

## **Benedict, Jeffrey**

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**From:** pmkandar@cox.net  
**Sent:** Saturday, July 09, 2011 12:58 PM  
**To:** Don Cornelison  
**Subject:** Re: FW: MAG Outside Right-of-Way Materials Working Group

Don:

Below are the other MAG sections that reference Section 701. The working group will need to check each to see if they need modification to accommodate the changes proposed in 701. These changes will need to be included in the case for 701. Most are just references to aggregates, but some will require relocating specific gradation or testing information that presently is in this 701 - just as was done with the changes to Section 702.

Peter

206.4.2(A)  
220.6 (second paragraph)  
325.2.1  
333.3.2  
603.4.6  
604.5(B)  
605.5 (second paragraph)  
620.2.2  
714.2.2  
715.2.2  
716.2.1  
725.3  
728.2  
728.3  
736.3.1  
776.3

----- Don Cornelison <~~dcornelison@speedie.net~~> wrote:

> Peter,  
>  
> Submitted to your alternate email address. Please see below.  
>  
> Donald L. Cornelison, P.E.  
> Vice President/Division Manager  
> 3331 E. Wood St., Phoenix, Arizona 85040  
> 602-997-6391 phone  
> 602-943-5508 fax  
> [cid:697060905@08072011-36B9]  
>  
> Visit us at: [www.speedie.net](http://www.speedie.net)<<http://www.speedie.net/>>  
>  
>  
>

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> From: Don Cornelison  
> Sent: Thursday, July 07, 2011 10:01 PM  
> To: 'Brian Gallimore'; 'Smith, Mike'; 'gtyus@mag.maricopa.gov'; 'Kandaris Peter M';  
> 'danselby@asphaltbusters.com'; 'Mike Whitman'; Jeff Benedict ([jeff.benedict@valero.com](mailto:jeff.benedict@valero.com)); Doug  
> Laquey; Phil Feliz ([phil.f@wt-us.com](mailto:phil.f@wt-us.com))

> Subject: MAG Outside Right-of-Way Materials Working Group  
>  
> As promised, please find the latest revisions of the assigned MAG Sections for your review  
> and for submittal to the MAG Specification & Details Committee. I am still waiting for the  
> latest draft of Section 309 and will forward it upon receipt.  
>  
> Regards,  
>  
> Donald L. Cornelison, P.E.  
> Vice President/Division Manager  
> 3331 E. Wood St., Phoenix, Arizona 85040  
> 602-997-6391 phone  
> 602-943-5508 fax  
> [cid:478485704@08072011-36AB]  
>  
> Visit us at: [www.speedie.net](http://www.speedie.net)<<http://www.speedie.net/>>  
>

SECTION 206

STRUCTURE EXCAVATION AND BACKFILL

206.1 DESCRIPTION:

Structure excavation shall consist of the removal of material for the construction of foundations for bridges, manholes, retaining walls, box culverts, head walls for culverts, and other structures, and other excavation designated on the plans or in these specifications or in the special provisions as structure excavation.

Structure backfill shall consist of furnishing material, if necessary, and placing and compacting backfill material around structures to the lines designated on the plans or specified or directed by the Engineer.

Structure excavation and structure backfill shall include the furnishing of all materials and equipment and the providing of other facilities which may be necessary to perform the excavations and place and compact the backfill, and the subsequent removal of these facilities, except where they are required or permitted by the plans, special provisions or Engineer to remain in place.

206.2 FOUNDATION MATERIAL TREATMENT:

When footing concrete or masonry is to rest upon rock, the rock shall be fully uncovered and the surface thereof shall be removed to a depth sufficient to expose sound rock. The rock shall be roughly leveled off or cut to approximate horizontal and vertical steps, and shall be roughened. Seams in the rock shall be grouted under pressure or treated as the Engineer may direct and the cost thereof will be paid for as extra work.

When no piles are used and footing concrete or masonry is to rest on an excavated surface other than rock, care shall be taken not to disturb the bottom of the excavation and final removal of the foundation material to grade shall not be made until just before the concrete or masonry is placed. Excavation below grade shall be replaced with the same class of concrete specified for the structure or with 1 1/2 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 material. Placement of controlled low strength material shall be per Section 604 which will require a time lag between placement of the material and the structural concrete. The placement of the additional material shall be at no cost to the Agency except when over-excavation is directed by the Engineer.

The excavation for structures shall be completed to the bottom of the footings before any piles are driven therein, and excess material remaining in the excavation after pile driving shall be removed to the elevation of the bottom of the footings.

When piles are used and ground displacement results from pile driving operations, the Contractor shall at his expense excavate or backfill the footing area to the grade of the bottom of the footing as shown on the plans with structure backfill material.

206.3 INSPECTION:

When any structure excavation is completed, the Contractor shall notify the Engineer who will make an inspection of the excavation. No concrete or masonry shall be placed until the excavation has been approved by the Engineer.

206.4 STRUCTURE BACKFILL:

**206.4.1 Preparation for Structure Backfill:** Prior to the placement of structure backfill, the Contractor shall remove all loose, unstable materials from the sides of the structure excavation that may constitute a safety concern or impact proposed backfill operations. The Contractor shall then compact the bottom of the remaining open structure excavation to a uniform density of not less than 95 percent maximum dry density. With the approval of the compaction of the bottom of the open structure excavation by the Engineer, the Contractor may start the placement of the Structure Backfill.

**206.4.2 Structure Backfill for Earth Retaining Structures:** Structure Backfill to be placed against concrete structures designed to retain earth loads, such as bridge abutment backwalls and wingwalls, box culvert outside walls and wingwalls, and retaining walls:

PHYSICAL PROPERTIES LISTED

(A) Shall conform to the material requirements of Section 701.2.1 Crushed Rock, and the gradation requirements for Select Material, Type A or B in Table 702-1 unless otherwise approved by the Engineer.

MATERIAL  
TYPE A OR B

OR  
(B) Shall not be placed until the concrete has reached its full design strength.

(C) Shall be placed in layers not more than 8 inches in depth before compaction, when compacted by pneumatic or mechanical tamping devices.

## SECTION 220

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

### 220.6 GROUTED RIPRAP:

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

The grout shall consist of 1 part cement and 3 parts by volume of aggregate. The portland cement shall be Type II as specified in Section 725 and the aggregate shall be 2 parts sand and 1 part gravel passing a 3/8 inch square mesh screen. The quality of the sand and gravel shall be as specified in Section ~~701~~ **725.3**

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

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

### 220.7 MEASUREMENT:

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

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

### 220.8 PAYMENT:

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

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

End of Section

SECTION 325

ASPHALT-RUBBER CONCRETE OVERLAY, GAP GRADED

325.1 DESCRIPTION:

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

325.2 MATERIALS:

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

325.2.1 AGGREGATE:

The aggregate shall meet the following gradation:

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

*Revised*

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

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

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

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

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

Asphalt Rubber Binder Content:

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

**SECTION 333**  
**FOG SEAL COATS**

**333.1 DESCRIPTION:**

Fog seal coats on bituminous paved surfaces shall consist of the application of emulsified asphalt and a sand blotter when necessary.

**333.2 TIME OF APPLICATION AND WEATHER CONDITIONS:**

Fog seal coats on new pavements shall be applied within 24 hours. This time restriction may be extended by the Engineer.

Emulsified asphalt shall not be applied when the surface is wet or when there is a threat of rain. The ambient temperature shall be at least 50 degrees F. and rising and the application shall cease when the temperature is 55 degrees F. and falling.

**333.3 MATERIALS:**

**333.3.1 Emulsified Asphalt:** Unless otherwise specified in the special provisions, emulsified asphalt may be a grade SS-1h, CSS-1h, or CQSH, as specified in Section 713. The emulsified asphalt shall be diluted in proportions of 50% water and 50% emulsified asphalt.

**333.3.2 Sand Blotter:** The sand shall be as specified in Section 704 and shall be graded in accordance with Table 333-1. *HAVE A SAND EQUIVALENT VALUE OF NOT LESS THAN 50 AND BE NON PLASTIC WHEN TESTED IN ACCORDANCE WITH ASTM'S T 176 T 89 AND T 90 (DRY PREP)*

TABLE 333-1	
SAND BLOTTER GRADATION	
Sieve Size	Percentage Passing (by weight)
3/8 inch	100%
No. 4	90-100%
No. 200	0-12%

**333.4 TESTS, TEST REPORTS AND CERTIFICATIONS:**

Asphalt emulsion shall meet requirements of Section 713.

Test reports and certifications shall be as specified in Section 711.

**333.5 PREPARATION OF SURFACES:**

Immediately before applying the emulsion, the area to be surfaced shall be cleaned of dirt and loose material by means of power brooms, or pick-up brooms supplemented by hand brooms if necessary. The fog seal shall not be applied until an inspection of the surfaces has been made by the Engineer and he has determined that the surfaces are suitable.

**333.6 APPLICATION OF ASPHALT EMULSION:**

The diluted material shall be well mixed before application. It shall be applied by a distributor truck equipped with fog nozzles at the approximate rate of 0.10 gallon per square yard. The exact rate shall be as directed by the Engineer. The distributor truck shall be as specified in Section 330.

## SECTION 603

For large-diameter pipe installations where the backfill material is other than coarse aggregate, consolidation shall be by mechanical means. Water consolidation may be used as a compaction method for the backfill material only when prior written approval to do so is provided by the Engineer.

**603.4.6 Specifications for Material:** Coarse aggregate shall consist of crushed rock ~~as defined in Section 701~~ with 100 percent of the specified size of aggregate having one fractured face, and having the gradation complying with ASTM D-448, Table 1, Size Numbers 6, 67, 68, 7, 78, or 8 as recommended by the Engineer. The gradation size number to be furnished shall be shown on the plans or in the project specifications.

**603.4.7 Rights-of-Way Belonging to Others:** Rights-of-way belonging to others shall comply with Subsection 601.4.7.

**603.4.8 Test Holes:** Test holes shall comply with Subsection 601.4.8.

**603.4.9 Foundation and Bedding for Electronic, Telephonic, Telegraphic, Electric, Oil and Gas Lines:** Foundation and bedding for electronic, telephonic, telegraphic, electric, oil and gas lines shall comply with Subsection 601.4.9.

### 603.5 PREPARING AND INSTALLING HDPE PIPE:

**603.5.1 Storage and Handling:** Pipe shall be stored and handled in such a way to minimize out-of-roundness. Pipe shall be stored in shaded areas to minimize adverse effects of thermal, and ultraviolet exposure.

Pipe that is out-of-round in excess of 3% of the nominal pipe diameter as specified in Section 738, shall not be installed and shall be removed if installed.

**603.5.2 Strutting:** Strutting of Profile HDPE pipe per Section 738 will be required when the diameter is 42 inches or larger. For Profile HDPE pipe with diameters smaller than 42 inches, strutting may be required at the discretion of the Engineer. Strutting of Corrugated HDPE pipe per Section 738 is not required.

Strutting consists of placing wood struts, whose length is typically 3% longer than the nominal pipe diameter, inside the pipe. A minimum of three (3) sets of struts are placed in each pipe length, oriented vertically, spaced equally throughout the length of pipe and set so as not to interfere with the jointing of the pipe. The struts shall be kept in place until the bedding material is placed and compacted around the pipe. The struts must be removed before any backfill or bedding is placed above the pipe. The procedure of strutting the pipe shall not damage the pipe in any way. If the pipe is out of round, the struts will be placed in the long direction of the out-of-round. If the strut cannot be held in place by the pipe, the pipe will be removed from the job site per Subsection 738.9.

**603.5.3 Orienting:** If the pipe is out-of-round, the pipe should be oriented so that the long axis is placed vertically when installed in the trench. When struts are used, the struts shall be oriented vertically when pipe is installed in the trench.

**603.5.4 Installing Pipe:** HDPE pipe and fittings shall be installed in accordance with ASTM D-2321 or manufacturer's recommendation. HDPE pipe shall be handled so as not to damage the pipe. Hoisting shall be accomplished with cloth belt slings or ropes. The pipe shall be protected by wood blocking when jointing is accomplished by pipe jacking, back hoe bucket, come-along, or cable pipe puller.

### 603.6 PAVEMENT REPLACEMENT AND SURFACE RESTORATION:

Pavement replacement and surface restoration shall comply with Subsection 601.5.

### 603.7 PAYMENT:

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

----- End of Section -----

## SECTION 604

### PLACEMENT OF CONTROLLED LOW STRENGTH MATERIAL

#### 604.1 DESCRIPTION:

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

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

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

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

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

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

#### 604.2 MATERIALS:

*ADD SECTION FOR AGGREGATES. IMPORT FROM OLD 701.3.5*

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

#### 604.3 PLACEMENT:

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

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

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

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

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

CLSM shall NOT be permitted to come in contact with any aluminum, copper or brass materials, e.g., aluminum pipes or culverts, copper water pipe, saddles, fittings, etc. Protection shall be any combination of the following: place a layer of noncorrosive material around the pipe e.g., native material, import material, etc. or provide a protective covering or wrapping such as polyethylene wrap per Section 610.6. Pipes smaller than 4 inches can be completely wrapped with tape as per Section 610.6 or approved equal.

## SECTION 604

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

### 604.4 PERFORMANCE TESTING:

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

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

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

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

### 604.5 ACCEPTANCE:

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

- A) The CLSM is outside of the limits specified in Table 728-1 and/or
- B) The aggregate gradation is outside the limits specified in Section ~~701.3.5~~ 604.2

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

### 604.6 PAYMENT:

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

**SECTION 605**

**SUBDRAINAGE**

**605.1 DESCRIPTION:**

The subdrainage system shall be constructed in accordance with the notes and details shown on the plans and the applicable provisions of these specifications except as modified in the special provisions.

**605.2 CONCRETE:**

All concrete placed in drainage structures, subdrain outlets, pipe collars, and similar features of the subdrainage system shall conform to the applicable provisions of Section 725.

**605.3 SUBDRAINAGE PIPE:**

Subdrainage pipe, both perforated and non-perforated, shall be either bell and spigot concrete, bell and spigot vitrified clay, corrugated metal pipe, or asbestos-cement pipe as shown on the plans or specified in the special provisions. However, if the particular kind of pipe is not shown on the plans nor specified in the special provisions, subdrainage pipe shall be concrete pipe of at least standard strength quality and shall conform to the requirements of Section 736. Vitrified clay pipe shall conform to the requirements of Section 743. Asbestos-cement pipe shall conform to the requirements of Section 737. Corrugated metal pipe shall conform to the requirements of Section 760.

**605.3.1 Pipe Joints:** Unless the pipe joints are of a self-aligning type, have the bottom half of the bell joint filled with mortar to securely hold the pipe in alignment and to bring the inner surface of abutting pipes flush and even. Where a tight joint for non-perforated pipe is required, the bell joint shall be completely filled with mortar.

Asbestos-cement pipe joints shall be made with couplings in accordance with the recommendations of the pipe manufacturer.

**605.4 SUBDRAINAGE MANHOLES:**

Subdrainage manholes, including inlets, outlets, flap gates, gate boxes, and drop steps, shall comply with the requirements of the plans and the special provisions.

**605.5 FILTER MATERIALS:**

The filter materials shall be placed within the limits shown on the plans. The compositions of the filter materials shall each conform to one of the grading requirements in Table 605-1; the particular requirement to be used will be specified in the special provision.

The materials used shall conform to requirements for concrete aggregates in Section <sup>725.3</sup>~~701~~; however, the requirements for grading, and reactivity, as stated therein, shall not apply. The minimum bulk specific gravity shall be 2.50, by ASTM C-127.

<b>TABLE 605-1</b>			
<b>FILTER MATERIAL GRADING - % PASSING</b>			
<b>Screen or Sieve Size</b>	<b>TYPE</b>		
	<b>F1</b>	<b>F2</b>	<b>F3</b>
3/4"		100	100
3/8"	100	80 - 100	70 - 100
No. 4	90 - 100	60 - 85	45 - 75
No. 8	75 - 90	45 - 70	30 - 60
No. 16	55 - 80	30 - 55	20 - 45
No. 30	30 - 60	15 - 40	10 - 30
No. 50	10 - 40	5 - 20	0 - 15
No. 100	0 - 15	0 - 10	0 - 5
No. 200	0 - 5	0 - 5	

## SECTION 620

### CAST-IN-PLACE CONCRETE PIPE

#### 620.1 GENERAL:

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

- (A) By experienced operators. The Engineer will be the sole judge as to experience level.
- (B) In the presence of the Engineer.
- (C) In ground capable of standing unsupported from the bottom of the trench to the top of the pipe without sloughing.
- (D) In fill when it can be demonstrated to the satisfaction of the Engineer that the fill will adequately support the pipe.

#### 620.2 MATERIALS:

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

620.2.2 Sand aggregate used for concrete and mortar shall conform to Section <sup>725.3</sup>701. Maximum size of the aggregate shall not be greater than  $\frac{1}{3}$  of the minimum wall thickness up to and including a wall thickness of 4  $\frac{1}{2}$  inches. The maximum aggregate size is 1  $\frac{1}{2}$  inches.

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

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

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

#### 620.3 CONSTRUCTION METHODS:

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

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

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

## SECTION 703

### RIPRAP

#### 703.1 STONE:

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

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

#### 703.2 SIZE OF STONE:

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

----- End of Section -----

*SEE RE-WRITE*

SECTION 705

PORTLAND CEMENT TREATED BASE

705.1 GENERAL:

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

705.2 AGGREGATE FOR CEMENT TREATED BASE:

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

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

705.3 PORTLAND CEMENT AND WATER:

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

705.4 COMPRESSIVE STRENGTH OF CEMENT TREATED BASE:

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

705.5 BITUMINOUS MATERIAL FOR CURING SEAL:

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

End of Section

*SEE RE-WRITE*

## SECTION 714

### MICROSURFACING MATERIALS

#### 714.1 GENERAL:

Microsurfacing materials shall consist of a properly proportioned mixture of cationic polymer modified asphalt emulsion, mineral aggregates, mineral filler, water, and other additives.

#### 714.2 AGGREGATE:

**714.2.1 Mineral Filler:** Mineral filler, as required by the mix design, shall be any recognized brand of non-air-entrained Type I/II normal Portland cement that is free of lumps and clods, with a minimum of 85% passing the #200 sieve, added by weight of aggregate as specified by the mix design.

**714.2.2 Mineral Aggregate:** Mineral aggregate shall consist of sound, durable crushed stone or crushed gravel, ~~per Section 701,~~ and approved mineral filler. The material shall be free from vegetable matter and other deleterious substances. Aggregates shall be 100% crushed with no rounded particles. No natural sand will be allowed. The mineral aggregate shall conform to Table 715-1 for gradation only. Application rates shall be 18-24 pounds of aggregate/square yard for Type II, and 24-35 pounds/square yard for Type III.

The mineral aggregate and mineral filler shall have a sand <sup>EQUIVALENT</sup> equivalency value not less than 50 (ASTM D 2419) and be non-plastic. <sup>ASTM T 176</sup> WHEN TESTED PER DRY PREP METHOD OF ASTM T 89 & 90.

If more than one kind of aggregate is used, the correct amount of each kind of aggregate needed to produce the required gradation shall be proportioned separately in a manner that will result in a uniform and homogeneous blend. The final blended aggregate shall meet the above requirements for grading, sand equivalency, and plasticity.

#### 714.3 BITUMINOUS MATERIAL:

The Polymerized Emulsion is a slow-setting, cationic type emulsion for mixing applications and seal coats. A minimum of 4% saturated polymer shall be high sheared into the asphalt prior to the emulsification process. The Agency may choose to sample the polymerized asphalt for testing. The amount of polymer will be based on weight of polymer and asphalt (total weight) and be certified by the supplier. The polymerized emulsion will meet the following specifications listed in Table 714-1.

SECTION 715

SLURRY SEAL MATERIALS

715.1 GENERAL:

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

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

715.2 AGGREGATE:

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

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

715.3 BITUMINOUS MATERIAL:

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

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

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

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

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

715.4 WATER:

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

715.5 TEST CERTIFICATES & REPORTS:

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

715.6 CONVERSION OF QUANTITIES:

Volumetric conversions shall be accomplished in accordance with Section 713.

## SECTION 725

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

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

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

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

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

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

### 725.3 AGGREGATES:

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

*NEED TO REVISE TO INCLUDE AGG GRADATION & QUALITY REQ.*

### 725.4 WATER:

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

### 725.5 ADMIXTURES AND ADDITIVES:

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

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

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

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

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

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

SECTION 728

CONTROLLED LOW STRENGTH MATERIAL

728.1 GENERAL:

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

728.2 MATERIALS:

Cementitious materials shall conform to Section 725.2.  
Coarse and fine aggregates shall conform to Section ~~701.3.5~~ 725.3.  
Water shall conform to Section 725.4.

728.3 PROPORTIONING OF MIXTURES AND PRODUCTION TOLERANCES:

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

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

Note for Table 728-1:

- 1) CLSM mixes meeting the table requirements will not generally be placeable by means of a concrete pump or may not provide the needed workability for certain conditions. When pumpable mixes or increased workability are required, the addition of fly ash or a natural pozzolan in excess of the required Portland Cement Content may be used.
- 2) Ready-mixed concrete shall not be used in lieu of CLSM without prior approval from the Engineer and shall be subject to rejection.

728.4 MIXING:

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

## SECTION 736

### NON-REINFORCED CONCRETE PIPE

#### 736.1 GENERAL:

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

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

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

#### 736.2 MATERIALS:

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

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

#### 736.3 PIPE JOINTS:

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

##### 736.3.1 Cement Mortar Joints:

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

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

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

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

#### 736.4 CURVES, BENDS AND CLOSURES:

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

## SECTION 776

### 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 ASTM C-207, Type S.

### 776.6 WATER:

The water used shall conform to section 725.

### 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  $110 \pm 5$  percent is  $40 \pm 3$  mm.

**776.8.2 Grout:** If required, tests shall be performed in accordance with Uniform Building Code Standard No. 24-23 Section 24.2301.

----- End of Section -----