SPECIAL CONDITIONS

General

Work shall be in accordance with the Maricopa Association of Governments' "Uniform Standard Specifications for Public Works Construction"; Maricopa Association of Governments' "Uniform Standard Details for Public Works Construction" current as of August 2004; and the Arizona Department Of Transportation's "Standard Specifications for Road and Bridge Construction" current as of August 2004, except to the extent that these specifications specify other procedures, processes, forms, materials, details, or other direction regarding the work, and as required to comply with local ordinances and regulations.

Whenever the term County is used it shall be held to mean the City of Sedona. Whenever the term County Engineer is used it shall be held to refer to the City Engineer.

Electrical work shall be subject to inspection by the City of Sedona Building Safety Division and compliance with its requirements.

A1. CONTRACTOR'S UNDERSTANDING

It is understood and mutually agreed that this project is unique in that it represents a continuous, full-time daily service to the City and the people it serves. For this reason, the Contractor must recognize that he and his employees shall act in a courteous and professional manner at all times. The City does not guarantee any use of the equipment or services described in this Contract and, therefore, no adjustments will be made because of non-use. Payment of the Construction Yard and Administration items costs shall be considered sufficient compensation for availability of equipment and services whether used or not.

When practical the City of Sedona will require that the Contractor provide estimates of cost in prior to being authorized to proceed with work. The Contractor shall give due diligence in preparing such estimates that they be complete as to a general description of the work to be performed, the type of items applicable to the work, unit costs, an estimate of the time required for the work, and totals for performance of the work and its various parts.

B1. EQUIPMENT HOURLY RATE SCHEDULE

The Equipment Hourly Rate Schedule may be used to establish equipment cost for changed and/or added work to this Contract. The City does not guarantee any use of the equipment listed in this Contract and, therefore, no adjustments will be made because of non-use.

The City will pay to the Contractor the hourly rate for the actual time used.

The hourly rates to be paid shall include, unless otherwise specified, all fuel, lubricants, supplies and all other materials required and necessary for the operation of said equipment and such hourly rates shall, in addition, cover all other materials, supplies, repairs and replacements of every kind and character, including all labor, tools, and equipment required for making such repairs and replacements, which may be necessary to constantly keep and maintain said equipment and all parts thereof in proper working order and serviceable repair. The Contractor

agrees to bear and pay the cost of all delays, breakdowns, repairs, or damage to said equipment listed.

The Contractor agrees to place any and all equipment which may be directed to be used by the Engineer under the terms of this Contract on the site of the work at his sole cost and expense, including the cost of any and all supplies, the wages of operators, and any other transportation expenses required in the moving of this equipment to the site of the work.

The Contractor, upon written notification, shall remove said equipment from work site or job locations at said Contractor's sole cost and expense, including the cost of any and all supplies, the wages of operators, and any other transportation expenses required in the removal of this equipment from the site of the work.

The Equipment Hourly Rate Schedules shall be annually adjusted in the same manner as all other unit prices.

C1. LEVEL OF SERVICE

The protection of the public health, safety and welfare requires that a reasonable level of service be provided for certain Contract work activities. For this Contract, the Contractor shall provide the following additional labor, materials and equipment:

A. Commercial Drivers License (CDL).

D1. OPERATIONS

A. The Contractor shall require work crews to complete a "Daily Crew Report Form", as approved by the Engineer, documenting, in reasonable detail, the personnel, materials and equipment by location for work completed.

B. Requests for payment shall use a format acceptable to the City and Contractor. The form shall at minimum identify the location and date of the work; if the work is emergency or non-emergency; falls into the road, storm drainage and/or sanitary sewer category, or other; identify the unit price items being currently billed and the total quantities billed currently and to date within the current period of the contract. The current period of the contract is the time since the initial authorization or extension date of the contract whichever is later.

C. Equipment, signs, covers, fences, and posts shall be maintained in a neat, operational, clean conditional. Graffiti, excessive dirt, rust and similar signs of deterioration shall be removed or repaired.

D. Loads of dirt, debris, trash, and material subject to being blown from or falling from vehicles moving or being pulled on streets shall be covered.

E. Piles of dirt, debris, trash, and material subject to being eroded or moved by storm water, rain, or high wind shall be covered or otherwise contained so that it will not become a pollutant.

F. Concrete shall not be washed into waterways or onto roadways.

G. Debris, trash, and other waste shall be properly collected and disposed of. This work shall be considered part of any task generating such, unless otherwise stated by the City Engineer.

H. Any excavation requires that the Contractor call in a blue stake to have utilities marked and identified per Arizona Revised Statutes 40-263.

E1. PLANS AND SPECIFICATIONS

The nature of this project is such that plans were not prepared. The Engineer will provide to the Contractor such information necessary to exhibit or explain the nature of the work directed to be completed.

It will be the Contractor's responsibility to obtain and maintain copy(ies) of the Maricopa Association of Governments' "Uniform Standard Specifications for Public Works Construction"; Maricopa Association of Governments' "Uniform Standard Details for Public Works Construction" current as of August 2004; and the Arizona Department Of Transportation's "Standard Specifications for Road and Bridge Construction" current as of August 2004. The Contractor shall also obtain and maintain a current copy of the Section 7-15 " Rights of Way" of the City Code, as well as the City's Public Works Department - City-Wide Integrated Pest Management Plan Policy..

F1. PROGRESS MEETINGS

In addition to regular weekly progress meetings, the Contractor shall on a regular basis meet with the Engineer and conduct field reviews of work in progress, proposed work and or general observation of the City's infrastructure.

G2. PROGRESS PAYMENTS

The City will make monthly payments for work completed during the preceding month. No retention will be withheld for completed work, except as may be specified for a work activity. Should any defective work or material be discovered or reasonable doubt arise as to the integrity of any part of the completed work, the payment for such defective or questioned work will not be allowed until the defect has been remedied or cause for doubt removed.

H1. SCHEDULE OF CONSTRUCTION

The Contractor shall prepare and submit to the Engineer on a regular basis the following schedules:

1. Weekly workcrew work plan for approved work.

I1. SIGN MAINTENANCE

As per MUTCD standards, signs shall be properly maintained for cleanliness, visibility and correct positioning. Signs that have lost significant legibility shall be promptly removed.

J1. TIME IS OF THE ESSENCE

A. The Contractor shall where specified perform certain work within a specified timeframe in the interest of public health, safety and welfare.

DESCRIPTION OF AND BASIS OF PAYMENT FOR UNIT PRICE JOC WORK ACTIVITY

The provisions in this section supercede those contained in the Technical Provisions Section

162 CONCRETE HANDICAPPED RAMP

The Contract unit price shall be full compensation for furnishing all labor, materials (except tactile material such as mats or bricks), and equipment to construct handicapped ramps, regardless of type, in conformance with then current ADA standards where directed by the Engineer. ADA facilities shall strictly meet ADA minimums and tolerances for concrete work. Reconstruction of ramps, sidewalks, and other facilities which do not meet the criteria specified for the facility shall be reconstructed at the Contractor's expense. Such price shall include concrete, forming, compacting, backfilling, grading to specified grade and traffic control. The quantity to be paid for shall be each (EA) ramp of 300 square feet or less. Larger ramps may be treated as multiple ramps. A ramp at a curb return shall be considered one ramp regardless of the number of directions served.

165 CONCRETE SIDEWALK (4 IN.)(NEW)

The Contract unit price shall be full compensation for furnishing all labor, materials and equipment to construct a sidewalk in conformance with then current City, MAG or ADOT standards where directed by the Engineer. Such price shall include fill under and adjacent to the sidewalk, expansion joints, excavation, grading and compacting the excavated area, backfilling and compacting, forming, finishing and hauling off and disposing of excess material and traffic control. Quantity of excavation included in the unit price shall be based on up to an eight (8) inch depth. A minimum of 4" of AB shall be compacted to 95% prior to concrete placement. The quantity to be paid for shall be for each square yard (S. Y.) accepted and measured in place.

166 CONCRETE SIDEWALK (6 IN.)(NEW)

The Contract unit price shall be full compensation for furnishing all labor, materials and equipment to construct a sidewalk in conformance with then current City, MAG or ADOT standards where directed by the Engineer. Such price shall include fill under and adjacent to the sidewalk, expansion joints, excavation, grading and compacting the excavated area, backfilling and compacting, forming, finishing and hauling off and disposing of excess material and traffic control. Quantity of excavation included in the unit price shall be based on up to an ten (10) inch depth. A minimum of 4" of AB shall be compacted to 95% prior to concrete placement. The quantity to be paid for shall be for each square yard (S. Y.) accepted and measured in place.

167 CONCRETE DRIVEWAY (6 IN.)(NEW)

The Contract unit price shall be full compensation for furnishing all labor, materials and equipment to construct a driveway in conformance with then current City, MAG or ADOT

standards where directed by the Engineer. Such price shall include fill under and adjacent to the driveway, expansion joints, excavation, grading and compacting the excavated area, backfilling and compacting, forming, finishing and hauling off and disposing of excess material and traffic control. Quantity of excavation shall be based on up to a ten (10) inch depth. The quantity to be paid for shall be for each square yard (S. Y.) accepted and measured in place.

175 CONCRETE DITCH AND SLOPE GUNITE (NEW)

The Contract unit price shall be full compensation for furnishing all labor, material, traffic control and equipment. Such price shall include grading, removal and disposal of excess material. The quantity to be paid for shall be for each square yard (S.Y.) of six (6) inch gunite accepted and measured in place.

180 CONCRETE CURB & GUTTER (MAG TYPE" A", 6 IN.) (REPLACE)

The Contract unit price shall be full compensation for furnishing all labor, materials and equipment. Such price shall include removal and disposal of existing curb, forming, finishing, backfilling and compacting next to new curb and hauling off and disposing of excess material and traffic control. A minimum of 4" of AB shall be compacted to 95% prior to concrete placement. The quantity to be paid for shall be for each linear foot (L.F.) accepted and measured in place.

181 CONCRETE CURB (MAG TYPE "B") (REPLACE)

The Contract unit price shall be full compensation for furnishing all labor, materials and equipment. Such price shall include removal and disposal of existing curb, forming, finishing, backfilling and compacting next to new curb and hauling off and disposing of excess material and traffic control. A minimum of 4" of AB shall be compacted to 95% prior to concrete placement. The quantity to be paid for shall be for each linear foot (L.F.) accepted and measured in place.

182 CONCRETE CURB & GUTTER (MAG TYPE "C") (REPLACE)

The Contract unit price shall be full compensation for furnishing all labor, materials and equipment. Such price shall include removal and disposal of existing curb, forming, finishing, backfilling and compacting next to new curb and hauling off and disposing of excess material and traffic control. A minimum of 4" of AB shall be compacted to 95% prior to concrete placement. The quantity to be paid for shall be for each linear foot (L.F.) accepted and measured in place.

185 CONCRETE SIDEWALK (4 IN.)(REPLACE)

The Contract unit price shall be full compensation for furnishing all labor, materials and equipment to construct a sidewalk in conformance with then current City, MAG or ADOT standards where directed by the Engineer. Such price shall include removal and disposal of existing sidewalk, fill under and adjacent to the sidewalk, grading and compacting the excavated area, expansion joints, excavation, backfilling and compacting, forming, finishing and hauling off and disposing of excess material and traffic control. A minimum of 4" of AB shall be compacted to 95% prior to concrete placement. Quantity of excavation included in the unit price shall be based on up to an eight (8) inch depth. The quantity to be paid for shall be for each square yard (S.Y.) accepted and measured in place. If the existing sidewalk is

greater than 4 inches thick but less than 6 inches thick, the price paid per square yard of inch thickness over 4 inches will be 75% of the unit price item divided by four.

186 CONCRETE SHORT LOAD CHARGE

The Contract unit price shall be full compensation for any short load charges associated with providing a concrete delivery of 5 cubic yards or less of concrete material for any work requiring concrete. Payment shall be per short load (SL). No short load charge will be allowed if the charge was not actually incurred and if the load is over 5 cubic yards.

188 ADDITIVE COST FIBER REINFORCED CONCRETE

The Contract unit price shall be full compensation for an additive cost for fiber reinforced concrete. The quantity to be paid for shall be for each cubic yard (C.Y.) of material.

190 CONCRETE DITCH AND SLOPE GUNITE (REPLACE)

The Contract unit price shall be full compensation for furnishing all traffic control, labor, materials and equipment. Such price shall include removal and disposal of existing gunite, forming, finishing and hauling off and disposing of excess material. The quantity to be paid for shall be for each square yard (S.Y.) of six (6) inch pavement accepted and measured in place.

195 RIP-RAP (GROUTED) INSTALL

The Contract unit price shall be full compensation for furnishing all traffic control, labor, materials and equipment. Such price shall include preparing the ground area, furnishing and installing the rock, bedding material, concrete grout and disposing of excess material. The quantity to be paid for shall be for each cubic yard (C.Y.) accepted and measured in place.

196 RIP-RAP INSTALL

The Contract unit price shall be full compensation for furnishing all traffic control, labor, materials and equipment. Such price shall include preparing the ground area, furnishing and installing the rock, bedding material, and disposing of excess material. The quantity to be paid for shall be for each cubic yard (C.Y.) accepted and measured in place.

198 SEDONA RED CONCRETE COLOR

The Contract unit price for Sedona Red Concrete is an additive charge for provision of Sedona Red Concrete. It is in addition to other charges paid for work involving provision of concrete. Sedona Red color is produced by the addition of liquid Davis Baja Red to concrete at the rate of 3.05 pounds per cubic yard concrete. This charge is payable per each cubic (C.Y.) of concrete provided with Sedona Red Concrete coloring.

CITY OF SEDONA

TECHNICAL SPECIFICATIONS

April 2010

TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

SECTION 201
CLEARING AND GRUBBING

201.1 DESCRIPTION:

This work shall consist of removing objectionable material from the right-of-way; easements and such other areas as may be specified in the special provisions. Clearing and grubbing shall be performed in advance of grading operations.

201.2 PRESERVATION OF PROPERTY:

Existing improvements, adjacent property, utilities and other facilities, and trees and plants not to be removed, shall be protected from injury or damage resulting from the Contractor's operations, see Section 107.

201.3 CONSTRUCTION METHODS:

The construction site and areas on each side of the roadway from centerline to the toe of an embankment, the top of a cut slope, the slope rounding limit or to a line 10 feet outside the edge of the surfaced area, whichever is greater, but not beyond the limits of the right-of-way, shall be cleared of all trees, stumps, brush, roots, rubbish, debris and other objectionable matter, except as follows.

All trees and shrubs found suitable for improvement and beautification, which will not interfere with excavation or embankment or cause disintegration of the improvements shall not be disturbed. In any event, the Contractor shall avoid, as far as practicable, injury to shrubbery, vines, plants, grasses and other vegetation growing outside of the clearing limits. The dragging and the piling of materials of various kinds and the performing of other work which may be injurious to vegetation shall, insofar as practicable, be confined to areas which have no operations. Vegetation or which will be covered by embankment or disturbed by excavation during grading operations.

For the full width of all watercourses within the right-of-way lines, no stump, root or other obstruction shall be left higher than the natural streambed.

From excavated areas, all stumps, roots, and other obstructions 3 inches or over in diameter shall be grubbed to a depth of not less than 18 inches below finish grade.

In embankment areas or other areas to be cleared outside the road prism slope lines, all stumps, roots and other obstructions shall not be left higher than specified in Table 201-1.

Height of Embankment Over Stump	**Height of Clearing And Grubbing**
0 Feet to 2 Feet	All stumps or roots 6 inches or over in diameter shall be grubbed to 18 inches below original grade. All others shall be cut flush with the ground.
2 Feet to 3 Feet	All stumps 1 foot and over in diameter shall be grubbed to 18 inches below original grade. All others shall be cut flush with the ground.
Over 3 Feet	No stumps shall be left higher than the stump top diameter, and in no case more than 18 inches.

Cavities left below sub grade elevation by removal of stumps or roots shall be carefully backfilled and compacted.

Tree branches extending over the roadway, which hang within 12 feet of the profile grade or that restrict sight distance shall be cut off close to the trunk or stem of the tree in a neat and workmanlike manner. The Contractor shall remove additional tree branches under the direction of the Engineer, in such a manner that the tree will present a balanced appearance. Scars resulting from the removal of branches shall be treated with a heavy coat of an approved tree sealant.
All tree trunks, stumps, brush, limbs, roots, vegetation and other debris removed in clearing and grubbing shall be removed to locations outside of and out of sight of the right-of-way, or otherwise disposed of so as to leave the construction site and adjacent areas in a neat and finished condition, free from unsightly debris.

201.4 REMOVAL AND DISPOSAL OF SALVAGEABLE ITEMS:

Items and materials of salvage value as determined by the Engineer, unless incorporated in the new work, shall remain the property of the Contracting Agency and shall be stored in adjacent areas as directed by the Engineer. Such items and materials shall be carefully removed and in such a manner as to permit reuse.

201.5 PAYMENT, CLEARING AND GRUBBING:

Unless otherwise provided in the special provisions or price proposal, no payment will be made for clearing and grubbing as such; the cost thereof shall be included in the price for the construction or installation of the items to which said clearing and grubbing are incidental or appurtenant.

201.6 MEASUREMENT, REMOVAL AND DISPOSAL OF TREES:

If the proposal includes separate estimates of quantities for the removal of trees, the tree will be classified by size as follows:

(A) Trees 12 inches or less in diameter at 1-foot above the original ground surface will be included in the price for clearing and grubbing or excavation and no additional compensation will be allowed therefore.

(B) Trees more than 12 inches in diameter at-1 foot above the original ground will be included as separate price item and payment will be made at the unit price quoted in the proposal.

201.7 PAYMENT, REMOVAL AND, DISPOSAL OF TREES:

Payment for removal of trees will be on a unit price for each tree measured and removed, in accordance with the above classifications, at the unit price stipulated in the proposal.

END SECTION 201

SECTION 211

FILL CONSTRUCTION

211.1 DESCRIPTION:

Fill construction shall consist of constructing embankments except as may otherwise be specified, including the preparation of the areas upon which they are to be placed; the construction of dikes; the placing and compacting of approved material within areas where unsuitable material has been removed; and the placing and compacting of material in holes, pits, and other depressions.

211.2 PLACING:

Rocks, broken concrete, or other solid material, which are larger than 4 inches in greatest dimension shall not be placed in fill areas where piles are to be placed or driven.

When fill is to be made and compacted on hillsides or where new fill is to be compacted against existing fill or where embankment is built 1/2 width at a time, the slopes of original hillsides and old or new fills shall be benched a minimum of 4 feet horizontally as the fill is placed. A new bench shall be started wherever the vertical cut of the next lower bench intersects the existing ground. Material thus cut out shall be re-compacted along with the new embankment material by the Contractor at no additional cost to the Contracting Agency, unless the width of the bench required exceeds 4 feet, in which case the excavated material in excess of 4 feet will be measured and paid for as excavation.

Clods or hard lumps of earth of 6 inches in greatest dimension shall be broken up before compacting the material in embankment, except as provided in the following paragraph:

When the fill material includes large rocky material, or hard lumps, such as hardpan or cemented gravel, which cannot be broken readily, such material, shall be well distributed throughout the fill. Sufficient earth or other fine material shall be placed around the larger material as it is deposited so as to fill the interstices and produce a dense, compact fill. However, such material shall not be placed within 2 feet of the finished grade of the fill.

211.3 COMPACTING:

Fill shall be constructed in compacted layers of uniform thickness and each layer shall be compacted in accordance with the requirements herein specified with the following exception.

Where fills are to be constructed across low, swampy ground which will not support the weight of hauling equipment, the lower part of the embankment may be constructed by dumping successive loads of suitable materials in a uniformly distributed layer of thickness not greater than that necessary to support the equipment while placing subsequent layers, after which the remainder of the embankment shall be constructed in layers and compacted as specified.

Unless specified herein, or in the special provisions, the construction of dikes, the placing and compacting of approved material within the right-of-way where unsuitable material has been

removed, and the filling of holes, pits and other depressions within the right-of-way, shall conform to all of the requirements herein specified for compacting fills. Trenches, holes, depressions and pits outside of areas where fills are to be constructed shall be graded to provide a presentable and well-drained area.

Areas over which fills are to be placed shall be cleared and scarified to a depth of 6 inches to provide a bond between the existing ground and the material to be deposited there on. Unless otherwise specified, the original ground area upon which fills are to be constructed shall be compacted to a uniform density of not less than 95 percent.

The loose thickness off each layer of fill material before compacting shall not exceed 8 inches, except as provided in the following paragraph for rocky material. Each layer shall be compacted in accordance with the following requirements to a uniform density of not less than 90 percent, except that where a new or widened roadway and appurtenances are required, density of the upper 2 feet and when the fill is within 2 feet of the above shall be not less than 95 percent.

When fill material contains by volume over 25 percent of rock larger than 6 inches in greatest dimension, the fill below a plane 3 feet below finished grade may be constructed in layers of a loose thickness before compaction not exceeding the maximum size of rock in the material but not exceeding 3 feet in thickness.

The interstices around the rock in each layer shall be filled with earth or other fine material and compacted. Broken Portland cement concrete and bituminous type pavement obtained from the project excavations will be permitted in the fill with the following limitation:

(A) The maximum dimension of any piece used shall be 6 inches.

(B) Pieces larger than 4 inches shall not be placed within 12 inches of any structure.

(C) Pieces larger than 2 1/2 inches shall not be placed within 12 inches of the sub-grade for paving.

(D) Nesting of pieces will not be permitted.

At the time of compaction, the moisture content of fill material shall be such that the specified relative compaction will be obtained and the fill is firm and unyielding. Fill material which contains excessive moisture shall not be compacted until the material is dry enough to obtain the required relative compaction. Full compensation for any additional work involved in drying fill material to the required moisture content shall be considered as included in the contract price paid and no additional compensation will be allowed therefore.

Embankments shall be constructed so that each layer shall have a cross fall least 2 percent but no more than 5 percent.

211.4 TESTS:

Unless otherwise provided in the plans or special provisions the fill shall be thoroughly compacted to not less than the stated densities when tested and determined by AASHTO T-99, Method, and T-191 or ASTM D-2922 and D-3017 with the percent of density adjusted in accordance with the rock correction procedure for maximum density determination, standard detail, to compensate for the rock content larger than, that which will pass, a No.4

211.5 MEASUREMENT:

The quantities of fill construction used to construct embankments or dikes will be those of the complete price item, in place, within the limits of dimensions shown on the plans.

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

211.6 PAYMENT:

Quantities of fill construction will be paid for at the contract unit price per cubic yard of fill as stipulated in the proposal. Such price shall include placing and compaction and all related work as specified above, unless an alternate basis of payment is stipulated in the proposal.

Unless otherwise provided in the special provisions, no payment will be made for fill construction to replace unsuitable material or for fill for holes, pits, and other depressions. The cost thereof shall be included in the price for the construction of the items to which such fill is incidental or appurtenant.

END SECTION 211

SECTION 220

RIPRAP CONSTRUCTION

220.1 DESCRIPTION:

The construction of riprap shall consist of furnishing and placing stone, with or without grout, or sacked concrete riprap. The depth and type of riprap shall be as shown on the plans or specified in the special provisions.

220.2 MATERIALS:

Materials furnished for riprap shall conform to the requirements of Section 703.

220.3 PREPARATION OF GROUND SURFACES:

The bed for the riprap shall be shaped and trimmed to provide even surfaces. A footing trench shall be excavated along the toe of the slope as shown on the plans.

220.4 PLAIN RIPRAP:

When the required riprap is less than 20 inches in depth, stone shall be placed by hand. Stone shall be placed to provide a minimum of voids. The larger stone shall be placed in the toe trench, foundation course, and on the outer surface of the riprap. Stones shall be placed with their longitudinal axis normal to the face of the embankment and so arranged that each stone above the foundation course has at least a 3-point bearing on the underlying stones. Bearing on smaller stones used to chink voids will not be acceptable. Interstices between stone shall be chinked with small stones and spalls. The finished surface shall be even and tight and shall not vary from the planned surface by more than 3 inches per foot of depth. When the required riprap is 20 inches or more in dept~1 the stone may be placed by dumping and spread in layers by bulldozers or other suitable equipment.

220.5 GROUTED RIPRAP:

Riprap shall be placed as specified and grouted with portland cement mortar. The grout shall consist of 1 part cement and 3 parts by volume or 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 to 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 ½ 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 specified consistency.

220.6 SACKED CONCRETE RIPRAP:

Slopes on which the sacked concrete riprap is to be placed shall be finished within 0.2 foot of the designated grades. The first course shall be a double row of stretchers laid in a neatly trimmed trench. The second course shall be a single row of headers. The third and remaining courses shall be stretchers or headers as shown on the plans or specified in the special provisions and shall be placed so that joints between courses are staggered. Dirt and debris shall be removed from the tops of sacks before the next course is laid thereon. Headers shall be placed with the folds upward. Not more than 4 vertical courses shall be placed in any tier until the initial set has taken place in the first course of any such tier

When, in the opinion of the Engineer, there will not be proper bearing or bond due to delays in placing succeeding layers of the hampering of work by storm, mud or for any cause, a small trench shall be excavated back of the row of sacks already in place and this trench filled with fresh concrete before more sacks are placed. Payment for excavating the trenches shall be considered as included in the payment for the concrete in the trench.

Sacked concrete riprap shall be cured by sprinkling with a fine spray of water every 2 hours during daylight for not less than 3 days.

220.7 MEASUREMENT:

The quantities of riprap construction shall be those of the completed price item, in place, within the limits of dimensions shown on the plans.

The Engineer will compute the quantities of riprap by a method which, in his opinion, is best suited to obtain an accurate determination

.

220.8 PAYMENT:

Payment for riprap will be made for the number of cubic yards of riprap in place, on the basis of unit prices stipulated in the proposal and shall include preparation of ground surfaces and trenching, unless an alternate basis for payment is stipulated in the proposal.

END SECTION 220

SECTION 225

DUST CONTROL AND 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 the Contractor 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 maybe 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 shall be applied by sprinkling with tank trucks equipped with spray bars and suitable apparatus.

For trenching a trencher will be used. Trenchers shall be equipped with mister bars to provide dust control. The mister bars will be per manufacturers standards or if fabricated shall have emitters attached to the bar and spaced at no more than 8 inches. The emitters will be sized and oriented away from the bar and have the ability to provide a minimum of 1 gpm of water per linear foot of bar at 40 psi.

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 for the construction operation to which such

watering is incidental or appurtenant, unless otherwise provided for in the special provisions or proposal.

END SECTION 225

SECTION 301

SUBGRADE PREPARATION

301.1 DESCRIPTION:

This section shall govern the preparation of natural, or excavated areas prior to the placement of sub-base material, pavement, curbs and gutters, driveways, sidewalks or other structures. It shall include stripping and disposal of all unsuitable material including existing pavement, rock and obstructions such as stumps, roots, rocks, etc., from the area to be paved.

301.2 PREPRATION OF SUBGRADE:

With the exception of areas where compacted fills have been constructed as specified in Section 211 in the areas where new construction is required the moisture content shall be brought to that required for compaction by the addition of water, by the addition and blending of dry, suitable material or by the drying of existing material. The material shall then be compacted to the specified relative density. If pumping subgrade should become evident at any time prior to paving, the Engineer may require proof rolling with a pneumatic-tire roller or other approved equipment in order to identify the limits of the unacceptable area. The proof rolling will be performed at no additional cost to the Contracting Agency.

In situations where rock is encountered in the subgrade, that portion occurring in the rock zone shall be over-excavated and backfilled with suitable material. No measurement or direct payment will be made for work in over-excavating the rock areas.

301.3 RELATIVE COMPACTION:

The sub-grade shall be scarified and loosened to a depth of 6 inches. When fill material is required, a layer of approximately 3 inches may be spread and compacted with the subgrade material to provide a better bond. The sub-grade cut and fill areas shall be constructed to achieve a uniform soil structure having the following minimum dry density when tested in accordance with AASHTO T -99, Method A, and T -191 or ASTM D-2922 and D-3017 with the percent of density adjusted in accordance with the rock correction procedures for maximum density determination, standard detail, to compensate for the rock content larger than that which will pass a No.4 sieve.

(A) All Streets ……..…… 95percent
(B) Other traffic ways ……90percent
(C) Curbs, gutters and sidewalks ……85percent

301.4 SUBGRADE TOLERANCES:

Sub-grade upon which pavement, sidewalk, curb and gutter, driveways, or other structures are to be directly placed shall not vary more than ¼ inch from the specified grade and cross-section. Sub-grade upon which sub-base material is to be placed shall not vary more than ¾ inch from the specified grade and cross-section. Variations within the above specified tolerances shall be compensating so that the average grade and cross-section specified are met.

301.5 GRADING OF AREAS NOT TO BE PAVED:

Areas where grade only is called for on the plan shall be graded to meet the tolerances for the subgrade where sub-base or base material is to be placed. The surface shall be constructed to a straight grade from the finished pavement elevations shown on the plans to the elevation of the existing ground at the extremities of the area to be graded.

301.6 PROTECTION OF EXISTING FACILITIES:

The Contractor shall exercise extreme caution to prevent debris from falling into manholes or other structures. In the event that debris should fall into a structure it shall immediately be removed.

301.7 MEASUREMENT:

Measurement for grading under pavement will be by the square yard. No separate measurement will be made for the removal of rock.

301.8 PAYMENT:

Payment for this grading work will be made only when it is performed for street or roadway paving projects. Payment for necessary grading for items outside of the lip of gutter shall be included in the cost of those items.

Payment will be made at the unit price per square yard, and such payment shall be compensation in full for the item complete in place, including stripping, excavating of dirt or rock, hauling, filling, compacting, and disposing of excess or unsuitable materials, together with all costs incidental thereto.

END SECTION 301

SECTION 310

UNTREATED BASE

310.1 DESCRIPTION:

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

310.2 PLACING:

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

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

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

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

310.3 DEFICIENCEY:

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

TABLE 310-1		
THICKNESS AND PLASTICITY DEFICIENCY		
Type	**Deficiency**	**Corrective Measure**
I	½" or more but less than 1" in thickness	Place asphalt chip seal using precoated chips in accordance with Section 330 for the full roadway width over the area involved but for not less than 660 feet or one City block in length.
II	1" or more in thickness	Place an additional asphalt concrete overlay, a 9.5 mm mix, of ½ the thickness of the deficiency in thickness for the full roadway width over the area involved, not less than 660 feet or one City block in length.
III	A placticity index of 6 to 7 inclusive*	Place an asphalt concrete overlay ½ inch in thickness over the same total area as required for Type I and II.
IV	A plasticity index of over 7*	Remove deficient material from affected area and replace with material complying with the specifications.

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

310.4 PAYMENT:

Payment for untreated base will be included in the basis of the price per square yard of AC pavement over ABC unless an alternate basis of payment is provided in the proposal.

END OF SECTION 310

SECTION 321

ASPHALT CONCRETE PAVEMENT

321.1 DESCRIPTION:

This section covers the placement of asphalt concrete either as a surface course, base course and/or curb upon a previously prepared base or sub-grade in accordance with these specifications or as shown on the plans or ordered in writing by the Engineer.

321.2 MATERIALS AND MANUFACTURE:

Materials and manufacture shall conform with Section 710 for the type specified.

321.3 WEATHER AND MOISTURE CONDITIONS:

Asphalt concrete shall be placed only when the surface is dry, and when the atmospheric temperature in the shade is 40°F. or above. No asphalt concrete shall be placed when the weather is foggy or rainy, or when the base on which the material is to be placed contains moisture in excess of the optimum. Asphalt concrete shall be placed only when the Engineer determines that weather conditions are suitable.

321.4 APPLICATION OF TACK COAT:

A tack coat shall be applied to all existing and to each new course of bituminous surfaces prior to the placing of a succeeding layer of bituminous mixed material. The tack coal may be deleted when a succeeding laxer of asphalt concrete is being applied over a freshly laid course that has been subjected to very little traffic when approved by the Engineer. The application of the tack coat shall comply with Section 329. The grade of emulsified asphalt shall be SS-1 h as specified in S. 713

The same material that is specified above for the tack coat shall be applied to the vertical surfaces of existing pavements, curbs, and gutters, against which asphalt concrete is to be placed.

The surface to be covered may require repair or patching as directed by the Engineer.

321.5 PLACING, SPREADING, AND FINISHING:

Asphalt concrete shall be delivered and placed at a temperature within the job mix formula limits specified in Section 710. Tarpaulins shall be furnished and used to cover all loads during transportation if the temperature of the mixture is below the job mix formula limits specified in Section 710. The temperature shall be taken at a point 6 inches below the exposed surface of the material, in the truck, on the job site, and just prior to placement. When releasing agents are placed in the truck beds, no free fluid shall be present in the truck bodies at the time of asphalt concrete loading. Diesel fuel shall not be used as a releasing agent.

The handling of the completed mixture shall at all times be such as to prevent segregation, and the material as spread shall be free from areas of excess coarse, or fine material. Float rock developed in

the process of raking shall be placed on an underlying course or otherwise disposed of. In no case shall it be scattered over the surface of a final course.

Placement shall begin on pavement at points farthest from the source of supply, and progress continuously toward the source of supply, unless otherwise ordered by the Engineer, and no more than 1/2 day's delivery to the project shall be placed in anyone lane in advance of the other lanes. The end of each lane shall be staggered in relation to the adjacent lane.

At locations where the mixture is to be placed over areas inaccessible to the required spreading or compacting equipment or over areas where the use of the required spreading and compacting equipment would not be practicable, the mixture may be spread or compacted by other methods as approved by the Engineer.

321.5.1 Base Preparation: The base prepared by the Contractor, on which the asphalt concrete is to be placed, shall be smooth, firm, and true to grade and cross-section as shown on the plans, and shall be so maintained throughout the period of placing asphalt concrete. If necessary, in order to obtain the above specified base condition, and if ordered by the Engineer, a leveling course of asphalt concrete compacted in layers not exceeding 2 inches in thickness or aggregate base shall be spread to level irregularities such as dips, depressions, and sags. All irregularities such as humps or high spots shall be removed in order to provide a smooth base of uniform grade and cross-section, so that subsequent surfacing will be of uniform thickness. No additional compensation will be allowed for furnishing and placing these materials, and full compensation for all materials and for all work incidental to the correcting of irregularities will be considered as included in the contract price for asphalt concrete. I Pavement termination per Detail 201, Type A or B, shall be installed on all street edges where no other curb or retainment has been installed. This will include but not be limited to the center line of half streets, diagonal or perpendicular end terminations, street edges without curb and gutter or single curb.

321.5.2 (A) Spreading and Finishing Equipment: Self-propelled mechanical spreading and finishing equipment shall be provided with a vibrating screed or strike off assembly capable of distributing not less than the full width of a traffic lane. The term screed includes any strike off device that operates by cutting, crowding, or other practical action which is effective on mixtures at workable temperatures without tearing, shoving, or gouging, and which will produce a finished surface of the smoothness and texture required. The screed shall be adjustable to the required template and elevation. The forward speed of operation of self-propelled mechanical spreading and finishing equipment shall be so regulated that no irregularities will result in the surface texture or smoothness of the mat due to excessive forward speed of the spreading machine. The forward speed of operation shall not exceed 55 feet per minute unless the contractor can demonstrate to the satisfaction of the Engineer that higher speeds will not affect the smoothness of the mat

All material within the self-propelled mechanical spreading and finishing equipment shall be handled to prevent segregation of the aggregate. This includes but is not limited to devices such as augers, screws or slat conveyors. These devices shall extend to the final or termination point where the material is being transported within the equipment. If any of the devices fail to function, the paving operation shall be terminated immediately until repairs are completed. 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 off 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.
Self-propelled mechanical spreading and finishing, equipment, shall be equipped with a control system capable of automatically maintaining the screed elevation as specified herein.

The control system sha1l be automatically actuated from either a reference line or surface through a system of mechanical sensors or sensor directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. When directed, the transverse slope control system shall be made inoperative and the screed shall be controlled by sensor directed automatic mechanisms which will independently control the elevation of each end of the screed from reference lines or surfaces.

The controls shall be capable of working in conjunction with any of the following attachments:

(A) Ski-type device of not less than 30 feet in length.
(B) Taut stringline or wire set to grade.
(C) Short ski or shoe.

The Contractor shall furnish all necessary equipment to perform the paving operation including a long ski or shoe and all required stakes and wire. Should the automatic control system become inoperative during the day's, work, the Contractor may be permitted to place the remaining material on site using manual controls; however, no further material shall be delivered to the project site, and work shall not be resumed thereafter until the automatic control system has been made operative.

In conditions where the curb and/or gutter is not even and true to grade, the Engineer may require the Contractor to use a ski-type device or stringline as described in A or B above to establish the grade of the asphalt concrete surface adjacent to the curb or gutter.

When trucks are backed into the self-propelled mechanical spreading and finishing equipment, it shall be in such a manner that the equipment will not be jarred excessively or moved out of line. Once in position, the truck shall be securely attached to the equipment during spreading and finishing.

When the Engineer deems that the automatic screed control operation is not practical under a particular set of conditions, he/she may order the use of manual control in lieu thereof. However, the machine shall be equipped with the automatic device.

Use of the spreader boxes will be permitted by the Engineer only in writing, under certain conditions, such as in alleys and on narrow paving projects where it is not practical to use self-propelled equipment. The spreader box will be equipped with a readily adjustable strike off blade. In order to obtain a smooth surface manipulation of the controls of the spreader box shall be held to a minimum. Trucks shall be backed into the spreader box in such a manner that the box will not be jarred excessively or moved out of line and the trucks shall be securely attached to the spreading and finishing.

If approved in writing by the Engineer, asphalt base course material may be placed with a self propelled pneumatic tired blade grader equipped with an automatic leveling device capable of

accurately maintaining transverse slope of the blade at a preset angle. The grader shall have a blade not less than 12 feet long. Motor graders shall be free from appreciable lost motion in the blade control.

321.5.2 (B) Compaction Equipment: All rollers used in compaction of asphalt concrete shall be self-propelled and reversible, with a minimum weight of 8 tons. All rollers shall be maintained to insure smooth operation in respect to steering, the ability to stop, start and reverse. All rollers shall be equipped with an automatic device or devices capable of properly dispensing an approved releasing agent on the wheels to prevent the wheels from picking up the asphalt concrete. Diesel fuel shall not be used as a releasing agent. All rollers shall be equipped with scrapers to keep the wheels clean from asphalt and other debris.

Pneumatic-tired rollers shall be of the 2-axle tandem type, having a rolling width of not less than 5 feet. All tires shall not be less than 20 inches in diameter, shall be of the same size and shall have treads satisfactory to the Engineer. The roller shall be so constructed that the operating weight per tire shall not be less than 2000 pounds and the tires shall be spaced so that the entire gap between adjacent tires will be covered by the tread of the following tire. Except as otherwise specified, each tire shall be inflated to 90 psi and at all times the air pressure in each tire shall not vary more than 5 psi from the specified pressure. Pneumatic-tired rollers shall be equipped with skirt-type devices mounted around the tires so that the temperature of the tires will be maintained during the rolling process.

Steel-wheeled tandem rollers or vibratory rollers may be used where applicable. In all cases, the larger of the two roller wheels will be operated in the forward position. The steel wheels shall be straight, free from grooves and/or pits. Vibratory rollers shall be operated in accordance with standard practices and manufacturer recommendations.

321.5.3 Leveling 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.

After the prime coat or tack coat has been applied, the leveling course mixture shall be spread to the proper width and to such depth as will compact to the required thickness. Actual quantities of the mixture required will be determined by the Engineer.

The distance to which a leveling course may be spread in advance of covering it with the following course shall be as ordered by the Engineer.

The leveling course material shall be placed in layers, 2 inches maximum compacted thickness, prior to finishing by means of self-propelled spreading equipment, spreader box or motor graders as discussed above. Other means may be permitted for placing the leveling course provided the method, at the discretion of the Engineer, can provide a finish surface that does not vary from the design surface by more than the amount specified below. In order to obtain a smooth surface, manipulation of controls of the paver shall be at a minimum. Unless otherwise permitted by the Engineer, adjustments shall not be made on less than 50 feet intervals and any adjustment shall not result in a change in thickness of the pavement in excess of 1/8 inch. Except where the machine is equipped with electronic grade controls.

The placing of the leveling course shall be not less than one lane width and for the longest practical length for anyone lay, preferably not less than 1200 feet. The exact width and length will be approved by the Engineer.

Compaction shall be accomplished by use of pneumatic-tire or steel-wheel rollers. Rolling shall proceed concurrently with the laydown of the leveling course. During the rolling operation, the speed of the roller shall not exceed 3 miles per hour. Additional rollers may be required depending on the placement rate of the asphalt concrete. If ample number of rollers are not present, the contractor shall adjust the placement rate to accommodate the roller speed.

The leveling course 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 1/2 inch from the lower edge of a 25-foot straightedge when the straightedge is placed parallel the centerline of the roadway. The straightedge shall be furnished by the Contractor and shall be constructed of such lightweight materials that it can be handled by the inspector without assistance.

When deviations in excess of the above tolerance are found, such places as humps, or depressions shall be corrected to meet the specified tolerance. All labor and equipment necessary to correct such deviations shall be at no additional cost to the Contracting Agency. Adjustment in the cost for the material may be requested by either the Contracting Agency or Contractor depending on the type of deviation.

321.5.4 Asphalt Base and Surface Course: Asphalt base and surface courses shall be spread and finished by means of self- propelled mechanical spreading and finishing equipment as described and specified above, except as otherwise noted. The compacted thickness of layers placed shall not exceed 150% of the Design Target Lift Thickness of Table 710-1 except as otherwise provided in the plans and specifications, or if approved in writing by the Engineer.

When more than one course is placed, longitudinal joints of each course shall be staggered not less than 6 inches with relation to the longitudinal joints of the underlying course. Before a surface course is placed adjacent to cold transverse construction joints, the joints shall be trimmed to a vertical face by cutting (e.g., saw cut) the material back to its full depth to expose a fresh surface! The joint shall be cut on a 10 to 15 degree skew from a line perpendicular to the center line of the street or roadway. The joint formed, when the fresh mixture is placed shall be dense and well sealed. The transverse surface joints shall be tested with a 25 foot, straight edge and shall conform to the requirements herein for surface smoothness. For short overnight intermissions in paving, a full depth bulkhead (e.g., wooden member) can be placed near the end of the day's pavement. The bulkheads and excess material will be removed just prior to the placement of the following day's pavement.

An approved joint heater shall be used on cold transverse or longitudinal joints where conditions are such that it is deemed necessary by the Engineer to seal the joint, a light coat of asphalt emulsion shall be applied to the exposed edge before the joint is made.

Sufficient rolling equipment shall be furnished to satisfactorily compact and finish the amount of mixture being placed. However there shall be a minimum of two rollers with two (2) operators on the project at all times. Upon direction of the Engineer, one of the rollers may be a pneumatic-tire roller. During rolling operations, the speed of the roller(s) shall not exceed 3 miles per hour .If ample

number of rollers are not present, the contractor shall adjust the asphalt placement rate to accommodate the roller(s) speed. The type and required number of rollers shall be on the project and in acceptable operating condition, prior to the placement of any asphalt material. All rollers shall be operated continuously from the breakdown through finish rolling. The contractor may use vibratory rollers in lieu of the steel-wheeled roller, however when the thickness of the asphalt is one (l) inch or less, all rolling will be done in the static mode.

When more than one width of asphalt concrete material will be placed, a 6 inch strip adjacent to the area on which future material is to be laid shall not be rolled until such material has been placed but shall not be left unrolled more than 2 hours after being placed, unless the 6 inch unrolled strip is first heated with a joint heater. After the first strip or width has been compacted, the second width shall be placed, finished and compacted as provided for the first width, except that rolling shall be extended to include the 6 inches of the first width not previously completed. At any place not accessible to the roller, the mixture shall be thoroughly compacted with tampers and finished, where necessary, with a hot smoothing iron to provide a uniform and smooth layer over the entire area compacted in this manner.

Breakdown rolling shall begin as soon as the mixture will bear the roller without undue displacement. Rolling shall be longitudinal, overlapping on successive trips by at least 1/2 but not more than 3/4 the width of the rear wheels. Alternate trips of the roller shall be of slightly different lengths. The motion of the roller shall at all time be slow enough to avoid displacement of the mixture.

Break down and compaction rolling shall be done by either steel-wheel or pneumatic-tire rollers. The Engineer may require a pneumatic-tire roller for one of the rolling operations. Rolling shall continue until the specific gravity of the compacted mixture is not less than 95 percent of the specific gravity of specimens composed of the same materials in similar proportions or composed of the same mixture compacted in the laboratory by the 75 blow method of AASHTO T-245 if the mix was designed by the Marshall method. If the mix was designed by The Asphalt Institute's SP-2 Gyratory method, rolling shall continue until the specific gravity of the compacted mixture is not less than 93 percent of the maximum theoretical specific gravity (ASTM D-2041) laboratory. Finish rolling shall be done by means of steel-wheeled roller or a vibratory steel-wheel roller operated in the static mode.

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 25 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 of 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.

321.5.5 Preservative Seal: An asphalt concrete preservative seal shall be used on all new asphalt concrete pavement and shall comply with Section 334. The Engineer will make a field determination and provide the actual application rate or delete the requirement. This seal is not required for pavement matching and surface replacement over pipe trenches, etc., unless specified in the special provisions.

321.6 CORRECTIVE REQUIREMENTS FOR DEFICIENCIES:

321.6.1 Thickness: When, in the opinion of the Engineer, there is reason to believe that the pavement may be deficient in thickness, cores will be taken by the Engineer at random locations, with 1 core for each 8 feet or portion thereof of width and for every 500 feet of lineal distance, with a minimum of 1 core per 8 feet of width between intersecting streets or portions thereof. When a deficiency of more than ¼ inch is found, 2 additional cores will be taken not closer than 100 feet apart nor closer than 100 feet to the original core, and the average of these 3 cores will be used to determine the amount of the deficiency. Further cores may be taken by the Contractor if he so chooses, to determine the limits of the deficiency, and shall be at no additional cost to the Contracting Agency but shall not be used in determining the average thickness for the pavement. Thickness of the cores shall be determined by average caliper measurement. Where pavement thickness is deficient by ¼ inch or less, it will be paid for at the contract price.

Where the pavement is deficient in thickness by more than 1/4 inch but not more than 1/2 inch, payment will be reduced per Table 321-1.

TABLE 321-1

PAVEMENT THICKNESS PAYMENT REDUCTION (AC)	
Specified Mat Thickness	**Reduction in Payment**
less than 1.50"	50%
1.50” to 1.99”	33%
2.00” to 2.49”	25%
2.50” to 2.99”	20%
3.00” and over	17%

When the deficiency of the pavement thickness exceeds 1/2 inch, the pavement shall be overlaid on the area affected, but in no case less than one City block or 660 feet whichever is less in length, for the full width of pavement, with a new mat of material specified by the Engineer, equal in thickness to the deficiency but not less than 1/2 inch in any instance. This is to be done at no additional cost to the Contracting Agency.

The monetary compensation shown in Table 321-1 will apply when a public agency is the Contracting Agency. When the contract is directly with a party other than a public agency, as in the case of permits, etc., the Contractor shall place an asphalt chip seal using precoated chips, complying with Section 330 when the pavement is deficient by more than 1/4 inch but not more than 1/2 inch in

lieu of the monetary consideration. The area covered shall be as specified in the preceding paragraph.

When the pavement is deficient in thickness by more than 1/4 inch, all coring done to establish this premise shall be at the expense of the Contractor.

321.6.2 Density: When, in the opinion of the Engineer, there is reason to believe that the compaction of the mixture is deficient, cores will be taken in the same pattern as that defined in the first paragraph of this subsection, except that the figure I percent will be substituted for 1/4 inch, and tested for specific gravity. Where the specific gravity is deficient by I percentage point or less, it will be paid for at the contract price. Where the specific gravity is deficient by more than I percentage point and the Contractor is unable to correct the deficiency, payment will be reduced per Table 321-2.

TABLE 321-2	
PAVEMENT DENSITY PAYMENT REDUCTION (AC)	
Deviation Below Specification	Reduction in Payment
2% points	2%
2 to 3% points	5%
3 to 5% points	10%

When the deviation is more than 5 percentage points, the Contractor shall place a standard pre-coated chip seal complying with Section 330 over the area involved but for not less than one City block or 660 feet whichever is less.

The monetary compensation shown in Table 321-2 will apply when a public agency is the Contracting Agency. When the contract is directly with a party other than a public agency, as in the case of permits, etc., the following applies in lieu of the monetary consideration above. When the deviation is 2% to 5% points inclusive, the Contractor shall place a asphalt chip seal using pre-coated chips complying with Section 330 over the area involved, but for not less than one City block or 660 feet, whichever is less.

321.6.3 Asphalt Cement Content: When the asphalt cement content exceeds the limits established in Section 710, 2 additional core tests will be made for each deficient test taken, and the average of all 3 tests made shall be used to determine the asphalt cement content.

When the asphalt cement content is in excess of that permitted, the Contractor shall remove any areas of bleeding, but in no case less than the specified roller width, as directed by the Engineer, and replace the affected material with new material meeting the specification requirements for the mix type involved. This shall be done, any time within a period of 1 year until the bleeding has been corrected, at no additional cost to the Contracting Agency.

Should the stability of the mix be affected by the excess asphalt cement to such an extent that the pavement is displaced under normal traffic loads, within a period of 1 year, the areas affected shall be removed and replaced with new material, at no additional cost to the Contracting Agency. When the asphalt cement content is from 0.0 to 0.2 percent points, weight of the total mixed material less than the minimum permitted in Section 710, payment to the Contractor for asphalt concrete

pavement will be reduced per Table 321-3.

TABLE 321-3	
ASPHALT CEMENT CONTENT PAYMENT REDUCTION (AC)	
Deviation from that Permitted	**Payment Reduction**
0.0 to 0.1% points	2%
Over 0.1 to 0.2% points	5%

When the deviation is more than 0.2 percent points, greater than the permitted deviation, the Contractor shall place an asphalt chip-seal using pre-coated chips complying with Section 330 over the area involved but not for less than one City block or 660 feet, whichever is less. The monetary compensation shown in Table 321-3 will apply when a public agency is the Contracting Agency. When the contract is directly with a party other than a public agency, as in the case of permits, etc., the following penalties apply in lieu of the monetary considerations listed in Table 321-3. When the deviation is in the range of 0.0 to 0.2% points, not inclusive, greater than the permitted deviation, a separate absorption test shall be made to determine the proper application rate for the preservative seal for this specific section. The Engineer shall make the decision as to the rate of application for this section. When the deviation is 0.2% points or more greater than the permitted deviation, the Contractor shall place an asphalt chip seal using pre-coated chips in accordance with Section 330 over the area involved for not less than one City block or 660 feet, whichever is less.

321.6.4 Mineral Aggregate: When the mineral aggregate gradation deviates from the requirements of this specification in an amount which, in the opinion of the Engineer, will affect the stability or durability of the mix, the Contractor shall, as directed by the Engineer, either; remove the asphalt concrete and replace it with material which meets the requirements of this specification or place an additional mat of such thickness and gradation as required by the Engineer which will, in the opinion of the Engineer , correct the deficiency.

The above corrective work, due to deviations from the requirements for mineral aggregate, shall be done at no additional cost to the Contracting Agency.

321.7 CURBS:

The curb shall be placed by an approved extrusion type machine. In the event the Contractor wishes to utilize a template which varies from the cross-section shown on the plans, such change must meet the approval of the Engineer. The asphalt mix used shall be a 9.5mm mix One percent by weight of the total mixture shall consist of a granulated synthetic resin stiffener. Lexite or equal, complying with the following characteristics:

Softening Point (Ring & Ball)	ASTM D-36	210 F. minimum
Acid Number	ASTM D-465	Less than 1.00

Saponifiable matter	ASTM D-464	Less than 1%
Iodine Number	ASTM D-29	175—185

321.8 MEASUREMENT:
Asphalt concrete pavement will be measured by the ton, computed to the nearest 0.10 of a ton or by the square yard, for the mixture actually used as allowed above, which shall include the required quantities of mineral aggregates, filler material, asphalt cement, and sand. 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.

Weighmaster's Certificates, in accordance with Section 109, will be provided regardless of method of measurement. The total tons placed will be compared to theoretical per typical section and shall be within the range of equal to up to no more than ½" greater than the typical section.

The price per ton or square yard for asphalt concrete shall include the cost of the asphalt cement in the percentages as specified in Section 710.

Asphalt concrete curbs, will be measured by the linear foot, parallel to the base or foundation, unless otherwise specified.

Preservative seal, for asphalt concrete pavement will be measured by the gallon diluted, unless otherwise indicated in the special provisions.

321.9 PAYMENT:

The asphalt concrete measured as provided above, will be paid for at the contract price per ton or square yard, 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.

The quantities of preservative seal, measured as provided above will be paid for at the contract price per gallon diluted or as specified, which price shall be full compensation for the item completed as herein described or as specified.

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 a unit weight of 145 pounds per cubic foot. The calculations and payment for overrun will be by individual price 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.

Payment for the curbs will be at the contract unit price per linear foot, which price shall be full compensation for the curb complete in place, including all necessary labor, equipment and material.

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.

END SECTION 321

SECTION 336

PAVEMENT MATCHING AND SURFACING REPLACEMENT

336.1 DESCRIPTION:

Street and alley pavement and surfacing within the Contracting Agency's rights-of-way, removed by construction activities or to be widened or matched in connection with the improvement of Public Works, shall be placed as shown on the plans and applicable standard details, in accordance with this specification and/or the special provisions, as indicated on the plans, and as required by Sections 321 and 710. Portland cement concrete pavement replacement shall be in accordance with Type C of the Standard Details, and as required by Sections 505 and 725.

ABC or decomposed granite surface replacement shall be constructed in accordance with Type F of standard details as indicated on the plans and in Section 702.

Temporary pavement replacement shall be constructed as required below.

Pavements to be matched by construction of new pavements adjacent to or at the ends of a project shall be saw cut in accordance with these specifications and where shown on the plans.

Pavement and surfacing replacement within ADOT rights-of-way shall be constructed in accordance with their permits and/or specification requirements.

336.2 MATERIALS AND CONSTRUCTION METHODS

Materials and construction methods used in the replacement or pavement and surfacing shall conform to the requirements of all applicable standard details and specifications latest revisions.

336.2.1 Pavement Widening or Extensions: Existing pavement which are to be matched by pavement widening or pavement extension shall be trimmed to a neat true line with straight vertical edges free from irregularities with a saw specifically designated for this purpose. The minimum depth of cut shall be 1 ½ inches or D/4, whichever is greater.

The existing pavement shall be cut and trimmed after placement of required ABC and just prior to placement of asphalt concrete for pavement widening or extension and the trimmed edges shall be painted with a light coating of asphalt cement or emulsified asphalt immediately prior to constructing the new abutting asphalt concrete pavements. No extra payment shall be provided for these items and all costs incurred in performing this work shall be incidental to the widening or pavement

extension.

The exact point of matching, termination, and overlay, may be adjusted in the field, if necessary, by the Engineer or designated representative.

336.2.2 Pavement to be Removed: Existing asphalt pavement to be removed for trenches or for other underground construction or repairs shall be cut by the device capable of making a neat, straight and smooth cut without damaging adjacent pavement that is not to be removed. The Engineer's decision as to the acceptability of the cutting device and manner of operation shall be final. If saw cutting, only, is to be utilized, it will be so specified in the plans or special provisions.

In lieu of cutting trenches across driveways, curbs and gutters, sidewalks, alley entrances, and other types of pavements, the Contractor may, when approved by the Engineer, elect to tunnel or bore under such structures and pavements.

When installations are within the street pavement and essentially parallel to the centerline of the street, the Contractor, with approval of the Engineer, may elect to bore or tunnel all or a portions of the installation. In such installations, the seal coat requirements, as discussed in Section 336.2.4, will be modified as follows:

(A) If the pavement cuts (bore pits, recovery pits, etc.) are 300 feet or more apart, the bore or tunneled distance will not be considered as part of the open trench and the seal coat may not be required.

(B) If the pavement cuts (bore pits, recovery pits, etc.) are less than 300 feet apart, the distance between the cuts will be considered the same as a trench cut and the distance will be added to any trench cut distances.

336.2.3 Temporary Pavement Replacement: Temporary pavement replacement, as required in Section 601, may be with cold-mix asphalt concrete, with a minimum thickness of 2 inches, using aggregate grading in accordance with Section 710.

Temporary pavement replacement shall be used in lieu of immediate placement of single course permanent replacement or the first course of two course pavement replacement only on transverse lines such as spur connections to inlets, driveways, road crossings, etc., special prior arrangement; or for emergency conditions where it may be required by the Engineer. Temporary pavement replacement shall be placed during the same shift in which the backfill to be covered is completed.

Rolling of the temporary pavement replacement shall conform to the following:

(A) Initial or breakdown rolling, shall be followed by rolling with a pneumatic-tired roller. Final compaction and finish rolling shall be done by means of a tandem power roller.

(B) On small areas or where equipment specified above is not available or is impractical, the Engineer will approve the use of small vibrating rollers or vibrating plate type compactors provided.

The surface of the temporary pavement shall be finished off flush with the adjacent pavement.

336.2.4 Permanent Pavement Replacement and Adjustments:

336.2.4 Permanent Pavement Replacement: Pavement replacement for cuts essentially parallel to the street centerline and greater than 50 feet in length shall be two, course pavement replacement as hereinafter specified. Pavement replacement shall provide a minimum of 22 feet of width for a two-lane roadway or match existing which ever is greater. For cuts greater than 600 feet in length the entire area shall then be seal chips or as otherwise specified. This seal coat shall extend from the edge of pavement or lip of gutter to the street center line except; that on residential streets less than 36 feet face to face of curb or where the pavement patch straddles the centerline, the entire width of street

In lieu of placing the seal coat as required previously, and with approval of the Contracting Agency, the Contractor may deposit with the Contracting Agency for credit to the Street Maintenance Department, a negotiated agreed upon amount. The Street Maintenance Department will incorporate this work into their street maintenance program.

Pavement replacement for cuts parallel to the street centerline less than 50 feet in length, transverse cuts, bell holes and similar small areas shall match gradation and thickness of the existing pavement. These one-course pavement patches shall be compacted with a vibratory roller to the same density specified for asphalt concrete pavements.

Laying of single course or the base course of the asphalt concrete pavement replacement where a two course replacement is applicable shall never be more than 600 feet behind the ABC placed for the pavement replacement.

The trench must be compacted to its required density, and required ABC must be in place prior to the placement of the asphalt concrete.

Single course replacement shall consist of a 12.5 mm or 19 mm mix placed and finished as directed by the Engineer.

The base course of two-course pavement replacement shall consist of a 19mm mix in accordance with Section 710.

Where the base course is to be placed with non-compactive equipment, it shall be not less than 2 inches in thickness and the material shall be immediately rolled with a pneumatic-tired roller. The surface course shall be of sufficient depth to provide the total required compacted thickness of the two courses, but not more than 1 inch. Where the trench is 6 feet or more in width, all courses, single or both courses of the two-course pavement replacement, shall be laid with a self-propelled compacting, spreading equipment. When the trench is from 6 to 8 feet in width, the self-propelled compacting, spreading equipment shall not be wider than 8 feet. All courses, except the surface course, shall be of a compacted thickness of not less than 11/2 inches.

The surface course shall consist of a 9.5 mm mix in accordance with Section 710 as specified by the

Engineer to match the existing surface. The surface course shall not be placed sooner than 2 weeks after the base course, except where the trench crosses a signalized intersection. In this case the surface course shall be placed within 48 hours, or the crossing pavement replacement shall be single course as specified above.

Placement of the surface course is to be by means, which will result in a surface texture satisfactory to the Engineer, and flush with the existing pavement.

The acceptable surface profile from the existing surface across a pavement replacement shall not vary more than ¼-inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel or perpendicular to the centerline of the roadway. When the width of the pavement replacement is greater than six (6) feet, compliance with the specification shall be measured by placing the straightedge a minimum of 4-feet overlapping the existing pavement.

Where deep lift asphalt concrete (asphalt concrete base and asphalt concrete wearing course) exists, the base course replacement shall be made in lifts not exceeding 6 inches in compacted thickness to within 1/2 inch of the finish grade.

336.2.4.2 Adjustments: When new or existing manholes, values, survey monuments, clean outs, etc. fall within the limits of the permanent pavement replacement as discussed in this Section, The Contractor shall be responsible for adjusting the various items to the new pavement surface or as directed by the Engineer. This will include but not be limited to slurry and chip seals.

The Contractor will coordinate with the Engineer and with representatives of the various utilities regarding the adjustment and inspection of the work. The Contractor shall be responsible for obtaining and complying with all specifications, special requirements, details, etc. of the Utility Company regarding the adjustments. When adjusting the Agency's utilities, survey monuments, etc., the adjustment will comply with these Specifications and Details.

The work will be done in compliance with OSHA standards and regulations regarding confined space entry.

The Contractor shall remove all material attached to the lids and/or the Utility Representative.

336.3 TYPES AND LOCATIONS OF PAVEMENT AND SURFACING REPLACEMENT:

Normally, the type of pavement replacement and backfill required will be noted on the plans or specified in other portions of the contract documents and construction will be in accordance with Detail 200. This detail requires that a 12-inch "T" Top be utilized when normal traffic flow is perpendicular to anyone of the four sides of the trench excavation. Therefore, Type A pavement replacement will require a "T" Top whenever the trench crosses a street or goes through an intersection and at the end(s) if they terminate in the street. Type B pavement replacement will require the "T" Top on the sides that are perpendicular to normal traffic flow.

If a type is not noted on the plans or specified in the special provisions, the following criteria will govern:

Type A pavement replacement, including the "T" Top, will be utilized on all streets where the excavation is parallel to the centerline of the street.

Type B pavement replacement, including the "T" Top, will be utilized on all streets where the excavation is transverse to the centerline of the street.

Type C pavement replacement will be used to match existing Portland cement concrete pavement.

Type D pavement replacement may be used when the condition of the existing pavement does not justify construction of Type A or B. Prior written approval of the Engineer is required.

Type F pavement replacement will be utilized to match existing ABC or decomposed granite roadways. Where a longitudinal trench is partly in pavement, the pavement shall be replaced to the outside edge of the existing pavement, on a straight line, as indicated on the plans. Measurements for payment shall be from the inner limit of pay width allowed below, to the outside edge of the existing pavement as defined herein.

Where a trench cut is in aggregate surfaced area, the surfacing replacement shall be of a like type and depth as the existing material, compacted to the densities required in Section 601.

336.4 Measurement:

Measurement for payment and surfacing replacement shall be by the square yard, based upon actual field measurement of the area covered except as noted below.

(A) In computing pay quantities for replacement Types A, B, and F, pay widths will be based on the actual field measured width, however the boundaries of the measurement will not extend further than ½ the distance, either side, from the centerline of the pipe as depicted on Table 601-1, Maximum Width At Top Of Pipe Greater Than O.D. Of Barrel

(B) In computing pay quantities for replacement Types C, D, E, and T, pay widths will be based on the actual field measured width, however the boundaries of the measurement will not extend further than ½ the distance plus 12 inches, either side, from the centerline of the pipe as depicted on Table 601-1, Maximum Width At Top Of Pipe Greater Than O.D. Of Barrel.

(C) Where a longitudinal trench is partly in pavement, computations of pay quantities shall be based on the limitations specified above.

(D) The length of pavement and surfacing replacement shall be measured through any manhole, valve box, or other structure constructed in the pipe line, and any pavement or surface replacement and/or seal treatment in excess of the above pay widths shall be considered and included in the price item for such structure.

(E) Any pavement replacement in excess of the specified pay widths, necessitated by the installation of valves, tapping sleeves and valves, valve by=passes, and concrete thrust blocks shall be included in the price for these items.

(F) When special provisions allow deviations from the trench widths specified in Section 601, the above allowed pay widths for pavement replacement may be altered where so specified.

(G) Measurement of pavement and surfacing replacement shall be made along the finished surface of the ground to the nearest foot, and shall be computed to the nearest square yard.

336.5 PAYMENT:

Direct payment for pavement or surfacing replacement will be made for replacement over all pipe trench cuts except as otherwise allowed in the special provisions. Payment for replacements over other work shall be included in the cost of constructing the work, in accordance with the applicable standard details and specifications.

Payment for temporary pavement replacement shall be included in the cost of the pipe.

When a Contractor has the option of either jacking and/or boring or open cut construction, and elects to construct a pipeline by the jacking and/or boring method, he will be paid for the replacement of such items of work as pavement, curb and gutter, sidewalk, driveway, and alley entrances, as allowed for open cut construction.

END SECTION 336

SECTION 340

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

340.1 DESCRIPTION:

The various types of MAG concrete curb, gutter, sidewalk, sidewalk ramps, driveways, and alley intersections shall be constructed to the dimensions indicated on the plans and standard detail drawings. Joints shall be designated as expansion joints or contraction joints and shall be constructed as per Subsection 340.3.

The various types of ADOT concrete curb, gutter, sidewalk, sidewalk ramps, driveways, and alley intersections shall be constructed to the dimensions indicated on the plans and standard detail drawings. Joints shall be designated as expansion joints or contraction joints and shall be constructed as per ADOT Standard Specifications Section 908.

340.2 MATERIALS:

Concrete shall be class B, conforming to the applicable requirements of Section 725. Expansion joints filler shall comply with Section 729.

340.3 CONSTRUCTION METHODS:

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

The sub-grade 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 sub-grade elevation and replaced with material satisfactory to the Engineer. When the Engineer determines that the existing sub-grade 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 Sub-grade shall then be compacted to relative density of 75% minimum to 85% maximum with 80% as ideal.

Material displaced in the constructio~shal1 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 properly 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 detail or not to exceed 1 inch per foot where sidewalks are concerned. Saw cutting is required at the match lines and payment will be made under the respective pay items as provided in the proposal an appropriate machine when approved by the Engineer. Concrete curbs, gutters and sidewalks shall be constructed by the conventional use of forms, or maybe 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 or better than the product 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 sub-grade 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.

Expansion joints, unless otherwise specified, shall be constructed in accordance with the standard details of the appropriate agency, and in a straight line and vertical plane perpendicular to the longitudinal line of the sidewalk or curb and gutter, except in cases of curved alignment, when they will be constructed along the radial lines of the curve. They shall be constructed to the full depth and width of the concrete and shall match the joints in the adjacent pavement sidewalk or curb and gutter. Joints shall be constructed at all radius points, driveways, alley entrances, and at adjoining structures with a maximum interval of 100 feet between joints.

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 in the gutter to a depth greater than ½ inch, or on the adjacent asphalt pavement, the defect or defects shall be corrected in a manner acceptable to the Engineer without additional cost to the Contracting Agency.

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

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

The Contractor shall stamp his name and year on all work done by him, on each end of the curb, gutter, sidewalk or sidewalk ramp. The letters shall not be less than ¾ inch in height.

340.4 BACKFILLING:

Unless otherwise specified the Contractor shall backfill behind the curbs, sidewalk or sidewalk ramps with soil native to the area I to the lines and grades shown on the plans.

340.5 MEASUREMENT:

Concrete curbs and gutters of the various types shown on the plans and in the proposal, will be measured along gutter flow line through inlets, catch basins, driveways, sidewalk ramps, etc., by the lineal foot to the nearest foot for each type, complete in place.
Concrete sidewalks, sidewalk ramps, driveways, alley intersections, valley gutters and aprons will be measured to the nearest square foot complete in place. When concrete sidewalk, sidewalk ramps, driveways, alley intersections, valley gutters, and/or aprons are cut during trenching operations, the square foot measurement for payment will be in accordance with Section 336.

340.6 PAYMENT:
Payment for the above named items will be made in accordance with the unit prices or lump sums as set forth in the proposal. Such payment shall include full compensation for furnishing all labor, material, tools and equipment and accomplishing all work in conformance with the contract documents.

END SECTION 340

SECTION 350

REMOVAL OF EXISTING IMPROVEMENTS

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

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

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

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

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

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

Removal of trees, stumps, irrigation structures, storm water inlets, headwalls and other items in the right-of-way shall be done in accordance with Section 201.

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

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

350.3 MISCELLANEOUS REMOVAL AND OTHER WORK:

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

A. Relocate existing fence and gate.

B. Remove, and reset mail boxes.

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

D. Remove planter boxes, block walls, concrete walls, and footings.

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

F. Remove wooden and concrete bridges.

G. Remove median island slabs.

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

350.4 PAYMENT:

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

SECTION 401

TRAFFIC CONTROL

401.1 DESCRIPTION:

Traffic control shall consist of traffic control devices and flagmen or pilot cars. All traffic control devices, the application of traffic control measures, and traffic regulation in these specifications are to supplement and are not intended to delete any of the provisions of the Contracting Agency's Traffic Barricade Manual, the Uniform Manual on Traffic Control Devices or any agency's Supplements to these Uniform Standard Specifications.

401.2 TRAFFIC CONTROL DEVICES:

Traffic control devices shall consist of providing, erecting, and maintaining necessary and adequate devices for the protection of the work, the workmen and the traveling public as approved by the Engineer.

(A) Temporary traffic control devices shall be used to guide traffic through construction areas. They include traffic cones to channelize traffic, portable barricades for warning, vertical panel channelizing devices to divert traffic, and lighting devices between the hours of sunset and sunrise.

(B) Advance warning devices shall be used to alert the motorist of an obstruction in the roadway. They include diamond-shaped signs, flags, and flasher type high level warning devices mounted 8 feet above the roadway.

401.3 FLAGMEN OR PILOT CARS:

Flagmen or pilot cars shall consist of providing sufficient flagmen, uniformed off-duty law enforcement officers or pilot cars to expedite the safe passage of traffic.

401.4 TRAFFIC CONTROL MEASURES:

The application of all traffic control measures shall be primarily upon the conditions existing at the time that such measures are deemed necessary. Prior to the start of any work that interrupt the normal flow of traffic, sufficient and adequate devices and measures shall be provided and erected as directed by Engineer. These devices shall be immediately removed when no longer needed,

401.5 GENERAL TRAFFIC REGULATIONS:

A traffic and shall be a minimum of 10 feet of clear street width with a safe motor vehicle operating speed of at 25 miles per hour.

An intersection shall be all of the area within the right of way intersection streets plus 300 feet beyond the edge of the intersected right of way on all legs of the intersection.

A minimum of two traffic lanes, one for each direction, shall be maintained open to traffic at all times on all major streets.

(A) On Bond Issue and Budget Projects: All existing traffic lanes on major streets shall be maintained open to traffic at signalized intersections between the hours of 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. weekdays unless otherwise specified in the special provisions.

(B) On Improvement District Projects: All existing traffic lanes on major streets shall be maintained open to traffic between the hours of 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. weekdays. All work that enters or crosses a major street must be done at times other than 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. unless otherwise specified in the special provisions.

Local access shall be maintained to all properties on the project at all possible times. When local access cannot be maintained, the Contractor must notify the affected property owner at least 24 hours in advance and restore access as soon as possible.

A traffic lane shall not be considered as satisfactorily open to traffic unless it is paved with hot mix or cold mix asphalt paving if surrounded by or adjacent to existing pavement. Where pavement did not previously exist or where all of the existing pavement maintained dust free as directed by the Engineer.

Arrangements for partial or complete street closure permits shall be handled through the Engineer on local projects or the Arizona Highway Department, Resident Engineer on Federal Aid Projects, to the Contracting Agency's Traffic Engineering Department. An advance notice of 48 hours for major streets and 24 hours for local streets and alleys is required from the Contractor.

The Contractor shall provide and maintain all necessary traffic controls to protect and guide traffic for all work in the construction area.

The Contractor shall maintain all existing STOP, YIELD and street name signs erect, clean, and in full view of the intended traffic at all times. If these signs interfere with construction, the Contractor shall temporarily relocate the signs away from construction but still in full view of the intended traffic.

The Traffic Engineering Department will reset all STOP, YIELD, and street name signs to permanent locations.

Existing traffic signs other than STOP, YIELD, and street name signs shall be maintained by the Contractor until such time as construction renders them obsolete. At the time the Contractor shall remove signs and posts without damage and deliver them as directed by the Engineer. The Traffic Engineering Department will reinstall all traffic signs.

Subject to the approval of the Traffic Engineer, the Contractor shall furnish and install the 25 MPH Construction Zone Speed Limit Signs. The Contractor shall maintain the signs erect, clean and in full view of the intended traffic at all times. Should the signs interfere with construction, the Contractor shall relocate the signs as necessary.

At any time project construction shall require the closure or disruption of traffic in any roadway, alley, or refuse collection easement such that normal refuse collection will be interfered with, the Contractor shall prior to causing such closure or disruption, make arrangements with the Contracting Agency's Sanitation Department in order that refuse collection service can be maintained.

Special traffic regulation will be listed in the special provisions.

401.6 MEASUREMENT:

No measurement will be made for traffic control devices.

Flagmen, uniformed off-duty law enforcement officers or pilot cars, with driver, will be measured by the hour for each individual including vehicle and equipment, required to perform traffic control. When an officer is used less than 3 hours, a minimum of 3 hours will be charged. Anything over 3 hours will be measured by the hour.

401.7 PAYMENT:

Payment will be made at the contract price in the proposal for uniformed, off-duty law enforcement officer. If the officer is utilized in excess of 8 hours in any calendar day or in excess of 40 hours in any calendar work week, payment shall be at the rate of 1 1/2 times the contract price for all hours worked in excess in either of the above time periods.

END SECTION 401

SECTION 402

PAVEMENT MARKINGS AND SIGNING
402.1 GENERAL:

The work under this item will provide the final striping and marking of all pavements and the installation of traffic control signs as described herein in accordance with Details and as shown on the plans.

Any striping other than the replacement of pre-existing striping shall be done in accordance with a plan prepared by a registered Engineer and approved by the City of Sedona Engineering Department.

All construction shall conform to Arizona Department of Transportation standard drawings and specifications unless otherwise specified in the "Manual On Uniform Traffic Control Devices", latest edition, or as otherwise specified in the contract documents.

402.2 PAVEMENT MARKINGS:

Permanent lane striping shall be hot-sprayed thermoplastic material conforming to all requirements of ADOT Standard Specifications Section 704, latest edition. Crosswalks and stop lines shall be 90 mil extruded hot thermoplastic material conforming to ADOT Standard Specifications Section 704.

The actual width of the stripe shall be:

Plan Width	Actual Width
4 inches	4 to 4.5 inches
6 inches	6 to 6.5 inches
8 inches	8 to 9 inches
over 8 inches	+/- 1 inch

Pavement symbols, arrows and legends shall be preformed markings, Type I (Permanent) conforming to all requirements of ADOT Standard Specifications Section 705, latest edition, unless noted otherwise on the plans.

Painting shall be provided on all median noses and at temporary pavement marking locations where indicated on the plans and standard details. Reflectorized paint materials shall be white or yellow as noted and shall meet ADOT Standard Specifications Section 708. Glass beads shall be applied to all painted surfaces.

Raised pavement markers shall conform to requirements of ADOT Standard Specifications Section 706, latest edition.

Obliteration of any existing pavement markings required for new work shall be accomplished per Specification Subsection 350.2.

402.2.1 Measurement And Payment: Pavement striping and markings shall be measured and paid for at the lump sum price in the Contract Price Schedule. Costs for temporary markings and signs are not included in this item but will be included in the price for traffic control.

402.3 SIGNING:
All traffic signs shown on the plans to be installed after the roadway improvements are completed shall be mounted on square tubular sign posts as specified herein when existing street light pole cannot be used, due to spacing or lack thereof.

Sign mounting heights and offset from edge of roadway shall per the MUTCD Manual. Sign blanks shall be 0.080 gauge anodized aluminum. Unless noted otherwise herein, sign faces shall be ASTM Type II retroflective sheeting, sometimes referred to as "super engineering grade". Background and legends shall both meet Federal Highway Administration Standards.

All existing signs shall be inventoried prior to roadway work. Signs which are not reused shall remain the property of the City and will be carefully removed and delivered to the City. The Contractor shall remove any existing concrete bases using care not to damage the post. Any signs that will be used at project completion shall be stored safely and protected against damage at the Contractor's job site and shall be leveled, squared and set in ground per MUTCD height and offset specifications.

402.3.1 Steel Square Tubular Sign Post Assembly: The sign post assembly shall consist of the post (1-3/4 inch x 1-3/4 inch square tubing, length per sign type according to MUTCD), sleeve (2-1/4 inch x 2-1/4 inch x 12 inches long square tubing) and anchor (2 inch x 2 inch x 36 inches long square tubing). (A) Material: Tubing shall be roll formed of 12 gauge steel or of a gauge sufficient to supply a minimum yield strength of 40,000 psi. Tubing shall conform to the Standard Specifications for Cold-Rolled Carbon Steel sheets, commercial quality, ASTM A-570, Grade 33 for plain finish, and ASTM A-446, Grade A for galvanized finish.

(B) Finish:

(1) Galvanized: All steel tubing shall be given a hot dipped zinc (galvanized) coating conforming to ASTM A-525, G-90. All exterior, interior, and corner weld surfaces shall be thoroughly coated.

(2) Painted: Galvanized tubing shall be cleaned and phosphated prior to application of a powder coat finish. The tubing shall be coated with polyester powder bake/fused or electrodeposited to the galvanized surface. The color is Perma-Green per Federal Standard 595-A, color number 14109 (dark limit V).

(C) Shape:

A cross section of the post shall be a square tube carefully rolled to size. Tubing shall be corner welded by high intensity resistance welding, in such a manner that neither the weld nor flash shall interfere with telescoping properties.

(D) Holes or Knockouts:

Hole or knockout diameter shall be 7/16-inch plus or minus 1/64-inch on 1 inch centers, on all 4 sides of the post for its entire length. Holes or knockouts shall be on the centerline of each side in true alignment and placed opposite and adjacent to each other. Tolerance on hole or knockout spacing is plus or minus 1/8-inch in 4 feet. The sleeve and post tubing shall have the first two sets of

knock outs pre-punched on one end.

(E) Telescoping Properties:

The finished post, sleeve and anchor shall be straight and have a smooth uniform finish. It shall be possible to telescope the post with each consecutive larger and smaller size of square tube, freely and for not less than 10 feet of their length without the necessity of matching any particular face to any other face. All ends shall be free from burrs and shall be cut square.

(F) Anchor/Sleeve Installation:

The Contractor shall install the anchor/sleeve by driving with a pneumatic hammer or by encasing in concrete.

(1) Pneumatic Hammer: The sign anchor and sleeve may be installed with a pneumatic hammer. The Contractor shall exercise extreme care to prevent deformation of the anchor tubing during installation. The sign post must be able to slide freely in and out of the anchor once it is in place.

(2) Concrete Encased: The sign anchor and sleeve may be wrapped with #30 tar paper and concentrically placed in an 8 inch diameter by 42-inch deep concrete encasement. The anchor tubing shall extend 35 inches into the concrete encasement. The sign post must be able to slide freely in and out of the anchor once it is in place.

402.3.2 Advance Street Name Signs:

(A) Material:

(1) Background shall be green, Type III sheeting per ASTM standard specifications, sometimes referred to as "high-intensity".

(2) Legend shall be silver, Type III sheeting per ASTM standard specifications, sometimes referred to as "high intensity".

(3) The sign width shall be a standard 18 inches. The sign length shall be variable and sized according to legend. The minimum length shall be 42 inches and maximum length shall be 72-inches.

(4) All vinyl sheeting shall carry a 10-year guarantee not to lose more than 20 percent of initial reflectivity by the end of a 10-year period.

(B) Sign Fabrication:

(1) All letters and numerals shall be Series "C". The first letter in each name shall be 8-inch upper case. All other letters shall be 6-inch lower case. In the event that a street name length will not fit on the maximum 72-inch blank, the letters shall be changed to Series "B". The street designation such as, Road, Street, etc., shall be abbreviated and may be down sized to a minimum of 4 inches. These adjustments are to be made only when the street name is of such length that it will not fit on a 72-inch blank.

(2) All street names shall be properly centered on a sign blank-

(C) Sign Installation:

(1) Sign installations shall be made in a high quality manner. All signs shall be level within 2 degrees. Sign poles shall be perpendicular to level plus or minus 2 degrees. Signs shall be installed at a height of 4 feet to the bottom of the sign.

(2) All signs shall be secured to each pole with no less than 2 each, 3/8-inch steel drive rivets.

(3) Signs over 60 inches in length will require 3 sign posts, equally spaced and centered on the sign-

(4) All signs must be clean and free of any contaminant upon completion of installation.

(5) The Engineer shall designate all sign locations, away from tress and other vegetation that may obstruct visibility.

402.3.3 Street Name Signs:

(A) Materials:

(1) Sign sheeting shall be ASTM Type II (super engineer grade) per ASTM Standard Specifications. Background color shall be green, legend color shall be white.

(2) Sign blanks shall be 9 inch-extruded aluminum blank, 0.091 gauge.

(3) Aluminum shall be chemically treated to meet ASTM B449 specification for corrosion resistance.

(B) Sign Fabrication:

(1) Letters for street name shall be upper case, 4-inch Series "C", Helvetica, medium stroke.

(2) Letters for block number, street direction and street designation (ST., RD., PL.) shall be upper case, 2- inch, Series "C", Helvetica, medium stroke.

(3) Letters and numbers for numerical streets shall be 4-inch (ie. E. 5 TH7200A YE). I 402.3.4 Metro Street Signs

(A) General:

(1) Workmanship: All items shall be new; the material and workmanship shall be of the best quality for the purpose.

(2) Drawings: All signs shall be made in accordance with the Standard Details. All sign layouts shall be the Contractor's responsibility and shall be subject to the City's Engineering Department approval.

(3) Warranty: Any sign delivered under this contract which does not conform to these specifications shall be replaced by the Contractor at no cost to the Engineer.

(B) Materials and Fabrication:

(I) Powder Coating: Aluminum frame and telescoping bracket shall be covered with opaque electrostatically applied TGIC POLYESTER POWDER COATING.

(a) Thickness: The thickness of the TGIC Powder Coating fused to the aluminum frame and telescoping bracket shall be .002-inch minimum. Thickness shall be determined in accordance with ASTM Designation D-1400, or other methods of equivalent or greater accuracy. The referee method, in case of dispute, shall be photomicrography.

(b) Color: Color shall be white TGIC Powder Coating on the mounting bracket and frame.

(2) 3M Diamond Grade Reflective Sheeting, ASTM Proposed Type IX (prismatic lens sheeting):

(a) Color shall be white legends on green background.

(b) The application and screening procedures must be in accordance with the sheeting manufacturer's specifications. May be applied or screen-printed.

(3) Base Metal:

(a) Description: The base metal substrate shall be new sheet aluminum alloy 3003-H14 or 5052-H32.

The thickness of the aluminum shall be .125-inch. The material shall be subject to inspection prior to degreasing and chromate conversion coating operations. Alloy and temper designations shall be verified by mill test certifications.

(b) Shearing: All sign panel edges shall be shear-trimmed or roll-slit to produce neat edges and rounded comers. Sign panel edges shall be straight within 1/32-inch from the straight plane. Edge delamination or incomplete coverage of the base metal substrate up to and coincident with the cut edge of the sign panel shall be sufficient basis for rejection of the entire sign panel.

(c) Pretreatment: All treatment tanks and/or spray applied systems must be performed on the Contractor's premises, to ensure proper adhesion of powder or reflective sheeting materials. All treatment tanks or spray applied systems shall be charged with fresh chemicals at least once a year. If pretreatment is performed by immersion methods, the tanks must be sufficient size to accommodate the complete panel. Titration equipment shall be available for the inspectors to check the solutions' strengths. The cleaned and coated base metal shall be handled only by a mechanical device or by operators wearing clean cotton or rubber gloves. After cleaning and coating operations, the panels shall be protected at all times from contact or exposure to grease, oils, dust or other contaminates.

The front and back surfaces of the aluminum base metal shall be cleaned, deoxidized, and coated with a light, tightly adherent chromate conversion coating free of any powdery residue. The base metal pretreatment process shall be in conformance with Section 5, "Recommended Processing Methods" of ASTM Designation 8-449. The coating weight shall be (30-100 mg/sq.ft.) a class 1 coating.

(4) Sign Message:

(a) The following letters/border sizes shall be used:

(1) Street legend 10-inch uppercase Series "D" or "C";

(2) Suffix and block number legend 4-inch uppercase Series "D" or "C";

(3) Arrow size 8-3/4 inches x 4-inches;

(4) One-inch border.

(b) The number of characters helps determine the length of each sign.

(5) Sign Frame & Panel Construction:

(a) inch x .125-inch wall thickness. Alloy 6063- T5. All joints of the aluminum channel shall be miter cut to form a 45-degree angle at each corner. The frame shall be welded with an inert gas shielded-arc welding process using 4043 electrode filler wire in accordance with good shop practice. The width of the filler wire shall be equal to the wall thickness of the channel being welded.

The top of the frame will have two 2-inch x 2-inch x .250-inch wall thickness channel members welded and fastened to the frame with stainless steel bolt, washer, ny-lock nuts and cotter pins. The adjustable swing assembly will be attached to these members as shown on the drawing.

(b) Assembly: A sign panel shall be fastened to both sides of the channel frame to make a double-faced unit. Each sign panel must be a continuous sheet, with no

vertical or horizontal splices to make up one panel. The sign panels shall be affixed to the frame with 3/16-inch diameter blind pop rivets, alloy 5052, or a type approved by the City Engineering Department. They must be aluminum approved. The exposed face of the rivet shall be of similar shade and compatible with the face color of the finished sign. The rivets shall be placed through the face of the sign with the wall of the channel placed against the back of the sign panel. Rivets shall be placed no closer than 1/2-inch from the edge of the sign panel and a maximum of 8 inches apart from one another. All rivets must penetrate the web of the channel frame for proper grip strength between sign panel and frame.

The swing hinge is attached to the 2-inch x 2-inch channel member with a 1/4-inch stainless steel bolt and bronze bushing, and then secured with a ny-lock nut. Total assembly with fasteners per spec drawing-

(c) Mounting Assemblies: The top of the sign frame shall have two free swinging mounting brackets. They shall be of all aluminum, bronze, and stainless steel parts. The 5-inch long Stainless steel bolt allows for fine adjustments. Dampening springs shall be used. Each of the swing brackets shall be adjusted vertically for leveling the sign to either a straight or curved mast arm. The bracket assembly shall permit the sign unit to swing perpendicular to the support hardware.

The hardware used to attach the sign and swing assembly to the mast arm will be "L-brackets" and "y-brackets"

The "L-bracket" shall be a two-piece telescoping design to adjust from 17 inches to 21 inches in l-inch increments without additional adapters required. The tubing shall be 6063-T6 aluminum extrusion. The outside tube shall be 1.5 inches x 1.25 inches x .150 inch wall with one wall .3 75 inch thick and threaded for two 3/8-inch stainless steel holding bolts with external tooth lock washers. The inside tube shall fit firm within each other to slide smoothly. Safety Tabs must be located on the ends of each tube. These tabs will not allow the tubes to completely separate from each other during shipping and installation procedures. When installing the telescoping L-bracket, the outside tube should be extended first, then the inside tube.

The "Y-bracket" shall be a one-piece solid 6063-T6 extrusion construction. There shall be four slots in the brackets to accommodate two 3/4-inch wide stainless steel straps side by side. The strapping shall be a minimum of .020-inch thick. The L-bracket shall attach to the y -bracket with a 1/2-inch stainless steel bolt, lock washer and ny-Iock nut.

When installation of the sign to the mast arm is complete, the sign should swing freely 90 degrees in both directions when moved by the installer without any binding or hindrance felt. The sign will then move freely under normal weather conditions.

(d) Finish: The finished sign shall be flat within a ratio of 0.040-inch per linear foot when measured across the plane of each from opposite corners or at any location on the panel. All finished signs shall have a smooth flat surface without defects or

objectionable marks of any kind on either the front or the back faces. All letters and designs shall be clearly cut and sharply defined.

The appearance of the sign face shall be uniform throughout and shall be free of wrinkles, gel, hard spots, streaks, extrusion marks, air bubbles or blemishes that may impair the serviceability, detract from the general appearance or color-matching of the sign when viewed from a distance of twenty-five (25) feet.

The finished sign shall be clean and free from all burrs, sharp edges, loose rivets and aluminum marks.

Signs with any defects or damage that affect their appearance and serviceability will not be acceptable. All metal parts shall be fabricated in a uniform and quality workmanlike manner with all sign surfaces and edges free of defects. No repairs shall be made to the face sheet without the approval of the entities' inspectors.

(C) Packaging: Packaging must be in accordance with the sheeting manufacturer's specifications. All signs shall be packaged in such a manner to insure delivery in perfect condition and shall be suitable protected for proper shipment and storage.

402.3.5 Measurement and Payment: All signing will be measured as a complete assembly, including all mounting hardware, for each sign installed as described herein.

Payment for signing will be at the unit costs as indicated in the price schedule and will be considered full compensation for the work as described herein and as shown on the plans.

END OF SECTION 402

SECTION 505

CONCRETE STRUCTURES

505.1 DESCRIPTION:

Concrete bridges, culverts, catch basins, manholes, retaining walls, abutments, piers, footings, foundations and similar structures shall be constructed in conformity with the plans and specifications. Concrete Box culverts and wing walls noted in the plans to be constructed per ADOT Standard Details shall be constructed per ADOT Standard Specifications Section 601and Section 1006. Concrete for use in work constructed of per MAG details under this specification and testing thereof shall conform to the requirements of Section 725. Reinforcing shall conform to the requirements of Section 727.

Safe and suitable ladders shall be provided to permit access to all portions of the work.

505.2 SUBGRADE FOR CONCRETE STRUCTURES:

Each sub-grade upon which concrete is placed shall be firm and free from water. Ground water shall be kept several inches below Sub-grade until the concrete has set. When the sub grade is in dry earth, it shall be moistened with water from a spray nozzle immediately before concrete is placed.

When the design details for the project provide for the construction of filter or drain material consisting of gravel or combination of gravel and sand, which material becomes sub-grade for concrete, the placing of steel reinforcement and pouring of concrete shall follow the placing of the filter or drain material as closely as practical. The filter or drain material shall be kept dewatered to the extent necessary to prevent any portion of concrete materials being carried away before the concrete has attained its final set. No payment will be made for the work required to keep such materials dewatered, other than such costs as may be included in the prices for various items of work or amount for dewatering when the schedule provides an item for same.

When concrete is to rest on rock, the rock shall be fully uncovered. The surface of the rock shall be removed to depth sufficient to expose sound rock. Bedrock shall be roughly leveled off or cut to approximately horizontal and vertical steps. Seams in the rock shall be grouted as directed by the Engineer and the base for structures shall be slush grouted or otherwise treated as the Engineer may direct.

505 3 FORMS:

Forms shall be of suitable material and of type, size, shape, quality, and strength to enable construction as designed. The forms shall be true to line and grade, mortar tight, and sufficiently rigid to resist any appreciable amount of springing out o shape during placing of the concrete. The responsibility for their adequacy shall rest with the Contractor. All dirt, chips, sawdust, nails, and other foreign matter shall be completely removed from forms before any concrete is deposited. The surfaces of forms shall be smooth and free from irregularities, dents, sags and holes that would appreciably deface the finished surface. Forms previously smooth and free from irregularities, dents, sags and holes that would appreciably deface the finished surface. Forms

previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being reused, and the reuse of forms shall be subject to the approval of the Engineer. Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly treated with an approved releasing agent that will leave no objectionable film on the surface of the forms that can be absorbed by the concrete. Care shall be exercised that no releasing agent is deposited on previously placed concrete.

Forms for all surfaces that will not be completely enclosed or hidden below the permanent surface of the ground shall be made of surfaced lumber, or material which will provide a surface at least equally satisfactory. Any lumber or material which becomes badly checked or warped prior to placing concrete may be rejected. Forms for all exposed surfaces of bridges, viaducts, over crossings and similar structures shall be constructed of plywood or an approved equal. Plywood for forms shall be exterior type, of the grade Concrete-Form Exterior, conforming to the specifications of the NBS, Commercial Standards latest edition. Plywood shall be furnished and placed in 48-inch widths and in uniform lengths of not less than 96 inches, except where the dimension of the member formed is less than the specified panel dimension. Plywood shall be placed with the grain of the outer plies in the direction of the span. Where plywood is attached directly to the studding or joints, the panels shall be not less than 5/8 inch thick, and the studdings or joints shall be spaced not more than 12 inches, center to center. Plywood less than 5/8 inch thick, otherwise conforming to the requirements specified, may be used with a continuous backing of 5/8 inch sheathing. All form panels shall be placed in a neat, symmetrical pattern with the horizontal joints level and continuous.

Wood forms for copings and curbs shall have a thickness of not less than 15/8 inches and a width of not less than the full depth of coping or curb.

Unless otherwise shown on the plans, all sharp edges shall be chamfered with 3/4 inch triangular fillets. Forms for curved surfaces shall be so constructed and placed that the finished surface will not deviate appreciably from the arc of the curve.

Forms shall be so constructed that portions, where finishing is required, may be removed without disturbing portion of forms to remain.

Forms for girders and slabs shall be cambered as may be required by the Engineer. Forms shall, as far as practicable, be so constructed that the form marks will conform to the general lines of the structure.

Form clamps or bolts, approved by the Engineer, shall be used to fasten forms. The use of twisted wire loop ties to hold forms in position will not be permitted, nor shall wooden spreaders be used unless authorized by the Engineer. Clamps or bolts shall be of sufficient strength and number to prevent spreading of the forms. They shall be of such type that they can be entirely removed or cut back 1 inch below the finished surface of the concrete. Forms for outside surfaces shall be constructed with stiff walls at right angles to the studs and all form clamps shall extend through and fasten such walls, all based on the rate of concrete pour.

The Contractor may at his own option, pour such portions of the concrete for the structure directly against the side of the excavation or sheathing without the use the outside forms, provided that the

following conditions are met.

(A) If concrete is poured directly against the sides of the excavation, the faces of the excavation must be firm and compact, and be able to stand without sloughing off and be at all points outside the concrete lines shown on the plans.

(B) If concrete is poured against sheathing, such sheathing shall be closely fitted and shall be outside of the concrete lines shown on the plans. Those surfaces against which the concrete is to be poured shall be faced with building paper. Except as otherwise specified all sheathing shall be removed, but not until either as least 7 days after placing concrete or until the concrete has attained a strength in compression of not less than 2,000 psi. Care should be used in pulling sheathing so as to avoid damaging the concrete. Voids left by the removal of sheathing, piles and/or similar sheathing supports shall be backfilled with material having a sand equivalent of not less than 30 and consolidated by jetting as directed by the Engineer. When, in the opinion of the Engineer, field conditions or the type of sheathing or methods of construction used by the Contractor are such as to make the removal of sheathing impracticable, that portion of the sheathing against which concrete has been poured may be left in place.

Regardless of the method used in pouring concrete without outside forms the following stipulations shall hold:

(A) The reinforcing steel shall be accurately set and held firmly in place, to the satisfaction of the Engineer.

(B) No direct payment will be made for building paper, sheeting, gunite or concrete placed outside of concrete lines shown on the plans, The cost thereof shall be absorbed in the prices for the various items of work.

(C) The Contractor shall assume all risks of damage to the work or to existing improvements due to any reason whatsoever that may be attributable to the method of construction outlined above.

505.3.1 Removal of Forms: The falsework supporting any span of a continuous or rigid frame structure subject to bending stress shall not be released until after the last concrete placed in the span and in the adjoining spans, excluding concrete above the deck slab, has attained a compressive strength of not less than twice the design unit stress, or 21 days after the concrete is placed, whichever occurs first. Stairway riser forms shall be removed and the finish of the steps completed on the day the concrete is placed. Metal stairway treads, if required by the plans, shall be installed immediately after the steps have been placed.

Side forms for beams, girders, columns, railings, or other members wherein the forms do not resist dead load bending shall be removed not more than 24 hours after placing concrete, where finishing is required, unless otherwise directed by the Engineer, provided that satisfactory arrangements are made to cure and protect the concrete thus exposed.

Side forms for arch rings, columns, and piers shall be removed before the members of the structure which they support are poured or placed so that the quality of the concrete may be inspected. Such forms shall be so constructed that they may be removed without disturbing other forms which resist direct load or bending stress. Forms and shoring for box and arch sections of sewers and storm drains may be removed as follows:

(A) Forms for open channel walls -16 hours.

(B) Outside forms of box sections and inside wall forms of box sections which do not support the slab forms -16

(C) Arch sections in open cut- 12 hours.

(D) Slab forms for box sections:

(1) Type II Cement -48 hours or 6 hours per foot of span between supports, whichever is greater.

(2) Type III Cement -24 hours or 3 hours per foot of span between supports, whichever is greater.

(3) Type V Cement- 56 hours or 7 hours per foot of span between supports, whichever is greater.

The periods of time at which the Contractor may remove forms, as set forth above, are permissive only and subject to the Contractor's assuming all risks that maybe involved in such removals. At his option, except for surfaces to be finished, the Contractor may leave the forms in place for such longer periods as are, in his opinion, required.

505.4 FALSEWORK:

All falsework shall be designed and constructed to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were poured at one time.

All falsework, staging, walkways, forms, ladders, cofferdams, and similar accessories shall equal or exceed the minimum applicable safety requirements of Section 107. Compliance with such requirements shall not relieve the Contractor from full responsibility for the adequacy and safety of said items.

Falsework shall be founded upon a solid footing safe against undermining and protected from softening. When the falsework is supported on timber piles, the piles shall be driven to a bearing value as determined by the formula specified in Section 501, equal to the total calculated pile loading. The maximum calculated pile loading shall not exceed 20 tons.

Falsework and forms shall be so constructed as to produce in the finished structure the lines and grades indicated on the plans. Suitable jacks or wedges shall be used in connection with the falsework to set the forms to grade or camber shown on the plans, or to take up any settlement in the form work either before or during the placement of concrete. Single wedges for this purpose will not be permitted; it being required that all such wedges be in pairs to

insure uniform bearing. Dead load deflection in stringers and joints will be compensated for by varying depths of the joists or by using varying depth nailing strips.

Arch centering shall be removed uniformly and gradually, beginning at the crown and working toward the springing, to permit the arch to take its load slowly and evenly. Centering for adjacent arch spans shall be struck simultaneously.

Falsework under any continuous unit or rigid frame shall be struck simultaneously; the supporting supports being released gradually and uniformly, starting at the center and working both ways towards the supports.

505.4.1 Falsework Design: Falsework shall be designed by the Contractor to carry all loads and pressures which may be applied to it. The construction loads to be applied are as follows:

Tunnel centering- 100 percent of the concrete load where concrete is placed by pumping. Forms shall be so constructed to provide adequate relief for excessive pump pressure.

All other structures -a live load of 30 pounds per square foot of horizontal area.

Transverse and longitudinal, bracing -- a horizontal force equal to 2 percent of the vertical load.

The unit stresses for wood falsework shall be those recommended in the West Coast Lumbermen's Association's standard grading and dressing rules increased 25 percent for short time loading.

Falsework may be bolted or spiked at the option of the Contractor, but the use of bolts and spikes shall not be combined in the same connection. The allowable spacings and connection values of bolts and spikes shall be in accordance with the national design specifications for stress-grade lumber and its fastenings as recommended by National Lumber Manufacturers Association except that an additional allowance of 25 percent for temporary use shall be added to the connection values for bolts and spikes.

Ends of columns bearing on wedges shall be tied in both direction by girts.

Unit stresses for steel falsework shall be in accordance with the requirements of the specifications for design, fabrication and erection of structural steel for buildings of the AISC.

505.5 PLACING REINFORCEMENT:

Reinforcing bars shall be accurately placed as shown on the plans and shall be firmly and securely held in position by wiring at intersections with wire not smaller than No. 16 gage and by using concrete or meta1chairs, spacers, metal hangers, supporting wires and other approved device of sufficient strength to resist crushing under full load. Wooden supports shall not be used

Placing bars on layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete will not be permitted. Before placing in the forms, all reinforcing steel shall be thoroughly cleaned of mortar, oil, dirt, loose mill scale, loose or thick rust and coatings of any character that would destroy or reduce the bond. No concrete shall be deposited until the placing

of the reinforcing steel has been inspected and approved.

Bundle bars shall be tied together at not more than 6-foot centers.

505.5.1 Splicing: Splices of bars shall be made only where shown on the plans or as approved by the Engineer. Where bars are spliced they shall be lapped at least 30 diameters, unless otherwise shown on the plans.

Welding of reinforcing steel will not be permitted unless specifically authorized by the Engineer. Bends and hooks in bars shall be made in the manner prescribed in the ACI, Manual of Standard Practice.

Bars shall not be bent nor straightened in a manner that will injure the material. Bars with kinks or unspecified bends shall not be used.

505.5.3 Welded Wire Fabric: Welded wire fabric shall be held firmly in place and spliced not less than 2 meshes.

505.6 PLACING CONCRETE:

Where a schedule for placing concrete is shown on the plans, no deviation will be permitted there from unless approved in writing by the Engineer.

The placing of concrete for a given pour shall start at the low point and shall proceed upgrade, unless otherwise permitted by the Engineer.

With the exception of concrete placed in slope paving and aprons, and concrete placed under water, all concrete shall be compacted by means of high frequency internal vibrators of a type, size and number approved by the Engineer. The number of vibrators employed shall be ample to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms. In all cases, at least 2 vibrators shall be available at the site of the structure in which more than 25 cubic yards of concrete is to be placed. The vibrators shall not be attached to or held against the forms or the reinforcing steel. The locations, manner and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without causing segregation of the mortar and coarse aggregate, and without causing water or cement paste to flush to the surface. Fresh concrete shall be spread in horizontal layers insofar as practicable and the thickness of the layers shall not be greater than can be satisfactorily consolidated with the vibrators. If additional concrete is to be placed, care shall be taken to remove all laitance and to roughen the surfaces of the concrete to insure that fresh concrete is deposited upon sound concrete surfaces. Layers of concrete shall not be tapered off in wedge-shaped slopes, but shall be built with square ends and level tops.

Mixed concrete, after being deposited, shall be consolidated until all voids are filled and free mortar appears on the surface. The concrete shall be placed as nearly as possible in its final position and the use of vibrators for extensive shifting of the mass of fresh concrete will not be permitted.

Fresh concrete shall not be permitted to fall from a height greater than 6 feet without the use of adjustable length pipes or elephant trunks.

The use of approved external vibrators for compacting concrete will be permitted when the concrete is inaccessible for adequate compaction provided the forms are constructed sufficiently rigid to resist displacement or damage from external vibration.

During the placing of concrete, care shall be taken that methods of compaction used will result in a surface of even texture free from voids, water or air pockets, and that the coarse aggregate is forced away from the forms in order to leave a mortar surface. Spades or broad-tined forks shall be provided and used to produce the desired results if required by the Engineer.

> **The use of chutes in conveying or depositing concrete will be allowed only at the discretion of the Engineer, and wherever they are used they shall be laid at such inclination as will permit the flow of concrete of such consistency as is required. The use of additional water in mixing the concrete to promote free flow in chutes of low inclination will not be allowed. Where necessary in order to prevent segregation, chutes shall be provided with baffle boards or a reversed section at the outlet.**

Columns shall be poured preferably through pipes of adjustable length and not less than 6 inches in diameter.

Horizontal members or sections shall not be placed until the concrete in the supporting vertical members or sections has been consolidated and a minimum 2-hour period has elapsed to permit shrinkage to occur.

Walkways shall be provided along each side and for the full length of bridge structures outside the deck area. These walkways shall be of sufficient width, and so constructed as to provide for the support of the bridges from which the longitudinal floats specified are to be operated. Inspection walkways and access thereto shall be provided under the deck forms between each pair of girders and outside of each outside girder for the full length of the bridge structure. The walkways shall be not more than 8 feet below the concrete to be inspected.

505.6.1 Joints: The work shall be so prosecuted that construction joints will occur at designated places shown on plans unless specifically permitted otherwise by the Engineer. The Contractor shall complete, by continuous depositing of concrete, section for the work comprised between such joints. The joints shall be kept moist until adjacent concrete is placed.

All construction joints at the bottom of walls or arches, at the top of walls, and all longitudinal construction joints having a keyed, stepped or roughened surface shall be cleaned by sandblasting prior to pouring the adjacent concrete. Any quality of sand may be used which will accomplish the desired results.

The sandblasting operations shall be continued until all unsatisfactory concrete, and all laitance, coatings, stains, debris, and other foreign materials are removed. The surface of the concrete shall be washed thoroughly to remove all loose material. The method used in disposing of wastewater employed in washing the concrete surfaces shall be such that the wastewater will not stain, discolor,

or affect exposed surfaces of the structures. The method of disposal will be subject to the approval of the Engineer. All horizontal construction joints or those on slight slopes, shall be covered with Class D mortar as specified in Section 776.

All horizontal construction joints or those on slight slopes, shall be covered with Class D mortar as specified in Section 776.

Expansion and contraction joints in the concrete structures shall be formed where shown on the plans and as directed. In general, such joints shall have smooth abutting surfaces, painted or separated and sealed as detailed on the plans. No reinforcement shall be extended through the joints, except where specifically noted or detailed on the plans. Concrete or mortar shall not be permitted to lap these joints in such a manner as to effect a tie or bond that would later promote spalling.

Asphalt paint or pre-molded asphalt filler used in joints shall be as specified in Section 729.

No direct payment will be made for furnishing and placing asphaltic paint, pre-molded asphaltic filler or other types of joint separators; their costs shall be included in the price for the item of work of which they are a part.

505.6.2 ADVERSE WEATHER CONCRETING:

A. Hot Weather Concreting: Hot weather is defined as any combination of high ambient temperature, low relative humidity, and wind velocity which would tend to impair the quality of fresh concrete. These effects become more pronounced as wind velocity increases. Since last minute improvisations are rarely successful, preplanning and coordination of all phases of the work are required to minimize these adverse effects.
As an absolute minimum, the Contractor shall insure that the following measures are taken:

I. An ample supply of water, hoses, and fog nozzles are available at the site.

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2. Spare vibrators are on hand in the ratio of one spare vibrator for each three in use,

3. Preplanning has been accomplished to insure prompt placement, consolidation, finishing, and curing of the concrete.

4. Concrete temperature on arrival should be approximately 60°F. any event shall not exceed 90°F. The use of cold water and ice is recommended.

5. The sub-grade is moist, but free of standing water.

6. Fog spray is utilized to cool the forms and steel.

Under extreme conditions of high ambient temperature, exposure to the direct rays of the sun, low relative humidity, and wind, even strict adherence to these measures may not produce the quality desired and it may be necessary to restrict concrete placement to early

morning only. If this decision is made, then particular attention must be directed to the curing process since the concrete will be exposed to severe thermal stresses due to temperature variation; heat of hydration plus midday sun radiation versus nighttime cooling.

B. Cold Weather Concreting: Concrete shall not be placed on frozen ground, nor shall it be placed when the ambient temperature is below 40°F. unless adequate means are used to heat the aggregate and/or water and satisfactory means have been taken for protecting and heating the concrete during the curing period.

C. Wet Weather Concreting: Placing of concrete shall be discontinued when the quantity of rainfall is such as to cause a flow or wash to the surface. Any concrete already placed and partially cured shall be covered to prevent dimpling. A construction joint will be installed prior to shut down.

D. Replacement of Damaged or Defective Concrete: Upon written notice from the Engineer, all concrete which has been damaged or is defective, shall be replaced by the Contractor at no cost to the Contracting Agency.

E. Recommended Reference:

1. ACI-305 Hot Weather Concreting
2. ACI-306 Cold Weather Concreting
3. ACI-308 Recommended Practices for Curing Concrete

505.7 CONCRETE DEPOSITED UNDER WATER:

When conditions render it impossible or inadvisable in the opinion of the Engineer to dewater excavation before placing concrete, the Contractor shall deposit under water, by means of a tremie or underwater bottom dump bucket, a layer of concrete of sufficient thickness to thoroughly seal the cofferdam. To prevent segregation the concrete shall be carefully placed in a compact mass and shall not be disturbed after being deposited. Water shall be maintained in a still condition at the point of deposit.

A tremie shall consist of a watertight tube having a diameter of not less than 10 inches with a hopper at the top. The tube shall be equipped with a device that will close the discharge end and prevent water from entering the tube while charging the tube with concrete. The tremie shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering, when necessary to retard or stop the flow of concrete. The discharge end shall be closed at the start of the work to prevent water entering the tube and shall be entirely sealed at all times, except when concrete is being placed. The tremie tube shall be kept full of concrete. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the deposited concrete. The flow shall be continuous until the work is completed and the resulting concrete seal shall be monolithic and homogeneous.

The underwater bucket shall have an open top and the bottom doors shall open freely and outward when tripped. The bucket shall be completely filled and slowly lowered to avoid back wash and shall not be dumped until it rests on the surface upon which the concrete is to be deposited. After discharge, the bucket shall be raised slowly until well above the concrete. Concrete deposited in

water shall have 10 percent extra cement added.

505.8 CURING:

As soon after the completion of the specified finishing operations, as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surface shall either be sprinkled with water, covered with earth, sand or burlap; sprayed with a curing compound or sealed with a material conforming with Section 726. All concrete for bridge structures shall be water cured unless otherwise permitted by the Engineer.

Concrete that is water cured must be kept continuously wet for at least 10 days after being placed; preferably being covered, if possible with at least 2 layers of not lighter than 7 ounce burlap, except that handrail, base rail, railing posts, tips of walls, and similar parts of the structure, if water cured, must be covered with burlap as above prescribed immediately following the finish treatment specified therefore, and such covering shall not be removed in less than 4 days. Roadway areas, floors, slabs, curbs, walks, and the like, that are water cured may be covered with sand to a depth of at least 2 inches, in lieu of the burlap as specified above, as soon as the condition of the concrete will properly permit, and such covering must remain wet and in place until the concrete so covered is at least 10 days old unless otherwise directed by the Engineer or provided by special provisions.

When a sprayed impervious membrane is used, it shall be applied under pressure through a spray nozzle in such manner and quantity as to entirely cover and seal all exposed surfaces of the concrete with a uniform film. To insure complete coverage, membrane shall be applied in two applications for a total coverage of 150 square feet per gallon. The membrane, however, shall not be applied to any surface until all of the finishing operations have been completed, such surfaces being kept damp, until the membrane is applied. All surfaces on which a bond is required, such as construction joints, shear planes, reinforcing steel, and the like, shall be adequately covered and protected before starting the application of the sealing medium in order to prevent any of the membrane from being deposited thereon; and any such surface with which the seal may have come in contact shall immediately thereafter be cleaned. Care shall be exercised to avoid and prevent any damage to the membrane seal during the curing period. Should the seal be broken or damaged before the expiration of 10 days after the placing of the concrete, the break shall be immediately repaired by the application of additional impervious membrane over the damaged area.

Should any forms be removed sooner than 10 days after the placing of the concrete, the surface so exposed shall either be immediately sprayed with a coating of the membrane seal, or kept continuously wet by the use of burlap or other suitable means until such concrete has cured for at least 10 days.

When tops of walls are cured by the membrane sealing method the side forms, except metal forms, must be kept continuously wet for the 10 days following the placing of the concrete.

If due to weather conditions, materials used, or for any other reason, there is any likelihood of the fresh concrete checking or cracking prior to the commencement of the curing operations, it shall be kept damp, but not wet, by means of an indirect fine spray of water until all danger of such checking or cracking is past, or until the curing operations are started in the particular area affected.

Since hot weather leads to more rapid drying of concrete, protection and curing are far more critical than in cool weather. Water curing should be used wherever it is practical and should be continuous to avoid volume changes due to alternation of wetting and drying. The need for adequate continuous curing is greatest during the first few hours after placement of concrete in hot weather.

505.9 FINISHING CONCRETE:

Immediately after the removal of forms as provided above, all concrete surfaces shall be finished in accordance with the requirements specified below.

All surfaces scheduled to be covered with backfill shall be finished so as to be free of open and rough spaces.

All surfaces that will remain exposed in the completed work shall be finished so as to be free of open and rough spaces, depressions or projections. All angles and fillets shall be sharp and true and the finished surface shall present a pleasing appearance of uniform color.

All top surfaces of walls, abutments, piers, etc., shall be finished to a smooth surface and shall be cured by an approved method.

If rock pockets or honeycomb are of such an extent and character as to affect materially the strength or the structure and to endanger the steel reinforcement the Engineer may declare the concrete defective and require the removal and replacement of the portion of the structure affected by the Contractor at no additional cost to the Contracting Agency.

If finishing operations are not carried out as set forth below, all placing of concrete shall stop until satisfactory arrangements are made by the Contractor to promptly correct defective finishing work and to carry out finishing operation as specified.

One of the classes of finish as specified shall be applied to the various surfaces as set forth under applicability of finishes.

No finishing or patching shall be permitted until the surface has been inspected by the Engineer.

505.9.1 Finishing\Fresh Concrete in Bridge Decks: Upon placing the deck to a uniform and true surface, screed supports shall promptly be removed from the surface and any necessary hand finishing shall be promptly accomplished in the areas where the screed supports have been removed.

After final floating of the plastic concrete, bridge decks subject to vehicular traffic shall be textured transversely. Apparatus producing textured grooved shall be mechanically operated from an independent self-propelled bridge. Grooves shall be 1/16 to 1/8 inch in width and 3/32 to 6/32 in depth. Center to center spacing of the grooves shall be as follows: 7/8", 3/4", 1 ", 3/4", 1-1/8" and then repeated, or other measurements as approved by the Engineer. Texturing shall be completed before surface of concrete is torn or unduly roughened by texturing operation. Grooves that close following texturing will not be permitted and will have to be retextured. Hand tine brooms shall be available on the job site, at all times during texturing operation, to repair faulty texturing grooves.

The finished surface will be tested with a 10-foot straightedge furnished by the Contractor. The testing will be accomplished by holding the straightedge in contact with the deck surface and parallel to the centerline. The surface shall not vary more than 1/8 inch from the lower edge of the straightedge. Areas showing high spots of more than 1/8 inch, shall be corrected by cutting or planning. The cutting or planning machine shall be a rotary type, equipped with an adjustable cutter and having a minimum wheel base of 10 feet. Areas showing low spots of more than 1/8 inch shall be filled with an approved mixture of sand, cement and epoxy. The mixture shall firmly adhere to the surface and shall match the surrounding concrete. All areas corrected shall not show deviations in excess of 1/8 inch when tested with a 10-foot straightedge.

505.9.2 Finishing Fresh Concrete in Sidewalks and Bridge Sidewalks: After the concrete has been placed and spread between the forms, it shall be thoroughly worked until all the coarse aggregate is below the surface and the mortar comes to the top. Concrete may be consolidated by means of mechanical vibrators approved by the Engineer.
The surface shall then be struck off and worked to grade and cross section with a wood float.

A mechanical finishing machine that will consolidate the concrete and strike off and finish the surface may be used if permitted by the Engineer, provided that the machine produces a sidewalk equal to or better in all respects than that produced by the methods specified herein.

The surface shall be sweat finished by means of a steel trowel followed by a light broom finish.

The sidewalks shall be marked and edged with the proper tools to form the joints, marking and edges shown on the plans.

505.9.3 Finishing Green Concrete: Class I Finish -All bolts, wires and rods shall be clipped and recessed. All holes, honeycomb, rock pockets and other surface imperfections shall be cleaned out, thoroughly moistened and carefully patched with mortar. Mortar shall be composed of 1 part of cement and 2 parts of fine sand. A portion of the required cement for mortar shall be white as required to match the color of the surrounding concrete.

Class II Finish -The surface shall be patched and pointed as specified above for Class I Finish and then promptly covered with polyethylene film, wet burlap or wet cotton mats. If polyethylene film is used, the film shall be held securely to the surface by means of weights, adhesive or other suitable means. Only white polyethylene film for covering will be acceptable.

When the mortar used in patching has set sufficiently, the surface shall be uncovered and thoroughly rubbed with either a float or a carborundum stone until the surface is covered with a lather. Cork, wood or rubber floats shall be used only on surfaces sufficiently green to work up such a lather, otherwise a carborundum stone shall be used. During the rubbing process, a thin grout composed of 1 part cement and 1 part of find sand may be used to facilitate producing a satisfactory lather; however, this grout shall no be used in quantities sufficient to cause a plaster coating to be left on the finished surface. A portion of the required cement for grout shall be white as required to match the color of the surrounding concrete, Rubbing shall continue until irregularities are removed and there is no excess material, At the time a light dust appears, the surface shall be brushed or sacked. Brushing or sacking shall be carried in one direction so as to produce a uniform texture.

Class III Finish – The surface shall be treated as specified above under Class II except that after brushing, the surface shall again be securely covered with polyethylene film, wet burlap or wet cotton mats in not one direction so as to produce a uniform texture.

505.9.4 Finish Hardened Concrete: If for reasons either beyond the control of the Contractor or with the approval of the Engineer, more than 6 days have elapsed between the time of placing concrete and the time of the removal of forms, the concrete shall be considered as hardened. Prior to finishing hardened concrete, the surface shall be covered with burlap or cotton mats and kept thoroughly wet for a period of at least 1 hour. Finishing shall be identical to the respective requirements for Class I, Class II and Class III Finish for green concrete, except that the use of a mechanically operated carborundum stone will be required for Class II and Class III Finishes.

505.9.5 Applicability of Finishes: Surfaces requiring Class I Finish -All formed structures that are to be covered by backfill and those surfaces that are normally not in view of either vehicular or pedestrian traffic such as the surfaces on the inside of barrels of culverts, the under surfaces of decks, surfaces of concrete girders, piers and abutment walls.

Surfaces requiring Class II Finish -All exposed surfaces of headwalls, wingwalls, deck edges on culverts, end of piers on bridges and culverts, retaining walls and those vertical surfaces under highway grade separation structures that are exposed to view of the traveling public, including piers and pier caps, the outside face of outside girders, and other similar surfaces.

When surfaces of uniform texture and pleasing appearance are obtained through the use of first class metal forms, paper tubing or the use of special form coatings and the use of special care, such surfaces may, upon approval of the Engineer, be excluded from the surfaces requiring Class II Finish.

Surfaces requiring Class III Finish for bridge structures -All formed or finished surfaces above the surface of the deck on the roadway side of the handrail and the outside vertical surfaces from the top of handrail and dado to the lower edge of the chamfer at the bottom of the deck.

505.10 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 sub-grade 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. However, all concrete shall be placed to line and grade within such tolerances as, in the opinion of the Engineer, are reasonable and acceptable for the type of work involved. 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.

END SECTION 505

SECTION 601

TRENCH EXCAVATION, BACKFILLING AND COMPACTION

601.1 DESCRIPTION:

The work covered by this specification consists of furnishing all plant, labor, equipment, appliances and materials, and performing all operations in connection with the excavation and backfilling of trenches in accordance with the plans and special provisions, except for the installation of high density polyethylene pipe (HDPE). See Section 603 for trench excavation, backfilling, and compaction of HDPE pipe.

Excavation for appurtenance structures, such as manholes, inlets, transition structures, junction structures, vaults, valve boxes, catch basins, etc., shall be deemed to be in the category of trench excavation.

601.2 EXCAVATION:

601.2.1 General: The Contractor shall perform all excavation of every description and of whatever substances encountered including rock, to the depths indicated on the plans, and including excavation ordered by the Engineer of compacted backfill for the purpose of making density tests on any portion of the backfill.

All excavation shall be open cut unless otherwise shown on the plans or approved by the Engineer.

All trenches in excess of 50 feet in length shall be excavated by trencher unless otherwise approved the Engineer.

601.2.2 Trench Widths: Trenches for other than cast-in-place concrete pipe shall conform to the dimensions in Table 601-1, unless otherwise specified in the special provisions, indicated on the plans, and/or approved by the Engineer.

TABLE 601-1

TRENCH WIDTHS

Size Of Pipe (I.D.)	**Maximum Width At Top Of Pipe Greater Than O.D. Of Barrel**	**Minimum Width At Springline Each Side of Pipe**
Less than 18”	16”	6”
18” to 24” inclusive	19”	7 ½”
27” to 39” inclusive	22”	9”
42” to 60” inclusive	½ O.D.	12”
Over 60”	36”	12”

The width of the trench shall not be greater than the maximum indicated in Table 601-1, at and below the level of the top of the pipe. The width of the trench above that level may be made as wide

as necessary for sheeting and bracing, and for proper installation of the work.

If the maximum trench width as specified in Table 601-1 is exceeded at the top of the pipe the Contractor shall provide, at no additional cost to the Contracting Agency, the necessary additional load bearing capacity by means of bedding, having a higher bedding factor than that specified, higher strength pipe, a concrete cradle, cap or encasement, or by other means approved in writing by the Engineer.

601.2.3 Trench Grade: Alignment and elevation stakes shall be furnished the Contractor at set intervals and agreed upon offsets. On water main projects, elevation stakes will be furnished for water pipe 12 inches or greater in diameter. In all cases where elevation stakes are furnished, the Contractors Surveyor will also furnish the Contractor with cut sheets.

For all pipe 12 inches or greater in diameter, the Contractor shall excavate for and provide an initial granular bedding at least 4 inches thick or 1/2 the O.D. of the pipe whichever is greater. This bedding material shall be placed at a uniform density with minimum compaction and fine graded as specified below. 601-1

Bell or coupling holes shall be dug after the trench bottom has been graded. Such holes shall be of sufficient width to provide ample room for caulking, banding, or bolting. Holes shall be excavated only as necessary to permit accurate work in the making of the joints and to insure that the pipe will rest upon the prepared bottom of the trench, and not be supported by any portion of the joint.

Depressions for joints, other than bell-and-spigot, shall be made in accordance with the recommendations of the joint manufacturer for the particular joint used.

601.2.4 Fine Grading: Unless otherwise specified in the plans and/or special provisions, the bottom of the trench shall be accurately graded to provide uniform bearing and support for each section of the pipe at every point along its entire length, except for portions of the pipe where it is necessary to excavate for bells and for proper sealing of the pipe joints.

601.2.5 Over excavation: Except at locations where excavation of rock from the bottom of the trench is required, care shall be taken not to excavate below the depth indicated.

Unauthorized excavation below the specified grade line shall be refilled at the Contractor's expense with ABC material compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T -99 and T -191 or ASTM D-2922 and D-3017. When AASHTO T -99, method A or B, and T -191 are used for density determination, MAG Detail 190 will be used for rock correction.

Whenever rock is encountered in the trench bottom, it shall be over excavated to a minimum depth of six inches below the O.D. of the pipe. This over excavation shall be filled with granular material placed with, the minimum possible compaction.

Whenever unsuitable soil incapable of supporting the pipe is encountered, the Contractor will notify the Engineer and a field determination will be made as to the depth of over excavation and the granular fill required.

For PVC and HDPE sewer pipe trenches over-excavated in excess of 0.30 feet, Class I, II, or III material shall be provided as a foundation (see ASTM D-2321). This foundation material shall be compacted within a range of +2 percent to - 4 percent of optimum moisture content to a minimum 90 percent density.

601.2.6 Excavation for Manholes, Valves, Inlets, Catch Basins and Other Accessories: The Contractor may excavate to place the concrete structure directly against the excavated surface, provided that the faces of the excavation are firm and unyielding and are at all points outside the structure lines shown on the plans. If the native material is such that it will not stand without sloughing or if precast structures are used, the Contractor shall over-excavation shall be backfilled with the same material required for the adjoining pipe line trench and compacted per Table 601-2.

Any unnecessary excavation below the elevation indicated for the foundation of any structure shall be replaced with the same class of concrete specified for the structure or with 1 ½ sack controlled low strength material as specified in Section 728. When the replacement material is structural concrete, the material shall be placed at the same time as the structure. However, when using 1 ½ sack controlled low strength material, placement of the material shall be per Section 604 which will require a time lag between the material and the structural concrete. The placement of the additional material shall be at no cost to the Agency.

601.2.7 Pavement and Concrete Cutting and Removal: Where trenches lie within the Portland cement concrete section of streets, alleys, driveways, or sidewalks, etc., such concrete shall be saw cut to neat, vertical, true lines in such a manner that the adjoining surface will not be damaged. The minimum depth of cut shall be 1 1/2 inches or 1/4 of the thickness, whichever is greater.

Asphalt pavement shall be clean-cut, with approved equipment and by approved methods in accordance with the requirements of Section 336.

No ripping or rooting will be permitted outside limits of cuts. Surfacing materials removed shall be hauled from the job site immediately, and will not be permitted in the backfill.

601.2.8 Grading and Stockpiling: All grading in the vicinity of trench excavation shall be controlled to prevent surface water from flowing into the trenches. Any water accumulated in the trenches shall be removed by pumping or by other approved methods.

During excavation, material suitable for backfilling shall be piled in an orderly manner, a sufficient distance back from the edges of trenches, to avoid overloading and to prevent slides or cave-ins. Material unsuitable for backfilling, or excess material, shall be hauled from the job site and disposed of by the Contractor.

The Contractor shall, prior to final acceptance of the work, submit a letter to the Contracting Agency stating the location of each disposal site for all excess or unsuitable material and certify that he has obtained the property owner's permission for the disposal of all such materials.

Where the plans and/or special provisions provide for segregation of topsoil from underlying material for purposes of backfill, the material shall not be mixed.

601.2.9 Shoring and Sheeting: The Contractor shall do such trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. The bracing, sheathing, or shoring shall not be removed in one operation but shall be done in successive stages as determined by the Engineer to prevent overloading of the pipe during backfilling operations. The cost of the bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price for the pipe. All shoring and sheeting deemed necessary to protect the excavation and to safeguard employees, shall be installed. See Section 107.

601.2.10 Open Trench: Except where otherwise noted in the special provisions, or approved in writing by the Engineer, the maximum length of open trench, where the construction is in any stage of completion (excavation, pipe laying or backfilling), shall not exceed 1320 feet in the aggregate at anyone location.

Any excavated area shall be considered open trench until milling and final pavement is placed. With the approval of the Engineer, pipe laying may be carried on at more than one separate location, the restrictions on open trench applying to each location. Trenches across streets shall be completely backfill as soon as possible after pipe laying.

Substantial steel plates with adequate trench bracing shall be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during regular work hours. Safe and convenient passage for pedestrians shall be provided. The Engineer may designate a passage to be provided at any point he deems necessary. Access to ambulances, fire stations and fire hydrants must be maintained at all times.

601.3 PROTECTION OF EXISTING, UTILITIES AND:

601.3.1 Utilities: Unless otherwise shown on the plans or stated in the specifications, all utilities, both underground or overhead, shall be maintained in continuous service throughout the entire contract period. The Contractor shall be responsible and liable for any damages to or interruption of service caused by the construction.

If the Contractor desires to simplify his operation by temporarily or permanently relocating or shutting down any utility or appurtenance, he shall make the necessary arrangements and agreements with the owner and shall be completely responsible for all costs concerned with the relocation or shutdown and reconstruction. All property shall be reconstructed in its original or new location as soon as possible and to a condition at least as good as its previous condition. This cycle of relocation or shutdown and reconstruction shall be subject to inspection and approval by both the Engineer and the owner of the utility.

The Contractor shall be entirely responsible for safeguarding and maintaining all conflicting utilities. This includes overhead wires and cables and their supporting poles whether they are inside or outside of the open trench. If, in the course of work, a conflicting utility line that was not shown on the plans is discovered, the Contracting Agency will either negotiate with the owner for relocation, relocate the utility, change the alignment and grade of the trench or as a last resort, declare the conflict as "extra work" to be accomplished by the Contractor.

601.3.2 Irrigation Ditches, Pipes and Structures: The Contractor shall contact the owners of all irrigation facilities, and make arrangements for necessary construction clearances and/or dry-up periods.

All irrigation ditches, dikes, head gates, pipe, valves, checks, etc., damaged or removed by the Contractor, shall be restored to their original condition or better, by the Contractor at no additional cost to the Contracting Agency.

601.3.3 Building, Foundations and Structures: Where trenches are located adjacent to building, foundations, and structures, the Contractor shall take all necessary precaution against damage to them. The Contractor shall be liable for any damage caused by the construction. 601-3

Except where authorized in the special provisions or in writing by the Engineer, water settling of backfill material in trenches adjacent to structures will not be permitted.

601.3.4 Permanent Pipe Supports: Permanent pipe supports for the various types and sizes of sewer, water and utility lines shall conform to the Standard Details or the details shown on the plans. Such pipe supports shall be erected at the locations shown on the plans and/or at any other locations as necessary as determined by the Engineer.

601.3.5 Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines: These underground facilities shall be adequately supported by the Contractor. Support for plastic pipes shall be continuous along the bottom of the pipe. Support for metal pipe and electrical conduit may be continuous or nylon webbing may be used for suspension at no greater than ten-foot intervals.

The Contractor shall avoid damaging the plastic pipe, pipeways or conduits during trench backfilling and during foundation and bedding placement. There will be no measurement or payment for this work. The Contractor will include all associated costs in the unit price for the conduit installation.

601.3.6 Utility/Water Line Crossings: Locator Strips and ABC Slurry: Primary electrical conductors, natural gas or fiber optic telephone lines shall not be allowed to cross above water lines unless approved in writing by the City of Sedona Engineering Department.

If a primary electrical conductor, natural gas, or fiber optic telephone line is allowed to cross above a water line, then ABC slurry and double utility locator strips shall be provided.

The required utility locator strips shall be a minimum of three (3) inch wide, color coded for the appropriate utility, and shall be laid in a criss-crossing pattern along both the water line and the over-crossing utility alignments. The horizontal placement of the utility locator strips shall be along the centerline of the alignments. The vertical placement of the utility locator strips shall be at an elevation one (1) foot above the over-crossing electrical/natural gas/fiber optic line. The utility locator strips shall extend six (6) feet on both sides of the point of intersection for both the water line and the over-crossing utility line. The requirement of placing criss-crossing locator strips may be waived if locator strip placement requires trenching in pre-existing pavement.

The required ABC slurry mix shall be placed in the over-crossing utility trench from the top of the shading/embedment zone (maximum of 12 inches above the uppermost conduit) and shall have a minimum thickness of one (1) foot. The ABC slurry shall extend six (6) feet on both sides of the point of intersection with the water line. This requirement may be waived by City of Sedona Engineering Department is the over-crossing line is being placed by means of boring. The ABC slurry mix shall meet the requirements in Section 728.

601.3.7 Pipe Marking Tape: Pipe marking tape shall be installed over all utility lines. Pipe marking tape shall be a minimum 4.0 mils thick, inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. For pipe diameter 24 inches or less, the tape width shall be 6 inches or greater. For pipe diameter larger than 24 inches, the tape width shall be 12 inches or greater. Marking tape shall be blue in color for water with the following message printed thereon: "CAUTION POTABLE WATER LINE", green in color for sewer with the following message printed thereon: "CAUTION SANITARY SEWER LINE", purple in color for reclaimed water with the following message printed thereon: "CAUTION: RECLAIMED WATER LINE" or similar wording printed in black lettering continuously along the entire length. Lettering shall be a minimum 1 ½ inches high. Spacing between the individual words of the message shall not exceed three inches.

601.4 FOUNDATION, BEDDING, BACKFILLING AND COMPACTION:

601.4.1 Foundation: The material upon which the conduit or structure is to be placed shall be accurately finished to the grade or dimensions shown on the plans or as directed by the Engineer. The bottom portion of the trench shall be brought to grade so that the conduit or structure will be continuously in contact with the material on it is being placed. If rocky or unsuitable soil is encountered, Subsection 601.2.5 applies.

601.4.2 Bedding: Bedding shall consist of granular material containing no pieces larger than 1-½ inches and free of broken concrete, broken pavement, wood or other deleterious material. Open graded rock will not be used without the written approval of the Engineer.

Where water consolidation is used, bedding for conduits, 24 inches or less in I.D., may be placed in one lift. For larger conduits the first lift shall not exceed the springline of the pipe.

Where mechanical compaction is used, the moisture content shall be such that the specified compaction can be obtained. The first lift shall be 8 inches or 2/3 of the distance to the springline whichever is greater. Succeeding lifts shall not exceed 2 feet loose and extreme care will be taken to prevent damage to or movement of the conduit by the compaction equipment.

601.4.3 Backfill: Backfill shall be sound earthen material free from broken concrete, broken pavement, wood or other deleterious material. Unless otherwise specified, this may be native material with no piece larger than 4 inches, select material with no piece larger than 4 inches, select material or aggregate base course. Backfill under street pavement shall be constructed per Detail 200 with the type of replacement noted on the plans or in the special provisions. Unless otherwise noted, backfill under single curb, curb and gutter, sidewalk, driveways, valley gutters, etc. shall be the same as the adjacent street pavement.

Where water consolidation is used, backfill will be placed in lifts as required in the following table prior to settlement.

Trench Width	Backfill Lifts
18" to 24"	Not to exceed 4'
25" to 36"	Not to exceed 6'
Over 36"	Not to exceed 8'

The above backfill lift limitations are not applicable when water saturation is done by the jetting method. Where mechanical compaction is used, backfill shall be placed in lifts the height of which shall not exceed that which can be effectively compacted depending on the type of material, type of equipment and methods used, and under no circumstances shall exceed 4 feet.

Backfill, around utilities that are exposed during trench excavation, shall be placed in accordance with the bedding methods.

601.4.4 Compaction Densities: Unless otherwise provided in the plans and/or special provisions, the trench backfill shall be thoroughly compacted to not less than the densities in Table 601-2 when tested and determined by AASHTO T -99 and T -191 or ASTM D-2922 and D-3017. When AASHTO T-99, method A or B, andT-191 are used for density determination, MAG Detail 190 will be used for rock correction. The density required will depend on the Type shown on the plans and/or called for in the special provisions. Density required for each type shall comply to Table 601-2.

TABLE 601-2

MINIMUM TRENCH COMPACTION DENSITIES

Backfill Type	**Location**	**From Surface To 2' Below Surface**	**From 2' Below Surface To 1' Above Top of Pipe**	**From 1' Above Top of Pipe To Bottom Of Trench**
I	Under any existing or proposed pavement, curb, gutter, sidewalk, or such construction included in the contract, or when any part of the trench excavation is within 2' of the above.	100% for granular 95% for non-granular	90%	90%
II	On any utility easement street, road or alley right-of-way outside limits of (I).	85%	85%	90%
III	Around any structures or exposed utilities	95%	In all cases	

Note: The type required will generally be shown on the plans and the plans will govern. Where no type is shown on the plans the type shall comply with Table 601-2.

And consideration in determining the backfill Types as shown on the plans, is based on the trench widths as shown in the Contract Documents. If these trench widths increase beyond those widths referred to above and fall within the 2-foor limit of such improvements shall be Type I even though Type II backfill is shown on the plans.

601.4.5 Compaction Methods: Water consolidation by jetting shall be accomplished with a 11/2" pipe of sufficient length to reach the bottom of the lift being settled with adequate hose attached and a water pressure of not less than 30 psi. All jetting shall be accomplished traversely across the trench at intervals of not more than 6 feet with the jetting locations on one side of the trench offset to the jetting locations on the other side of the trench. The entire lift shall be leveled and completely saturated working from the top to the bottom.

Jetting shall be used as the consolidation method for all conduit bedding. The Contractor shall be entirely responsible for establishing each lift depth so as to avoid floating the conduit being placed and shall make any repair or replacement at no cost to the Contracting Agency. However, for conduit larger than 24 inches I.D. the first lift shall not exceed the springline of the conduit.

Flooding is not acceptable as a water consolidation method unless authorized in the specification or by a written change order. It will consist of the inundation of the entire lift with water and then puddled with poles or bars to insure saturation of the entire lift.

Where jetting or flooding is utilized and the surrounding material is such that it does not permit proper drainage, the Contractor shall provide, at his expense a sump and a pump at the downstream end to remove the accumulated water.

The use of water consolidation does not relieve the Contractor from the responsibility to make his own determination that such methods will not result in damage to existing improvements. The Contractor shall be responsible for any damage incurred.

Where water consolidation is not permitted or does not result in adequate compaction, the backfill material shall be compacted with hand and/or mechanical work methods using equipment such as rollers, pneumatic tamps, and hydro-hammers or other approved devices which secure uniform and required density without injury to the pipe or related structures.

Where Type I backfill is required, water consolidation will not be permitted for non-granular material, except in the following situation. In a new development prior to paving and prior to opening the area to public traffic, water consolidation, will be permitted for non-granular material at the Contractor's discretion and responsibility.

601.4.6 Specifications for Granular Material: For purposes of this specification, granular material shall mean material for which the sum of the plasticity index and the percent of the material passing a No.200 sieve shall not exceed 23. The plasticity index shall be tested in accordance with AASHTO T -146 Method A (Wet Preparation), T -89 and T -90.

601.4.7 Rights-Of-Way Belonging to Others: Backfill and compaction for irrigation lines of any Utility or Irrigation Districts and for trenches in State of Arizona and Yavapai County rights-of-way outside the limits of the Contracting Agency shall be accomplished in accordance with their permit

and/or specifications.

601.4.8 Test Holes: Boring logs shown on the plans do not constitute a part of the contract and are included for the Contractor's convenience only. It is not intended to imply that the character of the material is the same as that shown on the logs at any point other than that where the boring was made. The Contractor shall satisfy himself regarding the character and amount of rock, grave, sand, silt, clay and water to be encountered in the work to be performed.

601.4.9 Foundation and Bedding for Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines: Foundation and bedding for these underground facilities shall be native material or sand which conforms to the grading requirement of ASTM C-33 for fine aggregate; When backfill material consists of: aggregate base course, crushed stone, or other material containing stones, only sand will be used for foundation, and bedding. The foundation depth shall be six inches and bedding depth shall be one foot above the top of the facility. Compaction will be in accordance With Section 601.

601.5 PAVEMENT REPLACEMENT AND SURFACE RESTORATION:

601.5.1 Grading: The Contractor shall do such grading in the area adjacent to backfilled trenches and structures as may be necessary to leave the area in a neat and satisfactory condition approved by the Engineer.

601.5.2 Restoring Surface: All streets, alleys, driveways, sidewalks, curbs, or other surfaces, in which the surface is broken into or damaged by the installation of the new work, shall be resurfaced in kind or as specified to the satisfaction of the Engineer in accordance with Section 336.

601.5.3 Cleanup: The job site shall be left in a neat and acceptable condition. Excess soil, concrete, etc., shall be removed from the premises.

601.5.4 Temporary Pavement: The Contractor shall install temporary asphalt pavement or the first course of permanent pavement replacement in accordance with Section 336 immediately following backfilling and compaction of trenches that have been cut through existing pavement. Except as otherwise provided in Section 336, this preliminary pavement shall be maintained in a safe and reasonably smooth condition until required backfill compaction is obtained and final pavement replacement, is ordered by the Engineer. Temporary paving removed shall be hauled from the job site and disposed of by the Contractor at no additional cost to the Contracting Agency.

601.6 PAYMENT: No pay item will be included in the proposal, nor direct payment made for trench or rock excavation, backfilling, compaction, or placement of temporary pavement. The cost of these features of the work shall be included in the unit price per linear foot for furnishing and laying pipe.

END OF SECTION 601

SECTION 615

SEWER LINE CONSTRUCTION

615.1 DESCRIPTION:

The construction or extension of sewer lines shall conform to the applicable standard specifications and details, except as otherwise required on the plans or as modified in the special provisions. Concrete pipe shall conform to Section 735. High density polyethylene (HDPE) pipe shall conform to Section 738. Vitrified clay pipe shall conform to Section 743. Polyvinylchloride (PVC) pipe and fittings shall conform to Section 745.

615.2 TRENCHING:

Excavation of trenches shall be accomplished in accordance with Sections 601, and 603 for HDPE pipe. The Contractors Surveyor shall furnish the Contractor alignment and elevation stakes at agreed-upon intervals and offset together with cut sheets showing the difference in elevation from the top of the stakes to the flow line of the pipe.

The trench shall be dry when the fine grading of the bottom of the trench is accomplished. Before placement of pipe the fine grade shall be carefully checked by use of a string line, laser beam, or other means so that when in final position the pipe will be true to line and grade, +/-0.05 feet for 8 inch through 12 inch, +/-0.10 feet for 15 inch and larger. For PVC pipe installation the width of trench as listed in Table 601-1 or as given in the contract documents may be increased to provide sufficient space for the installation of fittings or for compaction of the bedding. For HDPE pipe installation, the width of the trench will be per Subsection 603,2JThe adjusted maximum width at the top of the pipe must be approved by the Engineer. The adjustment of the trench shall be done at no additional cost to the Contracting Agency.

615.3 LAYING PIPE.

Pipe shall be of the type, class, and size called for on the plans. All pipes shall be protected during handling against impact shocks and free falls. No damaged or defective pipe shall be installed in the work. Pipe shall be kept clean at all times, and as the work progresses, the interior of the pipe shall be cleared of all dirt and superfluous materials of every description.

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

The alignment and grade of each length of pipe shall be checked after setting by measurement from the string line, laser beam target or other means approved by the Engineer.

At all times when work is not in progress, open ends of the pipe and fittings shall be securely closed

to the satisfaction of the Engineer, so that no water, earth or other substance will enter the pipe or fittings.

HDPE and PVC pipe and fittings shall be installed in accordance with ASTM D-2321. HDPE pipe bedding shall comply with Subsection 603.4. The PVC pipe bedding shall be placed in two lifts. The first lift will be from the bottom of the trench to the spring line of the pipe. The second lift will be from the spring line to one foot above the top of pipe. Separate inspections will be required on each lift. The Contractor shall place the first lift in a manner that will insure uniform support under the haunches and proper alignment of the pipe.

615.4 FITTINGS:
All fittings shall conform to the requirements of the pipe specifications and shall be located as shown on the plans, or as directed by the Engineer, in accordance with the standard details.

615.5 JOINTING:

Prior to making pipe joints, all surfaces of the portions of the pipes to be joined shall be cleaned, dried, and prepared in accordance with the manufacturer's recommendations. The joints shall then be carefully centered and completed.

Trenches shall be kept water-free during the installation of joints and couplings.

The joint and coupling materials will be as specified in the appropriate pipe sections and shall be installed in accordance with the manufacturer's recommendations. Cement mortar joints will NOT be permitted in sanitary sewer construction.

615.6 SANITARY SEWER SERVICE TAPS:

When the construction of sanitary sewer service taps are called for in the special provisions, they shall be constructed in accordance with standard details for sewer taps except for HDPE pipe.

To maintain structural integrity of the pipe, service taps for HDPE pipe shall be constructed in accordance with the manufacturer's I recommendations.

When any damage occurs to the pipe ribs or walls, outside of the tap area, the Contractor shall perform repairs, as recommended by the manufacturer at no cost to the Contracting Agency. Damage to the pipe will include but not be limited to gouging, marring, and scratching forming a clear depression in the pipe.
'
The location of the service tap for each property shall be in the downstream 1/3 of the lot, or as requested by the property owner. Sewer service taps shall not be covered until they been plugged and marked in accordance with standard details and their location has been recorded by the Engineer.

615.7 SANITARY SEWER CLEANOUTS:

The cleanouts shall be constructed at locations shown on the plans, in: accordance with the standard details for cleanouts.

615.8 MANHOLES:

Manholes shall be constructed Section 505 and standard details.

615.9 BACKFILLING:

Backfilling and compaction shall be done in accordance with Sections 601 and 603, for HDPE pipe.

615.10 TESTING:

Pressure testing off force mains shall be done in accordance with Section 610.14.

Sewers and pipelines shall be subject to acceptance testing after backfilling has been completed but prior to the placement of the finished surface material.

The Contracting Agency reserves the right to require testing of the entire installation. Cost of repairs or corrections necessary to conform to the following testing requirements will be borne by the Contractor at no additional cost to the Contracting Agency.

(A) Low Pressure Air Test:

Testing will be accomplished by the means of "Low Pressure Air Testing." Tests may be conducted by the Contractor or an independent testing firm. However, acceptance tests shall be made only in the presence of the Engineer. Test Procedure:

1. Before testing, the pipe shall be thoroughly cleaned.

2. The Contractor shall seal off the section of pipe to be tested at each manhole connection. Test plugs must be securely braced within the manholes.

3. A minimum of two connecting hoses to link the air inlet test plug with an above ground test monitoring panel must be provided.

a. One hose is to induce air through the test plug and into the test chamber.

b. The second hose is for the purpose of monitoring the test pressure from within the enclosed pipe.

4. UNDER NO CIRCUMSTANCES ARE WORKERS TO BE ALLOWED IN THE CONNECTING MANHOLES WHILE A PRESSURE TEST IS BEING CONDUCTED.

5. Add air slowly into the test section. After an internal pressure of 4.0 psi is obtained, allow internal air temperature to stabilize.

6. After stabilization period, adjust the internal air pressure to 3.5 psi, disconnect the air supply and begin timing the test.

7. Air test shall conform to ASTM F1417

8. Sections so determined to have\lost psi or less during the test period will have passed the leakage test. Those sections losing in excess of 1 psi during the test period will have failed the leakage test.

9. Appropriate repairs must then be completed and the line retested for acceptance.

(B) Hydrostatic Test:

Ex filtration Testing (water):

Sanitary sewer testing by means of ex filtration should only be considered when low pressure air testing cannot be used and only with the approval of the Engineer.

Testing Procedure:

1.The Contractor shall furnish all equipment for testing.

2. Seal off the downstream end of the line and fill with water to a minimum head of 4 feet in a stand pipe at the high end.

3. A period of at least one hour will be allowed for absorption time before making the test.

4. A suitable meter or method of measuring the quantity of water used is necessary.

5. The allowable water loss for sanitary sewers shall not exceed 0.158 gallons per hour per 100 feet of pipe per inch of diameter of pipe under a minimum test head of 4 feet above the top of the pipe at the upper end.

(C) Deflection Test for HDPE and PVC Pipe:

In addition to the tests prescribed above, the Contractor shall perform a deflection test on the system as directed by the Engineer. Any part of the installation, which shows deflection in excess of, 5% of the nominal inside diameter per Section 738 for HDPE pipe or in excess of 5% of the average inside diameter per ATM D-3034 for PVC pipe; shall be corrected.

After acceptance but prior to the termination of the warranty period, the Contracting Agency may test the long term deflection of the sewer. If the Contracting Agency determines that the deflection has exceeded 7 ½ % of the average inside diameter, that portion of the installation shall be corrected by the Contractor at no cost to the Contacting Agency.

(D) The Contractor as a part of final acceptance shall perform a mandrel test of the sanitary sewer after compaction of the trench. The mandrel test shall follow ASTM

(E) The Contractor shall be responsible for providing video viewing and taping as a part of the final inspection. Video viewing and taping for final inspection and acceptance shall not be done until after final asphaltic pavement has been placed. The Contractor shall flush the line with water just prior to video taping the sanitary sewer, no pulling or cleaning shall be done after flushing prior to

video taping. Ponding in excess of ½ inch or Defects will require correction and reinspection. All video tapes become the property of the City of Sedona. The cost of for video viewing and taping the sewer mains shall be considered incidental to the installation of the sanitary sewer mains.

615.11 PAVEMENT AND SURFACING REPLACEMENT:

Pavement and surfacing replacement shall be done in accordance with Section 336.

615.12 CLEANUP:

The Engineer has the right to close down forward trenching and pipe laying where testing, backfill, compaction and cleanup does not follow in an orderly manner.

615.13 MEASUREMENT AND PAYMENT:

(A) Sewer Pipe and Fittings: (PVC, cast iron and other approved types of pipe.)

Measurement will be made horizontally through manholes and fittings and from centerline to centerline of structures, for the various types and sizes of pipe called for on the plans and in the proposal.

Payment for the various sizes and types of pipe will be made at the unit price per linear foot, and shall be compensation in full for furnishing and installing the pipe and fittings complete in place, as specified, including excavation of soil and rock, removal of obstructions, backfilling, water settling, compaction, sheeting and bracing, testing, and all incidental work not specifically covered in other pay items.

(B) Sanitary Sewer Service Connection:

Measurement will be the linear feet of service connections installed.

Payment will be made at the unit price per linear foot, and shall be compensation in full for furnishing and installing pipe and fittings complete in place, as specified and called for on the plans and standard details, including all cost of excavation, removal of obstructions, shoring and bracing, backfilling, compaction, pavement replacement, maintenance of traffic, and all work incidental thereto.

(C) Sanitary Sewer Cleanouts:
Measurement will be the number of cleanouts installed.

Payment will be made at the unit price and shall be compensation in full for furnishing and installing pipe, fittings, and frame and cover as called for on the plans and in accordance with the standard detail.

END OF SECTION 615

SECTION 621

CORRUGATED METAL PIPE AND ARCHES

621.1 DESCRIPTION:

These specifications cover plain galvanized, bituminous coated, and bituminous coated and paved galvanized corrugated metal pipe for use in storm sewers. The pipe shall be of the types, constructed as specified, and shall be manufactured in accordance with the requirements of the stated specifications. Except as otherwise required, corrugated metal pipe shall conform to AASHTO M - 36 for Type I, Type IA, II and Type IIA. The external coating and internal lining shall be in accordance with AASHTO M –190 and Section 760.

621.2 MATERIALS:

The types of pipe and fabrication shall be in accordance with Section 760. All helically-wound corrugated metal pipe shall have a marking system which shall provide a quick external visual check of diameter variations during and after the manufacturing process.

621.3 INSTALLATION:

Excavation of soil and rock, bedding and backfill shall be in accordance with Section 601, except as modified by standard details.

No pipe shall be laid except in the presence of an inspector. Each pipe shall be carefully inspected immediately before it is laid and defective pipe will be rejected. Pipelines shall be laid to the grades and alignment indicated on the drawings. Variation from prescribed grade and alignment shall not exceed 0.l0 foot, and the rate of departure from, or return to established grade or alignment shall be no more than 1 inch in 10 feet, unless otherwise approved by the Engineer. Proper facilities shall be provided for lowering sections of pipe into trenches. All pipes, elliptical or round, as well as pipe arches requiring external coating or internal lining shall be equipped with lifting lugs as required and shall have connecting bands designed to provide positive connection without damaging the coating on the pipe or pipe arch.

All field repairs to the bituminous coating or paving shall be made with approved fiber reinforced bituminous mastic.

Corrugated metal pipe and/or pipe arches shall be laid with separate section joined together in such a manner that the joint space shall not exceed ½ inch, with the outside laps of circumferential joints pointing upstream and with longitudinal laps on the side. Elliptical pipe shall be installed so that the major or minor axis, whichever the case may be, and which should be indicated by suitable markings on the top of each end of the pipe sections, coincides with the survey alignment of the trench excavation. Any metal in the joints, which is not thoroughly protected shall be coated with

bituminous mastic. During the installation, the pipe shall be handled with care so as not to damage the external coating or internal lining. Coupling band bolts and damaged areas of the coupling bands and pipe shall be given a coating of bituminous mastic as specified above prior to placing the backfill. As determined by the Engineer, pipe that is damaged to such an extent that satisfactory field repairs cannot be made shall be removed and replaced at no additional cost to the Contracting Agency.

621.3.1 Joints: Before the connecting band is placed around the pipe, the ends of the pipe that will be beneath the band, shall be coated with bituminous mastic or, if of suitable design, fitted with circular rubber gaskets to provide a watertight joint. The band shall be tightened evenly, keeping equal tension on the bolts. If mastic is used, tension shall be maintained over an interval of time until the flow of mastic terminates. The joint shall remain uncovered over a period designated by the Engineer, and before covering the joint the nuts shall be tested for tightness. If the nut has a tendency to loosen its grip on the bolt, it shall be tightened again and remain uncovered until a tight, permanent joint can be obtained. Prior to backfilling around the joint, the bolts, lugs, and nuts shall be given a coating of bituminous mastic. The annular space between abutting pipe sections shall be filled with bituminous mastic after jointing.

621.3.2 Pipe Elongation: Except as otherwise specified, the standard details shall control as to conditions under which pipe must be elongated. Pipe shall be elongated 5 +/- 1/2 percent of the nominal diameter to take advantage of the buildup of side support as it settles back toward a full round shape under the backfill load. The method or technique for obtaining and releasing the elongation shall be optional to the Contractor. Under no circumstances shall the vertical diameter of the pipe at any point along the pipe section, after backfill and compaction is completed, be less than the nominal diameter of the pipe, or more than 5 percent greater than the nominal diameter of the pipe as shown on the plans or specified elsewhere in this specification. Any damage done as a result of strutting shall be repaired as directed by the Engineer at no additional cost to the Contracting Agency. Strutting of pipe shall be approved by the Engineer.

621.3.3 Cutting: The Contractor will be prohibited from using conventional welding torches in cutting full lined CMP due to fire hazard. Pipe will either be saw cut or cut with special cutting tools which will not expose the pipe to the fire hazard of a normal acetylene torch. Whenever possible, connections shall be shop fabricated to prevent any exposure to fire hazard.

621.3.4 Repair of Damage to Coatings: Corrugated metal pipe shall be carefully handled at all times to prevent damage to the external coating, spelter coating, or internal lining. Each length of pipe shall be carefully inspected immediately prior to placing in the trench to ascertain that no damage has been done to the exterior coating that will be concealed when the pipe is placed. Any damage to the spelter coating, shall be repaired to the satisfaction of the Engineer in accordance with Section 771. Any damage to the external coating or internal lining shall be repaired to the satisfaction of the Engineer with bituminous mastic as specified above.

621.4 TEST SPECIMENS:

All tests on the bituminous coating shall be made on samples secured from pipe delivered to or about to be delivered to the Contractor, or from the coating and lining facility of the pipe fabricator at the time the pipe is being coated.

Compliance with these specifications as set forth, shall be the responsibility of the Contractor. Three certified copies of test results indicating compliance shall be furnished for each lot or shipment prior to delivery of the material to the Contractor.

621.5 MEASUREMENT:

Measurement of corrugated metal pipe will be the number of linear feet of pipe, measured horizontally, from end to end of the pipe through manholes and specials. At changes in diameter the measurement will be to center of manhole or special.

621.6 PAYMENT:

Payment will be made at the contract unit price per linear foot, to the nearest foot, for each size and type of pipe and shall be compensation in full for furnishing and installing the corrugated metal pipe as specified, including removal of obstructions, excavation of soil and rock, backfilling, compacting, testing, and all incidental costs not specifically covered in other items in the proposal.

END SECTION 621

SECTION 625

MANHOLE CONSTRUCTION AND DROP SEWER CONNECTIONS

625.1 DESCRIPTION:

625.1.1 Sewer Manholes: Construction shall consist of furnishing all materials and constructing manholes complete in place, as detailed, including foundation walls, cast iron steps, manhole frames, covers, and any incidentals thereto, at locations shown on the plans.

625.1.2 Drop Sewer Connections: Construction shall consist of furnishing all materials and constructing drop sewer connections complete in place as detailed, including foundation materials, pipe, and any incidentals thereto, at locations shown on the plans.

625.2 MATERIALS:

Unless otherwise shown on the plans or specified in the special provisions, materials to be used shall conform with the following:

Bricks for manholes Section 775.

Cement mortar for manholes Class D, Section 776.

Concrete for manholes Class A, for drop sewer connection Class C, Section 725.

Pipe used in manholes or drop sewer connections, Section 743.

Manhole frame, cover and steps Section 787 and cast in accordance with standard details.

Plastic manhole steps, which conform to O.S.H.A. and A.S.T.M. C-487 requirements, and steel manhole steps, which are completely encapsulated in corrosion resistant rubber and conform to O.S.H.A. and A.S.T.M. C-478 requirements, may be substituted for cast iron manhole steps. The manufacturer shall furnish the Engineer a certification-indicating conformance.

625.3 CONSTRUCTION METHODS:

625.3.1 Manholes: Manholes shall be constructed of brick, of precast concrete sections, or of cast in place concrete with cast iron manhole steps, frames and covers, in accordance with the standard details. The invert channels shall be smooth and semi-circular in shape, conforming to the inside of the adjacent sewer sections. Changes in direction of flow shall be made with a smooth curve, having a radius as large as the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly.

Invert channels may be formed of concrete or brick masonry having a smooth plastered surface, may be half tile laid in concrete or brick, or may be constructed by laying full section of sewer pipe through the manhole and breaking out the top half after the surrounding concrete or brick masonry has hardened. The floor of the manhole outside the channels shall be smoothed and shall slope towards the channels.

The excavation shall be made cylindrical to a diameter sufficient in size to permit sheeting if necessary and leave room that the bricks may be laid in a workmanlike manner and the outside plaster coat properly applied or the pre-cast concrete sections or forms may be properly assembled.

A concrete foundation of Class A concrete shall be poured in accordance with the Standard Details and Section 505.

Brickwork shall not be laid upon a concrete foundation less than 24 hours after such foundation has been poured. No brickwork shall be laid in water, nor, except as prescribed for curing, shall water be allowed to stand or run on any brickwork until the mortar has thoroughly set. Where new work is joined to existing unfinished work, the contact surfaces of the latter shall be thoroughly cleaned and moistened. Bricks shall be thoroughly moistened prior to placing, and shall be laid in full cement mortar beds. Every course may be a header course, but at least every fourth course shall be a header course. The horizontal cross section of the manhole shall be circular unless otherwise called for on the plans or standard details. An oval or egg-shaped section will not be permitted. A double row-lock course of brick in the manhole wall shall be arched over the top half of the circumference of all inlet and outlet pipes. The brick manholes shall be plastered outside with 1/2 inch of cement mortar as shown on the standard details. Inside of brick wall shall be neatly pointed. The plaster coat shall be cured with a liquid membrane-forming compound conforming with Section 726 immediately after plaster has been placed and finished.

Frame and Cover. All machined surfaces on the frame and cover shall be such that the cover will lie flat in any position in the frame and have a uniform bearing through its entire circumference. Any frame and cover which creates any noise when passed over by automobiles shall be replaced. Frames shall be set firmly in a bed of mortar true to line and grade, all as shown on the plans and as called for in these specifications.

Backfilling shall be done in accordance with the requirements for trench backfilling as stated in Section 601.

625.3.2 Drop Sewer Connections: Drop sewer connections shall be constructed in conformance with standard details, as the case may be.

Backfilling shall be done in accordance with the requirements for trench backfilling as stated in Section 601.

625.4 MEASUREMENT:

Measurement will be per manhole installed, complete in place, regardless of depth.

625.5 PAYMENT:

Payment will be made at the unit price each manhole, and shall be compensation in full for furnishing and installing manhole, complete, with formed invert, concrete foundation, ladder rungs, cast iron frame and cover, excavation of soil and rock and backfill, paving cut replacement in excess of the applicable pay widths authorized in Section 336 and any incidentals thereto, in conformance

with the plans and specifications.

Payment will be made at the unit price each, and shall be compensation in full for furnishing and installing vitrified clay pipe sanitary sewer drop connections, concrete encasement, excavation, backfilling, water settling, compaction, sheeting and bracing, all work incidental thereto in conformance with the plans and specifications.

END OF SECTION 625

SECTION 702

BASE MATERIALS

702.1 GENERAL:

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

(A) Crushed Aggregate.

(B) Processed Natural Material.

(C) Processed Steel Slag.

(D) Decomposed Granite.

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

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

702.2 CRUSHED AGGREGATE:

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

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

702.2.2 Grading: The aggregate shall be well graded when tested in accordance with ASTM C-136 and C-117, The percentage composition by weight shall be within Table 702.1.

TABLE 702-1			
CRUSHED AGGREGATE GRADATION			
Sieve Sizes (Square Openings)	**Percentage by Weight Passing Sieve**		
	Select Material		**Aggregate Base**
	Type A	**Type B**	
3”	100		
1 ½”		100	
1 ¼”			100
No. 4	30-75	30-75	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 $hall 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 1/3 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 SECTION 702

SECTION 703

RIPRAP

703.1 STONE:

Stone for plain and grouted riprap shall be sound and durable, free from seams and coatings, and of such characteristics that it will not disintegrate when subjected to the action of water. Loss by abrasion shall not exceed the limits specified in Section 701.

Stone shall be of shapes which will form a stable protection structure of the required depth. Rounded boulders or cobbles shall not be used on slopes steeper than 2 to 1 unless grouted. Angular shapes may be used on any slope. Flat or needle shapes will not be acceptable unless the thickness of the piece is more than 1/3 the length.

Waste concrete may be used, if the pieces are sound free from coatings, and meet the size requirements specified for a stone.

703.2 SIZE OF STONE:

Riprap stone shall be as large as can be conveniently placed in a layer of the required depth. The stones, excepting small stones and spalls used to chink interstices shall weigh not less than 10 pounds and at least 50 percent of the stone shall weigh not less than 100 pounds.

703.3 CONCRETE:

The Portland cement, aggregates and mixing shall be as specified in Section 725 and as herein specified. The aggregate may be pit-run material, at least 80 percent of which shall pass a 1 ½ inch square mesh screen. Separating aggregates by primary sizes will not be required. Los Angels rattler tests and soundness tests will not be required.

703.4 SACKS:

Sacks shall be made of burlap not lighter than 10 ounces and shall be approximately 19 ½ inches by 36 inches measured inside the seams when the sack is laid flat. Sound reclaimed sacks may be used. The capacity of each sack shall be 1.25 cubic feet. Each sack shall contain 1 cubic foot of concrete loosely placed so as to leave room for folding the open end, the fold just enough to retain the concrete at the time the filled sacks are placed. Immediately after filling, the sacks shall be placed and lightly trampled to cause them to conform with the ground surface and with adjacent sacks in place.

END SECTION 703

SECTION 710

ASPHALT CONCRETE:

710.1 GENERAL:

Asphalt concrete shall be a mixture of asphalt cement and mineral aggregates. Mineral admixture, mineral filler and anti-stripping I agent shall be included in the mixture when required by the mix design or by the Engineer. All materials shall be proportioned by weight, volume or a combination in a central mix plant in the proportions required by the mix design to provide a homogeneous and workable mass.

The asphalt concrete mixes shall be of the types shown in Table 710-1.

TABLE 710-1		
ASPHALT CONCRETE MIXES		
Designation (mm)	Application	Design Target Lift Thickness (mm)
9.5	Surface Course	25.0
12.5	Surface Course	37.5
19.0	Base of Surface Course	50.0
25.0	Base Course	75.0
37.5	Base Course	100.0

The designation is the nominal maximum aggregate size of the mix. The nominal maximum aggregate size is defined as the next largest sieve size above the first standard sieve to retain more than 10 percent of the mineral aggregate. The standard sieve sizes 1 are 9.5 mm, 12.5 mm, 19 mm, 25 mm, and 37.5 mm and 50 mm.

Each mix can be designed for low, medium or high traffic conditions. Low traffic conditions are conditions where the asphalt, mix will be subject to low volume and low weight vehicle usage. Examples of this condition are residential streets and most "' parking lots. Medium traffic conditions are conditions where the asphalt mix will be subject to moderate volumes and heavy weight vehicle usage as found on collector streets and in parking lots with truck traffic. High traffic conditions are conditions where the asphalt mix will be subject to high volume and/or heavy weight vehicle usage as found on arterial streets.

710.2 MATERIAL:

710.2.1 Asphalt Cement: The asphalt cement specified in this section has been developed for use in desert climate conditions. Should it be utilized in other climates, consideration should be given to adjustments in the asphalt selection. The asphalt cement; shall be a performance grade asphalt conforming to the requirements of Section 711 for PG 70-10, unless otherwise specified in the plans or special provisions.

710.2.2 Aggregate: Coarse and fine aggregates shall conform to the applicable requirements of Section 701, except as modified herein.

Coarse aggregate is material retained above the 2.36 mm sieve and fine aggregate is material passing the 2.36 mm sieve.

Blend sand (naturally occurring or crushed fines) shall be clean, hard and sound material which will readily accept asphalt coating. II The blend sand grading shall be such that, when it is mixed with the other mineral aggregates, the combined product shall meet I the grading requirements of the designated mix, as specified in tables 710-2,710-3 and 710-4.

For gradations that pass under the restricted zone, the natural sand shall not exceed 15 percent by weight of the total aggregate.

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710.2.2.1 Aggregate Structure: For mix design only, the combined aggregates, including the mineral admixture, mineral filler and anti-strip agent, shall meet the gradation requirement in Table 710-2.

TABLE 710-2					
GRADATION REQUIREMENTS – PERCENT BY WEIGHT PASSING					
	Designation (mm)				
Seive Size (mm)	9.5	12.5	19	25	37.5
50.0	--	--	--	--	100
37.5	--	--	--	100	90-100
25.0	--	--	100	90-100	< 90
19.0	--	100	90-100	< 90	--
12.5	100	90-100	< 90	--	--
9.5	90-100	< 90	--	--	--
4.75	< 90	--	--	--	--
2.36	48-67	45-58	38-49	19-45	15-41
0.075	5.0-10.0	5.0-10.0	5.0-8.0	1.0-7.0	0-6.0

The limits of a restricted zone shall be defined as the sieve gradations in Table 710-3.

TABLE 710-3					
RESTRICTED ZONE BOUNDARY Percent Passing (Minimum – Maximum)					
	Designation (mm)				
Seive Size (mm)	9.5	12.5	19	25	37.5
4.75	--	--	--	39.5-39.5	34.7-34.7
2.36	47.2-47.2	39.1-39.1	34.6-34.6	26.8-30.8	23.3-27.3
1.18	31.6-37.6	25.6-31.6	22.3-28.3	18.1-24.1	15.5-21.5
0.60	23.5-27.5	19.1-23.1	16.7-20.7	13.6-17.6	11.7-15.7
0.30	18.7 –18.7	15.5-15.5	13.7-13.7	11.4-11.4	10.0-10.0

When plotted on a Federal Highway Administration 0.45 Power Gradation Chart, the aggregate grading shall miss the restricted zone as shown in Table710-3. Any gradation that passes through the restricted zone will be considered unacceptable. When the asphalt pavement will be subject to high or medium traffic conditions, the gradation curve shall fall below the restricted zone. When the asphalt pavement will be subject to low traffic conditions, the gradation curve may fall on either side of the restricted zone.

710.2.2.2 Aggregate Characteristics: The coarse and fine aggregates shall comply with the requirements of Table 710-4.

710.2.3 Mineral Filler, Mineral Admixture and Anti-Stripping Agent:

Mineral filler shall conform to the requirements of AASHTO M-17. The amount of mineral filler shall be determined by the mix design.

Mineral admixture or anti-stripping agent shall be dry hydrated lime, conforming to the requirements of ASTM C-207 Type N. or Portland cement conforming to Section 725. The amount of hydrated lime or Portland cement used shall be determined by the mix design.

When liquid anti-stripping agents are used, the agent shall conform to the requirements of AASHTO designation R 15-89. The agent shall be added in accordance with the manufacturer's recommended dosage rate.
Other mineral filler, mineral admixture, or ant-stripping agents, shall be approved by the Engineer prior to start of the mix design.

TABLE 710-4		
COARSE/FINE AGGREGATE REQUIREMENTS		
Characteristics	**Light volume Traffic**	**Medium or Heavy Volume Traffic**
Fractured faces % (Coarse aggregate only) AZ test method 212D	75.0,1 or more	85.0, 1 or more 80.0, 2 or more
Un-compacted voids % Min. (AASHTO T-304, Method A)	42.0	45.0
Flat & Elongated Pieces % Max. (ASTM D-4791)	10.0	10.0
Sand Equivalent % Min. (AASHTO T-176	40.0	50.0
Plasticity Index (AASHTO T-90)	Non-plastic	Non-plastic

710.3 MIX DESIGN REQUIREMENTS:

710.3.1 General: Unless authorized by the Engineer, no work shall be started on the project until the Contractor or his supplier has submitted an asphalt mix design acceptable to the Engineer, The mix design shall be prepared by a laboratory that is accredited through the AASHTO Accreditation Program in Hot Mix Asphalt Aggregates and Hot Mix Asphalt or the National Bureau of Standards in the National Voluntary Laboratory Accreditation Program (NVLAP) for Construction Services (Asphalt). The laboratory shall be under the direct supervision of a Civil Engineer, registered by the State of Arizona, with a minimum f five years experience in the development of asphalt concrete mix designs. A copy of the certification shall be required with each mix design submittal. The date of the design shall not be older than on year from the date of submittal, unless supportive documentation is provided and approved by the Engineer.

The mix design report shall include the following elements.

1. A description of all products that are incorporated in the asphalt concrete along with a statement disclosing the sources of all products, including mineral admixtures, asphalt modifiers, anti-stripping agents and their method of introduction.

2. The mix plant location, a copy of the certification of Hot Mix Asphalt Production Facilities, by Arizona Rock Products Association and a copy of all certifications for weighing and metering devices within the plant.

3. The results of testing performed on all aggregates to assure compliance with Section 701 and 710.

4. The results of all laboratory test associated with the mix design development, a plot of the gradation on Federal Highway Administration's 0.45 Power Gradation Chart, plots of all compaction curves and the results of the moisture damage testing (Section 710.3.6).

5. A specific recommendation for design asphalt content and any limiting conditions that may be associated with the use of the design, such as minimum percentages of crushed or washed fine aggregate.

6. Mixing and compaction temperatures.

7. The suppliers product code, the laboratory Engineer's seal (signed and dated), and the design was performed.

The mix design shall be submitted to the Agency by the Contractor for which it was developed. This submittal shall include a certification, signed by the Officer of the Contractor or his supplier stating that the materials submitted for the mix design are representative of those that will be utilized for the production of the asphalt concrete represented by the mix design. Once the mix design has been approved by the agency and the mixing plant selected, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer. Any changes in the plant operation, the producers pit, the asphalt cement, including modifiers, or any other item that will cause an adjustment in the mix, shall be justification for a new mix design to be submitted.

710.3.2 Mix Design Criteria: The mix design shall be performed by one of two methods, Marshall Mix Design or
Superpave TM Mix Design. The method shall be specified on the plans, special provisions, or by the Engineer. A minimum of 4 points will be used to establish the mix design results.

710.3.2.1 Marshall Mix Design: The Marshall Mix Design shall be performed in accordance with the requirements of The Asphalt Institute's Manual, MS-2 "Mix Design Methods for Asphalt Concrete". The mix shall utilize the compactive effort described in AASHTO T-245, "Standard Method of Test for the Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus." The mix shall comply with the criteria in Table 710-5.

TABLE 710-5	
MARSHALL MIX DESIGN CRITERIA	
Characteristics	Criteria
Compactive Effort (Each Side of Specimen)	75 blows
Marshall Stability, N	8.000 Minimum
Marshall Flow, 0.25 mm	8-16
Effective Air Voids, %	4 +- 0.2
Voids in Mineral Aggregate, %	Table 710-8
Voids Filled with Asphalt, %	70-80 (Light Traffic) 65-78 (Medium Traffic) 65-75 (Heavy Traffic)

710.3.2.2 Superpave TM Mix Design: The Superpave TM Mix Design shall be performed in accordance with the requirements of The Asphalt Institute's "Superpave TM Volumetric Mix Design Manual, AP-2" The design shall utilize the Superpave TM, gyratory compactor described in

AASHTO TP-4, Preparation of Compacted specimens of Modified and Unmodified Hot Mix Asphalt by Means of the SHRP Gyratory Compactor" and AASHTO PP-2 "Short and Long term Aging Bituminous Mixes" The mix shall comply with the criteria in Table 710-6.

TABLE 710-6				
SUPERPAVE TM MIX DESIGN CRITERIA				
	Low Traffic	Medium Traffic	Heavy Traffic	Criteria
Gyrations Nini Ndes Nmax	 7 82 127	 8 93 146	 8 105 167	 < 89* 96 + - 0.2* < 98*
% Voids in Mineral Aggregate	Table 710-8	Table 710-8	Table 710-8	--
% Voids Filled				--

* These criteria are expressed as a percentage of the maximum theoretical specific gravity.

710.3.3 Asphalt Cement Content: The design asphalt cement content shall be expressed as a percentage of the total mix weight and shall be stated in the mix design to the nearest 0.1 percent. Table 710- 7 is the allowable range of design asphalt cement contents for each mix designation. If the mix design places the design asphalt content outside of these ranges, the Contractor or his supplier will review the test data with the Engineer to determine if the design is acceptable. The Engineer shall approve the variance prior to the completion of the mix design.

TABLE 710-7		
ASPHALT CONTENT (%)		
Mix/ Designation (mm)	For Gradations Above The Restricted Zone	For Gradations Below The Restricted Zone
9.5 and 12.5 19.0 25.0 and 37.5	5.5 to 6.5 5.0 to 6.0 4.0 to 5.0	4.5 to 6.0 4.0 to 5.5 3.0 to 4.5

710.3.4 Voids in Mineral Aggregate: The voids in the mineral aggregate shall comply with the criteria in Table

TABLE 710-8		
VOIDS IN MINERAL AGGRAGATE		
Nominal Maximum Size/ Designation (mm)	Maximum Size (mm)	Minimum VMA (percent)
9.5 12.5 19.0 25.0	12.5 19.0 25.0 37.5	15 14 13 12

37.5	50.0	11

710.3.5 Dust Proportion: The dust proportion is defined as the ratio of the percent finer than the 0.075 mm sieve, including mineral filler, mineral admixture, and anti-stripping agent, to the effective binder content ($P0_{.075}/P_{be}$) The dust proportion shall be between 0.60 and 1.2 for aggregate gradations that fall below the restricted zone and between 0.60 and 1.4 for aggregate gradations that are above the restricted zone.

710.3.6 Moisture Sensitivity: The resistance to moisture damage shall be evaluated in accordance with AASHTO T -283, "Standard Method of Test for Resistance of Compacted Bituminous Mixture to Moisture Induced Damage," without the optional freeze-thaw cycle. The asphalt concrete, at the design binder content, shall have a minimum average dry tensile strength of 500 kPa and a minimum tensile strength ratio of 0.70 when the aggregate gradation is below the restricted zone and a minimum average dry tensile of750 kPa and a minimum tensile strength ratio of 0.60 when the aggregate gradation is above the restricted zone.

710.4 PRODUCTION TOLERANCES:

Asphalt concrete from the mixing facility shall be accepted on the basis of aggregate gradation, asphalt cement content, coarse/fine aggregates and volumetrics. These evaluations shall be performed on samples secured at the place of manufacture or from the roadway in accordance with the provisions of AASHTO Designation, T -168, "Standard Method of Test for Sampling Bituminous Paving Mixtures."

710.4.1 Aggregate Gradation: The Engineer at his discretion may accept the aggregate gradation on the basis of cold feed or hot bins. The testing shall be in accordance with AASHTO Designation T -11, "Standard Method of Test for Materials Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing" and AASHTO Designation T -27, "Sieve Analysis of Fine and Coarse Aggregates" or in accordance with AASHTO T -30, "Standard Method of Test for Mechanical Analysis of Extracted Aggregate," when solvent extraction or incineration methods are utilized to determine asphalt content.

The target values for all sieve sizes will be established by the mix design. The production tolerance for the gradation shall be tested against the following sieves: 0.075,0.15,0.6,2.36,4.75,9.5, 12.5, 19,25,37.5 mm sieves. The aggregate gradation will be considered acceptable when the variations from the mix design percentages do not exceed the tolerances in Table 710-9 for a single event test. The full tolerance will be applied to the mix design percentages for acceptance. The restricted zone is considered a design requirement only.

TABLE 710-9	
ALLOWABLE AGGREGATE VARIATION	
Maximum Aggregate Size	100% passing
Nominal Maximum Aggregate Size	+- 7%
2.36 mm Sieve to the Nominal Maximum Aggregate Size	+- 6%
0.150 mm and 0.600 mm Sieves	+- 4%
0.075 mm Sieve	+-2.0%

710.4.2 Asphalt Cement Content: The asphalt content may be determined in accordance with AASHTO Designation T-164, "Quantitative Extraction from Bituminous Paving Mixtures," AASHTO Designation T-287, "Asphalt Cement Content of Asphalt Concrete Mixtures by the Nuclear Method" or ARIZ 427 "Asphalt Cement Content Incineration." The asphalt content determined by solvent extraction methods may be corrected for a retention value determined in accordance with ARIZ 407d, "Determination of Asphalt Retained in Bituminous Mixtures."

The asphalt cement content shall be considered acceptable if it is within =- 0.40% of the mix design target value. Variations beyond these limits will be investigated and the Contractor will be required to correct the condition causing them.

If analysis shows a variation in the bitumen content which is greater than +-0.50% of the mix design target for a single event test, or greater than =- 0.40% for an average of the last 3 more consecutive tests, it will be cause for discontinuance of the plant production until the nonconformance has been corrected.

710.4.3 Coarse/Fine Aggregates: The coarse/fine aggregate requirements shall be considered acceptable if the test values on production material falls within the mix design requirements established in Table 710-4, except for the uncompacted voids.

The uncompacted voids may be determined from collected samples in accordance with AASHTO TP-304, Method A, "Test Method for Uncompacted Void Content of Fine Aggregate as influenced by Particle Shape, Surface Texture & Grading, Method A." This result shall be calculated using the fine aggregate bulk oven dry specific gravity reported in the mixture design report. This same procedure may be performed on aggregate resulting from solvent extraction or incineration methods. The fine aggregate angularity shall be considered acceptable if the test value on production material is not less than the uncompacted voids specified on the mix design minus 2.0% or not less than 1.0% below Table 710-4, which ever results in the higher uncompacted void content.

710.4.4 Volumetrics: The volumetrics shall be determined by The Asphalt Institute's manual, MS-2 "Mix Design Methods for Asphalt Concrete" or The Asphalt Institute's "Superpave TM Volumetric Mix Design Manual, SP-2." The volumetric values shall be considered acceptable if the test values on production material falls within the mix design criteria established in section 710.3.2. Except for the effective air voids. The effective air voids requirement shall be 1.O+/-% of the design asphalt cement content.

710.5 PRODUCTION REQUIREMENTS:

710.5.1 Quality Control: Quality control shall be the responsibility of the Contractor or his supplier. The Engineer reserves the right to obtain samples of any portion of any material at any point of the operations for his own use. Also, the Engineer reserves the right to 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 mix produced shall conform to the properties of the mix design. When the asphalt concrete mix does not conform to the approved mix design properties, the production shall cease immediately.

710.5.2 Handling and Storage of Aggregate: Aggregate shall be stockpiled so that segregation and contamination are minimized. Dividers of sufficient size to prevent intermingling of stockpiles shall be provided. This may be accomplished by sufficient separation of the stockpiles. Any method of handling or moving the material which may cause the segregation, degradation, contamination or the combining of materials of different gradings or stockpiles shall not be permitted. The affected material will be reprocessed or discarded.

710.5.3 Proportioning: The Contractor or his supplier shall provide documentation by calibration charts or other approved means showing the mineral aggregate, asphalt cement, mineral admixture, mineral filler or anti-stripping
Drying shall be to the extent that the moisture content of the asphalt concrete mix, when placed on grade immediately behind the paver, shall not exceed one half of one percent (0.5 %). The moisture content shall be determined in accordance with Arizona Test Method 406.

If a mineral admixture or anti-stripping agent is added in a drum mix plant, a positive signal system and a limit switch device shall be installed in the plant at the point of introduction of the admixture. The positive signal system shall be placed between the metering device and the mixing drum, and utilized during production, whereby the mixing shall be stopped automatically if the admixture is not being introduced into the mixture.

No fine mineral which has been collected in the dust collection system shall be returned to the mixture unless the Contractor or his supplier propose in writing to utilize a specific portion of the fines and approved by the Engineer. If used, the fine material shall be metered at a uniform rate into the mixture. The amount of mineral filler shall be determined by the mix design.

Filler material, if required, shall be added separately and in a thoroughly dry condition. Heating of filler material will not be required.

When hydrating lime or Portland cement is added as a mineral admixture or anti-stripping agent, the method of adding the lime or cement shall be such that the aggregate will be uniformly coated. The amount of lime or cement used shall be determined by the mix design.

When mineral aggregate, asphalt cement, mineral filler, mineral admixture or anti-stripping agent are proportioned by weight, the scales used in batching the materials, all boxes, hoppers, buckets or similar receptacles used for weighing materials, shall be insulated against the vibration or movement from the rest of the plant. Errors in weighing, while the entire operation is running, shall not exceed two percent for any setting or one and one-half percent for any batch. The asphalt shall be weighed in a heated, insulated bucket suspended from a springless deal scale or load cell system.

When mineral aggregate, asphalt cement, mineral filler, mineral admixture and/or anti-stripping agent are proportioned by volume, the correct portion of each mineral aggregate size introduced into the mixture shall be drawn from the storage bins by an appropriate type of continuous feeder. The feeder shall supply the correct amount of mineral aggregate in proportion to asphalt cement. Furthermore, the feeder shall allow each mineral aggregate size to be adjusted separately. The continuous feeder for the mineral aggregate shall be mechanically or electrically actuated.

If fine material sticks to the sides of the bin, the bin shall be equipped with a vibrating unit which

will effectively vibrate the side walls of the bin and prevent any hang up of segregated sizes while the plant is operating.

All scales or temperature devices shall be so located that the mixer operator and the plant inspector have an unobstructed close up view of the indicating or registering devices. The scales shall indicate the true net weight without the application of any factor. The dial for dial type scales shall not be less than 12 inches in diameter and the figures thereon shall be clearly legible.

710.5.4 Drying and Heating: The mixing plant shall be provided with accurate mechanical means for feeding the aggregates from the stockpiles or bunkers into the drier at such a rate that a uniform production and temperature of dried aggregates will be obtained. Drying and heating shall be accomplished in such a manner as to preclude the mineral aggregate from becoming coated with fuel oil or carbon.

A recording pyrometer or other approved recording thermometric instrument, sensitive to a rate of temperature change not less than 6º C. per minute, shall be placed at the discharge chute of the drier to automatically record the temperature of the asphalt concrete or mineral aggregate. When requested, a copy of the recording shall be given to the Engineer at the end of each shift. The mixing temperature of the asphalt mix shall not exceed +/- 10º C. of the mixing temperature stated on the approved mix design.

Heating of filter material will not be required.

The drier shall be equipped with a dust collector system capable of removing objectionable or excess dust from the aggregate. The dust collector shall comply with the Maricopa County Bureau of Air Pollution Control Rules and Regulations as adopted by the County board of Supervisors and applicable State laws or local ordinances.

710.5.5 Mixing: The production of the plant shall be governed by the rate required to obtain a thorough and uniform mixture of the materials not to exceed the rated capacity of the plant. Mixing shall continue until the uniformity of coating, when tested in accordance with the requirements of AASHTO T-195, is at least 95 percent.

The mineral aggregate, asphalt cement, mineral filler, mineral admixture and/or anti-stripping agent shall be mixed at a central mixing plant of the batch type mixer, continuous type mixer, or drum type mixer, as the Contractor or his supplier may elect. The plant shall be maintained and operated in accordance with the manufacturer's recommendations.

Pug mill mixers shall be of a twin-shaft type and shall be operated at the speed recommended by the manufacturer. It shall be equipped with paddles of sufficient size and number to deliver a thorough and uniform mixture. Should the paddles or other parts of the pug mill become worn to such extent as to adversely affect the quality of the mixing or allow leakage from the discharge gate, such parts shall be promptly replaced.

The amount of asphalt cement to be added to the mineral aggregate shall be as specified in the mix design. The asphalt cement shall be added at the temperature specified in the mix design or in Section 711.

The asphalt pump shall be a positive displacement type pump. The use of a pressure relief valve will not be permitted. The plant shall be equipped with an indicating meter between the pump and spray, and the meter shall be in good working condition and accurately record the volume of material pumped. All pipes, bins, fittings and meters shall be steam jacketed or otherwise properly insulated. The asphalt storage system shall be equipped with a device for automatic plant cut-off when the intake of the positive displacement pump is not working under positive pressure. Sampling ports shall be installed at the discharge end of the metering device for use by the Engineer in obtaining samples of the material.

A positive signal system shall be provided to indicate the low level of mineral aggregate in the bins of the batch plant and as the level of material in anyone bin approaches the strike off capacity of the feed gate, the device will automatically and promptly close down the feed of all materials to the mixer. The plant will not be permitted to operate unless this signal system is in good working condition. Each bin shall have an overflow chute or divider to prevent material from spilling into adjacent bins or waste excess material.

The temperature of the asphalt concrete upon discharge from the mixer shall not exceed the maximum mixing temperature specified in the mix design. If the asphalt concrete is discharged from the mixer to a hopper, the hopper shall be constructed so that segregation of the asphalt concrete will be minimized.

710.5.6 Temporary Storage of Bituminous Mixtures: Use of surge bins or storage bins for temporary storage of hot bituminous mixtures will be permitted. The bituminous mixture may be stored in insulated and heated storage bins for a period of time not to exceed 12 hours. If the Engineer determines that there is an excessive amount of heat loss, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

710.5.7 Plant Inspection: Each hot mix asphalt facility, producing under this specification, shall be inspected biannually by a Civil Engineer registered in the State of Arizona and knowledgeable in batch plant operation. The Civil Engineer shall be independent and not an employee of the Contractor or the supplier. This inspection shall be performed in accordance with the "Certification of Hot Mix Asphalt Production Facilities" by the Arizona Rock Products Association. A copy of the current certification shall be an integral part of the mix design which, if found unacceptable, could be cause for rejection of the entire submittal.

710.6 TRANSPORT AND DELIVERY REQUIREMENTS:

The beds of the trucks, utilized to transport asphalt concrete, shall be coated with a release agent. The release agent shall be certified to be non-reactive with the bituminous material. If, in the opinion of the Engineer or plant operator, there is an excess of release agent applied to the truck bed, the driver will be required to raise the bed and drain off the excess agent. Diesel fuel will not be acceptable as a releasing agent.

Mixtures shall be delivered to the job site without segregation of the ingredients and within the lay down temperature range specified in the mix design.

At the time of delivery to the job site, the Engineer shall be provided with an legible delivery ticket that has the weight of the material from a measuring device, which has been certified by the Arizona Department of Weights and Measures. The delivery ticket shall contain the following information:

(1). Date;(2).Supplier (3)Plant location and/or plant number;. (4)Ticket Number. (5)Truck Number. (6)Contractor's name;. (7)Project name and/or location;. (8)Production code/description with percent asphalt;. (9)Mineral filler/additive and/or anti-stripping agent and percent. (10)Temperature at Batching. (11)Time of batching, arrival and unloading;. (12)Material weight or vehicle weight with and without material; and. (13).Weight of accumulative

END SECTION 710

SECTION 725

PORTLAND CEMENT CONCRETE

725.1 GENERAL:
Portland cement concrete shall be composed of Portland cement or Portland Pozzolan cement, Pozzolonic Materials, fine and coarse aggregates, water, and, if provided for or allowed, certain admixtures.

All of the materials used for concrete shall be in accordance with these specifications and requirements for the particular material as provided herein.

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.

TABLE 725-1

CONCRETE CLASSES MINIMUM REQUIREMENTS

Class of Concrete	Min. Cement Content Lbs. Per Cu Yard	Minimum Compressive Strength (1)	
		At 14 Days psi	At 28 Days psi
AA	600	3200	4000
A	520	2400	3000
B	470	2000	2500
C	420	1600	2000

(1) As tested in accordance with ASTM C-39. when tested in accordance with ASTM C-143.

Class AA concrete shall used as specified.

Class A concrete shall be used for concrete structures, either reinforced or non-reinforced, and for concrete pavements.

Class B concrete may be used for curbs, gutters and sidewalks.

Class C concrete may be used for thrust blocks, encasements, fill or over-excavation, etc.

725.2 PORTLAND CEMENT:

Cement to be used or furnished under this specification shall be Portland cement, conforming with the requirements of ASTM C-150, Type II, low alkali, or Portland Pozzolan Cement, conforming with the requirements of ASTM C-595, Type IP (MS), low alkali, except when another type

including high early strength is specified in the special provisions or shown on the plans. Type V cement (ASTM C-150) shall be specified in the special provisions for use in concrete which will be exposed to contact with soils or waters containing water soluble sulfates (as S04) in concentration greater than 0.20% by weight of soil or 1500 PPM in solutions. Pozzolonic materials shall not be used as a directly added ingredient in concrete in combination with Portland Pozzolan Cement.

Cement shall be sampled and tested as prescribed in applicable ASTM specifications. The Contractor shall obtain and deliver to the Engineer a certification of compliance signed by the cement manufacturer, identifying the cement and stating that the cement delivered to the batching site complies with those specifications. When requested by the Engineer, the Contractor shall furnish him with 3 copies of said certification. The cost of furnishing tested cement shall be considered as included in the contract 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 cement, such facilities shall be used. Otherwise the cement shall be delivered in original unopened sacks that have been filled at the mill and bear the name or brand of the manufacturer. The type of cement, and the weight of cement contained in each sack shall be plainly marked thereon.

Cement 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 cement be delivered to the site show evidence of contamination, the Engineer may require that such lot be removed from the site.

A cement shall not be mixed with any other brand or type unless written permission has first been obtained from the Engineer. All cement used in the manufacture of concrete for any individual structure shall be of the same brand unless otherwise approved by the Engineer.

725.2.1 Pozzolonic Materials: Pozzolonic materials to be used in concrete or furnished under this specification shall conform to the requirements of ASTM C-618.

If an approved pozzolonic material is used, 15 percent by weight of the Table 725-1 minimum Portland cement requirements shall be replaced. The replacement ratio shall be l.2 pounds of pozzolan per pound of replaced Portland cement. If the class of concrete is not from Table 725-1, the amount of pozzolanic material used will be 17.5 percent of the combined weight of pozzolanic material and Portland cement.

Pozzolans shall be sampled and tested as prescribed in ASTM C-618 and ASTM C-311. The Contractor shall obtain and deliver to the Engineer a certification of compliance signed by the Pozzolan supplier identifying the Pozzolan and stating the Pozzolan delivered to the batching site complies with applicable specifications. The cost of furnishing tested Pozzolan shall be considered as included in the contract price and no additional allowance will be made therefore.

Pozzolan material shall be handled and stored in the same manner as Portland cement. When facilities for handling 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.

A Pozzolan shall not be mixed with any other brand or type unless written permission has first been obtained from the Engineer. All Pozzolan used in the manufacture of concrete for any individual structure shall be of the same type, and from the same source unless otherwise approved by the Engineer.

725.3 AGGREGATES:

Aggregates shall be crushed rock or gravel or a combination thereof and sand conforming to the requirements prescribed in Section 701. Prior to the delivery of the aggregates, the Contractor will be required to furnish samples for testing, and shall notify the Engineer as to when and where they will be available. Thereafter, additional required samples shall be furnished at the expense of the Contractor, but the cost of testing and making the grading analysis will be borne by the Contracting Agency. Samples shall be taken by the Engineer or in the presence of the Engineer

.

No method, which may cause the segregation, degradation or the combining of materials of different grading, shall be used.

725.4 AGGREGATE GRADING:

Aggregates for each batch of concrete to be prepared shall be combined from materials separately stored in the various sizes and gradations as prescribed in Section 701. The relative proportions of each aggregate used will be as required to meet the provisions of this specification and will be the responsibility of the Contractor.

Except where the amount of concrete for anyone job is 10 cubic yards or less, various sizes of both coarse and fine aggregate shall be proportioned by weight unless permission to do otherwise has first been obtained from the Engineer. Aggregates that are proportioned by volume shall be measured in containers of known capacity. Regardless of the method employed, either by weight or volume, each individually stored size of aggregate shall be proportioned separately, but not necessarily weighed individually.

The maximum size of the aggregate shall not be larger than one-fifth of the narrowest dimension between forms of the members for which the concrete is to be used, or larger than 3/4 of the minimum clear spacing between reinforcing bars.

725.5 WATER:

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.

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, positively and that the predetermined quantity of water required can be discharged rapidly in one operation into the mixing drum without dribbling. Tanks or other equipment for measuring and discharging water into the mixer shall be sufficiently accurate that the amount of water delivered to the mixer for any batch shall not vary more than 1 percent from the required quantity. Adequate means for determining and checking the accuracy of the equipment shall be provided and made

available to the Engineer at all times.

The water used for mixing with concrete shall be potable and free from oil, vegetable matter and other deleterious substances, and shall conform to the following requirements:

Water for prestressed concrete shall not contain chlorides calculated as sodium chloride in excess of 1,000 parts per million nor sulphates calculated as sodium

725.6 ADMIXTURES:

Admixtures of any type, except as otherwise specified, shall not be used unless written authorization has been obtained from the Engineer.

If an air-entraining agent is authorized, the amount used will be limited to the extent that the amount of entrained air by volume shall not be more than 6 percent. Air-entraining agents complying with AASHTO M-154 or ASTM C-260 will be permitted as long as strength requirements are met. Any admixture shall be measured accurately by mechanical means into each batch by equipment and in a method approved by the Engineer. Any admixtures used shall be included in the price for that item.

725.7 PROPORTIONING:

All proportioning equipment shall comply with the standards of the Concrete Plant Manufacturer's Bureau and the certification requirements of the Arizona Rock Products Association. The proportioning shall consist of combining the specified sizes of aggregates, each stored in a separate bin with cement, Pozzolanic Materials, and water as herein provided. Weigh hoppers shall be charged from bins located directly over the weigh hoppers or from conveyor belts. When conveyor belts are used, there shall be a separate belt for each size of aggregate.

Bulk cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the batch ingredients are released for discharge. The cement hopper shall be attached to a separate scale for individual weighing.

All Pozzolan that is to be incorporated into the concrete as a separate ingredient shall be weighed. When the cement scales are used for weighing both cement and Pozzolan, the cement shall be weighed first. If separate scales are provided, they shall be accurate to +/- 0.3 percent of the scale capacity.

Scales utilized in the proportioning device may be of the springless dial-type or of the multiple-beam type.

If the dial-type, the dial shall be of such size and so arranged that it may be read easily from the operating platform.

If the multiple beam-type, the scales shall be provided with an indicator operated by the main beam which will give positive visible evidence of over or under weight. The indicator shall be so designed that it will operate during the addition of the last 400 pounds of any weighing. The over travel of the indicator hand shall be at least 1/3 of the loading travel. Indicators shall be enclosed against moisture and dust.

Weighing equipment shall be as recommended by the Concrete Plant Manufacturer's Bureau and be

insulated against vibration or movement of other operating equipment in the plant. When the entire plant is running, the scale reading at cutoff shall not vary from the weight designated by the Engineer more than 1 percent for cement, Pozzolan or Cement Pozzolan, 1 1/2 percent for any size of aggregate, nor 1 percent for the total aggregate in any batch.

When proportioned at a central mixing plant there shall be an approved moisture meter, accurate within 1/2 percent, installed to indicate the moisture in the fine aggregate.

A concrete mix design carrying the producer's designated mix number of the concrete being furnished under these specifications shall be submitted to the Contracting Agency at least once each year. In the event there is any change in the source of material, another mix design shall be submitted.

725.8 MIXING:

Machine mixing will be required in all cases Other than those in which it would obviously prove to be impractical; in which latter event hand mixing will be permitted, only to the extent necessary. Regardless of the method employed, mixing shall be commenced as soon as possible after

725.8.1 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. They shall be equipped with an accurate automatic timing device so designed and constructed as to lock the discharge lever before aggregate, cement and Pozzolan enter the drum, and release such lever only after the specified mixing time has elapsed. The regulation of the setting of said device shall be under the supervision of the Engineer. Water control equipments as described in this specification shall also be provided with each concrete mixer.

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, cement, Pozzolan 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 anyone batch shall neither exceed the water level capacity of the mixer nor the manufacturer's catalog rated capacity of the mixer.

725.8.2 Transit Mixers: Transit mixers shall be high quality equipment and meet the requirements of the Truck Mixer Manufacturer's Bureau and the certification requirements of the Arizona Rock Products Association. Ready mix concrete shall comply with ASTM C-94 except as herein specified.

The total elapsed time between the addition of water at the batch plant and depositing the complete mix shall not exceed 90 minutes. 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.

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

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, shall be provided with a legible weighmaster’s certificate (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.

Type of cement.

Type of Pozzolan, any.

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, if any.

Serial number of the ticket.

The type, capacity and manner of operation of the mixing and transporting equipment for ready-mix concrete shall conform to the current Standards for Operation of Truck Mixers and Agitators of the National Ready-Mixed Concrete Association and the Truck Mixer and Agitators Standards of the Truck Mixer Manufacturer's Bureau. Water shall not be added to the batch during transit. Additional water may be added at the point of discharge to adjust slump providing the slump after such water addition does not exceed the maximum allowed by these specifications 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 will be cause for rejection of the load. The Contractor shall be responsible for all concrete to which water is added at the job site.

725.8.3 Hand Mixed Concrete: Hand mixed concrete shall be prepared on a watertight level platform in batches of not to exceed 1/3 cubic yard each. The required amount of coarse aggregate shall first be spread on the platform in an even and uniform layer, over which the proper proportion of fine aggregate shall then be likewise spread. The combined depth of both such layers shall not be greater than one foot. The required quantity of cement shall then be evenly distributed over the fine aggregate; following which the entire batch shall be turned with shovels at least twice before the water is added. The proper amount of water shall then be uniformly sprinkled or sprayed over the batch, which shall thereafter be returned with shovels not less than 3 times before being removed from the platform.

725.8.4 Dry batched Unmixed Concrete: Should the Contractor elect to use dry batched unmixed concrete, an accurate automatic batch weight recorder shall be provided to record the quantities of cement, aggregate and water batched into the containers; the weight of cement shall be recorded on either a separate charge from the aggregate or on the same chart using a separate needle. The recorder shall produce an autographic readable record on a visible chart of the weights of each of the materials batched. After batching, the needle on the chart shall return to zero. The chart scale along the ordinate shall be such that the major portion of the chart is used to record the total weights of the aggregates and water, and the cement. The date of batching, the container number and the batching certificate number shall be recorded on the recorder chart at the time of batching. The recorder charts, or copies thereof, shall become the property of the Contracting Agency and shall be submitted upon request.

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

Any spillage of cement, aggregate, water or admixture during the filing, 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.

725.9 LOADING AND TRANSPORTATION OF; MATERIALS; AND MIXED CONCRETE:

Concrete specimens for compression tests will be taken in the field by a representative of the Engineer in accordance with ASTM C-172 and C-31 or AASHTO T-23, except as noted hereinafter.

Concrete samples shall be taken from the approximate middle 50 percent of the batch in an uninterrupted stream from the chute directly into the wheelbarrow or similar equipment. Where excessive slump is suspected, a controlling slump test may be made from any portion of the batch, except for the approximate 5 percent on each end of the discharge. If excessive slump is verified, at any time, the remainder of the load shall be rejected and removed from the project and a set of cylinders for compressive. In strength shall be taken from the batch, if any concrete from the batch was placed. The rate of discharge of the batch shall be I regulated by the rate of revolutions of the drum and not by the size of the gate opening. Specimens for compression tests shall be stored in the field in accordance with methods approved by the Contracting Agency and protected from vibration and other disturbances, for a minimum of 28 hours and maximum of 76 hours. A maximum storage period would be involved only where weekends or holidays are involved. Cylinders stored in the field for the maximum period shall have the same validity as cylinders that have been stored overnight and brought in the following day.

Not less than 4 cylinder specimens will be made for each 50 cubic yards of each class of concrete with a minimum of 4 specimens for each class placed or not less than 4 specimens for each half-day's pour. Specimens will be tested in a laboratory designated by the Engineer in accordance with ASTM C-39 at the expense of the Contracting Agency.

Two cylinders shall be tested at 14 days. If their strength meets or exceeds the minimum 14-day requirements, the Contracting Agency will accept the concrete. The Engineer may test the other two cylinders at 28 days or discard at 60 days.

If this strength does not meet the 14-day requirement, the Contractor shall schedule and pay for two cores to be taken, on the 29^{th} day, from the area of concrete represented by the cylinders. The Engineer shall be present when the coring is accomplished or additional cores will be required.
The Engineer will test the remaining two cylinders on the 28th day. If this test meets or exceeds the 28-day minimum compressive strength requirement, the Contracting Agency will accept the concrete and the Contractor may cancel the scheduled coring.

If the 28-day cylinder test does not meet the minimum 28-day compressive strength requirement, the cores will be tested in accordance with ASTM C-42 in a laboratory designated by the Contracting Agency. If the cores meet or exceed the minimum 28-day strength, the concrete will be accepted by the Contracting Agency.

If the strength of the 28-day cylinders and the strength of the cores as calculated in accordance with ASTM C-42 are deficient, the Contractor shall remove all of the concrete represented by the failing test specimens with the exception that if the Contractor believes that the deficient concrete was

confined to a single batch, he may immediately cut a minimum of 4 additional cores, two on either side of the affected batch. The cores would be compared with the minimum specified compressive strength, for the purpose of defining the confines of the deficient concrete. All coring done to establish this premise would be at the expense of the Contractor. Evaluation of the cores shall be by the Engineer, or by a substitute agent designated by the Contracting Agency, and his decision shall be final.

725.11 ACCEPTANCE:

Concrete represented by a strength test of at least 95% of the required 28-day compressive strength will be acceptable. All concrete failing to meet this requirement as evidenced by tests of either standard cylinder or drilled core specimens shall be rejected, removed and replaced by the Contractor at the Contractor's expense.

When concrete is accepted on the basis of strength tests of less than 100% of the required minimum 28-day compressive strength, an adjustment in the contract unit price will be made for the quantity of concrete represented by such strength tests in accordance with the following schedule:

Adjustment in Contract Unit Price for Strength Deficiency

Percent of Specified Minimum 28-Day Compressive

Strength Attained (Nearest 1%)	**Percent of Concrete Unit Price Allowed**
100% or greater	100
98-99	90
96-97	85
95	80

END SECTION 725

SECTION 727

STEEL REINFORCEMENT

727.1 GENERAL:

The following specifications set forth the requirements for bar reinforcement, wire reinforcement, and wire mesh reinforcement being placed in any concrete work, shall be thoroughly cleaned of all loose rust, mill scale, mortar, oil, dirt, or coating of any character, which would be likely to destroy, reduce, or impair its proper binding with the concrete.

No reinforcing steel will be accepted under this specification until it has been approved by the Engineer. When required by the Engineer, the Contractor or supplier shall furnish a spot sample taken on the project and notify the Engineer as to when and where they will be available. Such samples shall be furnished at the expense of the Contractor or supplier, but the cost of any testing that may be required will be borne by the Contracting Agency. Samples shall only be taken in the presence of the Engineer. The Contractor shall furnish 3 certified mill test reports or certificates of compliance for each heat or size of steel which can be clearly identified with the lot. When such information has been furnished, placing of the steel will not be held up until results of spot samples have been received. Unless otherwise specified, all reinforcing steel bars shall be deformed intermediate grade 40 billet steel conforming with ASTM A-615 and the shapes shall conform with ASTM B-670.

In testing bar reinforcement, only the theoretical cross-sectional area will be used in all computations.

Bending of steel shall conform to the requirements of ACI-318. The various grades of steel shall not be used interchangeably in structures.

727.2 WIRE REINFORCEMENT:

Wire reinforcement shall in all respects fulfill requirements prescribed in ASTM A-82

727.3 WIRE MESH REINFORCEMET:

Mesh reinforcements shall, conform to ASTM A-185 .The gage of the wire and the dimension of the mesh will be specified in the special provisions or shown on the plans. The wire mesh reinforcement shall be so constructed as to retain its original shape and form during necessary handling. The effective cross-sectional area of the metal shall be equal to the specified or indicated on the plans.

727.4 WIRE TIES:

Wire for ties shall be black, annealed, not lighter than 16 gage.

END SECTION 727

SECTION 728

CONTROLLED LOW STRENGTH MATERIAL (SLURRY)

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 725.5.

728.3 PROPORTIONING OF MIXTURES AND PRODUCTION TOLERANCES:

Proportioning of the mixture shall comply to Section 701.3.5, Section 725.7 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
½ Sack CLSM	47 +-5%	7 +- 1	70 +- 30
1 Sack CLSM	94 +- 5%	7 +- 1	150 +- 50
1 ½ Sack CLSM	141 +- 5%	7 +- 1	425 +- 75

Notes for Table 728-1:

- The values specified in the table are for both mix design requirements and field production. The deviations are for production, testing and sampling tolerances.
- 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 be tested in accordance with ASTM D-4832. The supplier shall provide laboratory and/or field test data to verify the design strength.
- Sampling shall be in accordance with ASTM D-6023
- Temperature shall be taken in accordance with ASTM C-1064.
- 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 x 10-5 cm/sec or more, based on ASTM 0-5048.

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 725.8. 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 760

COATING CORRUGATED METAL PIPE AND ARCHES

760.1 GENERAL:

Corrugated metal pipe, pipe arches, and connectors to be used or furnished under this specification shall be manufactured and inspected in conformance with the requirements of AASHTO M-36, and as hereinafter specified. The size, type, and wall thickness of the pipe to be furnished shall be as specified on the project plans or specifications.

760.2 MATERIALS:

Corrugated metal products covered by this specification shall be plain galvanized conforming to the requirements of AASHTO M-36 as modified herein.

The types of bituminous coated pipe shall be as specified by the standard details or special provisions. In addition to the types listed in AASHTO M-190, there will be Type E.

Type E Pipe -Corrugated Metal Pipe with Smooth Metal Liner: The pipe shall be manufactured as per AASHTO M-36, Type lA except that the lock seam shall be on the tangent of the helical corrugation. The ends of each pipe shall be reformed with two annular corrugations for joining the pipes with approved band couplers. The minimum thickness of the pipe shell shall be as required to support external load with no credit for load carrying support given to the liner. The minimum thickness for the liner shall be 22 gauge (0.034 inches).

760.3 BASE METAL, SPELTER AND FABRICATION:

The nominal pipe diameter shall meet the tolerances of this specification. Elliptical pipe, when specified, shall be shaped after fabrication and coating have been completed.

Helically Corrugated Metal Pipe: The pipe shall be fabricated from flat sheets in coils. The base metal, spelter coating, method of sampling, accepted brands of metal, sheet manufacturer's certified analysis and guarantee, workmanship, marking, inspection and rejection, shall meet the requirements of AASHTO M-36. Structures furnished shall be either full circle, or pipe-arch in accordance with Table 4 of AASHTO M-36 or other shape as shown on the plans. The pipe dimensions shall conform to AASHTO M-36 in all respects, except the corrugations shall be helical instead of annular. The thickness of the galvanized metal shall be in accordance with project plans or specifications as otherwise specified. Pipe with helical corrugations shall have a continuous lock or weld seam extending from end to end of each length of pipe. The seams shall be fabricated in such a manner that they will not affect the shape or nominal diameter of the pipe and so that they will not create an element of weakness in the pipe.

Spiral Rib Metal Pipe: The pipe shall be fabricated from flat sheets in coils. The base metal, spelter coating, method of sampling, accepted brands of metal, inspection and rejection, shall meet the requirements of AASHTO M-36. Structures furnished shall be full circle on sizes of 18 inch and above as shown in Table 4 of AASHTO M-36. The pipe shall be fabricated with helical rectangular

ribs projecting outwardly from the pipe wall with a continuous lock seam extending from end to end of each length of pipe. Spiral Rib Pipe shall consist of two rectangular ribs and one half-circle rib equally spaced between seams. Rectangular ribs shall be 3/4 inch wide by I inch high. The half-circle rib diameter shall be 1/2 inch and shall be midway between the rectangular ribs. Maximum rectangular rib spacing shall be 11 1/2 inches. The thickness (gage) of the metal shall be in accordance with project plans and/or specifications or as otherwise specified.

760.4 COUPLING BANDS:

Watertight joints shall be fabricated for corrugated metal pipe by the use of galvanized couplers or connecting bands, bituminous coated where required, with each band overlapping by at least 2 inches. Corrugated coupling bands shall be constructed and connected as specified in AASHTO M-36, except as otherwise required herein. The couplers or bands shall be manufactured of material 2 gages lighter than the gage specified for the pipe material, shall have corrugations or dimples to match the pipe corrugations or end treatment or maybe flat, and shall be fastened with bolts. Dimpled coupling bands shall be 10 1/12 inches wide for diameters 12 through 60 inches, and 17 inches wide for diameters above 60 through 96 inches. The 10 1/12 inch wide bands shall have 2 rows of dimples of not less than 7 dimples per row, and the 17-inch wide bands shall have 4 rows of dimples of not less than 7 dimples per row. The dimple arrangements shall be such that a maximum spread can be attained. The shape of the dimple shall be such that it shall, in general conform to the standard pipe corrugation. The connecting angles for dimpled coupling bands may be diameter carriage bolts. Two bolts are required for pipe up to 36 inches in diameter, 3 bolts for 36 through 60-inch diameters and 5 bolts for pipes above 60 inches in diameter. Plain flat coupling bands and spiral rib flange bands shall have the same width and number of bolts as specified above. Flat coupling bands having a single circumferential corrugation rolled in each edge to match a similar corrugation in the end of each pipe may be 101/2 inches wide regardless of pipe diameter and shall be fastened with 2 bolts.

When flanges are provided on the pipe ends, the coupling shall be made by interlocking the flanges with a preformed channel band or other band incorporating a locking channel not less than 3/4 inches in width. The depth of the channel shall be not less than ½ inch. The channel band shall have a minimum nominal thickness of 0.079 inches.

760.5 PERMISSIBLE VARIATIONS IN DIMENSION:
The internal diameter of 12 through 24-inch pipe shall not vary more than +/-1.5 percent from the design diameter. The internal diameter of 27 through 108 inch shall not vary more than +/- 1 percent or 3/8 inch, whichever is greater from the design diameter. Type D Pipe: The design diameter of the metal pipe before paving shall be the diameter shown on the plans plus 1/4 inch. The design diameter may vary as above.

END SECTION 760

SECTION 776

MASONRY MORTAR AND GROUT

776.1 GENERAL:

Masonry mortar and grout shall consist of a mixture of cementitious material and aggregate to which sufficient water has been added to bring the resulting mixture to the desired consistency.

Table 776-1 and 776-2 indicates the average compressive strength obtained when the cementitious material aggregate, and water (the required amount to provide a flow of 110 +/-5 percent) are combined in the proportion shown in Table 776-3 and 776-4.

The mortar or grout to be used will be designated by class in the special provisions and the correct proportions of cementitious materials and aggregate will be combined with the minimum amount of water to provide a workable mixture.

Retempering of the mortar or grout will not be a standard practice and the Engineer's approval will be required for any exception.

TABLES 776-1 & 776-2

MASONRY MORTAR AND GROUT COMPRESSIVE STRENGTH

Table 776-1 Masonry Mortar		Table 776-2 Grout	
Type	Compressive Strength 28 Days (psi)	Type	Compressive Strength 28 Days (psi)
A	5500	Fine Grout	2500
B	5000	Coarse Grout	2500
C	4000		
D	3000		
M	2500		
S	1800		

TABLE 776-3

MASONRY MORTAR PROPORTIONS BY VOLUME

Type	Portland Cement	Hydrated Lime	Aggregate ASTM C-144
A	1	0	1
B	1	0	1 ½
C	1	0	2
D	1	0	2 ½
M	1	¼	2 ¼ to 3
*S	1	1/2	2 ¼ to 3

*Masonry cement type S may be substituted for the cementitious material. Prior approval of the

Engineer is required.

TABLE 776-4			
GROUT FOR REINFORCED MASONRY PROPORTIONS BY VOLUME FOR FIEL			
Type	Portland Cement	Fine Aggregate (ASTM C-404)	Coarse Aggregate (ASTM C-404)
Fine Grout	1	2 ¼ to 3	0
Coarse Grout	1	2 1/2	1 to 2

776.2 PORTLAND CEMENT:

The cement used shall conform with Section 725. For volumetric proportioning an unopened sack of cement weighing 94 pounds shall be considered as having a 1 cubic foot volume.

In proportioning the cement, it shall be measured loose, without shaking or compacting, in measuring devices of known capacity.

776.3 AGGREGATE:

The aggregate used shall conform with Section 701. It shall be approved by the Engineer prior to being utilized on the job. Any change of course will require additional approval or this neglect will be considered as sufficient cause for rejection of work.

In proportioning the aggregate, it shall be measured damp, loose without shaking or compacting, in measuring devices of known capacity.

776.4 MASONRY CEMENT:

Masonry cement used shall conform to ASTM C-91 with the exception that the average compressive strength shall not be less than 2500 psi at 28 days.

776.5 HYDRATED LIME:

Hydrated lime used shall conform to Type S.

776.6 WATER:

The water used shall conform

776.7 ADMIXTURES:

Admixtures, unless prescribed in the special provisions, will not be used without prior approval of the Engineer.

776.8 TESTS:

776.8.1 Mortar: If in the opinion of the Engineer there is sufficient cause to question the quality of the mortar being utilized, random field test in accordance with ASTM C-780 Annex A-1 and A-6 will be performed. For this area, the penetration of the cone penetrometer correlating to a flow of 110 +/ - 5 percent is 40 + /- 3mm.

776.8.2 Grout: If required, tests shall be performed in accordance with Uniform Building Code Standard No. 24-23 Section 24.2301.

END SECTION 776

SECTION 787

GRAY IRON CASTINGS

787.1 GENERAL:

The castings shall be true to pattern in form and dimension and free from pouring faults, spongings, cracks, blowholes, or other defects in locations affecting their strength and value for the service intended. Castings shall be filleted boldly at angles, and the arises shall be sharp and true.

Before the castings are removed from the foundry, they shall be thoroughly cleaned and the parting lines, gates, and risers ground flush.

787.2 TEST SPECIMENS:

Test coupons shall be cast separately of the castings, using a mold as described in ASTM A-48. A representative of the Engineer may be present at the time a melt is poured to identify both coupons and castings.

Two test coupons are required for each melt poured. Additional coupons shall be cast for use as replacements or in case a retest is required.

A representative of the Engineer may discard and replace specimens which show obvious lack of continuity of metal or if the machining is defective.

The manufacturer shall machine the tension specimens to the dimension specified or specimen B of ASTM A-48, at no additional cost to the Contracting Agency.

When approved by the Engineer transverse tests, may be+ made in lieu9ftensile tests, ill which case the castings shall meet the requirements of ASTM A-48

787.3 MANHOLE FRAME AND COVER SETS:

Castings shall conform to ASTM A-48, Class 30. The bearing surfaces of the frames and covers shall be machined and the cover shall seat firmly onto the frame without rocking.

Covers shall be the types and shall be imprinted as shown on the plans or standing details.

787.4 RAILINGS, RAILING POSTS, AND WHEEL GUARDS:

Castings shall conform to ASTM A-48, Class 48,and Class 40.

787.5 ROCKERS, ROCKER PLATE BEARINGS, AND BEARING PLATES FOR BRIDGES:

Castings shall conform to ASTM A-48, Class 50.

Castings shall be machined and finished as specified on the plans provided that tool marks on sliding contact surfaces shall run in the direction of plate movement, or in the case of rocker plate bearings, perpendicular to the rocker movement. Tool marks shall be not more than 1/32 inch apart.

787.6 UNCLASSIFIED CASTINGS:

All castings not specifically classified, shall conform to the requirements of ASTM A-48, Class 30.