job site. The Engineer will select the exact locations and times of sampling. The obtained liquid dust palliative/stabilizer samples will be split in three equal portions (minimum 2 ounce each), whereby the Contractor may retain one sealed portion for verification testing, and the Engineer will retain two sealed portions. One portion of the Engineer's samples will be provided to an AASHTO accredited test lab chosen by the Contractor. The other sample will be held for backup until the testing is completed. Sample containers will be labeled and sealed under the supervision of the Engineer.

The accredited lab will test the product in accordance with ASTM D2834 to confirm that the liquid dust palliative/stabilizer meets the requirements of Section 792.2 for active solids. Contractor is responsible for the cost of product verification testing.

If the test reports indicate that the minimum acceptable active solids content value as specified in Section 792.2 is not met, the quality of the liquid dust palliative/stabilizer product shall be deemed deficient by the Engineer. The delivery and application of a deficient product shall be stopped. Work shall not resume until all product verification testing is complete or the Contractor replaces the product and initial tests on the new material show compliance.

The Contractor may perform additional verification testing on the split samples. In case of dispute where the verification tests produce different results by the Contractor than the Engineer, the Engineer will hire a different independent AASHTO accredited testing laboratory to perform a third round of testing. Such testing and the results of the testing shall be considered final by both the Engineer and Contractor for verification.

230.3 COMPLIANCE:

At least two weeks prior to the start of work, the Contractor shall provide the Engineer the following Applicator qualifications: (a) Information showing that the Applicator has at least three years of experience within the last five years serving as either a primary contractor or subcontractor in delivering and applying dust palliative/stabilizer product services, (b) A minimum 3 local references (including company/organization name, contact person and telephone number) to demonstrates that the Applicator is familiar with local environmental and permitting requirements associated with soil stabilization and dust palliative, and (c) Copy of the Applicator's State of Arizona Registrar of Contractors License.

At least two weeks prior to the start of work, the Contractor shall provide the Engineer the proposed application methods and equipment for the project. The information provided shall include: (a) curing time for each application method required for the project, (b) application and dilution rates proposed for the project, and (c) equipment to be used during all phases of application that are in conformance with Section 230.4.

Prior to the commencement of any work, the Contractor shall provide copies of all required environmental/dust control permits, any required notices of intent, and the current Material Safety Data Sheet (MSDS) for the dust palliative/stabilizer product. The MSDS must include all chemical compounds present in concentrations greater than 1% for dust palliative/stabilizer product.

230.4 EQUIPMENT:

The Contractor shall provide all equipment necessary to complete the work. The equipment may include but not be limited to motorized graders, distribution trucks, mixing and pulverizing equipment, pneumatic-tired rollers, sprinkler systems, etc. All equipment used for this work is subject to approval by the Engineer. Equipment which fails to provide an acceptable application of properly diluted dust palliative/stabilizer product or does not perform satisfactorily shall be removed from the job and replaced with acceptable equipment meeting the requirement of this specification.

Distributor trucks shall be designed, equipped, maintained and operated so that dust palliative/stabilizer product may be applied uniformly on variable widths of surface up to 16 feet at readily determined and controlled rates from 0.03 to 1.0 gallons per square yard, with uniform pressure, and with an allowable transverse variation from any specified rate not to exceed 10% or 0.02 gallon per square yard, whichever is less. The maintenance and calibration of this vehicle shall be checked periodically. The record of maintenance and calibration shall be submitted to the Engineer for review upon request.

Distributor trucks proposed for use shall have been tested within 6 months from the date of spreading to determine the rate of the transverse spread. If requested, the Contractor shall furnish the Engineer with evidence that the transverse spread of the distributor truck, when the trucks were approved for use, was as uniform as practicable and under no condition was there a variance on any of the test pads greater than the allowable transverse variation; however, the Engineer may require that each distributor truck be tested to determine the rate of the transverse spread. The rate of the transverse spread shall be determined in accordance with the requirements of Arizona Test Method 411.

230.5 PREPARATION OF SURFACE:

All surface preparation shall be in conformance with Maricopa County Rule 310 and 310.01 as applicable.

230.5.1 Topical Preparation: Prior to the application of the dust palliative, the surface shall be graded to provide drainage.

Dust palliatives shall not be applied when the surface is excessively wet or saturated. Surfaces shall be pre-moistened only if required by the product manufacturer.

230.5.2 Surface Course Preparation: Areas to receive dust palliative shall be graded and scarified to at least the minimum depth and width shown on the plans. The soil shall be scarified/loosened by tilling, disking, ripping, or by other soil preparation methods, which achieves uniform results to the minimum depth shown on the plans. The material shall be damp at time of scarification to reduce dust and aid in pulverization. Soil clods shall be pulverized until all material, exclusive of gravel or stone, will past a 2-inch sieve.

All debris, weeds, organic material, stone larger than 4 inches, etc., shall be removed from the site. Surface gravel or stones shall be removed or thoroughly mixed with the surrounding soils to obtain a homogeneous mixture.

If pre-wetting is required, ample amount of water shall be added and mixed with the in-place material to obtain a moisture content near optimum. This moisture content shall be established prior to and maintained until the application of the dust palliative. The methods to establish and maintain the moisture shall be done in accordance with manufacturer's recommendations. The moisture must be uniformly distributed throughout the surface course and over the underlying undisturbed soil. Dust palliatives shall not be applied when the soil is excessively wet or saturated. Moisture content shall be determined in accordance with either ASTM D6938 or ASTM D4944.

230.6 APPLICATION:

230.6.1 General: The dust palliative shall be applied by a pressure type distributor vehicle equipped with a power unit for the pump, full circulation spray bars adjustable laterally and vertically, and computer controls. The distribution vehicle shall be calibrated to ensure a controlled application method. Spray bars and extensions shall be of the full circulating type. Valves which control the flow from nozzles shall be of a positive active design so as to provide a uniform, unbroken spread of dust palliative on the surface.

Corners or surface that cannot be accessed by the distributor truck shall be hand sprayed by means of hoses or bars pressurized by a gear pump or air tanks.

Distributor equipment shall be equipped with a tachometer and pressure gauge. To provide for accurate, rapid determination and control of the amount of dust palliative being applied, distributor equipment shall include one or more of the following: accurate volume measuring devices, a calibrated tank, and/or a certified meter or weight tickets and calibration charts relating to the specific gravity of the concentrate and/or dilution.

The dust palliative shall be applied at the dilution ratio and application rate specified in accordance with Section 792, unless otherwise directed by the Engineer. The Contractor shall dilute the dust palliative product as needed, with the dilution ratio adjusted within the ranges specified in Section 792, to bring the mixture to the desired moisture content. Products may be applied in multiple passes at reduced application rates to meet the total application rate specified and/or assure uniform coverage.

The Contractor shall notify the Engineer a minimum of 5 working days prior to any application of dust palliative.

230.6.2 Topical Application: Topical applications shall be rolled only when recommended by the manufacturer. Complete penetration of palliative will be required prior to the surface rolling. Complete penetration occurs when the compaction equipment will not track or pick up the dust palliative and/or the top layer of the surface material.

230.6.3 Surface Course Application: The stabilization product shall be applied, incorporated and thoroughly blended into the soil until the homogeneous mixture is obtained to the full depth of treatment. Mixing shall be done in-place using mixing equipment or by motorized grader (blade mixing). The blending methods utilized shall result in a uniformly treated mixture of soil and dust palliative at or near optimum moisture content (minus any post-compaction dust palliative top coat application quantity). The dilution ratio may be adjusted to bring the mixture to the desired moisture content. The amount of area treated each day shall be limited to that which the Contractor can thoroughly mix and compact within that work day.

Complete penetration of palliative will be required prior to compaction. Complete penetration occurs when the compaction equipment will not track or pick up the blended material.

The blended material shall be shaped to the required grade line and cross section shown on the plans and be compacted at least 95% of maximum density in accordance with ASTM D 698, unless otherwise directed by the Engineer. The final surface shall be rolled to a smooth and even grade. Sufficient grading shall be done to provide reasonable drainage within the limits of existing drainage patterns. Immediately after the compaction, a top coat of dust palliative shall be applied.

230.7 CURING:

No equipment or traffic will be permitted on the treated surface for 24 hours unless otherwise approved by the Engineer. Once cured, the dust palliative final coat shall form a skin at the surface or a crusted surface. For purpose of this work, a “skin” on the surface will be a formation of any palliative on the surface of the soil that cannot be dislodged from the soil by winds. Any formation of the palliative on the soil surface must adhere to the underlying soil to a depth of 1/8th inch when applied topically.

230.8 WEATHER CONDITIONS:

Dust palliative/stabilizer product shall be applied only when the ambient temperature is above 50°F. Application should be avoided during high wind or when there is the chance of rain within the next 8 hours. The Contractor shall be responsible to retreat at no additional cost if the application is degraded by weather within the first 24-hours of placement.

230.9 QUALITY CONTROL

The Contractor must provide manufacture-trained personnel for on-site technical assistance during initial delivery and application. This technical assistance is to assure that the dust palliative/stabilizer product is applied to proper dilution ratios and application rates on various soil, and subgrade types for optimum results.

At the start of each work day, the bulk tanker will be measured to verify the gallons of liquid dust palliative/stabilizer product brought to the job site. At the end of the day, the bulk tanker will be measured to verify the gallons of liquid dust palliative/stabilizer product remaining at the job site. The distributor truck shall be inspected to insure it is empty at the end of the day. The total gallons of liquid dust palliative/stabilizer product used for the day will be established by the start and end of day measurements of the bulk tanker.

A daily "Gallon Use Report" will be filled out by the distributor truck driver. The report will also identify the size of area treated for the day. It will be verified and signed by the Engineer or his designee. This report will be used to verify application rate and total product used. If the report indicates that the minimum application rate was not achieved, the work shall be deemed deficient by the Engineer.

230.10 DEFICIENCIES AND WARRANTY

If applied product active solids content is found deficient per Section 230.2.1, the Engineer may allow the Contractor to apply to any surfaces already treated by the deficient product additional topical coats of the dust palliative/stabilizer product to remedy the deficiency. Otherwise, the Contractor shall be required to repeat all work as directed by the Engineer with a different approved liquid dust palliative/stabilizer product that is compatible with the original product and will not result in adverse effects. The Contractor shall bear the cost of all remediation work for deficient product.

If the application rate as determined by the methods described in Section 230.9 or as agreed to in the contract documents is found to be deficient, the Contractor shall apply additional product within 24-hours of the original application to bring the total application rate to at least the minimum specified amount. If liquid dust palliative/stabilizer product was used as a soil stabilizer per Section 230.6.3, as directed by the Engineer, the Contractor shall re-scarify the stabilized section to its full depth and re-apply product at the original application rate. The Contractor shall bear the cost of all remediation work for deficient application rate.

For non-traffic areas (less than 150 vehicle trips per day), application of the dust palliative/stabilizer product placed in accordance with this Section shall provide a surface meeting the stabilization requirements of Maricopa County Rule 310 Section 302 and Maricopa County Rule 310.01 Section 302 for a minimum of 12 months from acceptance by the Engineer.

During the warranty period, the Contractor shall provide and install the product free of charge if the finished project fails to meet the performance requirement and specification/criteria outlined under this technical specification. The Contractor shall provide additional applications when within five working days of notification from the Engineer of performance failure.

230.11 MEASUREMENT:

Dust palliative surface course application shall be measured by the square yard, in place, treated, compacted, to the proper depth and accepted.

Dust palliative materials will be measured by the ton of undiluted material. Any conversion from volumetric quantities shall be done with Contractor-supplied calibration charts relating to the specific gravity of the concentrate and/or dilution.

230.12 PAYMENT:

Payment will be made for the applicable items at the Contract unit prices bid in the proposal, and shall constitute full compensation for the item completed, as herein described and specified.

PART 300

STREETS AND RELATED WORK

Section	Title	
301	Subgrade Preparation	301-1
306	Mechanically Stabilized Subgrade-Geogrid Reinforcement	306-1
309	Lime Slurry Stabilization	309-1
310	Untreated Base	310-1
311	Soil Cement Base Course	311-1
312	Cement Treated Base	312-1
313	Bituminous Treated Base Course	313-1
315	Bituminous Prime Coat	315-1
317	Asphalt Milling	317-1
320	Road-mixed Surfacing	320-1
321	Asphalt Concrete Pavement	321-1
323	Heater Remix Resurfacing	323-1
324	Portland Cement Concrete Street Pavement	324-1
325	Asphalt-Rubber Concrete Overlay, GAP Graded	325-1
327	Hot In-Place Recycling	327-1
329	Tack Coat	329-1
330	Asphalt Chip Seal	330-1
331	Microsurfacing Specifications	331-1
332	Asphalt Emulsion Slurry Seal Coat	332-1
333	Fog Seal Coats	333-1
334	Preservative Seal for Asphalt Concrete	334-1
335	Hot Asphalt-Rubber Seal	335-1
336	Pavement Matching and Surfacing Replacement	336-1
340	Concrete Curb, Gutter, Sidewalk, Sidewalk Ramps, Driveway and Alley Entrance	340-1
341	Terrazzo Sidewalks	341-1
342	Decorative Pavement Concrete Paving Stone or Brick	342-1
343	Exposed Aggregate Paving	343-1
345	Adjusting Frames, Covers, Valve Boxes and Water Meter Boxes	345-1
350	Removal of Existing Improvements	350-1
360	Telecommunications Installation	360-1

This Page is Reserved for Future Use

SECTION 306

MECHANICALLY STABILIZED SUBGRADE - GEOGRID REINFORCEMENT

306.1 DESCRIPTION:

Mechanically stabilized subgrade shall consist of furnishing and placing a geogrid material within or below untreated base to provide a stabilized platform on which paving materials are placed. Geogrid type, fill thickness, pavement cross-section and associated details, shall be as shown on the contract drawings.

306.2 MATERIALS:

The geogrid material shall be supplied in accordance with and conform to the material requirements of Section 796 and Table 796-4.

306.3 SUBGRADE PREPARATION:

The geogrid shall not be placed when weather or surface conditions do not meet the manufacturer's recommendations for installation.

306.3.1 Placing Geogrid on Soft Subgrade: Prior to placement of geogrid material, soft subgrade shall be lightly proof rolled to provide a firm surface, brought to grade and shaped to conform to the typical sections, lines and grades as shown on the plans. The surface on which the geogrid will be placed shall be free of rock and other material that could damage the geogrid. The placement of the geogrid shall be approved by the Engineer before placement of overlaying materials.

Subgrade tolerances shall be in accordance with MAG Section 301.4.

306.3.2 Placing Geogrid Within Untreated Base: Subgrade shall be prepared in accordance with MAG Section 301.

306.4 EQUIPMENT:

Mechanical or manual laydown equipment shall be capable of laying the geogrid properly and smoothly, in compliance with the manufacturer's recommendations.

306.5 GEOGRID PLACEMENT:

The geogrid shall be installed in accordance with the installation guidelines provided by the manufacturer or as directed by the Engineer.

The geogrid may be temporarily secured in place with ties, staples, pins, sand bags or acceptable fill material as required by fill placement procedures, weather conditions, or as directed by the Engineer. A 12-inch minimum secured overlap is required at all joints (both transverse and longitudinal). At transverse joints, the preceding roll shall overlap the following roll in the direction that the aggregate base will be placed. The geogrid shall be rolled out along the alignment in the direction of advancing construction. All wrinkles and folds shall be removed.

The geogrid shall be tensioned by hand and anchored to the ground at the edges, including overlaps, and in the center of the roll at 30-foot intervals along the roll length, at the corners if applicable, or as directed by the Engineer. Securing locations may be reduced or eliminated if it can be shown to the satisfaction of the Engineer that an alternative installation process will provide satisfactory results.

Geogrid shall be placed to obtain full coverage of the indicated area. Placement of geogrid on irregular shaped areas and radii may require cutting of the geogrid material and the use of diagonal overlapping joints. Buckling of geogrid material will not be allowed.

306.6 PLACING AND COMPACTING AGGREGATE FILL:

The aggregate shall be back dumped and spread in a uniform lift maintaining the design aggregate thickness at all times. The aggregate material shall be bladed on the geogrid in such a manner that the aggregate rolls forward onto the grid ahead.

When underlying substrate is trafficable with minimal rutting, rubber-tired equipment may pass over geogrid reinforcement at slow speeds (less than 10 mph). Sudden stops and turning by trucks shall be avoided on the geogrid. Traffic shall not be allowed onto coated geogrid materials. A minimum loose fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles shall be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.

Any ruts which develop during spreading or compacting aggregate fill shall have additional aggregate added rather than bladed from surrounding areas. Placing additional aggregate into the rutted areas limits disturbance to the underlying geogrid keeping it intact.

Untreated base shall be compacted as specified in Section 310. Untreated base material shall not be mixed or processed on the geogrid. Base materials will be uniformly blended and sampled for acceptance prior to placement on the geogrid material. Contamination and segregation of base materials during placement shall be minimized.

306.7 REPAIR:

Any geogrid material damaged before, during or after installation shall be replaced by the contractor at no additional cost to the Agency.

Replacement of geogrid reinforcement shall consist of removal and replacement of the geogrid and aggregate fill from the defective area. The aggregate fill shall be removed at least 3 feet beyond the limits of the defective area. The replacement geogrid shall be installed with proper overlaps. Aggregate fill replacement shall not commence until placement of the geogrid material has been inspection and approved.

306.8 PAYMENT:

The surface area of accepted in-place geogrid reinforcement will be measured to the nearest square yard.

Payment for geogrid reinforcement at the contract unit price shall be full compensation for furnishing all labor, material, equipment, and installing complete in place the geogrid as shown on the project plans.

321.7 TRANSPORTATION:

Petroleum distillates or other substances that will have a detrimental effect on the asphalt concrete shall not be used as a release agent.

The beds of all transportation units shall be clean and smooth to allow the free flow of material into the paving machine's hopper.

Tarpaulins shall be furnished on all trucks and used when weather condition warrant, or if directed by the Engineer.

321.8 PLACEMENT:

321.8.1 Placing: All courses of asphalt concrete shall be placed and finished by means of a self-propelled paving machine equipped with an automatically actuated control system, except under certain conditions or at locations where the Engineer deems the use of a self-propelled paving machine impracticable.

The control system shall control the elevation of the screed at each end by controlling the elevation of one end directly and the other end indirectly either through controlling the transverse slope or alternatively when directed, by controlling the elevation of each end independently.

The control system shall be capable of working with one of the following devices:

(A) Ski or non-contact device of not less than 30 feet in length, supported throughout its entire length
(B) Taut stringline or wire set to grade
(C) Short ski or sonar sensing units from curb control
(D) Joint matching shoe

Failure of the control system to function properly shall be cause for the suspension of asphalt concrete production. In order to achieve a continuous operation, the speed of the paving machine shall be coordinated with the hot mix plant and transport units.

If the asphalt concrete is dumped from the hauling vehicles directly into the paving machine, care shall be taken to avoid jarring the machine or moving it out of alignment. No vertical load shall be exerted on the paving machine by the truck.

If asphalt concrete is dumped upon the surface being paved and subsequently loaded in the paving machine, the loading equipment shall be self-supporting and shall not exert any vertical load on the paving machine. Substantially all of the asphalt concrete shall be picked up and loaded into the paving machine.

Self-propelled paving machines shall spread the mixture without segregation or tearing, true to line, grade and crown indicated on the Project plans. Pavers shall be equipped with hoppers and augers that will distribute the mixture uniformly in front of an adjustable floating screed. The raising of the hopper wings must be minimized and the paving machine will not be operated when in an empty condition.

Screeds shall include any strike-off device operated by tamping or vibrating action which is effective, without tearing, shoving or gouging the mixture and which produces a course with a uniform texture and density for the full width being paved. Screeds shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required. In the case of the screed, auger extensions and vibrators shall be installed wherever the screed is extended more than one (1) foot beyond the end of the base auger or auger extension. However, when placing material against an extremely uneven curb or edge over a short distance, the Engineer may waive the auger extensions and vibrators.

At any place not accessible to the roller, the mixture shall be thoroughly compacted with tampers to provide a uniform and smooth layer over the entire area compacted in this manner.

321.8.2 Joints: Transverse joints, before a surface course is placed in contact with a cold transverse construction joint, the cold existing asphalt concrete shall be trimmed to a vertical face for its full depth and exposing a fresh face. After placement and finishing the new asphalt concrete, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in

the area of the joint shall not deviate more than ¼ inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, parallel to the centerline.

Longitudinal Joints of each course shall be staggered a minimum of 6 inches with relation to the longitudinal joint of the immediate underlying course cold transverse construction joint, the cold existing asphalt concrete shall be trimmed to a vertical face for its full depth and exposing a fresh face. The fresh face shall be tacked prior to placement of the adjacent course. After placement and finishing the new asphalt concrete, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than ¼ inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, parallel to the centerline. The joint will be tack coated if required by the Engineer.

321.8.3 Leveling Course: A leveling course shall be used when specified, or as directed in writing by the Engineer, to bring existing pavement to a uniform grade prior to placing an overlay or other course. If a leveling course is being applied on an Asphalt surface, a tack coat shall be applied. The compaction requirements contained in Section 321.10 do not apply to leveling courses.

321.8.4 Compaction Base and Surface: It is the contractor's responsibility to perform any desired Quality Control monitoring and/or testing during compaction operations to achieve the required compaction. Asphalt concrete immediately behind the laydown machine shall be referenced to Table 321.3. The probe type thermocouple thermometer shall have a current calibration sticker attached. When measuring the temperature of the mat, the probe shall be inserted at mid-depth and as horizontal as possible to the mat.

Asphalt compaction equipment shall be of sufficient size and weight to accomplish the required compaction. All compaction equipment shall be operated and maintained in accordance with the manufacturer's recommendations and the project requirements. During the rolling operation, the speed of the roller shall not exceed 3 miles per hour, unless otherwise approved by the Engineer.

Pneumatic tired compactors shall be equipped with skirt-type devices mounted around the tires so that the temperature of the tires will be maintained during the compaction process.

The Engineer will determine the acceptability of the pavement compaction in accordance with Section 321.10.

321.8.5 Smoothness: 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 one-fourth (¼) inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway.

321.8.6 Asphalt Concrete Overlay: Asphalt concrete overlay consists of the placing and compacting plant mix asphalt concrete over existing asphalt concrete paving. The thickness of the overlay shall be as shown on the plans or as specified in the special provisions. Preliminary preparation of existing surfaces will be required except when accomplished by the Contracting Agency, and it is so stipulated in the special provisions. With the exception of those which have been preheated and remixed only, existing surfaces shall receive a tack coat.

Asphalt concrete mix aggregate gradation and percentage of asphalt binder shall be in accordance with Section 710 using a 1/2-inch Marshall-Low Traffic asphalt concrete mix designation for overlay more than one and one-half inch in thickness and a 3/8-inch Marshall-Low Traffic asphalt concrete mix designation for overlay one and one-half inch or less in thickness, unless otherwise shown or specified in the special provisions.

Except when they have been preheated and remixed, pavement surfaces shall be prepared as follows:

(a) Before placing asphalt concrete overlay, severely raveled areas or cracked areas that are depressed more than 3/4-inch from the adjoining pavement shall be cut out and patched at least 48 hours prior to the resurfacing operation. Over-asphalted areas or rough high spots shall be either milled or cut out and patched. Large shrinkage cracks shall be filled with asphalt sealing compound acceptable to the Engineer. The entire surface shall be cleaned with a power broom. Raveled areas that do not require removing shall be cleaned by hand brooming. The above are incidental, and the cost thereof shall be included in the bid items.

(b) Before placing asphalt concrete overlay, milling shall be done as shown on the plans or specified in the special provisions and shall be in accordance with Section 317.

(c) After surfaces have been prepared to the satisfaction of the Engineer, they shall receive a tack coat per Section 321.4. Traffic will not permitted over surfaces which have received a tack coat. When the overlay is to extend onto the concrete gutter, the gutter shall be throughly cleaned of loose dust and cement particles and shall be tack coated.

Asphalt concrete overlay shall be placed as specified in Section 321.8.1 and compacted as specified in Section 321.8.4. The surface smoothness shall meet the tolerances specified in Section 321.8.5.

Manholes shall be built up and the frames set flush with the finished surface of the new paving, and tops of value boxes, clean-outs and other existing structures shall be adjusted to finish grade. In the event the base course and original paving have been removed or disturbed in order to build up the manhole, they shall be replaced with approved materials which shall be throughly compacted. The asphalt concrete around the manhole frame shall be completed and made flush with the adjacent overlay.

321.8.7 Pavement Fabric Interlayer: Pavement fabric interlayer shall be used only when specified on the plans or in the specifications.

Pavement fabric interlayer shall be in accordance with Table 796-1 and be the class designated on the plans or in the specifications.

Asphalt binder coat used to bond the fabric to the pavement shall be paving asphalt PG 70-10 asphalt cement conforming to the requirements of Section 711. The application and distributing equipment for the asphalt binder shall conform to the requirements of Section 330. The asphalt binder coat shall be uniformly spray applied to the prepared pavement surface at the rate of 0.20 gallons per square yard for Class B fabric or at the rate of 0.25 gallons per square yard for Class A fabric. Some underlying surfaces may require a higher or lower application rate. A test strip may be necessary to determine the proper application rate. The width of liquid asphalt cement application shall be the fabric width, plus six inches.

Neither the asphalt binder coat or fabric interlayer shall be placed when weather conditions, in the opinion of the Engineer, are not suitable. The asphalt binder and fabric interlayer shall only be placed when the pavement is dry, the ambient air temperature is 50 degrees F and rising, and pavement temperature is 40 degrees F and rising.

Equipment for placing the fabric shall be mechanized and capable of handling full rolls of fabric. The equipment shall be able to lay the fabric smoothly to maximize pavement contact and remove air bubbles. Stiff bristle brooms shall be used to smooth the fabric. The equipment used to place the fabric shall be in good working order and is subject to approval by the Engineer.

Pavement fabric interlayer shall not be placed if the in-place binder is hotter than 325 degrees F or has cooled to 180 degrees F or below (as determined by non-contact thermometer).

Pavement fabric interlayer shall be placed onto the asphaltic binder with the heat bonded side up with a minimum amount of wrinkling or folding. Remaining wrinkles or folds 1-inch and larger shall be removed or slit and shingle-lapped in the direction of paving. Burning or torching of wrinkles is not allowed. Fabric shall overlap three to six inches to insure full closure of the joint. Transverse joints shall be shingle-lapped in the direction of paving to prevent edge pickup by the paver. A second application of hand-placed asphalt binder may be required at laps and repairs as determined by the Engineer to ensure proper binding of the narrow double fabric layer.

All areas where fabric has been placed shall be paved with asphaltic concrete during the same workshift. Placement of the asphaltic concrete shall closely follow fabric lay down. The temperature of the asphaltic concrete immediately behind the laydown machine shall not exceed 325 degrees F. In the event that the asphalt binder coat bleeds through the fabric causing construction problems before the overlay is placed, the affected areas shall be sanded with a sand blotter in compliance with Section 333. Excess sand shall be removed before beginning the paving operation. In the event of rainfall prior to the placement of the asphaltic concrete, the fabric shall be allowed to dry before the asphalt concrete is placed.

Turning of the paving machine or of other vehicles on the fabric shall be gradual and kept to a minimum to avoid damage to the fabric. Should equipment tires stick to the fabric during pavement operations, small quantities of paving asphalt concrete shall be broadcast on the fabric to prevent pick-up. Decrease of binder rate in order to minimize pick-up on tires is not allowed.

TABLE 321.2

MINIMUM ASPHALT CONCRETE PLACEMENT TEMPERATURE

Base [1] Temp (°F)	Mat Thickness (inches)					
	½	¾	1	1 ½	2	3 and greater
40 – 50	---	---	310	300	285	275
50 – 60	---	310	300	295	280	270
60 – 70	310	300	290	285	275	265
70 – 80	300	290	285	280	270	265
80 – 90	290	280	270	270	265	260
+90	280	275	265	265	260	255

(1) Base on which mix is to be placed

321.9 QUALITY CONTROL:

It is the contractor's responsibility to perform Quality Control monitoring and/or testing during asphalt concrete production to achieve the required compaction and to perform Quality Control monitoring and/ or testing during asphalt concrete production to achieve the required mix properties. The Engineer may obtain samples of any portion of any material at any point of the operations for his own use. Also, the Engineer may order the use of any drying, proportioning and mixing equipment or the handling of any material discontinued which, in his/her opinion, fails to produce a satisfactory mixture.

The asphalt concrete produced shall conform to the properties of the mix design. When the asphalt concrete does not conform to the approved mix design properties, it shall be reported to the Engineer, and corrective quality control measures shall be implemented, or production shall cease immediately at no additional cost to the contracting Agency or Engineer.

321.10 ACCEPTANCE:

321.10.1 Acceptance Criteria: Unless otherwise specified, asphalt concrete will be divided into lots for the purpose of acceptance. A lot shall be considered to be one day's production. When the quantity of asphalt concrete placed in a day exceeds 500 tons but is less than 2000 tons, the lot shall be divided into 500 ton sublots or fraction thereof. Where the quantity of asphalt concrete placed in a day exceeds 2000 tons, the day's production will be divided into four (4) approximately equal sublots. A minimum of one sample will be obtained from each lot. Tests used to determine acceptance will be performed by the Engineer or a laboratory employed by the Engineer. In either case the laboratory shall be accredited by the AASHTO Accreditation Program (AAP), for the tests being performed. The acceptance laboratory will take representative samples of the asphalt concrete from each sublot to allow for gradation, binder content, air voids, pavement thickness and compaction of base and surface course. Each sublot will be accepted based upon the test data from the sample(s) from that sublot. All acceptance samples shall be taken using random locations or times designated by the Engineer in accordance with ASTM D 3665.

321.10.2 Gradation, Binder Content and Air Voids: The acceptance laboratory will take a sample of the asphalt concrete in accordance with the requirements of Section 2 or 4 of Arizona Test Methods 104 or AASHTO T168 from each sublot. The minimum weight of the sample shall be 45 pounds. Asphalt binder content and gradation shall be determined in accordance with AASHTO T308 using the ignition furnace for each sublot. The acceptance laboratory is responsible for obtaining the necessary materials and performing an ignition furnace calibration as outlined in AASHTO T308 for each asphalt concrete mixture utilized on the project. The correction factor used for each test shall be clearly indicated on the report. The bulk density for Marshall Mix designs shall be tested in accordance with AASHTO T245. The bulk density for Gyratory mix designs shall be tested in

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 321-6, 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.

TABLE 321-6	
ASPHALT PAVEMENT THICKNESS PAYMENT REDUCTION **For Thickness Deficiency of More Than 0.25 inches and less than 0.50 inches**	
Specified Mat Thickness	**Reduction in Payment or Corrective Action**
Less than 1.5 inches	50%
1.50 inches to 1.99 inches	33%
2.00 inches to 2.49 inches	25%
2.50 inches to 2.99 inches	20%
3.00 inches and over	17%

321.10.5 Density: Achieving the required compaction is the responsibility of the contractor. The number and types of rollers is the contractor's responsibility and shall be sufficient to meet these requirements.

In-place air voids shall be determined in accordance with AASHTO T269 utilizing cores taken from the finished pavement. The maximum theoretical density used in the determination of in-place air voids will be the average value from the acceptance samples determined for the Lot as outlined in 321.10.1.

The Engineer will designate two random test locations for each sublot and the acceptance laboratory will obtain two cores from each location. The two cores will be averaged for acceptance. The outside one foot of each pass of the pavement course or any unconfined edge will be excluded from testing. The Engineer may exclude areas from the compaction lot that are not accessible by normal compaction equipment.

The Contractor will provide the traffic control to facilitate any coring operations necessary for compaction acceptance.

Cores will be taken per the Asphalt Concrete Coring Method. This method can be found in Section 321.14. The acceptance laboratory will furnish test results within three working days of receipt of the cores.

If the pavement density has in-place voids of 8.0% or less, the asphalt concrete will be paid for at the contract unit price. If the pavement density has in-place voids greater than 8.0%, the limits of the deficient area will be isolated within the sublot by coring at maximum intervals of 100 feet from the deficient core. The in-place voids of the original deficient core will be averaged with the in-place voids of the cores taken from 100 feet on each side of it to determine compliance with the acceptance requirements. If the average of the in-place voids is greater than 8.0% then Table 321-6 shall apply to the sublot.

TABLE 321-7		
PAVEMENT DENSITY PENALTIES		
Limits of In-place Air Voids Less than 1.5 inches	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
8.1% to 9.0%	$4.00	EA
9.1% to 10.0%	$6.00	EA and Type II Surry Seal
10.1% to 11.0%	Removal*	Removal*
Greater than 11.0%	Removal	Removal

Notes: Removal refers to Section 321-10.6. The Contractor shall remove and replace the entire sublot that is deficient. Removal for In-place Air Voids greater than 11.0% is not eligible for Section 321.10.6.

321.10.6 Engineering Analysis (EA): Within 10 working days after receiving notice that a sublot of asphalt concrete is deficient for "Removal" by the Engineer, the contractor may submit a written proposal (Engineering Analysis) to accept the material in place at the applicable penalties listed in the "Removal" category. Engineering Analysis can also be proposed for non-removal categories of "Corrective actions" when the contracting agency is not the owner (i.e. permits).

The Engineering Analysis shall contain an analysis of the anticipated performance of the asphalt concrete if left in place. The Engineering Analysis shall also detail the effect of any proposed corrective action on the performance. The Engineering Analysis shall be performed by a professional engineer experienced in asphalt concrete testing and mix designs. If the sublot is submitted for referee testing by the contractor, the ten working days allowed to prepare an engineering analysis will begin upon notification of referee test results.

When an Engineering Analysis recommends that a specific lot or sublot not be removed, the Engineering Analysis will recommend that the following penalties (Table 321-8) be paid when the contracting agency is the owner, for the specific criteria being reviewed by the EA.

TABLE 321-8		
ENGINEERING ANALYSIS PENALTIES for REMOVAL* LOTS/SUBLOTS LEFT IN-PLACE		
Acceptance Criteria	**Acceptance Limits**	**Penalty When Contracting Agency is the Owner ($/Ton)**
Asphalt Binder Content	Over 0.2% points from that Permitted	$9.00
Laboratory Air Voids (Measured at N_{des} or 75 blows as applicable)	Less than 1.5% or Greater Than 8.0%	$3.75
Limits of In-place Air Voids	10.1% to 11.0%	$9.00

Within 15 working days, the Engineer will determine whether or not to accept the contractor's proposed Engineering Analysis.

321.11 REFEREE:

In the event the contractor elects to question the acceptance test results for a sublot, the Contractor may make a written request for additional testing of that sublot. The Contractor will engage an independent laboratory (at the Contractors own expense) who

Is accredited by AAP in all of the acceptance tests. The independent laboratory shall be acceptable to the Engineer and shall perform a complete new set of acceptance tests (as required by Section 321.10 representing the area or set of tests in question).

These tests shall include asphalt binder content, aggregate gradation, Marshall or Gyratory unit weight, and maximum theoretical unit weight. Samples for referee testing shall come from representative samples obtained from the completed pavement, as directed by the Engineer.

The number of samples taken will be the same as specified in Section 321.10. The independent laboratory shall compile the test results and transmit them to both the Engineer and the Contractor. The independent laboratory shall include a letter signed by an Engineer registered in the State of Arizona, who is experienced in asphalt concrete testing and mix designs. The signed letter shall give an opinion that the material evaluated either does or does not comply with project specifications, and shall clearly describe any deficiencies, and the results will be binding between all parties.

321.12 MEASUREMENT:

Asphalt concrete pavement will be measured by the ton, or by the square yard, for the mixture actually used as allowed above, which shall include the required quantities of mineral aggregates, asphalt binder, and mineral admixture. Measurement shall include any tonnage used to construct intersections, roadways, streets, or other miscellaneous surfaces indicated on the plans or as directed by the Engineer.

321.13 PAYMENT:

The asphalt concrete measured as provided above will be paid for at the contract price per ton or square yard, as adjusted per Section 321.10, which price shall be full compensation for the item complete, as herein described and specified.

Payment for tack coat will be by the ton diluted, based on the rate of application, as directed by the Engineer.

No payment will be made for any overrun in quantity of asphalt concrete in excess of 10 percent based on actual field measurement of area covered, design thickness, and the mix design unit weight. The calculations and payment for overrun will be by individual pay item. To compensate or adjust for a thickness deficiency in an underlying asphalt concrete course, the Engineer may authorize a quantity increase in excess of 10 percent for a subsequent asphalt concrete course. In such cases, the quantity in excess of 10 percent will be paid for at the lowest unit price.

Except as otherwise specified in the special provisions, no separate payment will be made for work necessary to construct miscellaneous items or surfaces of asphalt concrete.

321.14 ASPHALT CORE METHOD: Core Drilling of Hot Mix Asphalt (HMA) for Specimens of 4" or 6" diameter

321.14.1 Scope: This method is to establish a consistent method of the use of a diamond bit core to recover specimens of 4 or 6 inch diameter for laboratory analysis and testing. The method will require the use of: water, ice (bagged or other suitable type), dry ice, and a water-soap solution to be utilized when coring asphalt rubber concrete. Individuals doing the specimen recovery should be observing all safety regulations from the equipment manufacturer as well as the required job site safety requirements for actions, and required personal protective equipment.

321.14.2 Core Drilling Device: The core drilling device will be powered by an electrical motor, or by an acceptable gasoline engine. Either device used shall be capable of applying enough effective rotational velocity to secure a drilled specimen. The specimen shall be cored perpendicularly to the surface of pavement, and that the sides of the core are cut in a manner to minimize sample distortion or damage. The machinery utilized for the procedure shall be on a mounted base, have a geared column and carriage that will permit the application of variable pressure to the core head and carriage throughout the entire drilling operation. The carriage and column apparatus shall be securely attached to the base of the apparatus; and the base will be secured with a mechanical fastener or held in place by the body weight of the operator. The core drilling apparatus shall be equipped with a water spindle to allow water to be introduced inside of the drill stem while operating. The cutting edge of the core drill bit shall be of

hardened steel or other suitable material with embedded diamond chips in the cutting surface. The core barrel shall be of sufficient diameter to secure a specimen that is a minimum of four or six inches or whichever is prescribed for necessary testing. The core barrel shall not be missing more than one of the teeth used for cutting; if so it shall be discarded and another barrel shall be used. The core barrel shall also be a minimum of two inches longer than the anticipated depth of pavement in accordance with project paving plans.

321.14.3 Accessory Equipment: A sufficient supply of ice and dry ice shall be provided to sufficiently cool the pavement prior to securing the samples from the designated areas in the pavement. The ice should also be used to adjust the temperature of the water used to cool the core bit. A water supply (usually a plastic 35 – 55 gal drum) with sufficient hose to introduce the water into and through the spindle of the coring device by gravity feed. The drum should be white or light in color to minimize excessive thermal heating of the water (*for coring of asphalt rubber cores see Note 1*). At no time shall the water utilized in the coring operation exceed 65° F during the coring operation. Ice shall be utilized o ensure the temperature control of the water being introduced during the cutting operation. An ice chest or other suitably insulated container that can maintain a temperature of less than 70° F shall be used to secure the specimens during transport. The container will be equipped with flat shelving that will support the drilled cores throughout the entire specimen dimension during transport back to the testing facility.

Miscellaneous hand tools to remove the drilled specimen from the drill hole or the core barrel taking great care in not disturbing the specimen more than necessary (refer to fig. 1 in ASTM D 5361-05).

321.14.4 Process: The pavement surface at the time of coring shall not exceed a temperature of 90° F, the pavement shall be conditioned with ice or dry ice to ensure that this requirement is met. Immediately after it has been ensured that the pavement has dropped to the required temperature, core drilling shall begin. The operator will then apply an even and continuous pressure (Note 2) to penetrate through the full depth of the pavement. The operator will concurrently ensure that enough water is moving over the core surface as to adequately remove any and all cuttings that could damage the drilled core. After the pavement thickness has been penetrated the core shall be carefully removed from either the drill hole or the core barrel and be immediately transferred to an ice chest or other suitable container. Each individual core shall be placed on a shelf in the cooler with the exposed side of the specimen facing down, or the "top side" down. If the specimen is a two lift core, the only acceptable means of separating lifts is with a power or other acceptable wet saw type of equipment (conforming to ASTM D 5361-05); however, at no time shall cores be split using a mallet and screwdriver or metal straight edge when being tested for bulk density. Perpendicularity of the specimen shall be checked in the field after the specimen has been extracted from the surface. The core operator shall hold the core up to eye level and place the core top side down in a "speed square" or small carpenters square. The specimen placed in the square shall not depart from perpendicular to the axis more than 0.5^{o} (approximately equivalent to 1/16 of an inch in 6 inches). If the specimen is outside of this distance from square it shall be discarded in the field and another sample cored that falls within tolerance. The cores upon arriving at the laboratory for testing shall be carefully cleaned and measured for thickness in accordance with ASTM D 3549. A speed square shall be utilized to measure squareness as compared to a 90° degree angle and shall not depart from perpendicular to the axis more than 0.5^{o} (approximately equivalent to 1/16 of an inch in 6 inches). All remaining testing shall be done within the parameters of the current project and / or agency required specification.

End of Section

• **Note 1** – It should be noted that when the material to be cored is a rubberized asphalt mixture a wetting agent such as liquid dish soap shall be added to the water barrel to hinder the material from sticking or allowing the binder to spread during coring.
• **Note 2** – This refers to pressure exerted on the core barrel and machine during the coring process. Too much pressure can cause damage to the core barrel and the motor; and too little pressure can cause a glazing of the diamonds, reducing cutting efficiency and premature wear of the barrel.

SECTION 322

Moved to Section 321.8.6 and revised.

SECTION 323

HEATER REMIX RESURFACING

323.1 DESCRIPTION:

Heater remix resurfacing consists of heating, scarifying and remixing existing asphalt concrete paved surfaces, and unless otherwise specified in the special provisions, followed by the application of a rejuvenating agent and an asphalt concrete overlay.

323.2 COORDINATION:

There shall be close coordination between those performing the heating and remixing operation and those placing the asphalt concrete overlay.

323.3 WEATHER CONDITIONS:

Heater remix resurfacing shall not be done when it is raining or there is a threat of rain. The ambient temperature shall be at least 50°F. and rising and the application shall cease when the temperature is 55°F. and falling.

323.4 SURFACE PREPARATION:

The pavement to be treated shall be cleaned of trash, debris, earth or other deleterious substances present in sufficient quantity to interfere with the work to be performed.

323.5 HEATER SCARIFY REMIX EQUIPMENT:

The heater remixer shall consist of an insulated 8-12 foot minimum adjustable width heating furnace chamber with ports to inject fuel and air for satisfactory combustion without excessive smoke. The use of highly volatile fuels for heating, such as gasoline, will not be permitted within the boundaries of any incorporated City. Use of said highly volatile fuels for heating may be permitted in unincorporated areas only if authorized in writing by the Engineer prior to such use. The burners shall be rated at 10,000,000 BTU per hour minimum. The hourly production shall be not less than 1100 square yards of heated and remixed surface. Movable exhaust ducts shall be provided and equipped with shields to protect trees and adjacent shrubbery. The heating chamber and scarifier shall be positively controlled by side shifting and rear wheel steering to heat areas divergent from the central axis of the machine at intersections and along existing structures. The scarifier shall be sectioned and spring tensioned to insure continuous and undiminished pavement contact. It shall be equipped with automatic release mechanism to protect manholes and valve boxes from damage.

323.6 HEATING AND REMIXING:

Prior to heating and remixing, all manholes in the path of the heater shall be checked for presence of explosive gases and ventilated, if necessary. The existing surface shall be evenly heated and remixed to a depth of from 0.05 to 0.08 foot by a continuously moving surface heater remixer machine. The remixed surface shall be left in an evenly spread condition and aggregate shall not be pulverized, spalled or broken. At least 80 percent of the aggregate shall be remixed by spinning or tumbling and heated to a minimum temperature of not less than 250°F. measured within 3 minutes following heating. The asphalt binder shall not be charred in excess of 0.10 of 1 percent. No uncontrolled heating causing differential softening of the upper surfaces without affecting the underlying structure will be permitted. The remixed layer shall be uniformly and evenly heated throughout.

323.7 ASPHALT REJUVENATING AGENTS:

Following the mixing operation, an asphalt rejuvenating agent, or emulsion, if required, of the type designated in the contract, shall be applied at the rate hereinafter specified, by a pressure distributor while the remixed material is still hot. The pressure distributor shall be as specified in Section 330.

Where the contract requires the use of an asphalt rejuvenating agent, or emulsion, it will designate one of the following types:
(A) Type I asphalt rejuvenating agent, a cationic oil and resin emulsion, shall comply with Section 718 and shall be applied at the rate of 0.07 to 0.15 gallons of undiluted concentrate per square yard. However, the exact quantity shall be as directed by the Engineer.

The Contractor shall furnish the Engineer with the brand name and name of the manufacturer of the Type I asphalt rejuvenating agent he proposes to use and the material shall be approved by the Engineer before it is used. The Contractor shall also furnish the Engineer with a manufacturer's certificate of compliance indicating quality and specification control.

(B) Type II asphalt emulsion shall be SS-1 or SS-1h emulsified asphalt as specified in Section 713 and shall be applied at the rate of 0.10 to 0.20 gallons per square yard undiluted. However, the exact quantity shall be as directed by the Engineer.

323.8 ASPHALT CONCRETE OVERLAY:

Asphalt concrete overlay shall be in accordance with applicable requirements specified in Section 321.8.6.

The asphalt concrete overlay shall be placed within 48 hours after the heating and remixing operation, unless otherwise specified in the special provisions.

The overlay shall also cover existing pavement over areas not accessible to the heater remixer. Such areas including edges of adjoining concrete, shall receive a tack coat and joints shall be finished as specified in Section 321.

323.9 PAYMENT:

Payment for heater remix surfacing will be made on the basis shown below:

(A)	Heater Remix Only	Square Yard
(B)	Type I Asphalt Rejuvenating Agent	Ton (Undiluted)
(C)	Type II Asphalt Emulsion	Ton (Undiluted)
(D)	Asphalt Concrete Overlay	Ton or Square Yard
(E)	Tack Coat	Ton (Diluted)

End of Section

SECTION 324

PORTLAND CEMENT CONCRETE STREET PAVEMENT

324.1 DESCRIPTION:

This item shall consist of construction of a pavement composed of plain jointed portland cement concrete on a prepared subgrade. The Contractor shall furnish all labor, materials and equipment necessary for the construction of the pavement in accordance with these specifications and in reasonably close conformity to the lines, grades, thicknesses and details indicated by the plans or as established by the Engineer. All tests shall be performed by a laboratory approved by the Engineer.

324.2 MATERIALS:

324.2.1 Portland Cement Concrete: Portland cement concrete shall conform to the applicable requirements of MAG Standard Specifications Section 725 and the additional requirements of this section.

Concrete shall develop a modulus of rupture of not less than 520 psi within 14 days after placement, and not less than 650 psi at 28 days' age as determined by tests of specimens fabricated in accordance with ASTM C-31 and tested in accordance with ASTM C-78 procedures. The Contractor shall submit data acceptable to the Engineer at least 30 days in advance of the start of concrete paving operations which demonstrate that concrete produced with materials and proportions as proposed for use in the construction will conform to the modulus of rupture requirements of these specifications. The data shall include results of compressive strength tests conducted at the same age as modulus of rupture tests to establish the correlation which can be expected between the flexural and compressive strength properties of the concrete. The Engineer may, at his option, use compressive strength tests of specimens fabricated in accordance with ASTM C-31 and tested in accordance with ASTM C-39 to verify conformance to the modulus of rupture requirements of these specifications.

The maximum concrete slump shall be as determined by the approved mix design.

324.2.2 Concrete Materials: Portland cement conforming to the requirements of ASTM C-150 for Type III, low-alkali, may be used at the Contractor's option. Aggregates shall be crushed rock or gravel conforming to the requirements of ASTM C-33. Coarse aggregate gradation shall conform to requirements for Size No. 57. Fine aggregates shall have an average sand equivalent of not less than 75 when tested in accordance with the requirements of AASHTO T-176 or ASTM D-2419.

324.2.3 Reinforcement: Tie bars shall be deformed billet steel reinforcing bars conforming to the requirements of ASTM A-615, Grade 40.

Dowel bars shall be plain round bars conforming to the requirements of ASTM A-615, Grade 40. One-half the length of each dowel bar shall be painted with one coat of tar paint.

Metal sleeves of an approved design shall be provided for use with dowel bars. Sleeves shall cover 2 inches, plus or minus 1/4 inch, of the dowel, shall have a closed end with a suitable stop to hold the end at least 1 inch from the end of the bar, and shall be designed to prevent collapse during construction. An approved basket support shall be used to hold bars parallel to pavement surface.

324.2.4 Curing Materials: Materials for curing concrete shall conform to the requirements of Section 726.

324.2.5 Joint Materials: Joint sealant shall be a one component, hot-poured type, conforming to the requirements of ASTM D-3406.

Back-up rod or tape and bond breakers provided to control the depth of sealant, achieve the desired shape factor, support sealant against indentation and sag, or to prevent bond of the sealant to the bottom concrete surface shall be compatible with the joint sealant material.

Other pour-type joint sealants conforming to the requirements of Subsection 729.2 may be used if approved by the Engineer.

Preformed expansion joint filler shall conform to the requirements of ASTM D-1751.

SECTION 325

ASPHALT-RUBBER CONCRETE OVERLAY, GAP GRADED

325.1 DESCRIPTION:
Asphalt-rubber concrete consists of supplying, placing and compaction of plant mixed gap graded asphalt-rubber concrete over asphalt surfaces. The thickness of the finished asphalt-rubber concrete overlay shall be within the range of one to two inches as shown on the plans or as specified in the special provisions.

325.2 MATERIALS:
Asphalt-rubber concrete shall consist of a mixture of aggregate and asphalt-rubber binder. Tack coat, asphalt-rubber concrete mix and transportation thereof shall be as specified in Sections 710 and 321, except as modified below:

325.2.1 AGGREGATE:
The aggregate shall meet the following gradation:

Sieve Size	Percent Passing
1/2 inch	100
3/8 inch	78-92
#4	28-42
#8	15-25
#30	5-15
#200	3-7
*Type II portland cement	1.5%
Or	
*Hydrated Lime	1.0%

***By total weight of the mineral aggregate.**

The aggregate shall conform to the requirements of Sections 701 and 710 for asphalt concrete, except as modified below:

Sand Equivalent	65% minimum
Crushed Aggregate retained on #8 sieve (at least one crushed face, produced by crushing)	85% minimum

325.2.2 Asphalt-Rubber Binder: The asphalt-rubber binder shall conform to Section 717.

325.2.3 Mix Designs: At the Pre-Construction Meeting, the Contractor shall submit the name of the asphalt-rubber concrete supplier, a description of the materials, and the job mix design(s). The design method used shall be in accordance with the Marshall Mix procedure, 75 blows, as described in "Design Methods for Hot-Mixed Asphalt-Rubber Concrete Paving Materials" by James G. Chehovits, October 1989. The job mix designs are subject to approval by the Engineer.

Asphalt Rubber Binder Content:

The percent of asphalt-rubber binder in the mix(es) shall be within the following range:

Traffic Condition	Asphalt Rubber Binder
Low Traffic	8.4% to 8.8%
High Traffic	8.0% to 8.4%

The amount of asphalt-rubber binder in each mix shall be provided in the design subject to approval by the Engineer. Low traffic areas include residential streets. High traffic areas include arterial streets.

Air Voids:
The percent of air voids in the mix(es) shall be within the following range:

Traffic Condition	Air Voids
Low Traffic	3.0% to 5.0%
High Traffic	4.0% to 6.0%

The amount of air voids in each mix shall be provided in the design subject to approval by the Engineer.

Mix designs shall include the following information as a minimum:

(1) Aggregate
- Source and identification (for each material used)
- Gradation (for each material used)
- Blend percentage
- Mixture gradation

(2) Asphalt - Rubber Binder (No extender oil allowed)
- Source and PG grade of asphalt cement
- Source and identification of ground rubber
- Ground rubber gradation
- Ground rubber percentage of the asphalt - rubber binder
- Type and amount of additive(s), if required
- Temperature when added to aggregate

(3) Recommended asphalt - rubber binder content by both weight of total mix and by weight of dry aggregate.

(4) Recommendations for maximum / minimum temperatures during material production and lay down; and the allowable ambient air and existing pavement surface temperatures during lay down.

The mix design shall include sufficient test results and documentation to assure that all requirements for rubber, aggregate and the asphalt-rubber binder are fulfilled.

325.2.4 Calibration Factors: A minimum of one week prior to the production of asphalt rubber hot mix, the Contractor shall submit to the Engineer samples of all hot mix materials that will be used on the project. The materials shall be used to determine the calibration factors using the acceptance laboratory and the Contractor supplied ignition furnaces and related quality control test equipment. Calibration factors shall be recalculated whenever a change in the asphalt rubber hot mix materials occurs and when requested by the Engineer.

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 (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, 1/2 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 1/2 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.

PART 500

STRUCTURES

Section	Title	
501	Driving Piles	501-1
505	Concrete Structures	505-1
506	Precast Prestressed Concrete Members	506-1
510	Concrete Block Masonry	510-1
511	Brick Masonry	511-1
515	Steel Structures	515-1
520	Steel and Aluminum Handrails	520-1
525	Pneumatically Placed Mortar	525-1
530	Painting	530-1

This Page is Reserved for Future Use

The quantity of concrete will be calculated considering any mortar used to cover construction joints as being concrete. The cost of cement used in any mortar for covering construction joints, patching, or other uses in the structure being constructed, in excess of that required for the design mix of the adjacent concrete, shall be absorbed in the cost of the item of work of which said mortar is a part.

505.11.3 Deck Joint Assemblies:

Deck joint assemblies will be measured to the nearest tenth of a foot. Measurement will be made along the centerline of the joint, at the surface of the roadway, from face-to-face of curb or barrier. No measurement will be made for that portion of the deck joint assembly required by plan details to extend through the barrier face or curb; that portion of the joint assembly will be considered incidental to the sealing of the joint.

505.11.4 Bridge Railing, Curbs, Barriers, and Approach Slabs

Bridge Pedestrian Fence and Curb, Bridge Pedestrian Fence and Parapet, and Bridge Fence and Parapet will be measured to the nearest tenth of a foot, from end post to end post.

Bridge Traffic and Pedestrian Rail will be measured to the nearest foot, determined from the outside dimensions of the rail.

Bridge Concrete Barrier will be measured to the nearest tenth of a foot.

Barrier Concrete Barrier Transition will be measured as a unit for each constructed.

Reinforced Concrete Approach Slab will be measured to the nearest square yard.

505.12 PAYMENT:

Payment for portland cement concrete structures will be made in conformity with the terms of the contract and will be based on unit prices and/or lump sums as set forth in the proposal. Such payment shall include full compensation for furnishing all labor, materials, tools and equipment, preparation of subgrade for placing of concrete and doing all work required to construct the structures in conformity with the plans and specifications.

505.12.1 Reinforcing Steel: The accepted quantities of reinforcing steel, of the type indicated on the Project Plans or specified in the Special Provisions, and measured in conformance with Section 505.11.1 will be paid for at the contract unit price per pound, complete in place.

The accepted quantity of dowels placed will be paid for at the contract unit price for Dowel Placement, which shall be full compensation for the work, complete in place. Steel reinforcement furnished for the dowels will be measured and paid for under the pay item Reinforcing Steel.

No measurement or direct payment will be made for dowels which are required to replace existing reinforcing steel that is damaged as a result of the Contractor's operations; the Contractor shall furnish and place such dowels at his own expense.

505.12.2 Concrete: Payment for Portland cement concrete structures will be made in conformity with the terms of the contract and will be based on unit prices and/or lump sums as set forth in the proposal. Such payment shall include full compensation for furnishing all labor, materials, tools and equipment, preparation of subgrade for placing of concrete, and doing all work required to construct the structures in conformity with the plans and specifications.

Where concrete is scheduled for payment on the basis of cubic yards, the calculation of the quantity of concrete for payment will be made only to the neat lines of the structures as shown on the plans and on the basis of the concrete having the specified lengths, breadths, and thicknesses. The quantity of such concrete will be calculated considering the mortar used to cover construction joints as being concrete and no deductions will be made for rounded or beveled edges, space occupied by reinforcing steel, metal inserts, or openings 5 square feet or less in area. The cost of cement used in mortar for covering construction joints, patching, or other uses in the structure being constructed, in excess of that required for the design mix of the adjacent concrete, shall be absorbed in the item of work of which said mortar is a part.

An adjustment in the contract unit price, to the nearest cent, will be made for the quantity of concrete represented by the results of cylinder strength tests that are less than the specified 28-day compressive strength. Strength tests will be conducted in accordance with Section 725.8 of the Uniform Standard Specifications. The adjustment in contract unit price, if the concrete is accepted, will be based on Table 725-2 in Section 725.9.

The contract unit price for structural concrete shall include full compensation for all items incidental to providing a concrete structure complete in place, including waterstops, roadway drains, scuppers, metal inserts, and bearing pads.

505.12.3 Minor Concrete Structures and Accessories:

The accepted quantities of:

Minor Structures	Each
Deck Joint Assemblies	0.1 Foot
Bridge Pedestrian Fence and Curb	0.1 Foot
Bridge Pedestrian Fence and Parapet	0.1 Foot
Bridge Fence and Parapet	0.1 Foot
Bridge Traffic and Pedestrian Rail	Foot
Bridge Concrete Barrier	0.1 Foot
Bridge Concrete Barrier Transition	Each
Reinforced Concrete Approach Slab	Square Yard

will be paid for at the unit price and/or lump sums as set forth in the proposal. The contract unit price shall include full compensation for all labor, materials, tools and equipment necessary to provide the concrete structure or accessory complete in place, including all concrete, reinforcing steel, and items embedded in the concrete, such as anchor bolts, grates and frames, metal inserts, etc.

End of Section

PART 600

WATER AND SEWER

Section	Title	
601	Trench Excavation, Backfilling and Compaction	601-1
602	Encasement of Water or Sewer Pipe by Jacking or Tunneling Operation	602-1
603	Installation for High Density Polyethylene Pipe	603-1
604	Placement of Controlled Low Strength Material	604-1
605	Subdrainage	605-1
610	Water Line Construction	610-1
611	Disinfecting Water Mains	611-1
615	Sewer Line Construction	615-1
616	Reclaimed Water Line Construction	616-1
618	Storm Drain Construction	618-1
620	Cast-In-Place Concrete Pipe	620-1
621	Corrugated Metal Pipe and Arches	621-1
625	Manhole Construction and Drop Sewer Connections	625-1
630	Tapping Sleeves, Valves and Valve Boxes on Water Lines	630-1
631	Water Taps and Meter Service Connections	631-1

This Page is Reserved for Future Use

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 Chambers 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 unit price bid each 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

Section	Title	
701	Rock, Gravel, and Sand	701-1
702	Base Materials	702-1
703	Riprap	703-1
705	Portland Cement Treated Base	705-1
709	Reclaimed Asphalt Pavement	709-1
710	Asphalt Concrete	710-1
711	Paving Asphalt	711-1
712	Liquid Asphalt	712-1
713	Emulsified Asphalts	713-1
714	Microsurfacing Materials	714-1
715	Slurry Seal Materials	715-1
716	Cover Material	716-1
717	Asphalt-rubber	717-1
718	Preservative Seal for Asphalt Concrete	718-1
719	Recycled Asphalt Concrete Hot Mixed	719-1
725	Portland Cement Concrete	725-1
726	Concrete Curing Materials	726-1
727	Steel Reinforcement	727-1
728	Controlled Low Strength Material	728-1
729	Expansion Joint Filler	729-1
735	Reinforced Concrete Pipe	735-1
736	Non-reinforced Concrete Pipe	736-1
737	Asbestos-cement Pipe and Fittings for Storm Drain and Sanitary Sewer	737-1
738	High Density Polyethylene Pipe & Fittings for Storm Drain & Sanitary Sewer	738-1
741	Lining for Reinforced Concrete Sanitary Sewer Pipe	741-1
743	Vitrified Clay Pipe	743-1
744	ABS Truss Pipe and Fittings	744-1
745	PVC Sewer Pipe and Fittings	745-1

750 Iron Water Pipe and Fittings 750-1
752 Asbestos-cement Water Pipe and Fittings 752-1
753 Galvanized Pipe and Fittings 753-1
754 Copper Pipe, Tubing and Fittings 754-1
755 Polyethylene Pipe for Water Distribution 755-1
756 Dry Barrel Fire Hydrants 756-1
757 Sprinkler Irrigation System 757-1
758 Concrete Pressure Pipe - Steel Cylinder Type 758-1
759 Steel Pipe 759-1
760 Coating Corrugated Metal Pipe and Arches 760-1
761 Structural Plate Pipe, Arches, and Pipe Arches 761-1
765 Rubber Gaskets for Concrete Pipe 765-1
770 Structural and Rivet Steel, Rivets, Bolts, Pins, and Anchor Bolts 770-1
771 Galvanizing 771-1
772 Chain Link Fence 772-2
775 Brick and Concrete Masonry Units (Blocks) 775-1
776 Masonry Mortar and Grout 776-1
778 Lumber 778-1
779 Wood Preservatives 779-1
780 Timber Piles 780-1
781 Steel Piles 781-1
782 Concrete Piles 782-1
785 Steel Castings 785-1
786 Bronze Castings 786-1
787 Gray Iron Castings 787-1
790 Paint 790-1
792 Dust Palliative 792-1
795 Landscape Material 795-1
796 Geosynthethics 796-1

SECTION 701

ROCK, GRAVEL, AND SAND

701.1 GENERAL:

The following specifications set forth the requirements for crushed rock, gravel, sand, and quarry stone. Samplings and sieve analysis shall be performed in accordance with ASTM D-75 and ASTM C-136. Sand equivalents shall be determined in accordance with AASHTO T-176. The liquid limit and plasticity index shall be determined in accordance with AASHTO T-89 and T-90.

701.2 CRUSHED ROCK AND GRAVEL:

Rock and gravel shall be clean, hard, sound, durable, uniform in quality, and free of any detrimental quantity of soft, friable, thin elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.

The loss by abrasion in the Los Angeles abrasion machine, determined as prescribed in ASTM C-131, Grading A, shall not exceed 10 percent, by weight, after 100 revolutions nor 40 percent after 500 revolutions.

701.2.1 Crushed Rock: Crushed rock shall consist of the product obtained by crushing rock, stone, or gravel so that at least 50 percent by weight of aggregate retained on the No. 4 sieve for 3/4 inch or larger maximum sizes, and 50 percent retained on the No. 8 sieve for maximum sizes less than 3/4 inch shall consist of particles which have at least one rough, angular surface produced by crushing. All material that will pass a grizzly with bars spaced 15 inches apart, clear opening, shall be crushed when producing from the Contracting Agency's source.

The gradation of crushed rock shall comply with ASTM D-448.

701.2.2 Gravel: Material designated herein as gravel shall be composed entirely of particles that are either fully or partially rounded and water-worn. Crushed rock obtained by crushing rock which exceeds ASTM D-448 maximum gradation sizes may be combined provided it is uniformly distributed throughout and blended with the gravel. The quality and gradation requirements shall be as stated in this specification.

701.3 AGGREGATE:

Sand shall be fine granular material produced by the crushing of rock or gravel or naturally produced by disintegration of rock and shall be sufficiently free of organic material, mica, loam, clay, and other deleterious substances to be thoroughly suitable for the purpose for which it is intended.

701.3.1 Sand for Asphalt Concrete Pavement: Sand for asphalt concrete pavement shall comply with AASHTO M-29 except that grading requirements shall be deleted and have a minimum sand equivalent of not less than 50 and shall be non-plastic when tested in accordance with AASHTO T-89 and T-90.

701.3.2 Sand for Mortar and Plaster: It shall be thoroughly and uniformly washed and shall be entirely free from oil and deleterious substances.

The average value of sand equivalent determined on 3 successive samples shall not be less than 70. No individual sample shall have a sand equivalent less than 65.

The size and grading of sand to be used in mortar, and plaster shall be such as to conform with the requirements specified as follows:

Mortar:	ASTM C-144
Plaster:	ASTM C-35

701.3.3 Aggregate for Portland Cement Concrete: Coarse and fine aggregate shall conform to the applicable requirements of ASTM C-33.

Coarse aggregate grading requirements shall conform to the appropriate rock size designation in the Grading Requirements for Coarse Aggregate Table. Fine aggregate grading requirements shall conform to the Fine Aggregate Grading section.

The average value of 3 successive sand equivalent samples shall not be less than 70 when tested in accordance with AASHTO T-176. No individual sample shall have a sand equivalent less than 65.

The loss by abrasion in the Los Angeles abrasion machine, determined as prescribed in ASTM C-131, Grading A, shall not exceed 10 percent, by weight, after 100 revolutions nor 40 percent after 500 revolutions.

701.3.4 Aggregate for Masonry Grout: The size and grading of the fine or coarse aggregate to be used in masonry grout shall conform to ASTM C-404.

701.3.5 Aggregate for Controlled Low Strength Material: Coarse aggregate shall conform to ASTM C-33 grading size No. 57. The size and gradation of fine aggregates (sand) shall conform to ASTM C-33.

701.4 QUARRY STONE:

701.4.1 General: Quarry stone shall be angular, sound, durable, hard, resistant to abrasion; free from laminations, weak cleavages, and undesirable weathering, leaching, exfoliation tendencies, and slaking; and of such character that it will not disintegrate from the action of air, water, or the conditions to be met in handling and placing. Stone shall be clean and free from deleterious impurities, including alkali, earth, clay, refuse, and adherent coatings. Suitable tests and/or service records will be used to determine the acceptability of the stone. Tests to which the material may be subjected include petrographic analysis, X-ray diffraction, specific gravity, absorption, abrasion, rock drop, soundness, wetting and drying, and such other tests as may be considered necessary to demonstrate to the Engineer that the materials are acceptable for use in the work. In connection therewith, the Contractor shall notify the Engineer in writing at least 60 days prior to use of the intended sources of quarry stone.

701.4.2 Test Requirements: Quarry stone shall meet the following requirements except as may be otherwise provided on the plans and in the special provisions:

(A) Apparent specific gravity: 2.65 minimum.

(B) Breakdown:

Rock drop breakdown:	5 percent maximum
Abrasion breakdown at 1000 revolutions:	40 percent maximum
Breakdown after 10 cycles of wetting and drying:	5 percent maximum
Solubility in water, breakdown, or softening:	None

701.4.3 Test Methods: Unless otherwise specified in the special provisions or indicated on the plans, test methods for quarry stone shall be as follows:

(A) Apparent specific gravity per ASTM C-127.

(B) Abrasion characteristics to be determined by either Rock Drop Test or Los Angeles Rattler, ASTM C-131, as required on the plans or the special provisions.

(1) Standard Rock Drop Test. Tests shall be made on groups of 5 accurately weighed sizes of rocks: No. 1, ranging from 75 to 100 lbs.; No. 2, 100 to 125 lbs.; No. 3, 125 to 150 lbs.; No. 4, 150 to 175 lbs.; No. 5, 175 to 225 lbs.

Each rock of the 5 sizes shall be dropped 3 times on the group of the other 4, in an enclosure, from successive heights of 10, 15, and 18 feet. The enclosure shall have a flexible medium weight galvanized iron floor or equivalent, set on a solid foundation.

Order of dropping shall be Nos. 3, 2, 4, 1, 5. All rock passing a 3 inch square mesh screen after test shall be weighed and recorded

as a percentage of the total initial weight of the 5 rocks.

(2) Los Angeles abrasion machine, per ASTM C-131, Grading B.

(C) Wetting and drying. The stone shall be crushed, screened, and 1000 or 1500 grams of the 3/4 inch to 3/8 inch fraction taken for the test.

The crushed and graded stone shall be submerged in water for 18 hours at room temperature, after which the sample shall be drained and oven-dried at 140°F. When dry, the sample shall be cooled to room temperature. This would complete one cycle.

The percent loss shall be determined by screening the tested sample on a No. 4 sieve and shall be computed as follows:

$$\frac{100 \times \text{Weight of Materials Passing No. 4 Sieve}}{\text{Total Weight of Sample}} = \%\ \text{Loss}$$

(D) Accelerated water breakdown and solubility test. Air-dry samples of representative stone weighing approximately 1 lb. each shall be immersed for 8 hours at 140°F., in distilled water, local tap water, or 3.5 percent sodium chloride solution.

End of Section

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			
	Percentage by Weight Passing Sieve		
Sieve Sizes (Square Openings)	Select Material		Aggregate Base
	Type A	Type B	
3"	100		
11/2"		100	
11/4"			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 703

RIPRAP

703.1 STONE:

Stone for plain and grouted riprap shall meet the requirements of Section 701.4. Stone shall be angular, rounded stone shall only be allowed when specified. Flat or needle shapes will not be acceptable unless the thickness of the piece is more than 1/3 the length.

Stone shall be color-matched with adjacent landscape aggregate if specified on the plans or in the special provisions.

703.2 SIZE OF STONE:

Unless otherwise indicated the maximum stone size shall be 150% of the indicated D_{50} size and the minimum stone size shall be 50% of the indicated D_{50} size.

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
38053	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

The RAP and the combined new aggregate shall be weighed on separate belt scales. They shall be of such accuracy that, when the plant is operating between 30 percent and 100 percent of belt capacity, the average difference between the indicated weight of the material delivered and the actual weight delivered will not exceed 1 percent of the actual weight for three 2-minute runs. For any of the three individual 2-minute runs, the indicated weight of material delivered shall not vary from the actual weight delivered by more than 2 percent of the actual weight. The actual weight of material delivered shall be determined by a vehicle platform scale or other certified weighing device approved by the Engineer.

The individual belt scales for the RAP and the combined new aggregate, the proportioning meters for the new asphalt and RA, and the other proportioning devices, shall be interlocked so that the rates of feed of the RAP, new aggregate, new asphalt, and RA will be adjusted automatically to maintain the proper proportions. The plant shall not be operated unless this automatic system is operating and in good working condition.

Belt scales and proportioning meters shall be equipped with resettable totalizers, so that the actual weight of asphalt, RA, RAP, and combined aggregates can be determined. The bins containing the mineral filler, if used, shall be equipped with a vibrating unit or other equipment which will prevent any hang-up of material while the plant is operating. Before the quantity of material in any one bin reaches the strike-off capacity of the feed gate, a device shall automatically close down the plant.

When mineral filler is used, a safe and suitable sampling device shall be installed in each feed line or surge tank preceding the proportioning device.

719.7.3 RAC Miscellaneous Requirements: New aggregate consisting of sand, rock dust, and various sizes of aggregates shall be stored separately at the plant and evenly fed to the dryer to ensure a uniform flow of properly combined aggregates. In placing materials in storage or in moving them from storage to the feeder, no method shall be used which may cause segregation, degradation, or the intermingling of different size aggregates. Materials not meeting the gradation requirements shall be discarded or reprocessed to comply with the requirements of Section 710.

End of Section

SECTION 725

PORTLAND CEMENT CONCRETE

725.1 GENERAL:

Portland cement concrete shall be composed of cementitious materials, fine and coarse aggregates, water, and, if specified or allowed, certain chemical admixtures and additives.

TABLE 725-1		
CONCRETE CLASSES - MINIMUM REQUIREMENTS		
Class of Concrete	Minimum Cementitious Materials Content (lbs. per cubic yard)	Minimum Compressive Strength (1) at 28 Days (psi)
AA	600	4000
A	520	3000
B	470	2500
C	420	2000

(1) In accordance with section 725.8.

725.2 CEMENTITIOUS MATERIALS:

Cementitious materials to be used or furnished under this specification shall be:

Portland cement, meeting the requirements of ASTM C-150
- Type II, low alkali, when no other specific type is specified
- Type III, low alkali, for high early strength, when applicable or specified
- Type V, low alkali, when specified in the special provisions for applications requiring high sulfate resistance

Portland Pozzolan Cement ASTM C-595
- Type IP (MS), when no other specific type is specified

Supplementary Cementitious Materials (SCM) shall not be used as an additional cementitious materials replacement in concrete in combination with Portland Pozzolan Cement.

Cementitious materials shall be sampled and tested as prescribed in the applicable ASTM specifications. The Contractor shall obtain and deliver to the Engineer a certification of compliance signed by the material manufacturer, identifying the cementitious material and stating that the cementitious material delivered to the batching site complies with the appropriate specifications. When requested by the Engineer, the Contractor shall furnish 3 copies of the cementitious materials certification. The cost of furnishing tested cementitious materials shall be considered as included in the contract bid price and no additional allowance will be made therefore.

When suitable facilities, as recommended by the Concrete Plant Manufacturer's Bureau, and approved by the Engineer, are available for handling and weighing bulk cementitious materials, such facilities shall be used. Otherwise the cementitious material shall be delivered in original unopened sacks that bear the name or brand of the manufacturer. The type of cementitious material, and the weight contained in each sack shall be plainly marked thereon.

Cementitious materials shall be stored in such manner as to permit ready access for the purpose of inspection and identification, and so as to be suitably protected against damage by contamination or moisture. Should any lot of bulk cementitious material be delivered to the site show evidence of contamination, the Engineer may require that such lot be removed from the site.

725.2.1 Supplementary Cementitious Materials (Pozzolans): Supplementary Cementitious Materials to be used in concrete or furnished under this specification shall conform to the appropriate ASTM requirements as follows:

Fly ash or natural pozzolan	ASTM C-618 and C-311
Silica Fume	ASTM C-1240

Up to 25 percent by weight of the Table 725-1 minimum cementitious materials requirements may be an approved fly ash or natural pozzolan. Additional pozzolanic material in excess of the minimum Table 725-1 requirements may be incorporated into a concrete mix design to achieve enhanced performance, upon approval of the Engineer.

The Contractor shall obtain and deliver to the Engineer a certification of compliance signed by the pozzolan supplier identifying the pozzolanic material and stating the pozzolan delivered to the batching site complies with the appropriate specifications. The cost of furnishing tested pozzolan shall be considered as included in the contract bid price and no additional allowance will be made therefore.

Pozzolanic materials shall be handled and stored in the same manner as other cementitious materials. When facilities for handling a bulk pozzolan are not available, the pozzolan shall be delivered in original unopened sacks bearing the name and brand of the supplier, the type and source of the pozzolan, and the weight contained in each sack plainly marked thereon.

725.3 AGGREGATES:

Coarse aggregates, consisting of crushed rock or gravel or a combination thereof, and fine aggregate shall conform to the requirements prescribed in Section 701.3.3. Prior to the delivery of the aggregates and whenever required during concrete production, the Contractor shall make stockpiles available to the Engineer for testing. All required samples shall be furnished at the expense of the Contractor, and the cost of sampling and testing shall be at the expense of the Contracting Agency.

725.4 WATER:

The water used for mixing concrete shall be potable or shall meet the requirements of ASTM C-1602, when tested by a qualified independent testing laboratory.

725.5 ADMIXTURES AND ADDITIVES:

Admixtures or additives of any type, except as otherwise specified, shall not be used unless identified in the approved mix design or authorized by the Engineer.

Water reducing admixtures incorporated into the approved concrete mix design shall meet the requirements of ASTM C-494 for the appropriate type.

Air entraining admixtures incorporated into the approved concrete mix design shall meet the requirements of ASTM C-260.

Pigments incorporated into the approved concrete mix design for integrally colored concrete shall meet the requirements of ASTM C-979.

Fibers incorporated into the approved concrete mix shall meet the requirements of ASTM C-1116.

Any admixtures used shall be included in the bid price for that item.

725.6 MIX DESIGN PROPORTIONING:

A concrete mix design carrying the producer's designated mix number for each type of concrete being furnished under these specifications shall be submitted to the Engineer at least once each year for approval. Each design shall utilize the proper proportioning of ingredients to produce a concrete mix that is homogeneous and sufficiently workable to provide a consistent and durable concrete product that meets the specified compressive strength and other properties as required by the application.

In the event there is a modification to the mix design proportions:

(A) Modifications that do not require a new mix design submittal/approval:

(1) Modifications which do not result in batch target weights for the fine aggregate or combined coarse aggregates changing by more than 5 percent from the original approved mix design.

(2) Modifications to the percentage of coarse aggregate fractions that do not change the total coarse aggregate volume.

(3) Modifications to dosages of chemical or air-entraining admixtures, within the manufacturer's recommendations.

(4) The incorporation or elimination of chemical admixtures which are listed on the mix design to effect a change in the time-of-set (retarders or accelerators).

(B) Modifications that require a new mix design submittal/approval and may require performance verification:

(1) Modification to the class of concrete per Table 725-1.

(2) Modification to the type/class/source of cement, fly ash, natural pozzolan, or silica fume.

(3) Modification to the percentage of fly ash, natural pozzolan, or silica fume.

(4) Modification to a coarse aggregate size designation.

(5) Modification of the type of chemical admixture, or the incorporation or elimination, of an air-entraining admixture.

(6) Modification of coarse or fine aggregate source.

725.7 MIXING:

All proportioning/batching/mixing equipment shall comply with the standards of the Concrete Plant Manufacturer's Bureau and the certification requirements of the Arizona Rock Products Association or National Ready Mixed Concrete Association. The proportioning shall consist of combining the specified sizes of aggregates with cementitious materials, admixtures/additives, and water as herein provided. No method which may cause the segregation or degradation of materials shall be used.

Weighing and metering devices used for the purpose of proportioning materials shall fulfill requirements as to accuracy and tolerance prescribed by the Weights and Measures Division of the State of Arizona and shall be sealed and certified in accordance with the procedures established by this agency. This certification shall not be over 12 months old and shall be renewed whenever required by the Engineer. When portable plants are set up at a new or temporary location, the scales and scale assembly shall be inspected and certificate issued regardless of the date when the scales were last tested. The Engineer may require the Contractor to run a quick scale check at any time with certified weights furnished by the Contractor and order the scale recertified if necessary.

Any admixture/additive shall be measured accurately by mechanical means into each batch by equipment or in a method pre-approved by the Engineer.

The equipment for measuring and supplying the water in the mixer shall be so constructed and arranged that the amount of water to be added to the mixture can be measured, in gallons or by weight. The amount of water shall be varied in accordance with the percentage of free moisture in the material and the requirements of the workability of the aggregate.

Machine mixing will be required in all cases unless pre-approved by the Engineer. Regardless of the method employed, mixing shall be commenced as soon as possible after the cementitious material is placed in contact with the aggregates or water. All concrete mixers shall be of such design and construction, and so operated, as to provide a thoroughly and properly mixed concrete in which the ingredients are uniformly distributed.

725.7.1 Paving and Stationary Mixers: Paving and stationary mixers shall comply with the standards of the Concrete Plant Manufacturer's Bureau and the certification requirements of the Arizona Rock Products Association or the National Ready Mixed Concrete Association.

Mixers shall be maintained in proper and serviceable working condition, and any part or portion thereof that is out of order, or becomes worn to such extent as to detrimentally affect the quality of mixing, shall be promptly repaired or replaced.

The proper proportions of aggregate, cementitious materials, admixtures/additives and water for each batch of concrete shall be placed in the mixer, and shall be mixed for a period of not less than 50 seconds after all such materials are in the drum.

The rotating speed at which the mixer shall be operated shall conform to that recommended by the manufacturer.

The total volume of materials mixed in any one batch shall neither exceed the water level capacity of the mixer nor the manufacturer's catalog rated capacity of the mixer.

725.7.2 Transit Mixers: Transit mixers shall meet the requirements of the Truck Mixer Manufacturer's Bureau and the certification requirements of the Arizona Rock Products Association or the National Ready Mixed Concrete Association. Ready mix concrete and shall comply with ASTM C-94 except as herein specified.

Each mixer and agitator shall have attached thereto in a prominent place a metal plate or plates, installed by the manufacturer, on which is plainly marked the capacity of the drum in terms of the volume of mixed concrete and the speed of rotation for the agitating and mixing speeds of the mixing drum or blades.

Each mixer shall have an identification number painted on the truck in such a location that it can be easily read from the batching platform.

The total volume of materials introduced into the mixer for mixing purposes shall not exceed the manufacturer's guaranteed mixing capacity. If the concrete so mixed does not meet the uniformity requirements of this section, the amount of materials charged into the mixer shall be reduced.

The rotation speed at which the mixer shall be operated shall conform to that recommended by the manufacturer.

Each batch of concrete placed in the mixer shall be mixed for not less than 70 nor more than 100 revolutions of the drum or blades, at the speed designated by the manufacturer of the equipment as mixing speed. Additional mixing shall be at the agitating speed designated by the manufacturer of the equipment. The revolving of the drum shall be continuous until the concrete is completely emptied from the drum. Before any portion of the materials for any batch of concrete is placed therein, the drum of the mixer shall be completely emptied of the previously mixed batch.

At the time of delivery to the job site, the Engineer shall be provided with a legible delivery ticket which shall contain the following information:

Date and Truck Number.

Name of the Supplier.

Name of the Contractor.

Specific designation of job (name and location).

Number of cubic yards in the batch.

Time the transit mixer is loaded.

Amount of water added at the job site at request of receiver, and his signature or initials.

Suppliers' mix design code number.

Type and amount of admixture or additive that is not already included in the approved mix design, if any.

Serial number of the ticket.

Additional water may be added on the jobsite in accordance with ASTM C-94 Tolerances in Slump section to adjust slump providing the slump after such water addition does not exceed the maximum allowed by these specifications in section 725.9 (A) (1) and that water so added is mixed into the batch for a minimum of 30 additional revolutions at mixing speed. Loss of cement mortar during discharge which in the opinion of the Engineer would be of sufficient amount to affect the homogeneity of the concrete shall be cause for rejection of the load. The Contractor shall be responsible for all concrete to which water is added at the job site.

725.7.3 Job Mixed Concrete: All job mixed materials and procedures shall be pre-approved by the Engineer. A prepackaged commercial product shall be used for job mixed concrete placement in accordance with the manufacturer's recommended procedure.

In lieu of the use of a prepackaged commercial product, individual ingredients for concrete placement shall be prepared in a watertight container of suitable volume in batches not to exceed 1/3 cubic yard each. Proportioning of batches shall be in accordance with the applicable required mix design in Table 725-1 and section 725.6. All mixing shall be done prior to placement in the forms and in accordance with the following procedure:

(A) Mixing shall be done in a mechanical batch mixer of approved type.
(B) The mixer shall be rotated at a speed recommended by the manufacturer.
(C) Mixing shall continue for at least 1-1/2 minutes after all materials are in the mixer, unless a shorter time is shown to be satisfactory by the mixing uniformity tests of ASTM C-94.
(D) Materials handling, batching, and mixing shall conform to the applicable provisions of ASTM C-94.
(E) Suitable records shall be kept to indentify the number of batches, proportions of materials used, and time and date of mixing and placement along with the approximate location in the structure.

725.7.4 Dry Batched Unmixed Concrete: All dry batched unmixed concrete materials and procedures shall be pre-approved by the Engineer. An accurate batch weight shall be provided to record the quantities of cementitious materials, aggregate, admixtures/additives, and water batched into the containers. The date of batching, the container number and the batching certificate number shall be recorded at the time of batching. Copies of the batch weight records shall be submitted to the Engineer upon request.

All dry batched unmixed concrete delivered to the job site shall be stored in containers so constructed that the cement cannot comingle with the water and aggregate within the container. Any admixture/additive added in powder form shall be added to the cement; if added in liquid form, it shall be added to the water.

The contents of the container shall be discharged into a mixer at the job site. Following discharge of the first container into the mixer, the mixer shall be operated at mixing speeds during the discharge of the remaining containers. After the contents of the last container have been discharged into the mixer, the concrete shall be mixed as specified in this specification for transit mixers, and drum or turbine type mixers.

Any spillage of cementitious materials, aggregate, water or admixtures/additives during the filling, transporting, or the discharging of the container, shall be cause for rejection of the container or the contents of the mixer if any portion of the rejected container is discharged into the mixer.

725.7.5 Volumetric Batching and Continuous Mixing Concrete and Equipment: Volumetric-batching and continuous-mixing concrete and equipment may be utilized upon approval of the Engineer for job site concreting applications. Material handling, procedures, and operations shall be in accordance with ACI 304.6R, Guide for the use of Volumetric-Measuring and Continuous-Mixing Concrete Equipment and all concrete produced and all test performed shall be in accordance with ASTM C-685, Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing. All equipment shall meet the requirements of the Volumetric Mixer Standards of the Volumetric Mixer Manufacturers Bureau and shall have a suitable copyrighted rating plate furnished by the Bureau and attached to the volumetric mixing equipment.

725.8 TESTS AND TEST METHODS:

725.8.1 Field Sampling and Tests: Concrete shall be sampled in accordance with ASTM C-172 for determination of temperature, slump, unit weight and yield (when required) and air content (when required) as well as for fabrication of test cylinders for compressive strength determination at 28 days. Samples shall be of sufficient size to perform all the required tests and fabricate the necessary test cylinders but in no case less than 1 cubic foot. Concrete shall be sampled during discharge of the middle portion of the batch. At the discretion of the Engineer, a sample may be obtained at the beginning of the discharge if the properties of the concrete do not appear to be within the specification limits for slump or temperature.

All sampling and testing shall be done by a certified technician meeting the requirements of the ACI Concrete Field Testing Technician, Grade I or equivalent.

Temperature of the concrete mixture shall be determined in accordance with ASTM C-1064.

Slump of the concrete mixture shall be determined in accordance with ASTM C-143.

Air content of the concrete mixture (when required) shall be determined in accordance with ASTM C-231 or C-173, whichever is applicable.

Unit weight and yield of the concrete mixture (when required) shall be determined in accordance with ASTM C-138.

All compressive strength test specimens shall be made, cured, handled, protected, and transported in accordance with the requirements of ASTM C-31. The contractor shall provide and maintain for the sole use of the testing laboratory/technician adequate facilities for safe storage and proper curing of concrete test cylinders on the project site including sufficient access on weekends and holidays to allow the timely pick-up of cylinders specimens. Any and all deviations from the standard procedure of any test method shall be promptly identified and corrected. Any deviations shall be clearly noted by the testing laboratory on all written reports. Testing results obtained from non-standard testing procedures shall be considered invalid and discarded by Engineer.

Sampling and testing performed for concrete acceptance will be at the expense of the Contracting Agency. Sampling and testing for the Contractor's purposes of quality control or other needs shall be at the Contractor's expense.

725.8.2 Concrete Cylinder Test: A cylinder strength test shall be the average of the strengths of at least two 6 inch by 12 inch cylinders or at least two 4 inch by 8 inch cylinders made from the same sample of concrete and tested at 28 days. An adequate number of cylinder specimens shall be made for each 50 cubic yards or not less than each half-day's placement of each class of concrete. All specimens will be tested in a laboratory approved by the Engineer in accordance with ASTM C-39 for concrete acceptance. Should an individual cylinder show evidence of improper sampling, molding, curing, or testing, the results shall be discarded and the compressive strength shall be the result of the average of the remaining cylinder(s). Additional cylinder specimens may be made and tested at other ages to obtain additional compressive strength information and shall not be considered as acceptance tests. Cylinder testing performed for concrete acceptance will be at the expense of the Contracting Agency. Cylinder testing for the Contractor's purposes of quality control or other needs shall be at the Contractor's expense.

725.8.3 Additional Concrete Testing: If the 28-day strength test does not meet the compressive strength requirements, additional concrete testing may be performed to further evaluate the concrete in question for purposes of acceptability or payment. This may involve testing of additional cylinders at later ages, (for example - hold cylinders at 56 days or more), or core testing to determine in-place concrete strengths. This additional testing and all coring repairs shall be pre-approved by the Engineer and at the expense of the Contractor. If core testing is performed, at least three representative cores shall be obtained, conditioned and tested in accordance with ASTM C-42 from each concrete member or area of concrete to be tested at locations designated by the Engineer. Cores damaged subsequent to or during removal shall be rejected and additional core samples taken. Cores shall be obtained and delivered to a laboratory acceptable to the Engineer in time to allow complete strength testing within 48 days of original concrete placement. The Contractor may elect to have a representative present during sampling and testing. A core strength test shall be the average of the results of the three cores. Should an individual core show evidence of improper sampling, curing, or testing, the results shall be discarded and the compressive strength shall be the result of the average of the remaining core(s). Results of the core strength testing shall replace the results of the cylinder strength test for that sample.

725.9 ACCEPTANCE:

(A) **Plastic Concrete Properties**

(1) The slump of the concrete shall meet the requirements of ASTM C-94 Tolerances in Slump section. When the approved mix design or project specification requirements for slump are a "maximum" or "not to exceed", the following tolerances apply:

Specified slump:	If 3" or less	If more than 3"
Plus tolerance	0 inch	0 inch
Minus tolerance	1 1/2 inch	2 1/2 inch

When the approved mix design or project specification requirements for slump are not written as a "maximum" or "not to exceed", the following tolerances apply:

For design slump of:	Tolerance
2 inch and less	+/- 1/2 inch
More than 2 through 4 inch	+/- 1 inch
More than 4 inch	+/- 1 1/2 inch

(2) Limit the maximum allowable temperature of the concrete mixture immediately before placement to 90 degrees F unless otherwise specified or unless a higher allowable temperature is pre-approved by the Engineer. At the discretion of the Engineer, recommended practices in ACI 305, Specification for Hot Weather Concreting, can provide good reference information and may be used to modify maximum allowable concrete temperature and acceptance.

Per ACI 306, Specification for Cold Weather Concreting, when the atmospheric temperature at the time of placing concrete is above 30°F the temperature of the concrete, as placed, shall not be less than 60°F. When the atmospheric temperature at the time of placing concrete is between 0°F and 30°F the temperature of the concrete, as placed, shall not be less than 65°F.

(3) Air entrained concrete shall meet the requirements of ASTM C-94 Air-Entrained Concrete section. The air content of air-entrained concrete when sampled from the transportation unit at the point of discharge shall be within the approved mix design tolerance or +/- 1.5 % of the specified value. When a representative sample taken prior to discharge shows an air content below the specified level by more than the allowable tolerance, additional air entraining admixture shall be added to the concrete mix to achieve the desired air content level, followed by a minimum of 30 revolutions at mixing speed.

(4) Per ASTM C-94 Mixing and Delivery section, discharge of the concrete shall be completed within 1 1/2 hour after the introduction of the mixing water to the cementitious materials or the introduction of the cementitious materials to the aggregates. The Engineer may allow the continuation of concrete placement after the 1 1/2 hour time limit has been reached if the concrete is of such slump or workability that it can be placed without the addition of water to the batch.

Any concrete failing to meet the tolerances for plastic concrete properties in 725.9 (A) (1) through (4) shall be reviewed by the Engineer and is subject to rejection.

(B) **Hardened Concrete Properties – Compressive Strength**

Compressive strength of concrete shall be determined on the basis of cylinder strength tests obtained in accordance with section 725.8.2 and shall be acceptable if the tests meet or exceed the minimum specified strength. When the validity of cylinder strength tests are suspect, the strength of concrete in question shall be determined in accordance with section 725.8.3.

When compressive strength test results are less than the specified minimum, an Engineering Analysis to determine the impact of the strength reduction may be required by the Engineer prior to the decision to accept or reject the concrete. The Engineering Analysis will be at the Contractor's expense. Any concrete that is rejected by the Engineer shall be removed and replaced by the Contractor at the Contractor's expense.

When concrete is accepted by the Engineer on the basis of test results of less than 100% of the required minimum compressive strength, an adjustment in the concrete unit price may be made for the quantity of concrete represented by such strength tests in accordance with Table 725-2.

TABLE 725-2

ADJUSTMENT IN CONCRETE UNIT PRICE BASED ON STRENGTH DEFICIENCY

Class AA and Class A		Class B and Class C	
Percent of Specified Minimum 28-day Compressive Strength Attained (Nearest 1%)	Percent of Concrete Unit Price Allowed	Percent of Specified Minimum 28-day Compressive Strength Attained (Nearest 1%)	Percent of Concrete Unit Price Allowed
100 % or greater	100	100 % or greater	100
98-99	90	95-99	95
96-97	85	90-94	90
95	80	85-89	85

End of Section

This Page is Reserved for Future Use

SECTION 728

CONTROLLED LOW STRENGTH MATERIAL

728.1 GENERAL:

Controlled Low Strength Material (CLSM) is a mixture of portland cement, aggregate and water that, as the cement hydrates, forms a soil replacement. CLSM is a self-compacting, flowable, cementitious material that is primarily used as a backfill or structural fill in lieu of compacted fill or unsuitable native material.

728.2 MATERIALS:

Portland Cement shall conform to Section 725.2.
Coarse and fine aggregates shall conform to Section 701.
Water shall conform to Section 725.4

728.3 PROPORTIONING OF MIXTURES AND PRODUCTION TOLERANCES:

Proportioning of the mixture shall comply to Section 701.3.5, Section 725.6 and Table 728-1. A mix design shall be submitted with test data for the Engineer's approval prior to the excavation for which the material is intended for use.

TABLE 728-1			
CONTROLLED LOW STRENGTH MATERIAL REQUIREMENTS			
Description of CLSM	Cement Content, lbs/cu yd	Slump, inches	Compressive Strength at 28 days, psi
1/2 Sack CLSM	47±5%	7±1	70±30
1 Sack CLSM	94±5%	7±1	150±50
1 1/2 Sack CLSM	141±5%	7±1	425±75

Notes for Table 728-1:

1. The values specified in the table are for both mix design requirements and field production. The deviations are for production, testing and sampling tolerances.
2. Slump shall be tested in accordance with ASTM C-143. Flow consistency test can be substituted for the slump test. When used, the CLSM shall have a flow consistency of 8 inches as tested in accordance with ASTM D-6103.
3. Compressive strength shall be tested in accordance with ASTM D-4832 . The supplier shall provide laboratory and/or field test data to verify the design strength.
4. Sampling shall be in accordance with ASTM D-4832.
5. Unit weight shall be obtained by ASTM D-6023.
6. Temperature shall be taken in accordance with ASTM C-1064.
7. Cement content shall be tested in accordance with ASTM D-5982.

Where CLSM is to be used as backfill around gas pipelines (totally encapsulating the gas pipeline), the material shall meet a minimum permeability coefficient (k) of 1×10^{-5} cm/sec or more, based on ASTM D-5048.

728.4 MIXING:

The total elapsed time between the addition of the water and placement of the complete mix shall not exceed 90 minutes. The Engineer may waive this limitation if the slump is such that the material can be placed without addition of water.

Mixing shall continue until the cementitious material and water are thoroughly dispersed throughout the material. Mixes shall be homogenous, readily placeable and uniformly workable. Proportioning of ingredients shall produce consistency, durability, workability and other required properties appropriate for the intended usage. When the CLSM is mixed other than at the project site, the mixing shall comply with Section 725.7. When the CLSM is mixed at the job site, the Contractor will submit for the Engineer's approval, the methods, equipment and procedures for proportioning and mixing of the material.

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 emulsionin 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.

SECTION 790

Paint Number	Type
1-A	(Red Lead — Linseed Oil)
1-B	(Red Lead — Alkyd Resin)
1-D	(Zinc Chromate)
4	(Dull Black)
5	(Jet Black)
6	(Black — For Timber Primer Only)
7	(White — For Timber Primer Only)
8	(White)
9	(Light Grey)
10	(Aluminum)
11	(White Enamel)
15	(Zinc)

End of Section

SECTION 792

DUST PALLIATIVE

792.1 GENERAL:

Dust palliatives shall consist of various chemical dust suppressants which work by binding together lighter soil particles.

All materials must meet the environmental requirements of Section 792.3 and must be approved by the Engineer prior to their use.

792.2 TYPE OF MATERIALS AND APPLICATION RATES:

Emulsions shall be miscible with water in all proportions as noted in Table 792-1. The dilution ratio will vary based upon the local soil and weather conditions. The ratios shall be proposed by the Contractor and agreed upon by the Engineer.

The rate of application noted in Table 792-1 shall be for the treatment, method and use specified by the Contracting Agency, or as directed by the Engineer. To compensate for local conditions or changes in soil type, the Contractor may adjust the application rate within the ranges specified.

Products specifically formulated as tackifiers which prevent wind-blown erosion shall not be acceptable as dust palliatives for vehicular traffic, but may be used for their intended purposes.

TABLE 792-1

DUST PALLIATIVE DILUTION RATIOS AND APPLICATION RATES

Product Type	Use/Treatment (1)	Dilution Ratio (2)		Application Rate (3) (gal/sy)
		Range	Typical	
Acrylic Copolymer And Polymers	Topical - Road or parking Lot Topical - Road Shoulder Surface Course (per inch of depth)	20:1 to 4:1 20:1 to 4:1 20:1 to 4:1	9:1 15:1 9:1	0.20 to 0.15 0.16 to 0.12 0.08 to 0.06
Lignin-Based Type (Lignosulfonate)	Topical - Road or parking Lot Topical - Road Shoulder Surface Course (per inch of depth)	1:1 7:1 to 4:1 1:1	1:1 8:1 1:1	0.10 to 0.05 0.05 to 0.03 0.30 to 0.10
Organic Resin	Topical - All Surface Course (per inch of depth)	10:1 to 2:1 2:1 to 1:1	5:1 1:1	0.25 to 0.15 0.15 to 0.10
Petroleum Resin	Topical - Road or parking Lot Topical - Road Shoulder Surface Course (per inch of depth)	4:1 10:1 to 7:1 4:1	4:1 8:1 4:1	0.15 to 0.10 0.15 to 0.07 0.11 to 0.07
Tall Oil Pitch Emulsion	Topical - Road or parking Lot Topical - Road Shoulder Surface Course (per inch of depth)	20:1 to 5:1 20:1 to 3:1 20:1 to 2:1	5:1 3:1 10:1	0.20 to 0.15 0.16 to 0.12 0.08 to 0.06
Other	As approved by the Engineer			

(1) Topical application rates shown are to obtain 1/2 to 1 inch penetration. Higher rates should be used if greater penetration is anticipated.
(2) The dilution ratio (water:product) is variable and shall be appropriate for the local soil and weather conditions, as proposed by the Contractor and agreed upon by the Engineer.
(3) Application rate of undiluted concentrate.

Contractor shall submit proof of conformance in the form of test reports to verify that the dust palliative product proposed for use meets the minimum material requirements specified in this section. Testing must be specific to the proposed product and not generic to similar type palliative products. Testing shall be performed by independent AASHTO accredited laboratories, and signed and sealed by Professional Engineers registered in the State of Arizona. The Contractor is responsible for any costs associated with the testing of soil and palliative product prior to the application of as specified herein.

(A) Acrylic Copolymer and Polymer Types:

The material shall be a white or clear emulsion that can penetrate, saturate and bond together treated soils to create a hard, dust-free and water resistant surface. The material shall have the following properties in its undiluted state:

Specification Designation	ASTM Test Method	Requirements
Composition	--	Acrylics, acrylates & acetates
pH	E 70	4.0 – 9.5
Residue (active solids content), %	D 2834	40 min.
Flash Point	D 92	None
Absolute Viscosity (Brookfield), cP, 77°F	--	1500 max.
Specific Gravity, 60/60°F	D 1298	1.00 – 1.15

(B) Lignin-Based Types:

Lignin-based dust palliative shall be an aqueous lignosulfonates (a residual co-product of wood pulping by the sulfite process in the manufacturer of cellulose products) that dispersed readily in water to yield a stable, brown-colored solution. The material shall have the following properties in its undiluted state:

Specification Designation	ASTM Test Method	Requirements
Absolute Viscosity (Brookfield), cP, 77°	--	<1000
Residue (total solids content), %	D 2834	48 min.
Lignin sulfonate content (% of solids)	D 2834	60 min.
pH	E 70	5.0 - 7.0
Specific Gravity (liquid), 77/60°F	D 1298	1.00 min.

(C) Organic Resinous Types:

The material shall be a tan emulsion designed specifically for dust control of unpaved roads, traffic surfaces, and road shoulders that utilize non-petroleum based organic esters and resins combined with other additives to penetrate, bond and coat treated soils. The material shall have the following properties in its undiluted state:

Specification Designation	ASTM Test Method	Requirements
Absolute Viscosity (Brookfield), cP, 77°	--	50 – 200
pH	E 70	3.0 - 9.0
Residue (active solids content), %	D 2834	45 min.
Flash Point	D 92	None
Specific Gravity, 60/60°F	D 1298	1.00 min.

(D) Petroleum Resinous Types:

The materials shall be a light yellow petroleum resinous emulsion suitable for use as agglomerate for soil particles. The material shall have the following properties in its undiluted emulsified state:

Specification Designation	ASTM Test Method	Requirements
Kinematic Viscosity, SFS at 77°F	D 244	188 min.
pH	E 70	4.0 – 7.0
Residue, % wt (1)	D 2834	60 min.
Sieve Test, % wt. Retained (2)	D 244	0.1 max.
Particle Charge Test	D 244	Positive
Flash Point of base product, CO, °F.	D 92	400 min.
Specific Gravity, 60/60°F	D 1298	1.00 min.

(1) ASTM test modified by heating 50 g of sample to 300 °F. until foaming ceases, then cooling immediately and calculation results.
(2) Replace 2% sodium oleate solution with distilled water in test.

The emulsion shall be stable, i.e., should not break when stored in clean closed containers at temperatures between 35°F. and 200 °F. for a minimum of 3 months. The sequestering agents shall make the preparation stable against hard water, thus permitting dilution of the emulsion with almost all types of water. The emulsion shall be non-corrosive to metal containers. The materials shall penetrate into the soil and not form a skin at the surface or a crusted surface.

(E) Tall Oil Pitch Emulsion:

The material shall be a light brown tree resinous emulsion produced from distilled tall oil and not associated with the use of chlorine-based chemicals to bleach pulp from the production of paper. The product shall be designed specifically for dust control of unpaved roads, traffic surfaces, and road shoulders that can penetrate, saturate and bond together soils to create a hard, dust-free and water repellant surface. The product shall be non-water soluble once cured. The emulsion shall have the following properties in its undiluted state:

Specification Designation	ASTM Test Method	Requirements
pH	E 70	2.5 - 9.0
Residue (active solids content), %	D 2834	35 min.
Flash Point	D 92	None
Specific Gravity, 60/60°F	D 1298	0.998 min.

(F) Other Types:

Other types of dust palliative may be approved for use by the Engineer. Test methods, requirements, dilution ratios and application rates shall be as specified by the manufacturer.

792.3 PERFORMANCE STANDARDS AND TEST METHODS:

Product shall be blended at the specified stabilizer content application rate with soil that is either representative of the site soils to be treated or be a local A-7 in accordance with AASHTO M145 (as determined by the Engineer) and tested in accordance with ASTM D1883. Results of treated soil must show a minimum 25% increase in CBR (California Bearing Ratio) value over the untreated soil for the product to be accepted for either topical dust suppression or soil stabilization.

Testing shall be in accordance with ASTM D1883, as modified herein. Test reporting shall include all the information required by ASTM D1883, Section 10.0 for both treated and untreated CBR samples. In addition, the penetration vs. stress plot for each test shall be included (ASTM D1883, Fig. 2) along with the rate of product application and the percent stabilizer solids. CBR specimens, after molding, shall be left in their mold, on their sides and cured in the laboratory air for 7 days prior to being immersed in water for 96 hours and then tested for CBR. At least three CBR test specimens shall be compacted at the optimum moisture content, both treated and untreated (ASTM D698, method C), with the result reported as the average value. The surcharge weight shall be 10 pounds.

792.4 ENVIRONMENTAL CRITERIA:

Contractor shall submit proof to the Engineer in the form of test reports and certificates to verify that the dust palliative product is in environmental compliance. The Contractor is responsible for any costs associated with the testing of soil and palliative product prior to the application of as specified herein.

Products shall not contain or emit chlorinated fluorocarbons (CFC's or Freon's) and shall not contain or emit volatile organic compounds (VOC's) that exceed Federal, State or Local air quality limitations.

Products and their degradation products shall not be composed of elements, compounds, mixtures or produce runoffs with the characteristics identified under Arizona Revised Statutes 36-2822 of the Arizona Hazardous Waste Management Act, emit or off-gas during placement, use or degradation of any hazardous air pollutant listed under Section 112 of the Federal Clean Air Act [42 U.S.C. § 7412], be a hazardous chemical substance or mixture pursuant to Section 7 of the Federal Toxic Substances Control Act [15 U.S.C.§ 2606], be designated by rule an extremely hazardous chemical substance pursuant to the Arizona Environmental Quality Act, be prohibited for use by the Arizona Department of Environmental Quality, the Environmental Protection Agency, or any applicable law, rule or regulation.

Product runoff and their degradation product runoffs shall not contain concentrations that exceed the parameters designated in Section 2.18 'Table 5' of the National Pollution Discharge Elimination System (NDES) Multi-Sector General Permit for Industrial Activities (*see Note A*). Adequate proof can be shown by providing one of the following:

(A) Complete aquatic toxicity test for lethal concentration at 50% (LC50).

(B) Provide complete and accurate listing of all individual chemical constituents (including proprietary chemical information) and percentage of each in a given volume of pure chemical product.

(C) Surface water runoff test. This test involves running distilled water over a treated soil area, collecting the test water, and submitting to a certified lab for analysis.

Contractor shall obtain from the dust palliative product manufacturer independent verification and certification of performance and environmental claims by a recognized agency of the United States, Canadian Precertification, Environmental Technology Verification, or EcoLogo Certification programs for chemical dust suppressants.

Products or their components and degradation products shall be tested and certified by the manufacturer not to be substances or composed of substances known to be, or reasonably anticipated to be carcinogenic or toxic by the U.S. Department of Health and Human Services.

Products must have hazardous Materials Identification System (HMIS) ratings equal to or less than the following for each category: H=1; F=1; R=1; PPE=X.

Note A: Parameter benchmark values shall be provided by the Engineer and based on the Contracting Agency's requirements.

End of Section

This Page is Reserved For Future Use

SECTION 796

GEOSYNTHETICS

796.1 GENERAL:

This section defines the requirements for geosynthetic fabrics, grids and membranes typically used as pavement fabric beneath asphalt concrete overlays, filtration/drainage separation between soil/aggregate layers, erosion control filter/separators for riprap protection, and soil or base reinforcement to improve the stability of weak soils or reinforce aggregate bases.

796.2 MATERIALS AND REQUIREMENTS:

Identification, packaging, delivery, storage and handling of geosynthetic materials shall be in accordance with manufacturer's recommendations and ASTM D4873. Each roll shall be labeled or tagged to provide product identification sufficient to determine the product type, manufacturer, quantity, lot number, roll number date of manufacture, and shipping date.

Geosynthetic materials shall be inert to commonly encountered chemicals, resistant to rot and mildew, and shall have no tears or defects which adversely affect or alter its physical properties.

Geosynthetic materials shall be packaged with material that will protect the geosythetic (including ends of rolls) from damage due to shipment, water, sunlight and contaminates. During storage, geosynthetic materials shall be elevated off the ground and protected from the following: site construction damage, precipitation, extended ultraviolet radiation, strong acid or strong base chemicals, flames (including welding sparks), temperatures in excess of 160°F, and any other environmental condition that may damage geosynthetic material property values. Protection shall be in accordance with manufacturer's specifications and shall be maintained during periods of shipment and storage.

Materials required for complete and proper installation of geosynthetic materials that are not specifically described herein (such as pins, nails, washers, etc.) shall conform to the manufacturer's recommendations and be as selected and supplied by Contractor subject to final approval by the Engineer.

Requirements represent minimum average roll values in the weaker principal direction. Average of test results from any sampled roll in a lot shall meet or exceed the minimum values noted herein. Lot sampling shall be in accordance with ASTM D 4354.

796.2.1 Pavement: Pavement fabric geosynthetics are non-woven polyester or polypropylene fabrics that are field saturated with an asphalt binder and placed as an interlayer beneath a pavement overlay or between pavement layers. When placed, the fabric becomes an integral part of the roadway section, forming a barrier to water infiltration and absorbing stresses to reduce reflective and fatigue cracking of the new pavement surface layer.

Pavement fabric shall be constructed of at least 95 percent (by weight) nonwoven synthetic fibers of polyester or polypropylene, thermally bonded on one side. The fabric material shall additionally conform to the physical properties shown in Table 796-1.

TABLE 796-1

PAVEMENT GEOSYNTHETIC PROPERTIES

Property	Class A	Class B	Test Method
Weight: oz/yd^2	4.1 min.	4.0 min.	ASTM D3776
Grab tensile strength: lbs.	100 min.	90 min.	ASTM D4632
Elongation at break: %	50 min.	50 min.	ASTM D4632
Melting point: degree F	300 min.	300 min.	ASTM D276
Asphalt retention: gal/yd^2	0.25 min.(1)	0.20 min.	ASTM D6140

(1) May be reduced within street intersections, on steep grades or in other zones where vehicle braking is common, but not less than 0.20 gal/yd^2, when approved by the Engineer.

796.2.2 Filtration (Drainage) and Separation: Filtration and separation fabrics are nonwoven or woven polypropylene or polyester fabrics with specified strength characteristics used as permeable separators to restrain soil or other particles subjected to hydrodynamic forces while allowing the passage of fluids into or across a geotextile and to prevent inter-migration of adjacent soil layers of vastly different particle sizes and particle distributions.

Filtration and separation fabrics shall be nonwoven or woven fabric consisting only of long chain polymeric filaments such as polypropylene or polyester formed or woven into a stable network such that the filaments retain their relative position to each other. The fabric material shall additionally conform to the physical properties shown in Table 796-2.

TABLE 796-2			
FILTRATION & DRAINAGE GEOSYNTHETIC PROPERTIES			
Property	**Class A (1)**	**Class B (2)**	**Test Method**
Grab tensile strength: lbs.	180 min.	80 min.	ASTM D4632
Seam strength: lbs.	160 min.	70 min.	ASTM D4632
Puncture strength: lbs.	80 min.	25 min.	ASTM D4833
Trapezoidal tear: lbs	50 min.	25 min.	ASTM D4533
Apparent opening size: US Standard sieve size	>50	>50	ASTM D4751
Ultraviolet Stability: %	50 min.	50 min.	ASTM D4355

(1) Class A - Use where installation stresses are more severe than for Class B application (i.e. very coarse sharp angular aggregate or high compaction requirements).
(2) Class B – Use with smooth graded surface having no sharp angular projections and sharp angular aggregate.

796.2.3 Erosion Control: Erosion control fabrics are used below areas to receive aggregate or riprap slope protection and act as filter/separators to provide sustained permeability while maintaining structural stability.

Erosion control fabrics shall be a woven monofilament fabric or a nonwoven fabric consisting only of long chain polymeric filaments such as polypropylene or polyester formed into a stable network that the filaments retain their relative position to each other. The fabric material shall additionally conform to the physical properties shown in Table 796-3.

TABLE 796-3			
EROSION CONTROL GEOSYNTHETIC PROPERTIES			
Property	**Class A**	**Class B**	**Test Method**
Grab tensile strength: lbs.	270 min.	200 min.	ASTM D4632
Elongation at break: %	45min., 115 max.	15 min., 115 max.	ASTM D4632
Puncture strength: lbs.	110 min	75 min.	ASTM D4833
Burst strength: psi	430 min.	320 min.	ASTM D3786
Trapezoidal tear: lbs	75 min.	50 min.	ASTM D4533
Permittivity: second^{-1}	0.07 min.	0.07 min.	ARIZ 730 (1)
Apparent opening size: US Standard sieve size	30 – 140	30 - 140	ASTM D4751
Ultraviolet Stability: %	70 min.	70 min.	ASTM D4355

(1) Arizona Department of Transportation test method.

796.2.4 Soil or Base Reinforcement: Geogrid geosynthetic materials are used for improving the stability of weak soils or reinforcing aggregate bases. Geogrids are defined as biaxial or triaxial polymeric grids formed by a regular network of integrally connected polymer tensile elements with apertures of sufficient size to permit significant mechanical interlock with the surrounding soil, aggregate, or other fill materials to function primarily as reinforcement.

The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. Geogrids shall be integrally formed and deployed as a single layer; comprised of 100 percent polypropylene or high-density polyethylene. Geogrids shall additionally conform to the physical properties shown in Table 796-4.

TABLE 796-4			
REINFORCEMENT GEOGRID PROPERTIES			
Property	**Type 1**	**Type 2**	**Test Method**
Aperture size: inches	1 min.	1-3/8 min.	ID callipered
Ultimate Tensile Strength: lb/ft	850 min.	1300 min.	ASTM D4945
Flexural Rigidity: Mg-cm	250,000 min.	750,000 min.	ASTM D1388
Tensile Strength @ 2% Strain: lb/ft MD (1)	270 min.	410 min.	ASTM D6637
Tensile Strength @ 2% Strain: lb/ft CMD (2)	380 min.	620 min.	ASTM D6637
Tensile Strength @ 5% Strain: lb/ft MD (1)	550 min.	810 min.	ASTM D6637
Tensile Strength @ 5% Strain: lb/ft CMD (2)	720 min.	1340 min.	ASTM D6637
Junction Efficiency: % Ultimate Tensile Strength	75 min.		GRI-GG2 (3)
Ultraviolet Stability: % Retained Strength	70 min.		ASTM D4355

(1) MD = Test in the machine direction along roll length
(2) CMD = Test in the cross-machine (transverse) direction across roll width
(3) Geosynthetic Research Institute test method

796.3 TEST AND CERTIFICATION REQUIREMENTS:

Certificates of compliance shall be submitted to the engineer upon delivery of material for use on a specified project. Samples of materials shall be submitted for testing. Each geosynthetic material lot or shipment must be approved by the Engineer before the materials may be incorporated in the work.

Testing methods and results shown in the certificate of compliance shall conform to the listed specifications for the proposed geosynthetic use. Manufacturer's supporting documentation including, but not limited to, product information sheets, installation procedures and recommendations, recommended use, and project references shall be submitted to the Engineer for product evaluation and approval.

End of Section

This Page is Reserved For Future Use

INDEX

A

Abbreviations 101-1
ABS Truss Pipe and Fittings 744-1
Acceptance of Work
    final 105-6
    partial 105-5
Access to Property 107-4, 401-1
Actual Cost of Work 109-3
Addendum 101-6
Adjusting
    frames 345-1
    manhole and valve covers 345-1
    public and private utilities 105-2
    valve boxes 345-1
    water meter boxes 345-1
Affidavit, Contractor's . . . . . xiii, 109-6
Aggregate Base 101-1, 702-1
Aggregate for
    asphalt chip seal 330-1, 716-1
    asphalt concrete overlay 321-4
    bituminous treated base course 313-1
    chips 716-1
    fog seal 333-1
    hot asphalt-rubber seal 335-1
    portland cement concrete 324-1, 705-1, 725-1
    portland cement treated base 705-1
    precoated chips 716-2
    riprap 703-1
    road-mixed surfacing 320-2
    sand blotter 333-2
    slurry seal 332-1, 715-1
    soil cement base course 311-2, 725-1
    subdrainage 605-1
    trench bedding of pipe 601-4, 603-1, 615-1
    uncoated chips 716-2
Aggregate Paving
    exposed 343-1
Aggregate, Mineral 715-1
Air Release Valves 630-7
Air Test, Sewer Lines 615-2
Alley Entrances 104-2, 340-1
Aluminum Handrail 520-1
Approval of
    contract, bonds and insurance 103-1, 103-2
    materials 106-1
    proposal 102-1, 103-1
    shop drawings 105-1
    subcontracts 108-1
    substitutes 106-2
Archaeological Reports 107-2
Asbestos-Cement Pipe & Fittings for Storm Drain / Sanitary Sewer 737-1
Asbestos-Cement Water Pipe and Fittings 752-1
Asphalt
    concrete 718-1, 719-1
    emulsified 713-1
    liquid 712-1
    Milling 317-1
    preservative seal for 718-1
    rubber 717-1
Asphalt Chip Seal 330-1
Asphalt Concrete
    preservative seal for 334-1
Asphalt Concrete Hot Mixed, Recycled 719-1
Asphalt Concrete Overlay 321-4
Asphalt Concrete 710-1

Acceptance 321-4
Application of Tack Coat 321-1
Asphalt Core Method 321-9
Materials and Manufacture 321-1
Measurement 321-9
Mix Design 321-1
Mix Production 321-2
Payment 321-9
Placement 321-3
Qualit y Control 321-4
Referee 321-9
Transportation 321-3
Weather and Moisture Conditions 321-1
Asphalt Distributing Equipment 330-3
Asphalt Emulsion
slurry seal coat 332-1
Asphalt Milling 317-1
Asphalt Pavement, Reclaimed 709-1
Asphalt-Rubber Concrete Overlay, GAP Graded 325-1
Assignment of
contract 108-1
payments 109-2
Authority of the
engineer 105-1
inspector 105-4
Authorized Signature Form xv
Award
and execution 103-1
cancellation of 103-1
of contact 103-1

B

Backfill, Structure 206-1
Barricades and Warning Signs 107-3
Base Materials
crushed aggregate 702-1
decomposed granite 702-2
processed natural material 702-2
Beginning Work 108-1
Bench Marks 105-4
Bid Guarantee
amount 102-2
forfeiture of 103-3
return of 103-1
Bidder
disqualification of 102-3
eligibility and preference 102-1
successful 102-3
Bidding Requirements and Conditions 102-1
Bituminous Prime Coat 315-1
Bituminous Treated Base Course 313-1
Blasting
discontinue 107-4
operations 107-4
Bolts 770-1
Bolts, Anchor 770-1
Bonds
acceptable to 103-1
amount 103-1
executed by 103-3
forms . . . . . iv, ix, x
payment, labor and material 103-1
performance, contract 103-1
proposal guarantee 102-2
requirement of 103-1
surety, improvement district iv

INDEX

Borrow Excavation
- local and imported . . . 210-1
- placing and compacting . . . 210-1

Brick
- building, facing and manhole . . . 775-1
- concrete paving . . . 342-1
- decorative pavement . . . 342-1

Brick Masonry
- bricklaying . . . 511-1
- curing, grouting and reinforcing . . . 511-2

Bridges
- concrete . . . 505-1
- steel . . . 515-1

Bronze
- castings . . . 786-1

C

Cable
- installation . . . 360-1

Cancellation of
- award . . . 103-1
- contract . . . 108-5
- insurance . . . xii

Cast Iron Pipe . . . 750-1

Cast-In-Place Concrete Pipe
- construction . . . 620-1
- materials . . . 620-1
- tests . . . 620-3

Castings
- bronze . . . 786-1
- gray iron . . . 787-1
- steel . . . 785-1

Catch Basins . . . 505-1

Cement Concrete
- admixtures . . . 725-2
- aggregate . . . 725-2
- cement . . . 725-1
- classes of concrete . . . 725-1
- mixing . . . 725-3
- testing . . . 725-8
- water . . . 725-2

Cement Mortar and Grout . . . 776-1

Cement Treated Base
- construction . . . 312-1
- curing . . . 312-3
- inverted section . . . 312-3
- mixing . . . 312-2

Certificate of
- compliance and analysis . . . 106-1
- insurance . . . 103-2
- insurance form . . . xi
- weighmaster's . . . 109-1

Chain Link Fences . . . 420-1, 772-2

Change Order
- additional time . . . 108-3
- alteration of work . . . 104-2, 109-2
- extra work . . . 104-2, 109-2
- payment . . . 104-2
- unforseen circumstances . . . 109-2

Changed Conditions
- additional compensation . . . 110-3
- additional time . . . 110-3
- dispute resolution . . . 110-1
- notification . . . 110-1

Channels, Open . . . 215-1

INDEX

Chip Seal Coat
- application of asphalt and aggregate . . . 330-1
- materials . . . 330-1
- weather conditions . . . 330-1

Chlorine
- disinfecting water mains . . . 611-1

City Sealer of Weights . . . 109-1

Classes, Grades and Types
- concrete . . . 725-1
- emulsified asphalt . . . 713-1
- liquid asphalt . . . 712-1
- paving asphalts . . . 711-1
- slurry seal . . . 332-1

Clay Pipe Vitrified . . . 743-1

Clean Up
- during construction . . . 104-1
- final . . . 104-2

Clearing and Grubbing . . . 201-1

Coating Corrugated Metal Pipe & Arches . . . 760-1

Collusion, Evidence of . . . 102-3, 108-5

Commencement, Prosecution and Progress . . . 108-1

Compensation for
- alternation of work . . . 109-2
- change order . . . 104-2
- extra work . . . 109-2

Concrete
- alley entrance . . . 340-1
- asphalt . . . 710-1
- block . . . 775-1
- curb . . . 340-1
- curing materials . . . 726-1
- driveway . . . 340-1
- gutter . . . 340-1
- masonry units . . . 775-1
- non-reinforced pipe . . . 736-1
- paving stone or brick . . . 342-1
- piles . . . 782-1
- portland cement . . . 725-1
- pressure pipe . . . 758-1
- sidewalk . . . 340-1
- sidewalk ramps . . . 340-1

Concrete Pipe
- cast-in-place . . . 620-1
- lining . . . 741-1
- non-reinforced . . . 736-1
- reinforced . . . 735-1

Concrete Block Masonry
- construction . . . 510-1
- curing . . . 510-2
- reinforcing . . . 510-1
- testing . . . 776-2

Concrete Classes . . . 725-1

Concrete Curing Materials . . . 726-1

Concrete Structures
- adverse weather concreting . . . 505-7
- concrete deposited under water . . . 505-9
- curing . . . 505-9
- dimensional tolerances . . . 505-12
- falsework . . . 505-3
- finishing concrete . . . 505-10
- forms . . . 505-1
- measurement . . . 505-13
- minor structures . . . 505-1

placing reinforcement 505-4
placing concrete 505-6
subgrade for concrete structures 505-1
Conformity with Plans and Specifications 105-1
Construction
cleanup and dust control 104-1, 225-1
fill 211-1
maintenance during 105-5
manhole 625-1
reclaimed water line 616-1
riprap 220-1
schedule, contractor's 108-1
stakes, lines and grades 105-4
storm drain 618-1
Contract
approval 103-3
assignment 108-1
award and execution of 103-1
award of 103-1
bond form . . . . . i, iv, v, ix, x
bonds, requirement of 103-1
execution 103-3
failure to complete 108-4
failure to execute 103-1
final acceptance 105-5
final payment 109-5
forms . . . . . i, iv, v, ix, x
insurance 103-2
partial acceptance 105-5
partial payment 109-5
requirements, labor 107-1, 107-2
subletting of 108-1
surety bond, improvement district iv
terminations 108-5
time extensions 108-3
time of completion 108-1
Contractor's
accident prevention requirements 107-2, 107-3
affidavit, settlement of claims xiii
construction schedule 108-1
correspondence to 108-1
default 108-5
eligibility and preference 102-1
examine site prior to bidding 102-1
insurance certificate xi
liability of 107-1
Marshaling Yard 107-2
notice to 108-1
notify public utilities 105-2, 107-5
personnel and equipment 108-2
requested changes 104-2
responsibilities 107-5
superintendent 105-2, 105-4
Control of
materials 106-1
work 105-1
Controlled Low Strength Material 728-1
mixing 728-1
payment 604-2
placement of 604-1
Cooperation
between contractors 105-3
of contractor 105-2
with utilities 105-2
Coordination of Plans and Specifications 105-2
Copper Pipe, Tubing and Fittings 754-1

Corrugated Metal Pipe and Arches
coating . . . 760-1
installation . . . 621-1
test specimens . . . 621-2
Cover Material for Chip Seal . . . 716-1
Crushed Aggregate . . . 702-1
Crushed Rock and Gravel . . . 701-1
Curbs
asphalt . . . 321-8
concrete . . . 340-1
safety . . . 410-1
Curing
cast-in-place concrete pipe . . . 620-3
concrete block masonry . . . 511-1
concrete curb, gutters and sidewalks . . . 340-2
concrete structures . . . 505-7
gunite . . . 525-2
materials . . . 726-1
precast prestressed concrete members . . . 506-1
terrazzo sidewalks . . . 341-2

D

Damages, Liquidated . . . 108-4
Decomposed Granite . . . 430-2, 702-2
Decreased Quantities . . . 109-2
Definitions . . . 101-1
Definitions and Terms . . . 101-6
Delays
asbestos . . . 107-2
between contractors . . . 105-3
beyond control of contractor . . . 108-3
contracting agency . . . 109-6
extension of time . . . 108-3, 109-6
in payment . . . 109-6
payment for . . . 109-6
utility owners . . . 105-3
Discontinue Blasting . . . 107-4
Discrimination Clause . . . 107-1
Disinfecting Water Mains
final flushing, sampling and testing . . . 611-1, 611-3
methods of applying chlorine . . . 611-2
rate of application . . . 611-2
Disposal of Surplus Material . . . 205-2
Dispute Resolution . . . 110-1
administrative process . . . 110-2
amount of dispute . . . 110-4
arbitration . . . 110-4
dispute review board . . . 110-5
final documentation and payment . . . 110-5
mediation . . . 110-4
Disqualification of Bidders . . . 102-3
Drainage and Irrigation Structures . . . 505-1
Drawings, Shop . . . 105-1
Driveway . . . 340-1
Driveways
access . . . 107-4, 340-1, 401-1
Driving Piles
bearing value . . . 501-2
cutoff and extension . . . 501-3
description . . . 501-1
equipment . . . 501-1
testing . . . 501-4

INDEX

Drop Sewer Connections 625-1
Ductile Iron Pipe 750-1
Dust Control 104-1, 225-1
Dust Pallative 230-1
    application 230-2
    curing 230-2
    measurement 230-2
    weather conditions 230-2
Dust Palliative
    materials 792-1
    ratios and application rates 792-1
Duties of Inspector 105-4

E

Earthwork 201-1
    for open channels 215-1
Earthwork for Open Channels
    Excavation 215-1
    fill and backfill 215-2
    grading 215-2
    stripping 215-1
Easements 107-5
Eligibility of Contractor 102-1
Emergency
    contractor's representative 104-1, 105-2
    defects 108-3
    services for public 104-1
Emulsified Asphalt
    grades 713-1
    test reports and certification 713-1
Encasement of
    sewer pipe 602-1
    water pipe 602-1
Engineer
    authority of 105-1
    decisions 105-1
    suspension of work 104-1, 105-1, 108-2, 108-3
Equipment
    approval of 106-1
    asphalt distributors 330-3
    rental rates 109-3
    storage of 106-2
    watering 225-1
Examination of
    plans 102-1
    site of work 102-1
    special provisions 102-1
Excavation
    borrow 210-1
    roadway 205-1
    structure 206-1
Excavation, Borrow Roadway, Structure, Trenches 601-1
Execution of Contract 103-3
Exfiltration Test, Sewer Lines 615-2
Existing Improvements
    removal of 350-1
Expansion Joint Filler
    application 729-3
    pour type 729-2
    premolded 729-2
    test report and certification 729-3

Explosives
discontinue use of . . . 107-4
use of . . . 107-4
Exposed Aggregate Paving . . . 343-1
Extension of Time . . . 108-3
Extra Work
actual cost . . . 109-3
claims for . . . 104-2
force account . . . 109-3
method of ordering . . . 109-2
method of payment . . . 109-2
Extruded
alley entrance . . . 340-1
asphalt curbs . . . 109-3
concrete curb . . . 340-1
driveway . . . 340-1
gutter . . . 340-1
sidewalk . . . 340-1
sidewalk ramps . . . 340-1

F

Failure to
complete on time . . . 108-4
execute contract . . . 103-3, 108-5
maintain construction, roadway or structure . . . 105-5
Federal Aid Project . . . 107-1
Fence
chain link . . . 772-2
Fill Construction . . . 211-1
compacting . . . 211-1
placing . . . 211-1
tests . . . 211-2
Final
acceptance, final or partial . . . 105-5
cleaning up . . . 104-2
estimate . . . 109-5
inspection . . . 105-6
payment . . . 109-5
Fire Hydrants
installation . . . 610-4, 756-1
Flagman or Pilot Cars . . . 401-1
Flexible Metal Guardrail . . . 415-1
Fog Seal Coats
application . . . 333-1
materials . . . 333-1
test reports and certificates . . . 333-1
weather conditions . . . 333-1
Force Account Work . . . 109-3
Forfeiture of
contract . . . 108-5
proposal guarantees . . . 103-3
Foundation Data, Test Holes . . . 102-1, 601-6
Foundation Material Treatment . . . 206-1
Furnished Materials . . . 106-3

G

Galvanized Pipe and Fittings . . . 753-1
Galvanizing . . . 771-1
Gaskets
for concrete pipe . . . 765-1

INDEX

Grading
- parkway . . . 424-1
- under pavements . . . 301-1

Granular Material . . . 601-6
Gravel Crushed . . . 701-1
Gray Iron
- castings . . . 787-1

Ground Water, Logs . . . 102-1, 601-6
Grout . . . 776-1
Grubbing and Clearing . . . 201-1
Guarantee
- bid . . . 102-2
- forfeiture of . . . 103-3
- proposal . . . 102-2
- provisions . . . 108-3
- return of . . . 103-1
- workmanship or materials . . . 108-3

Guardrail . . . 415-1
Gutter . . . 340-1

H

Hand Mixed Concrete . . . 725-6
Handrails
- aluminum . . . 520-1
- steel . . . 520-1

Health, Safety and Sanitation . . . 107-2
Heater Remix Resurfacing
- asphalt rejuvenating agent . . . 323-1
- equipment . . . 323-1
- heating and remixing . . . 323-1
- weather conditions . . . 323-1

Holes, Test . . . 102-1, 601-6
Hot Asphalt-Rubber Seal
- equipment . . . 335-1
- mixing . . . 335-1
- spreading . . . 335-2
- temperatures . . . 335-2

Hot In-Place Recycling . . . 327-1
Hydrants, Fire
- installation . . . 610-4
- types . . . 756-1
- working around . . . 107-5

I

Increased Quantities . . . 109-2
Inspection
- by others . . . 105-4
- final . . . 105-6
- of materials . . . 106-1
- of plant . . . 106-1
- of trees and shrubs . . . 430-2
- of work . . . 105-4
- section to be notified . . . 108-1

Inspector
- authority of . . . 105-4
- duties of . . . 105-4

Installation of
- cable . . . 360-1
- high density polyethylene pipe . . . 603-1
- sprinkler irrigation system . . . 440-1
- telecommunications . . . 360-1

INDEX

Insurance
- approval of . . . 103-2
- cancellation of . . . xii
- certificate of . . . x
- contractor's . . . 103-2
- damage claims . . . x
- fire and extended coverage . . . 103-2
- occupational disease . . . 103-2
- property damage . . . 103-2
- public liability . . . 103-2
- renewal certificate . . . xii
- types of . . . 103-2
- workman's compensation . . . 103-2

Iron Water Pipe and Fittings
- cast iron . . . 750-1
- ductile iron . . . 750-1

Irregular Proposals . . . 102-2
Irrigation Structures . . . 505-1

J

Jacked Steel Casing . . . 602-1
Jetting
- for settling trench backfill . . . 601-5

Joint Filler . . . 729-2
Joints
- asbestos cement pipe . . . 737-1
- asphalt concrete pavement . . . 321-4
- cast-in-place concrete pipe, stoppage . . . 620-2
- concrete curb, gutter and sidewalks . . . 340-2
- concrete structures . . . 505-5
- corrugated metal pipe . . . 621-1
- gunite . . . 525-2
- high density polyethylene pipe . . . 738-1
- iron water pipe . . . 750-1
- mortar, brick . . . 511-1
- mortar, concrete block . . . 510-1
- non-reinforced concrete pipe . . . 736-1
- pneumatically placed mortar . . . 525-3
- reinforced concrete pipe . . . 735-1
- rubber gaskets . . . 765-1
- sewer lines . . . 615-2
- subdrainage systems . . . 605-1
- vitrified clay pipe . . . 615-2
- water lines . . . 610-5

L

Labor and Materials
- payment bond . . . x, 103-1
- payment bond form . . . x

Labor Requirements . . . 107-1, 108-2
Laboratory Tests . . . 106-1
Landscape and Property Protection and Restoration . . . 107-4
Landscaping
- and planting . . . 430-1
- materials . . . 795-1

Laws
- contractor's responsibility to observe . . . 107-1

Legal Regulations and Responsibility to Public . . . 107-1
Legal Rights, No Waiver of . . . 107-5
Lime Slurry Stabilization . . . 309-1
- composition . . . 309-1

construction . . . 309-2
materials . . . 309-1
measurement . . . 309-4
payment . . . 309-4
Limitation of Operations . . . 108-2
Lining for Reinforced Concrete
installation . . . 741-1
sanitary sewer pipe . . . 741-1
testing and repairing . . . 741-3
Liquid Asphalt . . . 712-1
Liquidated Damages . . . 108-4
Location of Underground Utilities
expose all underground utilities . . . 107-5
notify prior to blasting . . . 107-3
notify utility companies . . . 105-2, 107-1
protection thereof . . . 107-5
that differ from those shown . . . 105-3
Lumber . . . 778-1

M

Maintenance
during construction . . . 105-5
of traffic . . . 104-1
unsatisfactory . . . 104-1, 107-2, 401-1
Major Item
dollar value of . . . 109-6
Manhole Construction . . . 625-1
Marshaling Yard . . . 107-3
Marshall Mix Design . . . 710-3
Masonry Mortar and Grout . . . 776-1
Materials
approval . . . 106-1
control of . . . 106-1
equal . . . 106-2
furnished . . . 106-1
handling . . . 106-2
landscape . . . 795-1
new and unused . . . 106-1
patented . . . 106-2
payment of . . . 109-5
quality . . . 106-1
reasonably acceptable . . . 105-2
rejection . . . 105-5, 106-1
samples and tests . . . 106-1
source of . . . 106-1
storage of . . . 106-2
substitutions . . . 106-2
unacceptable . . . 106-3
Measurement of Quantities and Payment . . . 109-1
Meter Service Connections, Water . . . 631-1
Methods and Equipment . . . 108-2
Microsurfacing Materials . . . 714-1
Microsurfacing Specifications . . . 331-1
Application . . . 331-4
Equipment . . . 331-3
Materials . . . 331-1
Mix Design . . . 331-1
Payment . . . 331-5
Proportioning . . . 331-1
Testing . . . 331-2
Mill Reports
handrails, steel and aluminum . . . 520-1
reinforcing steel . . . 727-1

structural steel 515-1
Mineral
aggregate 715-1
filler 715-1
Mineral Admixture 710-2
Mineral Filler 710-2
Monthly Payments 109-5
Monuments
construction 405-1
protection of 107-4

N

Name Stamped in Concrete 340-2
Noise 107-3
Non-Discrimination Statute 107-1
Non-Reinforced Concrete Pipe
joints 736-1
materials 736-1
test 736-2
Notice
of award 103-1
to contractor 108-1
to engineer 104-2, 105-2
to proceed 108-1
Notifications of Changed Conditions 110-1
Notify
inspection section 108-1
survey section 105-4, 108-1

O

Occupational Disease Insurance 107-2
Occupational Safety and Health Act 107-2
Officials, Public
personal liability of . . . . . x, 107-5
Open Channels, Earthwork 215-1
Open Trench 601-3
Opening Sections to Traffic 104-1, 108-1
Or Equal, Substitutions 106-2
Overtime
contractor 105-2, 108-2
inspection 108-3

P

Paint 790-1
Painting
application 530-1
surface preparation 530-2
testing 530-4
weather conditions 530-1
Parkway Grading 424-1
Partial Payments 107-4, 109-5
Partial Use or Occupancy 105-5
Patented Devices, Materials and Processes 107-2
Pavements
asphalt chip seal 330-1
asphalt concrete 321-1
asphalt concrete overlay 321-4
asphalt emulsion slurry seal coat 332-1
chip seal coat "chips" 330-1, 716-1

decorative 342-1
drainage 321-5
exposed aggregate 343-1
fog seal coats 333-1
hot asphalt-rubber seal 335-1
matching and surface replacement 336-1
precoated chip seal 335-2, 716-2
preservative seal 334-1
reclaimed asphalt 709-1
replacement for cuts 336-2
slurry seal coat 332-1
tack coat 329-1
Paving Asphalts
temperatures 711-2
test reports and certification 711-2
viscosity grades 711-1
Payments
actual cost work 109-3
assignment 109-2
extra cost work 109-2
final payment 109-5
partial payment 109-5
projects 109-4
scope of 109-1
stored materials 109-5
withheld 109-6
Pedestrian Crossing-Trenches 601-3
Permanent Pavement Replacement 336-2
Permits 107-1
Personal Liability of Public Officials . . . . . xi, 107-1, 107-5
Piles
concrete 782-1
driving 501-2
steel 781-1
timber 780-1
Pilot Cars or Flagman 401-1
Pins 770-1
Pipe
cast-in-place bedding 620-2
cast-in-place curing and backfill 620-3
cast-in-place trench widths 620-1
Pipe Installation for
sewer lines 615-1
sprinkler irrigation system 440-1
storm sewers 618-1
subdrainage 605-1
water lines 610-1
Plans
bidder's copies 102-2
conformity with 105-1
contractor's copies 105-2
coordination of 105-2
examination of 102-1
govern 102-1
shop drawings 105-1
Planting
and landscaping 430-1
Pneumatically Placed Mortar (gunite)
composition 525-1
curing 525-2
finishing 525-2
materials 525-1
placing 525-2

tests 525-2
Polyethylene Pipe 755-1
high density 603-1, 738-1
installation of 603-2
Portland Cement Concrete
admixtures 725-2
aggregate 725-2
cement 725-1
classes 725-1
loading and transportation 725-7
proportioning 725-3
street pavement 324-1
tests 725-6
water 725-2
Portland Cement Treated Base 705-1
Power of Attorney 103-2
Precast Prestressed Concrete Members
anchorages and distribution 506-3
bonding and grouting 506-5
concrete 506-1
enclosures 506-3
handling 506-6
prestressing 506-4
prestressing steel 506-2
samples for tests 506-5
Precast Safety Curbs 410-1
Precoated Chip Seal
asphalt grade 330-1
construction methods 330-1
temperatures 330-1, 330-2
Precoated Chips 330-1, 716-2
Preservative Seal 334-1, 718-1
Preservative Seal for Asphalt Concrete 334-1, 718-1
Preservatives
wood 779-1
Prime Coat 315-1
Processed Natural Material 702-2
Progress, Commencement and Prosecution 108-1
Property and Landscape Protection and Restoration 107-4
Property Marks and Monuments 107-4
Proposal
addenda 102-2
consideration of 103-1
forms . . . . . i, iii
irregular 102-2
more than one 102-3
opening 102-3
preparation 102-2
rejected 102-2
revision 102-3
submission of 102-3
withdrawal of 102-3
Proposal Guarantee
amount 102-2
forfeiture of 102-2, 103-3
return of 103-1
Public
convenience 107-2
property 107-3
safety 107-2
Public Officials
personal liability of 107-6, 108-1
PVC Sewer Pipe and Fittings 745-1

Q

Quantities
in proposal . . . 102-1
increase or decrease . . . 109-2
measurement of . . . 109-1
payment . . . 109-1
Quarry Stone . . . 701-2

R

Ready-Mix Concrete . . . 725-4
Reclaimed Asphalt Pavement . . . 709-1
Reclaimed Water Line
construction . . . 616-1
Recycling
hot in-place . . . 327-1
Reinforced Concrete Pipe
curing . . . 735-2
general . . . 735-1
manufacturer's qualifications . . . 735-2
materials . . . 735-1
tests and acceptance . . . 735-2
Reinforcing Steel . . . 727-1
Rejected Materials . . . 106-2
Removal of
defective materials . . . 105-5
existing improvements . . . 350-1
salvage items . . . 201-2
unacceptable work . . . 105-5
unauthorized work . . . 105-5
Rental Equipment . . . 109-4
Reports
archaeological . . . 107-2
blasting survey . . . 107-4
extra work . . . 104-2
final payments . . . 109-5
partial payments . . . 109-5
site conditions . . . 109-2
Responsibility, Contractor's . . . 107-4
Retaining Walls . . . 505-1
Revision of Proposal . . . 102-3
Right-of-Way
and traffic control . . . 401-1
furnishing . . . 107-5
monuments . . . 405-1
storage of materials . . . 106-2
Riprap
concrete . . . 703-1
construction . . . 220-1
sacks . . . 703-1
stone . . . 703-1
Riprap Construction
grouted . . . 220-1
materials . . . 703-1
plain . . . 220-1
preparation of ground surfaces . . . 220-1
rivets . . . 770-1
sacked concrete . . . 220-1
Rivets . . . 770-1
Road Closures . . . 107-3, 401-1

Road-Mixed Surfacing 320-2
application of liquid asphalt 320-2
materials 320-2
mixing 320-2
spreading aggregate 320-2
spreading and compaction 320-3
Roadway Excavation 205-1
overshooting 205-1
slides and slipouts 205-1
slopes 205-1
surplus material 205-2
unsuitable material 205-1
Roadway, Failure to Maintain 105-5
Rock, Gravel, and Sand 701-1
Rolling, Pavements
asphalt concrete 321-4
chip seal 330-3
hot asphalt-rubber 335-2
permanent 336-2
precoated chip 329-1
slurry seal 332-3
temporary 336-2
Rubber
asphalt 717-1
Rubber Gaskets 765-1

S

Safety
and public convenience 104-1, 107-2
curbs 410-1
for workman 105-1, 107-2
health and sanitation 107-2
of employees 107-2
of public 104-1, 105-1, 107-2
OSHA 107-2
Samples and Tests of Materials 106-1
Sand 321-7, 324-1, 342-1, 701-1
Sanitary Conditions 107-2
Sanitary Sewer
fittings for 738-2
Saw Cut
pavement 336-1, 601-2
portland cement concrete 324-6
Scarify 323-1
Schedule, Construction 108-1
Scope of Work 104-1
Seal Coats
chip 330-1
fog 333-1
hot asphalt-rubber 335-1
precoated 329-1
preservative 334-1
slurry 332-1
tack coat 329-1
Sewer Line Construction
air test 615-3
exfiltration test 615-4
jointing 615-2
laying pipe 615-1
materials 615-1
service taps 615-2
trenching 615-1

Sewer Manholes 625-1
Sewer Pipe
fittings for 745-1
Shop Drawings
approved by 105-1
cost of 105-1
furnished by 105-1
Sidewalk 340-1
Sidewalk Ramps 340-1
Sidewalks
terrazzo 341-1
Signs
barricades and warning 107-3
blasting operations 107-3
Site of Work
clean up 104-1
examination 102-1
Slurry Seal 332-1
materials 715-1
Slurry Seal Coat
construction methods 332-1
equipment 332-1
job mix 332-1
Soil Cement Base Course 311-2
Source of Materials and Quality 106-1
Specifications
conformity with 105-1
coordination with 105-2
examination 102-1
Sprinkler
irrigation system 757-1
irrigation system installation 440-1
Stakes, Construction 105-4
State inspector of weights 109-1
Steel
castings 785-1
piles 781-1
Steel and Aluminum Handrails 520-1
Steel Pipe 759-1
Steel Plates for Street Crossings 601-3
Steel Reinforcement 727-1
Steel Structures
buildings 515-1
computed weights 515-2
description 515-1
painting 515-2
workmanship 515-2
Stone
concrete paving 342-1
Storage of
equipment 106-2
explosive 107-3
materials 106-2
paid materials 109-4
Storm Drain 618-1
fittings for 738-1
Streets and Related Work 301-1
Structural and Rivet Steel 770-1
Structural Plate Pipes and Arches 761-1
Structure Excavation and Backfill 206-1
foundation material treatment 206-1
inspection 206-1
measurement 206-2
payment 206-2
structure backfill 206-1
Structure, Failure to Maintain 105-5

Structures
concrete . . . 505-1
steel . . . 515-1
Subcontractor's
eligibility and preference . . . 102-1
employment of labor . . . 108-2
insurance . . . 103-2
list of, when required . . . 102-2
personnel . . . 108-2
Subcontracts
approval of . . . 108-1
discrimination clause . . . 107-5
in accordance with . . . 108-1
liability . . . 108-1
Subdrainage
filter material . . . 605-1
pipe . . . 605-1
placement . . . 605-2
tests . . . 605-2
Subgrade
base materials . . . 702-1
bituminous treated . . . 313-1
cement treated . . . 312-1
curbs, driveways, gutters, sidewalks, sidewalk ramps . . . 340-1
preparation . . . 301-1
soil-cement . . . 311-2
Substitutions . . . 106-2
Subsurface Data . . . 104-2
Surety, Power of Attorney . . . 103-1
Survey
monuments . . . 405-1
section to be notified . . . 105-3, 108-1
Suspend the Work . . . 104-1, 104-3, 108-2, 108-3, 109-4

T

Tack Coat . . . 329-1
Tapping Sleeves and Valves . . . 630-1
air release and vacuum valves . . . 630-7
butterfly valves . . . 630-5
gate valves . . . 630-1
Telecommunications
installation . . . 360-1
Temperature
portland cement concrete . . . 725-4
Temperatures
asphalt concrete . . . 711-2
emulsified asphalts . . . 330-2, 713-3
expansion joint filler . . . 729-2
heater remix resurfacing . . . 323-1
hot asphalt-rubber seal . . . 335-1
liquid asphalts . . . 330-2, 712-1
non-reinforced concrete pipe . . . 736-1
portland cement concrete . . . 725-4
precoated chip seal . . . 330-1, 330-2
prestressed concrete members . . . 506-2
Temporary Pavement Replacement . . . 336-2, 601-7
Termination of Contract . . . 108-5
Terrazzo Sidewalks . . . 341-1

INDEX

Test
- award of contract . . . 103-1
- bidding . . . 102-3
- contract . . . 108-3
- execution of contract . . . 103-3
- extension of . . . 108-3
- failure to complete on . . . 108-4
- holes . . . 102-1, 601-6
- laboratory . . . 106-1
- procedures and methods . . . 106-1
- right to retest . . . 106-1
- samples of materials . . . 106-1

Testing
- asbestos-cement pipe . . . 737-1, 752-1
- asphalt concrete pavements . . . 321-6
- base materials . . . 702-2
- bronze castings . . . 785-1
- cast-in-place concrete pipe . . . 620-3
- concrete . . . 725-6
- curbs . . . 340-2, 725-6
- emulsified asphalts . . . 713-1
- galvanized materials . . . 771-1
- gray iron castings . . . 787-1
- gunite . . . 525-2
- gutters . . . 340-2
- lining for concrete pipe . . . 741-3
- liquid asphalts . . . 712-1
- mortar . . . 776-2
- non-reinforced concrete pipe . . . 737-1
- paint . . . 530-4
- paving asphalts . . . 711-1
- piles . . . 501-4
- polyethylene pipe . . . 755-1
- preservative seal . . . 718-1
- reinforced concrete pipe . . . 735-2
- rock, gravel and sand . . . 701-2
- rubber gaskets . . . 765-1
- sewer lines . . . 615-2
- sidewalks . . . 340-2
- sprinkler irrigation system . . . 440-5
- steel castings . . . 785-1
- structural and rivet steel . . . 770-1
- subdrainage systems . . . 605-2
- water lines . . . 610-7

Timber
- piles . . . 780-1

Topsoil . . . 425-1, 795-1

Trade Names and Substitution . . . 106-2

Traffic
- barricade manual . . . 107-3, 108-2, 401-1
- control . . . 401-1
- control devices . . . 401-1
- maintenance of . . . 104-1
- Tree and Shrub Planting . . . 430-2

Trench Excavation, Backfilling and Compaction . . . 601-1
- backfill and compaction . . . 601-4
- cutting pavements . . . 601-2
- density required . . . 601-5
- excavation . . . 601-1
- open trench . . . 601-3
- pavement replacement . . . 601-7
- protection of improvements . . . 601-3
- trench widths . . . 601-1

Truss Pipe
fittings for 744-1
Tunneled Steel Liner Plate 602-1
Tunneling Operation 602-1
Types of Pavement Replacement 336-1

U

Unacceptable
materials 106-3
work 105-5
Uniformed Off-Duty Law Enforcement Officer 401-2
Untreated Base 310-1
Use or Occupy 105-5
Utilities
cooperation with 105-2
moved by the owners 105-2
notify before blasting 107-3
protection of 107-5

V

Valves
air release and vacuum 630-7
butterfly 630-5
gate 630-1
sprinkler irrigation 440-3
Vitrified Clay Pipe 743-1

W

Wage Rates 107-1
Waiver of Legal Rights 107-6
Warranties 108-3
Water and Sewer 600-1
Water Line
construction 610-1
Water Line Construction
blocking 610-8
construction methods 610-1
couplings, joints, gaskets, flanges 610-7
disinfecting 610-9
fire hydrants 610-4
manholes and vaults 610-4
materials 610-1
meter service connections 610-6
Separations 610-2
polyethylene corrosion protection 610-3
testing 610-8
valves 610-3
Water Settlement 601-5
Water Taps and Meter Service Connections 631-1
Watering 225-1
Weather for
asphalt concrete pavement 321-1
chip seal coat 330-1
concrete structures 505-6
fog seal coat 333-1
heater remix resurfacing 323-1
hot asphalt-rubber seal 335-1
painting 530-1
slurry seal coat 332-2
Weighmaster's Certificates 109-1
Wire Reinforcement 727-1

INDEX

Withholding Assignments 109-2
Wood
- piles 780-1
- preservatives 779-1

Work
- acceptance 105-5
- actual cost work 109-3
- alteration of 104-2
- compensation for alteration 109-2
- contractor's responsibility 107-4
- control of 105-1
- extra 104-2, 109-2
- force account 109-2
- hours 108-1
- inspection of 105-4
- overtime 105-2, 108-2
- rejected 105-4
- scope of 104-1
- suspension of 105-1, 105-4, 107-5
- to be done 104-1
- unacceptable 105-5
- unauthorized 105-5
- weekend or holiday 108-2, 108-3

Workmen
- character of 108-2
- compensation insurance 103-3
- safety 105-1, 107-2

This Page is Reserved for Future Use