

March 24, 2009

TO: Members of the MAG Specifications and Details Committee

FROM: Robert Herz, Maricopa County DOT, Chairman

SUBJECT: MEETING NOTIFICATION AND TRANSMITTAL OF AGENDA

Wednesday, April 1, 2009 at 1:30 p.m.  
MAG Office, Second Floor, Cholla Room  
302 North First Avenue, Phoenix

The meeting of the MAG Specifications and Details Committee will be held at the place and time indicated above. The agenda for the meeting is provided below. **Please park in the garage under the building. Bring your ticket to the meeting, parking will be validated. For those using transit, the Regional Public Transportation Authority will provide transit tickets for your trip. For those using bicycles, please lock your bicycle in the bike rack in the garage.** Please call me at (602) 506-4760 if you have questions about the upcoming meeting.

Pursuant to Title II of the Americans with Disabilities Act (ADA), MAG does not discriminate on the basis of disability in admissions to or participation in its public meetings. Persons with a disability may request a reasonable accommodation, such as a sign language interpreter, by contacting Gordon Tyus at the MAG Office at (602) 254-6300. Requests should be made as early as possible to allow time to arrange the accommodation.

### AGENDA

#### ITEM

1. Call to Order
2. Approval of March 4, 2009 Meeting Minutes
3. 2008 & 2009 Cases
4. General Discussion
5. Adjournment

#### COMMITTEE ACTION REQUESTED

1. No action required.
2. Corrections and approval of March 4, 2009 minutes.
3. Review submitted cases and submission of new cases.
4. Open general discussion.
5. No action required.

MEETING MINUTES FROM THE  
MARICOPA ASSOCIATION OF GOVERNMENTS  
STANDARD SPECIFICATIONS AND DETAILS COMMITTEE

March 4, 2009

Maricopa Association of Governments Office, Cholla Room  
302 North First Avenue  
Phoenix, Arizona

AGENCY MEMBERS

Jim Badowich, Avondale	Gordon Haws, Mesa
* Scott Zipprich, Buckeye	Jesse Gonzalez, Peoria
Warren White, Chandler	Jeff Van Skike, Phoenix (St. Trans.)
Dennis Teller, El Mirage	Jami Erickson, Phoenix (Water)
Edgar Medina, Gilbert	* Mark Palichuk, Queen Creek
Tom Kaczmarowski, Glendale	Rodney Ramos, Scottsdale
Troy Tobiasson, Goodyear	Nick Mascia, Surprise
Bob Herz, MCDOT	Tom Wilhite, Tempe

ADVISORY MEMBERS

John Ashley, ACA	* Adrian Green, ARPA
Jeff Benedict, AGC	Paul R. Nebeker, Independent
Brian Gallimore, AGC	* William Ast, NUCA
Peter Kandaris, SRP, Vice Chairman	Bill Davis, NUCA
James Carusone, ARPA	

MAG ADMINISTRATIVE STAFF

Gordon Tyus

\* Members not attending or represented by proxy.

GUESTS/VISITORS

Doug Berg, Contech Construction Products  
Jeff Hearne, ARPA – Salt River Materials Group  
John Roper, Tekway Dome Tiles  
Barbara Rust, Coe & Van Loo  
Mike Sabatini, MCDOT  
Paul Siders, Coe & Van Loo

1. Call to Order

Chairman, Bob Herz, called the meeting to order at 1:34 p.m.

2. Approval of Minutes

The members reviewed the February 4, 2009 meeting minutes. Jesse Gonzalez introduced a motion to accept the minutes as written. Troy Tobiasson seconded the motion. A voice vote of all ayes and no nays was recorded.

3. 2008 Cases (old cases)

a. **Case 08-10 – Modification to Trench Backfill and Pavement Replacement, Detail 200, Section 336 and Section 601:** Revisions to reduce numerous agency trench backfill and pavement replacement supplemental details by combining the most common practices. The committee had no discussion on this item. Committee members are requested to continue reviewing the case and provide comments as soon as possible so that this case can be resolved this year.

4. 2009 Cases (new cases)

a. **Case 09-01 – Modification to Detectable Warnings, Section 340.2.1:** Update detectable warning specifications to conform to current ADA requirements. The committee had no discussion on this item. Committee members are requested to review the case and provide comments for the next meeting.

b. **Case 09-02 – Modifying Acceptable Vacuum Relief Valve Vendors, Section 630.6:** Include A.R.I. as an additional approved vendor for vacuum relief. The committee had no discussion on this item. Case revisions by Jami Erickson are anticipated for next month's meeting.

c. **Case 09-03 – New Geosynthetic Materials Specification, Section 796:** Create a geosynthetic material specification, Section 796. The original case has been divided into four separate cases for ease in review. Peter Kandaris reviewed the scope of the work and requested members review the case and provide comments for the next meeting.

d. **Case 09-04 –AC Overlay Interlayer Fabric Requirements, Section 322:** Modify Section 322 to include interlayer fabric for asphalt concrete overlays (originally part of Case 09-03). Committee members noted that Section 322 will probably be incorporated into Section 321 later this year, but that the proposed fabric interlayer addition could be included with that effort. A revision will be prepared to make the needed changes for the next meeting.

e. **Case 09-05 – Modify Riprap Construction to Include Filter Fabric, Sections 220 and 703:** Modify Sections 220 and 703 to incorporate Maricopa County Supplemental Specification Section 224 for filter fabric (originally part of Case 09-03). It was noted that the handout did not include the second page of 220 revisions and the proposed revisions to 703. Also, members requested that revisions include payment and measurement methods for filter fabric. Peter Kandaris will review and revise as needed to

include these items. Committee members are requested to review the case and provide comments for the next meeting.

f. **Case 09-06 – New Geogrid Fabric Specification, Section 306:** Create a new geogrid application Section 306 (originally part of Case 09-03). Peter Kandaris reviewed the scope of the work and requested members review the case and provide comments for the next meeting.

g. **Case 09-07 – Revisions to Concrete Materials Specification, Section 725 and 701:** Troy Tobiasson presented a case to revise Section 725 and portions of Section 701 to make the sections current with modern concrete manufacture, materials and quality control practices. The changes are the result of input from many agencies and industry representatives over the past months during meetings of the concrete modernization working group. Members are encouraged to download the case and the support documents to better understand the scope and reasoning for the revisions. Committee members are requested to review the proposal and return with comments for the next meeting.

h. **Case 09-08 – Modification to Valley Gutter, Detail 240:** Bob Herz proposed modifications to Detail 240 to increase valley gutter thickness from 8 inches to 10 inches, bringing it in conformance with increased concrete driveway thickness for commercial and industrial driveways as noted in Detail 250. Committee members are requested to review the proposal and return with comments for the next meeting.

i. **Case 09-09 – Modification to Dust Palliative, Section 792:** Peter Kandaris presented proposed modifications to Section 792 to update dust palliative product requirements, include submittal of compliance/product data requirements, and provide more defined environmental requirements. Committee members are requested to review the proposal and return with comments for the next meeting.

## 5. General Discussion:

Jesse Gonzalez initiated a discussion on the committee's interest in expanding the MAG standards to include a series of on-site specifications and details for work outside of the right-of-way, but not within the building footprint. The committee has been reluctant to include this type of work in the past since it is outside the arena of public works. Some members noted that on-site standards could aid in development reviews, create consistency in submittal drawings to agencies, and provide guidance for public works projects out of the right-of-way (libraries, parks, fire stations, stadiums, etc.). Bob Herz mentioned that MCDOT could make available their CAD and drawing symbol standards for this effort. Others noted that local consultants probably have created a symbol library that could be used. It was agreed that a subcommittee should be formed to investigate the scope and parameters of such a document.

Bob Herz asked how agencies contend with the use of plastic pipe for water line construction since the MAG standards do not permit their use. He also inquired if there is an interest in

revising MAG to allow plastic. Members noted that use of plastic water pipe is generally dealt with under city supplemental standards for both private and fire line use, but it is generally not accepted for other uses. It was mentioned that the existing MAG standards include discontinued water line materials such as asbestos-cement pipe (ACP) since there are many miles of these materials still in the ground. Some members noted that the issue of retaining standards or details for rarely used or discontinued materials may need to be addressed in the future.

Jeff Van Skike announced that the City of Phoenix has approved a pilot chip seal program for road maintenance. Tom Wilhite noted that the City of Tempe is also performing a few chip seal projects.

6. Adjournment:

The meeting was adjourned at 3:08 p.m.

**LIST OF MEMBERS**  
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**MAG Standard Specifications and Details Committee**

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## 2009 PROPOSED REVISIONS TO MAG SPECIFICATIONS AND DETAILS

(Updated information can be found on the website: <http://www.mag.maricopa.gov/detail.cms?item=9688> )

CASE	DESCRIPTION	PROPOSED BY	MEMBER	SUBMITTAL DATE Last Revision	VOTE DATE	VOTE	
						Yes	No Abstain
08-10	Revised Detail 200 and Sections 336 and 601 – Trench backfill and pavement Replacement	SRP	Peter Kandarlis	2/06/2008 1/07/2009		0 0 0	Yes No Abstain
09-01	Modification to Section 340.2.1 – Detectable Warnings	MCDOT	Bob Herz	01/07/2009		0 0 0	Yes No Abstain
09-02	Revisions to Section 630.6 – Update list of Air Release and Vacuum Valves	Phoenix	Jami Erickson	02/04/2009		0 0 0	Yes No Abstain
09-03	New Section 795 – Geosynthetic Specifications	SRP	Peter Kandarlis	02/04/2009 03/04/2009		0 0 0	Yes No Abstain
09-04	Revisions of Concrete Sections (Sections 322 and/or 321) to include Geosynthetics	SRP	Peter Kandarlis	02/04/2009 03/04/2009		0 0 0	Yes No Abstain
09-05	Revisions to Riprap (Sections 220 and 703) to include Geosynthetics	SRP	Peter Kandarlis	02/04/2009 03/04/2009		0 0 0	Yes No Abstain
09-06	New Section 306 – Mechanically Stabilized Subgrade - Geogrids	SRP	Peter Kandarlis	02/04/2009 03/04/2009		0 0 0	Yes No Abstain
09-07	Revisions to Sections 725 and 701 – Portland Cement Concrete	Goodyear	Troy Tobaisson	03/04/2009		0 0 0	Yes No Abstain
09-08	Modification to Detail 240 – Valley Gutter	MCDOT	Bob Herz	03/04/2009		0 0 0	Yes No Abstain
09-09	Revisions to Section – 792 Dust Palliative	SRP	Peter Kandarlis	03/04/2009		0 0 0	Yes No Abstain

\* Case was approved with verbal modifications at time of voting.



P.O. Box 52025  
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Case # 08-10

DATE: January 7, 2009

TO: MAG Specifications and Details Committee Members

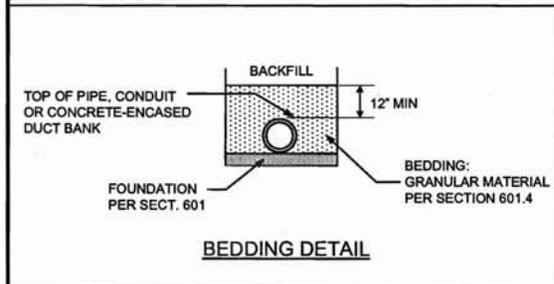
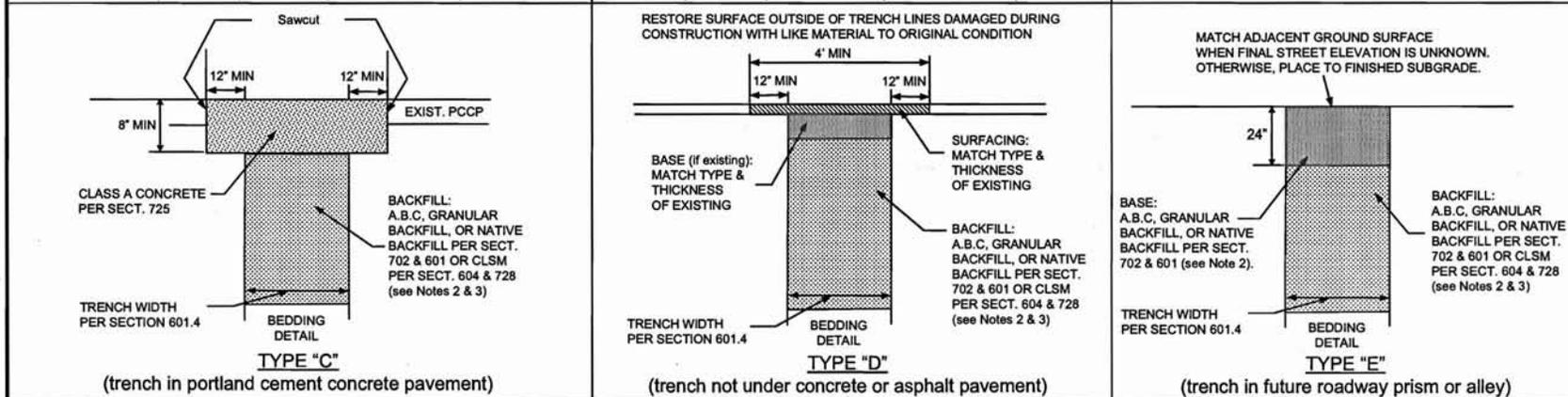
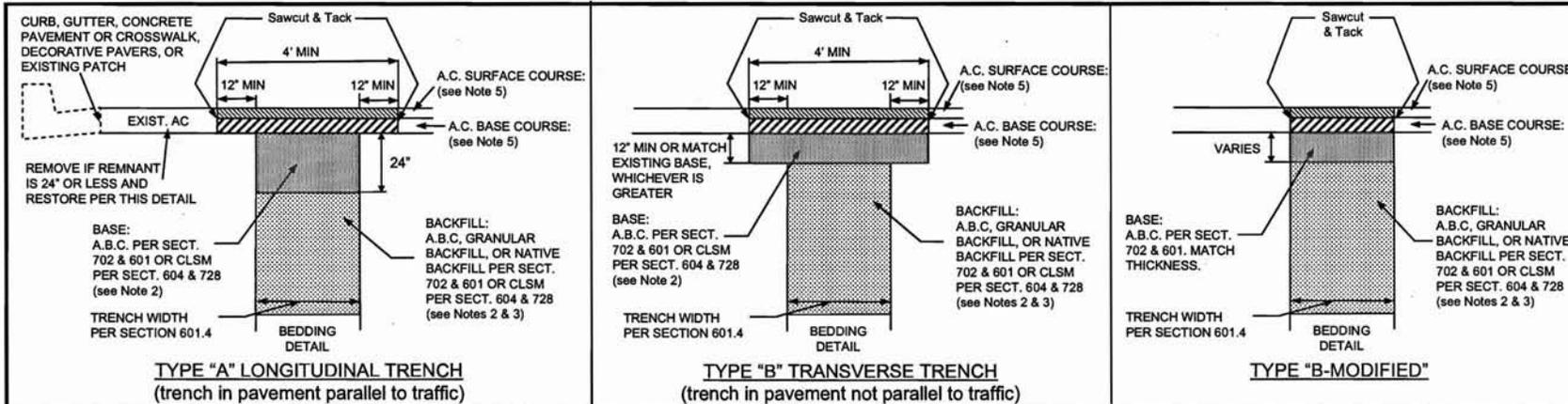
FROM: Peter Kandarlis, SRP Representative

RE: **Modifications Detail 200, Section 336 & Section 601: Trench Backfill and Pavement Replacement**

The attached details and specification section revisions have been modified per comments received from Maricopa County and City of Tempe.

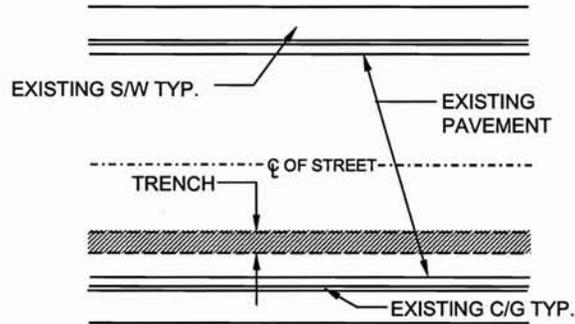
Maricopa County also recommends reducing the depth of base ABC under pavement in Type "A" longitudinal trench repair from 24 inches to 12 inches (or match existing, whichever is greater) to make this detail more compatible with Type "B" requirements. Please provide feedback on this concept in your subsequent comments.

Please review and provide any additional comments so that we may finalize the case in the near future. The focus of this case is on standardizing trench geometry and backfill. Many agencies will still need to retain supplemental details because of the widely varying methods, approaches and materials used for asphalt concrete pavement repair. The goal of this revision is to reduce the scope of trench repair variations, making more standard the trench cross section below the pavement section. Agencies should be able to scale back (but probably not eliminate) supplemental recommendations. It is still recommended that a separate subcommittee meeting be held to discuss a more uniform approach to asphalt pavement section repair.

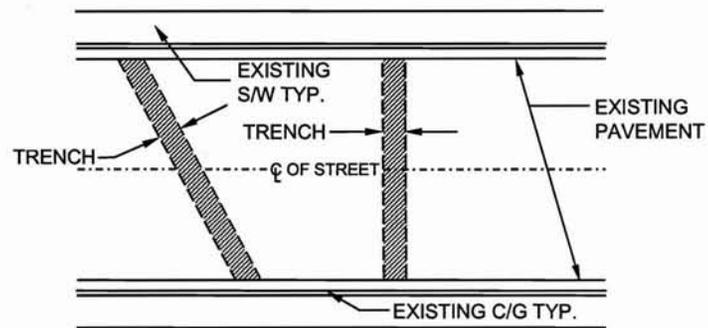


- NOTES:**
1. PAVEMENT MATCHING AND SURFACE REPLACEMENT SHALL BE IN ACCORDANCE WITH SECTION 336.
  2. TYPE OF BACKFILL AND BASE (IF APPLICABLE) SHALL BE AT CONTRACTOR'S OPTION UNLESS OTHERWISE SPECIFIED IN CONTRACT DOCUMENTS.
  3. TRENCHES LESS THAN 24" WIDE SHALL BE BACKFILLED FROM TOP OF BEDDING TO BOTTOM SURFACING MATERIALS WITH 1-SACK CLSM PER SECTIONS 604 AND 728.
  4. BASE, BACKFILL, BEDDING AND FOUNDATION COMPACTION REQUIREMENTS SHALL BE IN ACCORDANCE WITH SECTION 601.
  5. ASPHALT CONCRETE BASE AND SURFACE COURSE SHALL COMPLY WITH SECTION 336.2.4.1.
  6. PROVIDE 12" MINIMUM BASE WIDENED AS SHOWN IN TRANSVERSE TRENCH (TYPE B) AT ENDS OF LONGITUDINAL TRENCH (TYPE A), EXCEPT WHERE EDGE ABUTS EXISTING CONCRETE.
  7. USE TRANSVERSE TRENCH (TYPE B) SURFACE REPLACEMENT WHERE A LONGITUDINAL TRENCH (TYPE A) CROSSES A STREET OR GOES THROUGH AN INTERSECTION.
  8. COPPER OR POLYETHYLENE WATER PIPES EXPOSED IN TRENCHES TO BE BACKFILLED WITH CLSM SHALL BE WRAPPED WITH MIN 3/4" THICK CLOSED CELL FOAM INSULATION OR 3/4" WIDE BLACK INSULATION BEFORE PLACING CLSM.

**TYPE "A" LONGITUDINAL TRENCH**  
(trench in pavement parallel to traffic)



**TYPE "B" TRANSVERSE TRENCH**  
(trench in pavement not parallel to traffic)



NOTES:

1. SEE DETAIL 200-1 FOR DETAILED TRENCH REPAIR REQUIREMENTS FOR TRENCH TYPES NOTED HEREIN.
2. SEE MAG DETAIL 211 FOR REQUIREMENTS REGARDING THE USE OF PLATING OF TRANSVERSE TRENCHES. USE OF STEEL PLATES SHALL NOT EXCEED 72 HOURS AFTER COMPLETION OF BACKFILL AND PRIOR TO FINAL PATCHING.
3. IF REQUIRED BY AGENCY, USE TYPE B MODIFIED TRENCH IN LIEU OF TYPE B FOR TRANSVERSE TRENCH REPAIR.

DETAIL NO. 200-1		STANDARD DETAIL ENGLISH	<b>BACKFILL, PAVEMENT AND SURFACE REPLACEMENT</b>	REVISED 1/7/09 DRAFT	DETAIL NO. 200-2
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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.

Asphalt concrete pavement replacement shall be constructed in accordance with Type A, B, ~~D or E~~ <sup>roadway</sup> or B Modified <sup>Standard Detail 200 and</sup> 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, <sup>200</sup> and as required by Sections ~~595 and 725.~~ 324.

~~ABC or decomposed granite~~ <sup>All other</sup> surface replacement shall be constructed in accordance with Type ~~F~~ <sup>in the right-of-way but not in paved roadways</sup> of standard details as indicated in the Contracting Agency Special Provisions or on the plans ~~and in Section 702.~~ <sup>D of Standard Detail 200 and</sup>

Temporary pavement replacement shall be constructed as required ~~below.~~ <sup>herein</sup>

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 of 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 pavements 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 designed for this purpose. The minimum depth of cut shall be 1 1/2 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 a 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 center line of the street, the Contractor, with approval of the Engineer, may elect to bore or tunnel all or a portion of the installation. In such installations, the seal coat requirements, as discussed in Section 336.2.4, will be modified as follows:

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(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.

Permanent pavement replacement shall replace temporary repairs within 5 working days after completion of temporary work.

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., when required by the Engineer, by utilities or others who subcontract their permanent pavement replacement, under 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 comparable compaction is obtained.

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

**336.2.4 Permanent Pavement Replacement and Adjustments:**

(336.2.4.1 rearranged – new text in green)

~~336.2.4.1 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. For cuts greater than 600 feet in length the entire area shall then be seal coated in accordance with Section 330 (coated chips) or as otherwise specified. This seal coat shall extend from the edge of pavement or lip of gutter to the street centerline 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 shall be seal coated.

**336.2.4.1 Permanent Pavement Replacement:** Pavement replacement for longitudinal cuts (essentially parallel to the street centerline) greater than 50 feet in length and transverse cuts of any length shall be at least a two-course pavement replacement ~~as specified herein.~~ Pavement replacement for longitudinal cuts parallel to the street centerline less than 50 feet in length, ~~transverse cuts,~~ bell holes and similar small areas may be a single course provided the layer thickness complies with requirements of Section 321.5.4. All pavement replacement shall match gradation and thickness of the existing pavement. ~~These one course~~ ~~Pavement patches~~ replacement shall be compacted with a vibratory roller to the same density specified for asphalt concrete pavements in Section 321.

~~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.~~

Unless otherwise noted, pavement replacement shall comply with the following:

~~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.~~

(A) Single course pavement replacement shall consist of a 12.5 mm or 19 mm mix placed and finished as directed by the Engineer in accordance with Section 710.

(B) The base course(s) of ~~a~~ a multi-course pavement replacement shall consist of a 19 mm mix in accordance with Section 710.

~~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.~~

(C) The surface course of a multi-course pavement replacement shall consist of a 9.5 mm or 12.5 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 a single course as specified above.

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

(D) 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 compaction thickness of the two courses, but not more than 1 inch.

~~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 19 mm mix in accordance with Section 710.~~

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~~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 1 1/2 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.~~

~~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, valves, 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 covers including that of prior work. The method of removal shall be approved by the Engineer 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 any one 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.~~

Details 200-1 and 200-2.

Placed as Notes 6 and 7 in Detail 200-1

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. Use type B pavement replacement whenever a longitudinal trench crosses a street or goes through an intersection.

essentially longitudinal or

or at an angle

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.

will be utilized to repair asphalt concrete, portland concrete and aggregate surfaces in the right-of-way, but not in paved roadways. It may also

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. for this condition.

SECTION 336

~~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 no part of a trench is in pavement, surfacing replacement will only be specified where existing surfacing materials have been removed.

When 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 1/2 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 Modified and E

(B) In computing pay quantities for replacement Types ~~C, D, E, and F~~, pay widths will be based on the actual field measured width, however the boundaries of the measurement will not extend further than 1/2 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.

A, B, C and D

(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 bid 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 bid 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 that 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 of Section

SECTION 601

The Contractor shall be entirely responsible for safeguarding and maintaining all conflicting utilities that are shown on the plans (Sections 107 and 105 apply). 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 in accordance with Section 104.

**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, headgates, 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.

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 bid price for the conduit installation.

**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 which 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 1/2 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.

Recycled or reclaimed asphalt concrete shall not be used.

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 two-thirds 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.

Bedding for underground utilities exposed during construction shall be restored in compliance with the requirements established by the utility owner.

**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 or aggregate base course. Backfill under street pavement shall be constructed per Detail 200 with the type of replacement noted on the plans

Recycled or reclaimed asphalt concrete shall not be used.

SECTION 601

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, and T-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.

Backfill Type	Location	From Surface To 2 feet Below Surface	From 2 feet Below Surface To 1 foot Above Top of Pipe	From 1 foot 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		

Add a comma between "easement" and "street"

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.

A 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-foot limit of paved surfaces and other improvements due to construction exigencies, the backfill designation for that portion within the 2-foot limit of such improvements shall be Type I even though Type II backfill is shown on the plans.

Utilities installed within a future roadway prism or within an unsurfaced alley shall be in accordance with Type E of Standard Detail 200 unless otherwise noted.



MARICOPA COUNTY  
Department of Transportation

CASE 09-01

MEMORANDUM

Date: January 6, 2009 (Revised 1/07/2009)  
To: MAG Specifications and Details Committee  
From: Robert Herz, MCDOT Representative  
Subject: Modification to Section 340.2.1 Detectable Warnings Case 09- 01

PURPOSE: Update requirements to conform with current ADA requirements.

REVISION:

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

- Deleted: 0.4 inches
- Deleted: ,
- Deleted: and
- Deleted: spacing

**TAPPING SLEEVES, VALVES AND VALVE BOXES ON WATER LINES**

**630.6 AIR RELEASE AND VACUUM VALVES:**

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

(A) Air release on water mains shall be controlled by the use of an air release valve assembly, or size and type as shown on the plans. Air release valves shall be of the flanged or screwed type as shown and shall be similar and equal to Apco, Crispin, A.R.I. or Simplex.

(B) Vacuum and Air Relief when called for on the plans shall be controlled by a vacuum relief valve on the air release valve noted above and the valves shall be of the same manufacture or may be a combination air and vacuum valve assembly similar and equal to Apco, Crispin, A.R.I. or Simplex.

**SECTION 796**  
**GEOSYNTHETICS**

**796.1 GENERAL:**

Geosynthetic fabrics, grids and membranes used for construction purposes, including woven and non-woven materials, shall be in conformance with this Section.

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

Geosynthetic materials shall be packaged in a manner that will protect the materials from harmful environmental conditions as referred to in the manufacturer's specifications. Fabric rolls shall be stored and protected from the weather. If stored outdoors, the rolls shall be elevated and protected with a waterproof cover, and in no case shall geosynthetics be exposed to mud, dirt, dust and debris.

**796.2 MATERIALS AND REQUIREMENTS;**

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

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

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

**796.2.1 Pavement:** Pavement fabric to be placed as an interlayer beneath a pavement overlay or between pavement layers shall be constructed of at least 95 percent (by weight) nonwoven synthetic fibers of polyester or polypropylene, thermally bonded on one side. The fabric material shall additionally conform to the physical properties shown in Table 796-1.

<b>TABLE 796-1</b>			
<b>PAVEMENT GEOSYNTHETIC PROPERTIES</b>			
<b>Property</b>	<b>Class A</b>	<b>Class B</b>	<b>ASTM Test Method</b>
Weight: oz/yd <sup>2</sup>	4.1 min.	4.0 min	D3776
Grab tensile strength: lbs.	100 min.	90 min	D4632
Elongation at break: %	50 min.	50 min	D4632
Melting point: degree F	300 min.	300 min	D276
Asphalt retention: gal/yd <sup>2</sup>	0.25 min. <sup>(1)</sup>	0.20 min	D6140

(1) May be reduced within street intersections, on steep grades or in other zones where vehicle braking is common, but not less than 0.20 gal/yd<sup>2</sup>.

**796.2.2 Filtration (Drainage) and Separation:** Fabric for use in subsurface drainage or as a permeable separator shall be nonwoven or woven fabric consisting only of long chain polymeric filaments such as polypropylene or polyester formed or woven into a stable network such that the filaments retain their relative position to each other. The fabric material shall additionally conform to the physical properties shown in Table 796-2.

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

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

**796.2.3 Erosion Control:** Erosion control fabric for use below all areas to receive aggregate or rip-rap rock slope protection shall be a woven monofilament fabric or a nonwoven fabric consisting only of long chain polymeric filaments such as polypropylene or polyester formed into a stable network that the filaments retain their relative position to each other. The fabric material shall additionally conform to the physical properties shown in Table 796-3.

TABLE 796-3			
EROSION CONTROL GEOSYNTHETIC PROPERTIES			
Property	Class A <sup>(1)</sup>	Class B <sup>(2)</sup>	ASTM Test Method
Weight: oz/yd <sup>2</sup>	8.0 min	6.0 min	D3776
Grab tensile strength: lbs.	270 min	200 min.	D4632
Elongation at break: %	45min,115 max	15 min.,115 max.	D4632
Puncture strength: lbs.	110 min	75 min.	D4833
Burst strength: psi	430 min	320 min.	D3786
Trapezoidal tear: lbs	75 min	50 min.	D4533
Apparent opening size: US Standard sieve size	30 - 140	30 - 140	D4751
Ultraviolet Stability: %	70 min.	70 min	D4355

- (1) Class A - Use where installation stresses are more severe than for Class B applications.
- (2) Class B - Use with structures or under conditions where the fabric is protected by sand cushion or by "zero drop height" placement of stone (stone placement depth < 3 ft; stone wt < 250 lbs).

**796.2.4 Soil or Base Reinforcement:** Geosynthetics (geogrids) used for improving the stability of weak soils or reinforcing aggregate bases shall be a network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil, aggregate, or other fill materials. The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. Geogrids shall be comprised of 100 percent punched and drawn or extruded virgin resin polypropylene or high-density polyethylene, with a maximum of 5 percent in-plant regrind material. Geogrids shall additionally conform to the physical properties shown in Table 796-4.

### 796.3 TEST & CERTIFICATION REQUIREMENTS:

Certificates of compliance shall be submitted to the engineer upon delivery of material for use of a specified project. Samples of materials shall be submitted for testing. No samples shall be taken within five feet from either end of roll. Dimension and determination of the amount of samples needed shall be determined by the Engineer. Each geosynthetic material lot or shipment must be approved by the Engineer before the materials may be incorporated in the work.

Testing methods and results shown in the certificate of compliance shall conform to the listed specifications for the proposed geosynthetic use. Supporting documentation including, but not limited to, product information sheets, installation procedures and recommendations, recommended use, and project references shall also be submitted by the supplier or manufacturer as part of product evaluation and pre-approval.

<b>TABLE 796-4</b>			
<b>REINFORCEMENT GEOGRID PROPERTIES</b>			
<b>Property</b>	<b>Requirement</b>		<b>Test Method</b>
	<b>Type 1</b>	<b>Type 2</b>	
Aperture size: in	1 min.	1-3/8 min.	ID callipered
Rib Thickness: mil	30 min.	50 min.	ASTM D1777
Rib Shape	Rectangular or Square	Rectangular or Square	Observation
Junction Thickness: mil	60 min.	60 min.	ASTM D1777
Ultimate Tensile Strength: lb/ft	850	1300	ASTM D4945
Flexural Rigidity: Mg-cm	250,000	750,000	ASTM D1388
Min Tensile Strength @ 2% Strain: lb/ft MD	280	410	ASTM D6637
Min Tensile Strength @ 2% Strain: lb/ft CMD	450	620	ASTM D6637
Min Tensile Strength @ 5% Strain: lb/ft MD	580	810	ASTM D6637
Min Tensile Strength @ 5% Strain: lb/ft CMD	920	1340	ASTM D6637
Junction Strength: %	80 min.		ASTM 638
Ultraviolet Stability: %	70 min		D4355

(1) (MD) Machine Direction (2) (CMD) Cross-Machine (transverse) Direction

## SECTION 322

## ASPHALT CONCRETE OVERLAY

## 322.1 DESCRIPTION:

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

## 322.2 MATERIALS:

The tack coat, asphalt concrete mix and transportation of the mix shall be as specified in Sections 710 and 321, except for the maximum size of aggregate and percentage of binder which shall be as specified in the following paragraph.

## 322.3 ASPHALT CONCRETE:

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

322.4 PREPARATION OF SURFACES:  
322.5

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

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

After surfaces have been prepared to the satisfaction of the Engineer, they shall receive a tack coat as specified in Section 321. Traffic will not be permitted over surfaces which have received a tack coat. When the overlay is to extend onto the concrete gutter, the gutter shall be thoroughly cleaned of loose dust and cement particles and shall be tack coated.

322.5 CONSTRUCTION METHODS:  
322.6

Placing and rolling on the asphalt concrete and the smoothness of the surface shall be as specified in Section 321.

322.6 MANHOLES:  
322.7

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

322.7 PAYMENT:  
322.8

Payment for tack coat and asphalt concrete will be as specified in Section 321 except as noted above.

If used, a pavement fabric interlayer shall be shown on the plans or specified in the special provisions.

## 322.4 PAVEMENT FABRIC INTERLAYER:

Pavement fabric interlayer shall be in accordance with Class B in Table 796-1 unless otherwise shown on the plans or specified in the special provisions.

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

Neither the asphalt binder coat nor fabric interlayer shall be placed when weather conditions, in the opinion of the Engineer, are not suitable. Placement of the asphalt binder and fabric interlayer shall be placed either when (a) the ambient air temperature is above 50 degrees F and rising, or (b) the pavement is dry and pavement temperature is 40 degrees F and rising.

Equipment for placing the fabric shall be mechanized and capable of handling full rolls of fabric. The equipment shall be able to lay the fabric smoothly in order to maximize pavement contact and remove air bubbles. Stiff bristle brooms shall be used to smooth the fabric, scissors or blades to cut the fabric are also required. The equipment used to place the fabric shall be in good working order and is subject to approval by the Contracting Agency.

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

Pavement fabric interlayer shall be placed with the heat bonded side up onto the asphaltic binder with a minimum amount of wrinkling or folding. Large wrinkles (1-inch and larger) shall be slit and lapped in the direction of paving. Burning or torching of wrinkles is not be allowed. Fabric joints shall overlap three to six inches to insure full closure of the joint. Transverse joints shall be lapped in the direction of paving to prevent edge pickup by the paver. A second application of hand-placed asphalt binder may be required at laps and repairs as determined by the Engineer to ensure proper binding of the narrow double fabric layer. No joints shall be lapped with more than two layers of fabric.

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

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

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:~~  
220.4

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:~~  
220.5

~~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 stones 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 depth, 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 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 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.~~

and underlain with erosion control geosynthetic fabric.

Erosion control geosynthetic fabric shall conform to the requirements of Section 796, Class B in accordance with Table 796-3.

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

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

Bedding material shall consist of processed natural material conforming to the requirements of Section 702.3, with a material gradation conforming to Select Materials Type A or B, or Aggregate Base as specified in Table 702-1.

220.3 PLACEMENT OF EROSION CONTROL GEOTEXTILE FABRIC:

Fabric shall be placed in a manner and at the locations shown on the project plans. The surface to receive fabric shall be free of obstructions, depressions, and debris. Any defects or soft yielding places which occur in the subgrade for any cause whatsoever shall be corrected and compacted to require density and stability before fabric is placed. These repairs shall be made at the expense of the contractor. The fabric shall be loosely laid (not in a stretched condition), aligned and placed with no wrinkles that lap.

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

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

Use the following description per MCDOT supplemental specification:

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

Riprap shall be placed in a manner which will produce a reasonably well-graded mass without segregation and with a minimum amount of voids, with the larger stone evenly distributed through the riprap mass. The individual placement of larger riprap stones may be required to obtain a uniform distribution of stone size. The riprap placement shall be supplemented by such hand methods as are required to obtain a uniform finished surface. Allowable tolerance from the slope lines and grades shown for the finished riprap surfaces shall not exceed a distance equal to  $0.67 \times D_{50}$  above or  $0.33 \times D_{50}$  below the design surfaces. Special care shall be exercised in placing riprap within 3 feet of structures to avoid damage to such structures.

Delete. An archaic specification (dates back to the 1950's) that may violate present-day environmental regulations. More typically used today for emergency actions. Can become a long-term maintenance item.

SECTION 220

220.7 MEASUREMENT:

The quantities of riprap construction shall be those of the completed bid 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.~~

Measurement will be in cubic yards rounded to the nearest cubic yard. Measurement shall extend from the erosion control geosynthetic fabric to the top of the riprap. Quantities will be computed by the average end area method.

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

220.8 PAYMENT:

Payment for riprap will be made for the number of cubic yards of ~~riprap in place~~ <sup>construction</sup>, on the basis of unit prices stipulated in the proposal and shall include ~~preparation of ground surfaces and trenching~~.

complete in-place riprap construction as measured in 220.7

excavation, ground surface preparation, erosion control geosynthetic fabric, bedding material, riprap rock, grout (if used for the project) and backfilling.

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

End of Section



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 701.4. ← meet the requirements of Section 701.4.

Stone shall be of shapes which will form a stable protection structure of the required depth. <sup>If specified, rounded</sup> boulders or cobbles <sup>may</sup> ~~shall~~ not be used on slopes <sup>flatter</sup> 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.~~

Delete. Provides no method to determine if durability requirements can be met.

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:

← Delete. The application is not provided within Section 220 and contradicts grouted riprap per the same section.

~~The portland cement, aggregates and mixing shall be as specified in Section 725 and as herein specified. The aggregate may be pitrun material, at least 80 percent of which shall pass a 1 1/2 inch square mesh screen. Separating aggregates by primary sizes will not be required. Los Angeles rattler tests and soundness tests will not be required.~~

~~The mixed concrete shall contain 376 pounds of portland cement per cubic yard.~~

~~The amount of water shall be such as to produce a mixture with a clump of 2 to 5 inches, when tested in accordance with ASTM C-143.~~

703.4 SACKS:

← Delete. An archaic specification (dates back to the 1950's) that may violate present-day environmental regulations. More typically used today for emergency actions. Can become a long-term maintenance item.

~~Sacks shall be made of burlap not lighter than 10 ounce and shall be approximately 19 1/2 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 of Section

**SECTION 306****MECHANICALLY STABILIZED SUBGRADE - GEOGRID****306.1 DESCRIPTION:**

The work under this section shall consist of furnishing and placing a geogrid material within or below the aggregate base as shown on the project plans to mechanically stabilize the subgrade. Work shall provide a stabilized paving platform section on which paving materials can be placed. Geogrid type, fill thickness, pavement cross-section and associated details, shall be as shown on the contract drawings.

This specification shall be used for a construction platform and not as a means of mitigating swell (retaining moisture in subgrades) unless retaining moisture in the section can be assured by other means.

**306.2 MATERIALS:**

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

Other geosynthetic fabrics as described in Section 796 may be used in the cross-section to provide separation, filtration or drainage; however, no structural contribution shall be attributed to the geosynthetic materials other than the specified geogrid.

**306.3 PREPARATION:**

The surface upon which the geogrid is to be placed shall be brought to a compacted condition, true to line and grade as directed by the Engineer or as shown on the plans. During this process any unsuitable soil or material shall be removed and replaced with acceptable material. The compacted surface shall be at the proper elevation as specified, shown on the plans, or as directed by the Engineer, for the placement of the geogrid. At completion of this phase, the material and surface shall be approved by the Engineer before proceeding with the next step.

The geogrid shall not be placed when weather or surface conditions, in the opinion of the Engineer, are not suitable for placement. This will normally be at times of wet and snowy conditions, heavy rainfall, extreme cold or frost conditions, or extreme heat.

**306.4 EQUIPMENT:**

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

**306.5 GEOGRID PLACEMENT:**

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

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

The geogrid shall be tensioned by hand and anchored to the ground at the edges, including overlaps, and in the center of the roll at 30-foot intervals along the roll length, at the corners if applicable, or as directed by the Engineer. Securing locations may be reduced or eliminated by the Engineer if it can be shown that by careful installation the geogrid is adequately tensioned by hand and anchored by the placed aggregate in a progressive installation process as recommended by the manufacturer's representative.

Care shall be taken to ensure that geogrid sections do not separate at overlaps during construction. Placement of geogrid around corners will require cutting of the geogrid product and diagonal overlapping of the same to make sure that excessive buckling of geogrid material does not occur.

### **306.6 PLACING AND COMPACTING AGGREGATE FILL:**

The aggregate shall be back dumped and spread in a uniform lift maintaining the design aggregate thickness at all times. The aggregate material shall be bladed onto the geogrid in such a manner that the aggregate rolls onto the grid ahead, by gradually raising the dozer blade while moving ahead.

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

Any ruts which might develop during spreading or compacting the aggregate shall be filled with additional aggregate rather than bladed from surrounding areas. Placing additional aggregate into the rutted areas insures that the design aggregate thickness is maintained.

Aggregate base shall be compacted as specified in Section 310. Aggregate base material shall not be mixed or processed on the geogrid. The aggregate base material shall be premixed at the stockpile area or another location in a manner approved by the Engineer. Aggregate base materials will be sampled for acceptance after premixing and prior to placement on the geogrid material. Contamination and segregation of aggregate base materials prior to or during placement shall be minimized.

### **306.7 REPAIR:**

Any roll of geogrid damaged before, during and after installation shall be replaced by the contractor at no additional cost to the owner.

Proper replacement shall consist of replacing the affected area overlapping geogrid at least 3 feet beyond all sides of the affected area.

### **306.8 PAYMENT:**

Geogrid reinforcement will be measured by the square yard in-place. Measurement will be to the nearest square yard. No allowance will be made for material in laps.

The accepted quantity of geogrid reinforcement, measured as provided above, will be paid for at the contract unit price per square yard, which price shall be full compensation for furnishing all labor, material, and equipment, and performing all operations in connection with placing the geogrid as shown on the project plans. No payment will be made for geogrid reinforcement rejected due to either contamination or damage due to either the fault or negligence of the contractor.

Paving platform found deficient shall be removed and replaced.

Case Introduction – Revisions to MAG Section 725 and the associated portion of Section 701 – Submitted on March 4, 2009

Rationale:

Section 725 of the MAG Specifications have not been revised or updated for many years – perhaps decades. With the inevitable changes in concrete technology, materials, and construction methods, other associated Industry Standards have continued to be enhanced and updated leaving this section far behind. Some of the issues with the existing specification were:

- 1) Much of the wording was out of date regarding current Industry practice
- 2) Many currently used concreting materials were not included
- 3) Some of the organization of information was redundant or needed re-working to provide a clearer, easier to use and more complete document for field personnel
- 4) References to other widely recognized Industry Standards were missing – ASTM, ACI, ADOT, etc. This did not take advantage of accepted technical information and standards that could make this section a more living document – able to change with future advancements without the need for major re-writing

To correct or augment the existing language, individual Agencies were prompted to write their own supplemental documents. This negates the original design of the MAG Specifications themselves – one document that would provide a unified standard for all the Agencies in Maricopa County and beyond. Many individuals have come together from a number of perspectives - cities, testing laboratories, contractors, and material suppliers - to work together to provide current input and develop a more technically usable document for all. We submit this to the MAG Specifications and Details Committee with the request to make this a case for consideration.

Some of the major changes/revisions are:

- 1) Elimination of the 14 day compressive strength requirement in Table 725-1
- 2) Increase in the allowable amount of fly ash or natural pozzolan (SCM) to provide additional long term durability to align other similar Industry Specifications (ADOT, ACI) – 725.2.1
- 3) Moving concrete aggregate requirements to section 701 where they are more appropriate – 725.3, 725.4
- 4) Inclusion of a new section on additional concrete additives – 725.6
- 5) Re-organizing much of the sections on mix design proportioning, mixing, and delivery to provide a more up-to date and clear presentation of the technical requirements – 725.7, 725.8
- 6) Elimination of no longer needed or applicable language – 725.9
- 7) Re-wording and clarifying key components to the fields testing section to provide a better reference document for field personnel – 725.10
- 8) Additions to the Acceptance section involving plastic concrete properties and updating of the compressive strength acceptance criteria and adjustment table – 725.11
- 9) Updated references throughout to appropriate ACI and ASTM documents

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**PORTLAND CEMENT CONCRETE****725.1 GENERAL:**

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

<b>CONCRETE CLASSES MINIMUM REQUIREMENTS</b>			
<b>Class of Concrete</b>	<b>Minimum Cementitious Materials Content (Lbs. Per Cu Yard)</b>	<b>Minimum Compressive Strength (1)</b>	
		<b>at 28 Days psi</b>	
AA	600	4000	
A	520	3000	
B	470	2500	
C	420	2000	

(1) In accordance with section 725.10.

Class AA concrete shall be 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 CEMENTITIOUS MATERIALS:**

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

Portland cement, meeting the requirements of ASTM C-150  
 Type II, low alkali, when no other specific type is specified  
 Type III, low alkali, for high early strength, when applicable  
 Type V, low alkali, when specified in the special provisions for use in concrete which will be exposed to contact with soils or waters containing water soluble sulfates (as SO<sub>4</sub>) in concentration greater than 0.20% by weight of soil or 1500 PPM in solutions

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

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

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

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

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

**725.2.1 Supplementary Cementitious (Pozzolan) Materials (SCM):** Supplementary cementitious (pozzolanic) 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 or Agency.

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, 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.

**725.4**

**725.5 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.

**725.6 ADMIXTURES AND ADDITIVES:**

Admixtures or additives of any type, except as otherwise specified, shall not be used unless incorporated into the approved mix design or authorized by the Engineer or appropriate Agency representative.

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

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

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

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

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

**725.7 MIX DESIGN PROPORTIONING:**

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

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

- 1 Modifications which do not result in batch target weights for the fine aggregate or combined coarse aggregates changing by more than 5 percent from the original approved mix design.
- 2 Modifications to the percentage of coarse aggregate fractions that do not change the total coarse aggregate volume.
- 3 Modifications to dosages of chemical or air-entraining admixtures, within the manufacturer's recommendations.
- 4 The incorporation or elimination of chemical admixtures which are listed on the mix design to effect a change in the time-of-set (retarders or accelerators).

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

- 1 Modification to the class of concrete per Table 725-1.
- 2 Modification to the type/class of cement, fly ash, natural pozzolan, or silica fume.
- 3 Modification to the percentage of fly ash, natural pozzolan, or silica fume.
- 4 Modification to a coarse aggregate size designation.
- 5 Modification of the type of chemical admixture, or the incorporation or elimination, of an air-entraining admixture.
6. Modification of coarse or fine aggregate source

**725.8 MIXING:**

All proportioning/batching/mixing equipment shall comply with the standards of the Concrete Plant Manufacturer's Bureau and the certification requirements of the Arizona Rock Products Association or National Ready Mixed Concrete Association. The

proportioning shall consist of combining the specified sizes of aggregates with cement, supplementary cementitious materials, admixtures/additives, and water as herein provided. No method which may cause the segregation or degradation of materials shall be used.

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

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

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

Machine mixing will be required in all cases 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 the cement is placed in contact with the aggregates. All concrete mixers shall be of such design and construction, and so operated, as to provide a thoroughly and properly mixed concrete in which the ingredients are uniformly distributed.

**725.8.1 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.

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 any one 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 meet the requirements of the Truck Mixer Manufacturer's Bureau and the certification requirements of the Arizona Rock Products Association. Ready mix concrete and shall comply with ASTM C-94 except as herein specified.

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

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

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

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

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

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

Date and Truck Number.

Name of the Supplier.

Name of the Contractor.

Specific designation of job (name and location).

Number of cubic yards in the batch.

Time the transit mixer is loaded.

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

Suppliers' mix design code number.

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

Serial number of the ticket.

Additional water may be added at the point of discharge in accordance with ASTM C-94 Tolerances in Slump section to adjust slump providing the slump after such water addition does not exceed the maximum allowed by these specifications in section 725.11 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 batch weight shall be provided to record the quantities of cementitious materials, aggregate and water batched into the containers. The date of batching, the container number and the batching certificate number shall be recorded at the time of batching. Copies of the batch weight records shall be submitted to the Agency or Engineer upon request.

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

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

Any spillage of cement, aggregate, water or admixture during the filling, transporting, or the discharging of the container, shall be cause for rejection of the container or the

contents of the mixer if any portion of the rejected container is discharged into the mixer.

**725.9**

**725.10 TESTS AND TEST METHODS:**

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

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

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

Slump of the concrete mixture will be determined in accordance with ASTM C143.

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

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

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

725.10.2 In accordance with ACI 318 Chapter 5 Section 5.6.2.4, a cylinder strength test shall be the average of the strengths of at least two 6 inch by 12 inch cylinders or at least three 4 inch by 8 inch cylinders made from the same sample of concrete and tested at 28 days. An adequate number of cylinder specimens will be made for each 50

cubic yards or not less than each half-day's placement of each class of concrete. All specimens will be tested in a laboratory approved by the Agency and/or Engineer in accordance with ASTM C-39 for concrete acceptance. Should an individual cylinder show evidence of improper sampling, molding, curing, or testing, the results shall be discarded and the compressive strength shall be the result of the average of the remaining cylinder(s). Additional cylinder specimens may be made and tested at other ages to obtain additional compressive strength information and may not be considered as acceptance tests.

725.10.3 If the 28-day strength test does not meet the compressive strength requirements, the contractor may choose to contest the compressive strength results of any test for purposes of acceptability or payment. This may involve an engineering study to determine the acceptability of the concrete in question or core testing to determine in-place concrete strengths. If core testing is performed, at least three representative cores shall be obtained, conditioned and tested in accordance with ASTM C-42 from each concrete member or area of concrete to be tested at locations designated by the Agency and/or Engineer. Cores damaged subsequent to or during removal shall be rejected and additional core samples taken. Cores must be obtained and delivered to a laboratory acceptable to the Agency and/or Engineer in time to allow complete strength testing within 48 days of original concrete placement. The contractor may elect to have a representative present during sampling and testing. A core strength test shall be the average of the results of the three cores. Should an individual core show evidence of improper sampling, curing, or testing, the results shall be discarded and the compressive strength shall be the result of the average of the remaining core(s). Results of the core strength testing will replace the results of the cylinder strength test for that sample.

#### 725.11 ACCEPTANCE:

##### A) Plastic Concrete Properties

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

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

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

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

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More than 4 inch

+/- 1 1/2 inch

- 2) Per ACI 305, Specification for Hot Weather Concreting, limit the maximum allowable temperature of the concrete mixture immediately before placement to 95 degrees F unless otherwise specified or unless a higher allowable temperature is accepted by the Engineer/Agency. This acceptance can be based upon past field experience or preconstruction testing using a concrete mixture similar to one known to have been successfully used at a higher concrete temperature.

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

- 3) Air entrained concrete shall meet the requirements of ASTM - Air-Entrained Concrete section. The air content of air-entrained concrete when sampled from the transportation unit at the point of discharge shall be within the approved mix design tolerance or +/- 1.5 % of the specified value. When a representative sample taken prior to discharge shows an air content below the specific level by more than the allowable tolerance, additional air entraining admixture may be used to achieve the desired air content level, followed by a minimum of 30 revolutions at mixing speed.
- 4) Per ASTM C-94 Mixing and Delivery section, discharge of the concrete shall be completed within 1 1/2 hour after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. The Engineer/Agency or their representative may allow the continuation of concrete placement after the 1 1/2 hour time limit has been reached if the concrete is of such slump or workability that it can be placed without the addition of water to the batch.

Concrete failing to meet the tolerances for plastic concrete properties in 1-4 above shall be reviewed by the Engineer/Agency or their representative and may be subject to rejection.

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

- 1) Concrete represented by a cylinder strength test obtained in accordance with section 725.10.2 shall be acceptable if the 28-day strength meets or exceeds the specified design strength. Concrete achieving at least 85% of the specified 28-day strength will be evaluated by the Agency and/or Engineer for acceptability. Core strength tests obtained in accordance with section 725.10.3 shall be considered satisfactory if their average is equal to or greater than 85 percent of the specified strength and no single core is less than 75 percent of the specified

strength. If the core strength test meets or exceeds the minimum 28-day strength, the concrete will be accepted by the Agency at full contract price. All concrete failing to meet the acceptability 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, unless the Contractor can submit evidence that will indicate to the Agency and/or Engineer that the strength and quality of the concrete is such that the concrete should be considered acceptable and be allowed to remain in place.

- 2) When concrete is accepted on the basis of cylinder or core strength tests of less than 100% of the required minimum 28-day compressive strength, an adjustment in the concrete unit price may be made for the quantity of concrete represented by such strength tests in accordance with the following schedule:

**Adjustment in Concrete Unit Price Based on Cylinder or Core Strength Testing**

<b>Percent of Specified Minimum 28-day Compressive Strength Attained (Nearest 1%)</b>	<b>Percent of concrete Unit Price Allowed</b>
100 % or greater	100
95-99	95
90-94	90
85-89	85

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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.

→ chemical admixtures and additives.

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

→ Deleted – redundant

~~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.~~

→ Moved to section 725.8

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

→ rename to - Minimum Cementitious Materials Content

→ Delete 14 day acceptance criteria

In accordance with section 725.10.

→ removed and handled in section 725.11 Acceptance

(1) ~~As tested in accordance with ASTM C-39. Maximum slump 5 inches when tested in accordance with ASTM C-143.~~

Class AA concrete shall be 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.

Reorganize and reword this paragraph in list form for increased clarity.

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

- Portland cement, meeting the requirements of ASTM C-150
- Type II, low alkali, when no other specific type is specified
- Type III, low alkali, for high early strength, when applicable
- Type V, low alkali, when 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
- Portland Pozzolan Cement ASTM C-595
- Type IP (MS), when no other specific type is specified

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

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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 bid price and no additional allowance will be made therefore.

When suitable facilities, as recommended by the Concrete Plant Manufacturer's Bureau, and approved by the Engineer, are available for handling and weighing bulk 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.~~

Remove as no longer needed.

~~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.~~

**Supplementary Cementitious (Pozzolanic) Materials (SCM):** Supplementary cementitious (pozzolanic) 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

~~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 1.2 pounds of pozzolan per pound of replaced portland cement. If the class of concrete is not from Table 725-1, the amount of pozzolonic material used will be 17.5 percent of the combined weight of pozzolonic material and portland cement.~~

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 pozzolonic 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 or Agency.

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 bid 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.~~

Remove as no longer needed.

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.~~

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.

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

Unclear wording and location – the proper section is 725.8 Mixing and the method of combining materials is addressed there

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.~~

Moved and reworded to the proper section 701.3.3 on aggregate grading

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~~Except where the amount of concrete for any one 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.~~

Remove as redundant and misplaced – mixing is properly handled in section 725.8

~~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.~~

Removed as a misplaced item in the Portland Cement Concrete section – should be handled in the design specifications/standard drawings

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.~~

Moved and reworded to the proper section 725.8 on Mixing - also handled in the required Concrete Plant/ARPA certification

~~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:~~

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.

~~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 sulphate in excess of 1,000 parts per million nor any sulphates calculated as sulphate in excess of 1,000 parts per million. Water shall not contain an amount of impurities that will cause a change in the time of setting of portland cement of more than 25 percent nor a reduction in the compressive strength of portland cement mortar of more than 5 percent compared to results obtained with distilled water.~~

Included in the requirements of ASTM C-1602

725.6 ADMIXTURES: → AND ADDITIVES:

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

Admixtures or additives of any type, except as otherwise specified, shall not be used unless incorporated into the approved mix design or authorized by the Engineer or appropriate Agency representative.  
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.

~~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 bid price for that item.~~

725.7 PROPORTIONING: → MIX DESIGN 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.~~

moved to the proper section 725.8 on Mixing

~~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.~~

Moved and reworded to the proper section 725.8 on Mixing

~~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.~~

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~~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 the cement is placed in contact with the aggregates.~~

~~The temperature of materials as charged in the mixer shall be such that the temperature of the mixed concrete at the time it is placed in final position does not exceed 90°F. When the atmospheric temperature at the time of placing concrete is less than 40°F the temperature of the concrete, as placed, shall not be less than 60°F.~~

~~All concrete mixers shall be of such design and construction, and so operated, as to provide a thoroughly and properly mixed concrete in which the ingredients are uniformly distributed.~~

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

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

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

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

Machine mixing will be required in all cases 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 the cement is placed in contact with the aggregates. All concrete mixers shall be of such design and construction, and so operated, as to provide a thoroughly and properly mixed concrete in which the ingredients are uniformly distributed

included in the Concrete Plant/ARPA certification

Each design shall utilize the proper proportioning of ingredients to produce a concrete mix that is homogeneous and sufficiently workable to provide a consistent and durable concrete product that meets the specified compressive strength and other properties as required by the application. In the event there is any modification to the mix design proportions:

- A) Modifications that will not require a new mix design submittal/approval:
  - 1 Modifications which do not result in batch target weights for the fine aggregate or combined coarse aggregates changing by more than 5 percent from the original approved mix design.
  - 2 Modifications to the percentage of coarse aggregate fractions that do not change the total coarse aggregate volume.
  - 3 Modifications to dosages of chemical or air-entraining admixtures, within the manufacturer's recommendations.
  - 4 The incorporation or elimination of chemical admixtures which are listed on the mix design to effect a change in the time-of-set (retarders or accelerators).
- B) Modifications that will require a new mix design submittal/approval and may require performance verification:
  - 1 Modification to the class of concrete per Table 725-1.
  - 2 Modification to the type/class of cement, fly ash, natural pozzolan, or silica fume.
  - 3 Modification to the percentage of fly ash, natural pozzolan, or silica fume.
  - 4 Modification to a coarse aggregate size designation.
  - 5 Modification of the type of chemical admixture, or the incorporation or elimination, of an air-entraining admixture.
  6. Modification of coarse or fine aggregate source

moved to later in the section

moved to section 725.11 Acceptance and expanded

included in the required Concrete Plant/ARPA certification

moved from section 725.7

moved from section 725.1

moved from section 725.6

moved from 725.5

moved from earlier in the section

**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 equipment as described in this specification shall also be provided with each concrete mixer.~~

no longer needed as this is included in the required Concrete Plant/ARPA certification

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 any one batch shall neither exceed the water level capacity of the mixer nor the manufacturer's catalog rated capacity of the mixer.

too subjective and not needed

**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.

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~~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.~~

move to the proper section 725.11 on Acceptance and expanded

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 any one 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, the Engineer 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, if 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.

Agency or

Not needed based on required mix design submittal/approval process in section 725.7

not needed based on required Concrete Plant/ARPA certification in section 725.8

or additive that is not already included in the approved mix design

redundant – already required earlier in the section

~~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.~~

Additional water may be added at the point of discharge in accordance with ASTM C-94 Tolerances in Slump section to adjust slump providing the slump after such water addition does not exceed the maximum allowed by these specifications in section 725.11 and that water so added is mixed into the batch for a minimum of 30 additional revolutions at mixing speed.

**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 Drybatched Unmixed Concrete:** Should the Contractor elect to use drybatched 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 chart 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.~~

Should the Contractor elect to use dry batched unmixed concrete, an accurate batch weight shall be provided to record the quantities of cementitious materials, aggregate and water batched into the containers. The date of batching, the container number and the batching certificate number shall be recorded at the time of batching. Copies of the batch weight records shall be submitted to the Agency or Engineer upon request.

All drybatched unmixed concrete delivered to the job site shall be stored in containers so constructed that the cement cannot come in contact 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, and drum or turbine type mixers.

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

**725.9 LOADING AND TRANSPORTATION OF MATERIALS AND MIXED CONCRETE:**

~~The compartments of trucks or other equipment used for the purpose of transporting proportioned aggregates, bulk cement or mixed concrete, shall be sufficiently high and tight, and otherwise suitably constructed and adequately protected, to prevent loss or leakage of the contents thereof during transit or charging.~~

→ this section is no longer needed in the Portland Cement Concrete Section

**725.10 TESTS: TESTS AND TEST METHODS:**

~~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 strength shall be taken from the batch, if any concrete from the batch was placed. The rate of discharge of the batch shall be 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.~~

→ rewritten, expanded and divided into 3 new sections for clarity

~~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.~~

**725-6**

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

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

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

Slump of the concrete mixture will be determined in accordance with ASTM C143.

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

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

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

~~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.~~

14 day requirements removed from Table 725-1 as acceptance testing is based on 28 day results. Additional early testing may be performed as noted in section 725.10.2

~~If this strength does not meet the 14-day requirement, the Contractor shall schedule and pay for two cores to be taken, on the 29th 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.~~

removed due to confusing language and impossible timing requirement - see section 725.10.3 for references to widely accepted coring procedure/analysis method in ASTM C-42 and ACI 318 and current ADOT specifications

~~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.~~

reworded and expanded in section 725.10.3

~~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.~~

moved to proper section 725.11 on Acceptance and rewritten to reflect widely accepted coring procedure/analysis method in ASTM C-42 and ACI 318 and current ADOT specifications

725.10.2 In accordance with ACI 318 Chapter 5 Section 5.6.2.4, a cylinder strength test shall be the average of the strengths of at least two 6 inch by 12 inch cylinders or at least three 4 inch by 8 inch cylinders made from the same sample of concrete and tested at 28 days. An adequate number of cylinder specimens will be made for each 50 cubic yards or not less than each half-day's placement of each class of concrete. All specimens will be tested in a laboratory approved by the Agency and/or Engineer in accordance with ASTM C-39 for concrete acceptance. Should an individual cylinder show evidence of improper sampling, molding, curing, or testing, the results shall be discarded and the compressive strength shall be the result of the average of the remaining cylinder(s). Additional cylinder specimens may be made and tested at other ages to obtain additional compressive strength information and may not be considered as acceptance tests.

725.10.3 If the 28-day strength test does not meet the compressive strength requirements, the contractor may choose to contest the compressive strength results of any test for purposes of acceptability or payment. This may involve an engineering study to determine the acceptability of the concrete in question or core testing to determine in-place concrete strengths. If core testing is performed, at least three representative cores shall be obtained, conditioned and tested in accordance with ASTM C-42 from each concrete member or area of concrete to be tested at locations designated by the Agency and/or Engineer. Cores damaged subsequent to or during removal shall be rejected and additional core samples taken. Cores must be obtained and delivered to a laboratory acceptable to the Agency and/or Engineer in time to allow complete strength testing within 48 days of original concrete placement. The contractor may elect to have a representative present during sampling and testing. A core strength test shall be the average of the results of the three cores. Should an individual core show evidence of improper sampling, curing, or testing, the results shall be discarded and the compressive strength shall be the result of the average of the remaining core(s). Results of the core strength testing will replace the results of the cylinder strength test for that sample.

**725.11 ACCEPTANCE:**

•Plastic Concrete Properties

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

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

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

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

•Per ACI 305, Specification for Hot Weather Concreting, limit the maximum allowable temperature of the concrete mixture immediately before placement to 95 degrees F unless otherwise specified or unless a higher allowable temperature is accepted by the Engineer/Agency. This acceptance can be based upon past field experience or preconstruction testing using a concrete mixture similar to one known to have been successfully used at a higher concrete temperature.

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

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

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

Concrete failing to meet the tolerances for plastic concrete properties in 1-4 above shall be reviewed by the Engineer/Agency or their representative and may be subject to rejection.

→ expanded from footnote of Table 725-1 on maximum slump

→ expanded from section 725-8 on minimum and maximum temperature

→ expanded from section 725-6 on air-entraining

→ expanded from section 725-8.2 on maximum delivery time

~~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.~~

re-written and expanded to encompass widely accepted coring procedure/analysis method in ASTM C-42 and ACI 318 and current ADOT specifications

**Hardened Concrete Properties – Compressive Strength**

Concrete represented by a cylinder strength test obtained in accordance with section 725.10.2 shall be acceptable if the 28-day strength meets or exceeds the specified design strength. Concrete achieving at least 85% of the specified 28-day strength will be evaluated by the Agency and/or Engineer for acceptability. Core strength tests obtained in accordance with section 725.10.3 shall be considered satisfactory if their average is equal to or greater than 85 percent of the specified strength and no single core is less than 75 percent of the specified strength. If the core strength test meets or exceeds the minimum 28-day strength, the concrete will be accepted by the Agency at full contract price. All concrete failing to meet the acceptability 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, unless the Contractor can submit evidence that will indicate to the Agency and/or Engineer that the strength and quality of the concrete is such that the concrete should be considered acceptable and be allowed to remain in place.

cylinder or core

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:

Concrete

Based on Cylinder or Core Strength Testing

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
<del>98-99</del> 95-99	<del>90</del> 95
<del>96-97</del> 90-94	<del>85</del> 90
<del>95</del> 85-89	<del>80</del> 85

End of Section

## **ROCK, GRAVEL, AND SAND**

### **701.1 GENERAL:**

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

### **701.2 CRUSHED ROCK AND GRAVEL:**

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

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

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

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

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

### **701.3 AGGREGATE:**

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

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

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

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

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

Mortar:           ASTM C-144

Plaster:           ASTM C-35

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

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

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

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

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

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

#### **701.4 QUARRY STONE:**

**701.4.1 General:** Quarry stone shall be angular, sound, durable, hard, resistant to abrasion; free from laminations, weak cleavages, and undesirable weathering, leaching, exfoliation tendencies, and slaking; and of such character that it will not disintegrate from the action of air, water, or the conditions to be met in handling and placing. Stone shall be clean and free from deleterious impurities, including alkali, earth, clay, refuse, and adherent coatings. Suitable tests and/or service records will be used to determine the acceptability of the stone. Tests to which the material may be subjected include petrographic analysis, X-ray diffraction, specific gravity, absorption, abrasion, rock drop, soundness, wetting and drying, and such other tests as may be considered necessary

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to demonstrate to the Engineer that the materials are acceptable for use in the work. In connection therewith, the Contractor shall notify the Engineer in writing at least 60 days prior to use of the intended sources of quarry stone.

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

(A) Apparent specific gravity: 2.65 minimum.

(B) Breakdown:

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

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

Apparent specific gravity per ASTM C-127.

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

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

Each rock of the 5 sizes shall be dropped 3 times on the group of the other 4, in an enclosure, from successive heights of 10, 15, and 18 feet. The enclosure shall have a flexible medium weight galvanized iron floor or equivalent, set on a solid foundation. Order of dropping shall be Nos. 3, 2, 4, 1, 5. All rock passing a 3 inch square mesh screen after test shall be weighed and recorded as a percentage of the total initial weight of the 5 rocks.

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

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

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

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

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

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

DRAFT

SECTION 701

ROCK, GRAVEL, AND SAND

701.1 GENERAL:

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

701.2 CRUSHED ROCK AND GRAVEL:

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

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

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

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

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

701.3 SAND:

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

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

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

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

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

<del>Concrete:</del>	<del>ASTM C-33</del>
Mortar:	ASTM C-144
Plaster:	ASTM C-35

Change the title of section 701.3 to Aggregate

Delete Portland Cement Concrete from the title of 701.3.2

Delete cement concrete, and , after mortar

Delete Concrete ASTM C-33

**SECTION 701**

Delete Coarse in the title of 701.3.3

~~701.3.3 Coarse Aggregate for Portland Cement Concrete: Coarse aggregate shall conform to ASTM C-33 grading size No. 467, 57, 67, and 7.~~

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

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

**701.4 QUARRY STONE:**

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

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

(A) Apparent specific gravity: 2.65 minimum.

(B) Breakdown:

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

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

A) Apparent specific gravity per ASTM C-127.

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

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

Each rock of the 5 sizes shall be dropped 3 times on the group of the other 4, in an enclosure, from successive heights of 10, 15, and 18 feet. The enclosure shall have a flexible medium weight galvanized iron floor or equivalent, set on a solid foundation. Order of dropping shall be Nos. 3, 2, 4, 1, 5. All rock passing a 3 inch square mesh screen after test shall be weighed and recorded as a percentage of the total initial weight of the 5 rocks.

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

Delete existing text of 701.3.3 and insert the following:

Coarse and fine aggregate shall conform to the applicable requirements of ASTM C-33.

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

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

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

SECTION 701

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

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

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

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

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

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End of Section

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**MARICOPA COUNTY**  
*Department of Transportation*

MEMORANDUM

**Date:** March 4, 2009

**To:** MAG Specifications and Details Committee

**From:** Robert Herz, MCDOT Representative

**Subject:** Modification to Detail 240 VALLEY GUTTER

**Case 09-08**

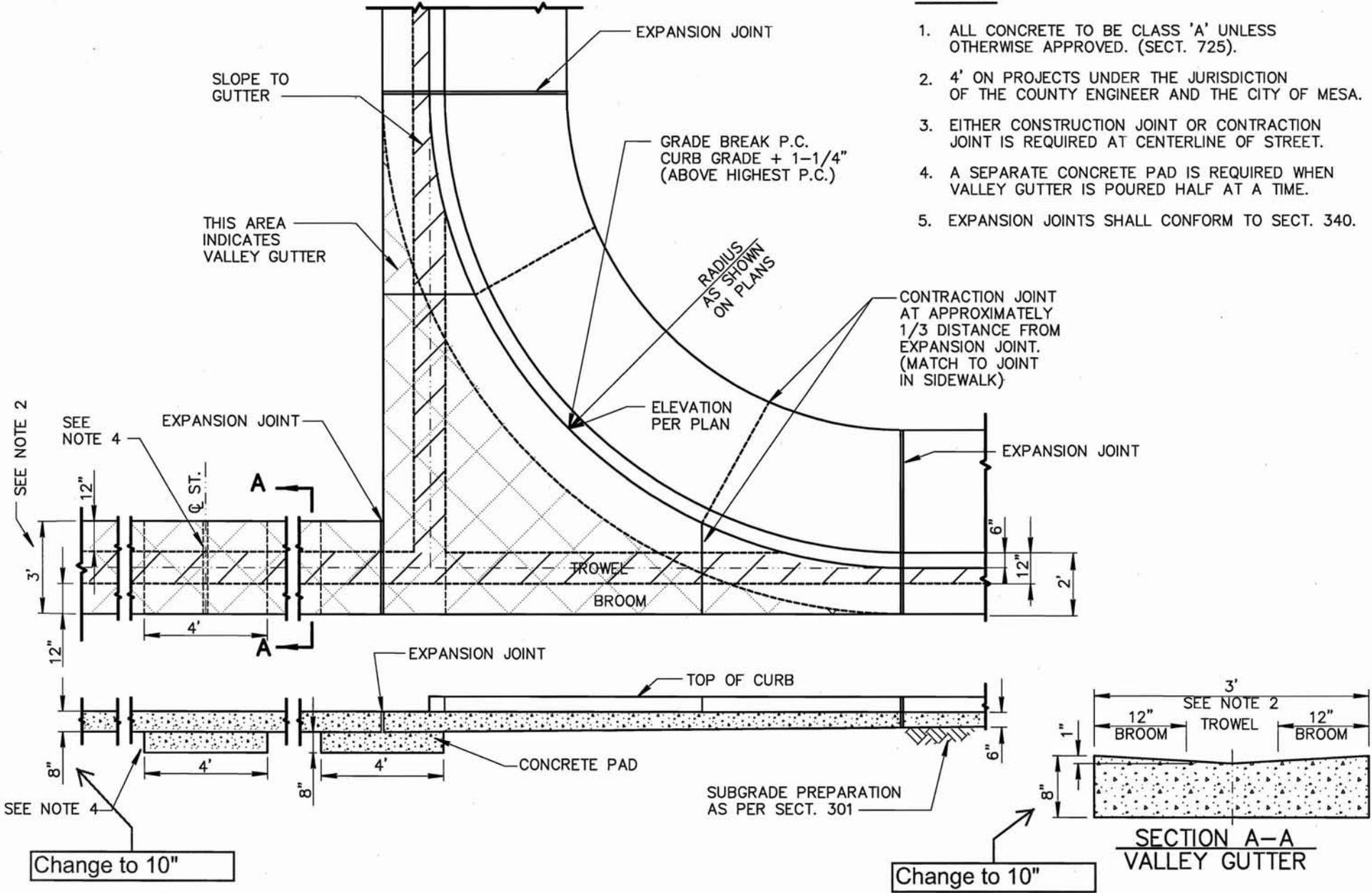
**PURPOSE:** Revised valley gutter required thickness to conform with increased concrete thickness required for commercial and industrial driveways as shown in Detail 250.

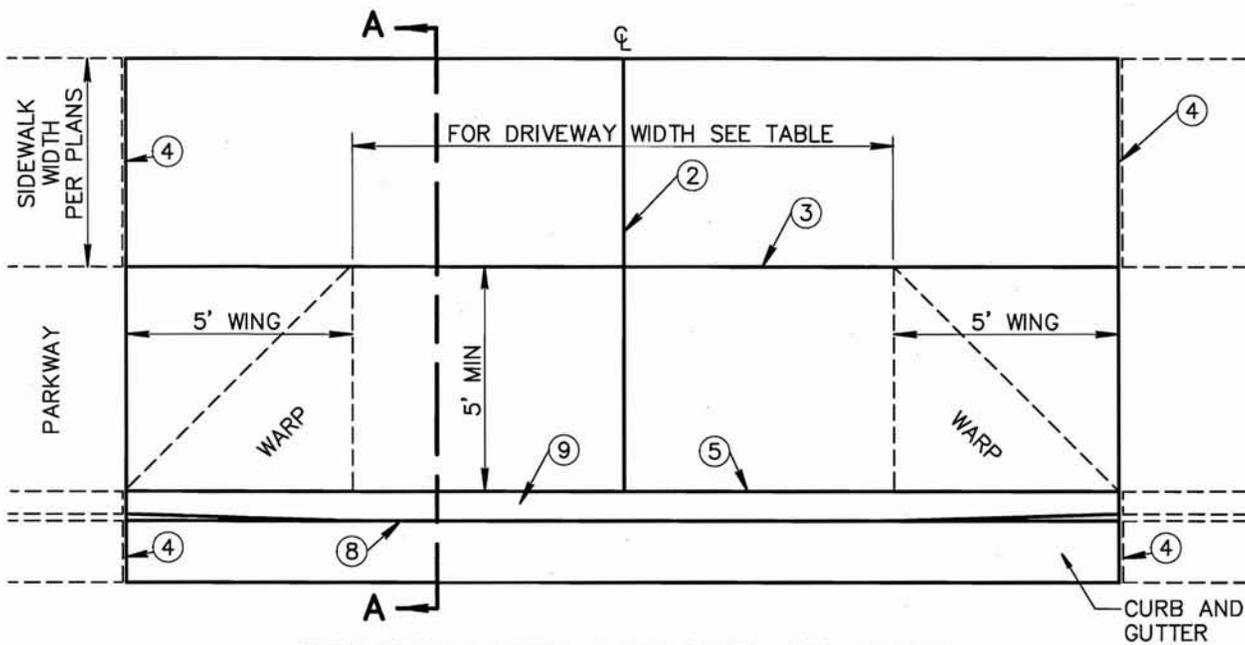
**REVISION:**

Change the outside edge depth of valley gutters from 8" to 10".

**NOTES:**

1. ALL CONCRETE TO BE CLASS 'A' UNLESS OTHERWISE APPROVED. (SECT. 725).
2. 4' ON PROJECTS UNDER THE JURISDICTION OF THE COUNTY ENGINEER AND THE CITY OF MESA.
3. EITHER CONSTRUCTION JOINT OR CONTRACTION JOINT IS REQUIRED AT CENTERLINE OF STREET.
4. A SEPARATE CONCRETE PAD IS REQUIRED WHEN VALLEY GUTTER IS POURED HALF AT A TIME.
5. EXPANSION JOINTS SHALL CONFORM TO SECT. 340.

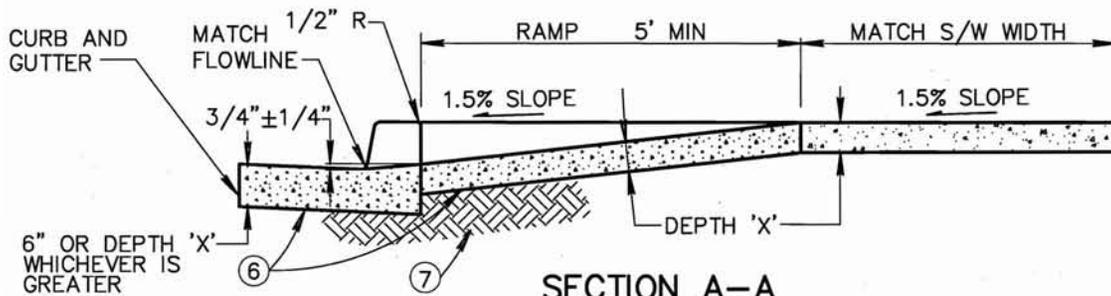
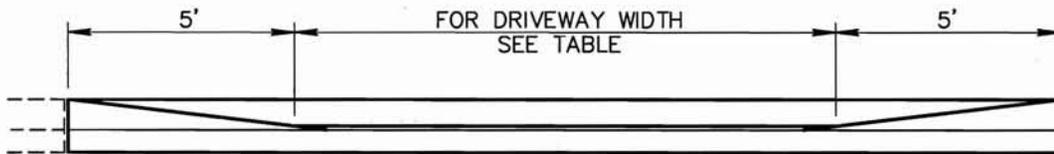




**DRIVEWAY WITH DETACHED SIDEWALK**

**NOTES:**

1. DEPRESSED CURB SHALL BE PAID FOR AT THE UNIT PRICE BID FOR THE TYPE OF CURB USED AT THAT LOCATION.
2. CONTRACTION JOINT ON D/W CENTERLINE.
3. CONTRACTION JOINT.
4. 1/2-INCH EXPANSION JOINTS SHALL COMPLY WITH SECTION 340.
5. BACK OF CURB - CONSTRUCTION JOINT.
6. CONCRETE CLASS AS NOTED IN TABLE. CONCRETE PER SECTION 725.
7. SUBGRADE PREPARATION, SECT. 301.
8. FLOW LINE OF GUTTER.
9. DEPRESSED CURB.
10. SECT. A-A AND ELEVATION: D/W SHOWN WITH VERTICAL CURB AND GUTTER, ROLL TYPE CURB AND GUTTER TREATED SIMILARLY.
11. ROUGH BROOM FINISH FULL WIDTH OF RAMP AND WINGS. TROWEL AND USE LIGHT HAIR BROOM FINISH FOR WALKWAY AREA.



**SECTION A-A**

COMMERCIAL AND INDUSTRIAL				
DRIVEWAY WIDTH	MIN.	MAX.	CLASS	DEPTH 'X'
COMMERCIAL	* 16'	40'	A	9"
INDUSTRIAL	* 16'	40'	A	9"
* 24' MIN. FOR TWO WAY TRAFFIC				
RESIDENTIAL				
DRIVEWAY WIDTH	MIN.	MAX.	CLASS	DEPTH 'X'
MAJOR STREET	16'	30'	B	5"
COLLECTOR STREET	* 12'	30'	B	5"
LOCAL STREET	12'	30'	B	5"
* 16' DESIRABLE				

DETAIL NO.

**250-1**



STANDARD DETAIL  
ENGLISH

**DRIVEWAY ENTRANCES WITH  
DETACHED SIDEWALK**

REVISED

01-01-2009

DETAIL NO.

**250-1**



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P.O. Box 52025  
Phoenix, AZ 85072-2025  
(602) 236-5900

DATE: March 4, 2009

TO: MAG Specifications and Details Committee Members

FROM: Peter Kandaris, SRP Representative

RE: **Request for Modifying MAG 792 "Dust Palliative"**

**Purpose:** Provide revisions to MAG 792 to (a) update products information based on changes in the market, (b) include submittal of compliance requirements for product data, and (c) provide more defined environmental requirements.

**Rational:** The existing specifications (last revised in 2000) do not give methods to objectively qualify vendors or their products. Changes are proposed so that quantitative data can be obtained and reviewed instead of just relying on vendor sales information.

Since the last time these specifications were revised there have been a number of changes in dust control materials. Additionally, other area agencies have revised their specifications to include their experiences and updated practices. It is recommended that the dust palliative specifications be updated to include the most recent improvements in product and vendor verification.

SECTION 792

DUST PALLIATIVE

792.1 GENERAL:

Dust palliatives shall consist of various chemical dust suppressants which work by binding together lighter soil particles. All materials must meet the environmental requirements of Section 792.3 and must be approved by the Engineer prior to their use.

792.2 TYPE OF MATERIALS AND APPLICATION RATES:

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

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

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

Product Type	Use/Treatment <sup>(1)</sup>	Dilution Ratio <sup>(2)</sup>		Application Rate <sup>(3)</sup> (gal/sy) [l/m <sup>2</sup> ]
		Range	Typical	
Acrylic Copolymer and Polymer	Topical - Road or parking Lot	20:1 to 4:1	9:1	<del>0.20 to 0.10</del>
	Topical - Road Shoulder	20:1 to 4:1	15:1	<del>0.16 to 0.09</del>
	Surface Course (per inch of depth)	20:1 to 4:1	9:1	<del>0.10 to 0.06</del>
Petroleum Resin Emulsified	Topical - Road or parking Lot	4:1	4:1	0.15 to 0.10
	Topical - Road Shoulder	10:1 to 7:1	8:1	0.15 to 0.07
	Surface Course (per inch of depth)	4:1	4:1	0.11 to 0.07
Lignin-Based Type (Lignosulfonate)	Topical - Road or parking Lot	1:1	1:1	0.10 to 0.05
	Topical - Road Shoulder	7:1 to 4:1	4:1	0.05 to 0.03
	Surface Course (per inch of depth)	1:1	1:1	0.30 to 0.10
Organic Resin	Topical - All	10:1 to 2:1	5:1	0.25 to 0.15
	Surface Course (per inch of depth)	2:1 to 1:1	1:1	0.15 to 0.10
Other	As approved by the Engineer			

Based on input from product vendors, the values for polymers needed to be adjusted. Also, the market is now broadened to both polymers and copolymers. Changes are intended to keep up with changes in products.

0.20 to 0.15  
0.16 to 0.12  
0.08 to 0.06

Paragraph included to insure testing and product compliance are performed, with the responsibility on the contractor.

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

(A) Acrylic Copolymer Types: \_\_\_\_\_ and Polymer

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

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

SECTION 792

Specification Designation	ASTM Test Method	Requirements
Composition	-	Acrylics, acrylates & acetates
pH	E 70	4.0 - 9.5
Residue (active solids content), %	D 244	40 min.
Flash Point, °F	D 92	None
Absolute Viscosity (Brookfield), cP, 77 °F.	-	1500 max.
Specific Gravity, 60/60 °F.	D 1298	1.00 - 1.15

Language from COP Aviation specification for acrylic products to quantify the binding characteristics of the product.

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

(B) Petroleum Resin Emulsified Types:

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

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

Specification Designation	ASTM Test Method	Requirements
Kinematic Viscosity, SFS at 77 °F.	D 244	15 min.
pH	E 70	4.0 - 7.0
Residue, % wt. (1)	D 244	64±4
Sieve Test, % wt. Retained (2)	D 244	0.1 max.
Particle Charge Test	D 244	Positive
Flash Point of base product, CO, °F.	D 92	400 °F. min.
Specific Gravity of base product, 60/60°F.	D 1298	1.00 to 1.04

(A) ASTM test modified by heating 50 g of sample to 300 °F. until foaming ceases, then cooling immediately and calculation results.

(B) Replace 2% sodium oleate solution with distilled water in test.

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

(C) Lignin-Based Types:

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

Specification Designation	ASTM Test Method	Requirements
Absolute Viscosity (Brookfield), cP, 77°F.	-	< 1,000
Residue (total solids content), %	D 244	48 min.
Lignin sulfonate content (% of solids)	D 244	60 min.
pH	E 70	5.0 - 7.0
Specific Gravity (liquid), 77/60°F.	D 1298	1.00 min.

SECTION 792

(D) Organic Resinous Types:

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

Specification Designation	Test Method	ASTM	Requirements
Absolute Viscosity (Brookfield), cP, 77°F	-		50 - 200
PH	E 70		3.0 - 9.0
Residue (active solids content), %	D 244		45 min
Flash Point	D 92		None
Specific Gravity, 60/60°F	D 1298		1.00 min.

(E) Other Types:

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

792.3 ENVIRONMENTAL CRITERIA:

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

Products and their degradation products shall not be composed of elements, compounds, mixtures or produce runoffs with the characteristics identified under Arizona Revised Statutes 36-2822 of the Arizona Hazardous Waste Management Act, emit or off-gas during placement, use or degradation of any hazardous air pollutant listed under Section 112 of the Federal Clean Air Act [42 U.S.C. § 7412], be a hazardous chemical substance or mixture pursuant to Section 7 of the Federal Toxic Substances Control Act [15 U.S.C. § 2606], be designated by rule an extremely hazardous chemical substance pursuant to the Arizona Environmental Quality Act, ~~produce runoffs that contain concentrations exceeding the parameters designated in Section 2.18 Table 5 of the National Pollution Discharge Elimination System (NPDES) Multi-Sector General Permit for Industrial Activities. (see Note A),~~ be prohibited for use by the Arizona Department of Environmental Quality, the Environmental Protection Agency, or any applicable law, rule or regulation.

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

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

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

End of Section

Paragraph included to insure testing and product compliance are performed, with the responsibility on the contractor.

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

Included to provide more defined method to insure environmental compliance (language adapted from COP Aviation specification).

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

- A. Complete aquatic toxicity test for lethal concentration at 50% (LC50).
- B. Provide complete and accurate listing of all individual chemical constituents (including proprietary chemical information) and percentage of each in a given volume of pure chemical product.
- C. Surface water runoff test. This test involves running distilled water over a treated soil area, collecting the test water, and submitting to a certified lab for analysis.

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