

September 24, 2014

TO: Members of the MAG Standard Specifications and Details Committee

FROM: Tom Wilhite, City of Tempe, Chair

SUBJECT: MEETING NOTIFICATION AND TRANSMITTAL OF TENTATIVE AGENDA

Wednesday, October 1, 2014 at 1:30 p.m.
MAG Office, Suite 200 (Second Floor), Ironwood Room
302 North 1st Avenue, Phoenix

A meeting of the MAG Specifications and Details Committee has been scheduled for the time and place noted above. Members of the MAG Specifications and Details Committee may attend the meeting either in person, by videoconference or by telephone conference call. If you have any questions regarding the meeting, please contact Committee Chair Tom Wilhite at 480-350-2921 or Gordon Tyus, MAG staff at 602-254-6300.

In 1996, the Regional Council approved a simple majority quorum for all MAG advisory committees. If the MAG Specifications and Details Committee does not meet the quorum requirement, no action can be taken. Attendance at the meeting is strongly encouraged.

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. Requests should be made as early as possible to allow time to arrange the accommodation.

It is requested (not required) that written comments on active cases be prepared in advance for distribution at the meeting.

MAG Standard Specifications and Details Committee
TENTATIVE AGENDA
October 1, 2014

COMMITTEE ACTION REQUESTED

1. Call to Order and Introductions
2. Call to the Audience
An opportunity is provided to the public to address the MAG Specifications and Details Committee on items that are not on the agenda that are within the jurisdiction of MAG, or non-action agenda items that are on the agenda for discussion or information only. Citizens will be requested not to exceed a three minute time period for their comments. A total of 15 minutes will be provided for the Call to the Audience agenda item, unless the committee requests an exception to this limit. Please note that those wishing to comment on agenda items posted for action will be provided the opportunity at the time the item is heard.
3. Approval of September 3, 2014, Meeting Minutes

2. Information.

3. **Review and approve minutes of the September 3, 2014 meeting.**

Carry Forward Cases from 2013

4. Case 13-15:
Revisions to MAG Sections 101, 601, 603, 615 and 618 for installing rigid and flexible pipe. Update Details 200-1, 200-2 and 212. Update references in 206, 335, 739, and 740.

4. **Information, discussion and possible action.**
Sponsor: Warren White, Chandler,
Updated

New Cases for 2014

5. Case 14-01: Misc. Corrections
 - A. Change "transverse" to "longitudinal" in Section 321.8.2
 - B. In section 739.1 delete the extra occurrence of the word 'Pipe'.
 - C. Delete "OR BRICK" from the title of Section 345.
 - D. Change "forecast" to "for cast" in Section 750.3 Joint Requirements.
 - E. Revise working in Section 107.11 to match "careful and prudent manner in Section 101.2.
 - F. Change "off" to "of" in Section 211.3
 - G. Change "values" to "valves" in 336, 345, 616.
 - H. Remove steps from Details 429 and 522.

5. **Information, discussion and possible action.**
Sponsors: Rod Ramos, Scottsdale
Bob Herz, MCDOT, Jami Erickson, Phoenix.
Craig Sharp, Buckeye
Updated

- 6. Case 14-13: Revisions to Section 321.
Incorporate MCDOT enhancements to Section 321 PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT into the MAG Specifications.
- 7. Case 14-19: Revisions to Section 325 and 717
Add provisions for terminal-blended asphalt-rubber binder (ARB).

- 6. **Information, discussion and possible action.**
Sponsor: Bob Herz, MCDOT
Updated
- 7. **Information, discussion and possible action.**
Sponsor: Brian Gallimore, Materials WG
Updated

General Discussion

- 8. Working Group Reports

- 8. Information and discussion.
Water/Sewer Chair: Jim Badowich
09/11/14 Meeting

Asphalt Chair: Jeff Benedict

Materials Chair: Brian Gallimore

Concrete Chair: Jeff Hearne

Outside ROW: Peter Kandarlis

- 9. General Discussion

- 9. Information and discussion.

- 10. Request for Future Agenda Items

- 10. Information and discussion.

Adjournment

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

September 3, 2014

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

AGENCY MEMBERS

Jim Badowich, Avondale, Vice Chair	Julie Christoph, Mesa
Al Gonzales, Buckeye (proxy)	Dan Nissen, Peoria
Warren White, Chandler	Syd Anderson, Phoenix (St. Trans.)
Antonio Hernandez, El Mirage	Jami Erickson, Phoenix (Water)
* Wayne Costa, Florence	Rod Ramos, Scottsdale
* Tom Condit, Gilbert	Dan Shaffer, Surprise
Mark Ivanich, Glendale	Tom Wilhite, Tempe, Chair
* Tom Vassalo, Goodyear	Harvey Estrada, Valley Metro (audio)
Bob Herz, MCDOT	Gregory Arrington, Youngtown

ADVISORY MEMBERS

Jeff Benedict, ARPA	Jeff Hearne, ARPA
* Arvid Veidmark, AZUCA	Peter Kandarlis, Independent
Mike Sanders, AZUCA	* Paul R. Nebeker, Independent
* Adrian Green, AGC	Jacob Rodriguez, SRP
Brian Gallimore, AGC	

MAG ADMINISTRATIVE STAFF

Gordon Tyus

* Members not attending or represented by proxy.

GUESTS/VISITORS

Stew Waller, Rinker
Mike S. Molina, Oldcastle Precast

1. Call to Order

Chair Tom Wilhite called the meeting to order at 1:34 p.m.

2. Call to the Audience

Chair Wilhite introduced Al Gonzales from the City of Buckeye, filling in for Craig Sharp. Mr. Wilhite then opened the call to the audience. No members of the audience requested to speak.

3. Approval of Minutes

The members reviewed the August 6, 2014 meeting minutes. Rod Ramos moved to accept the minutes as written. Warren White seconded the motion. A voice vote of all ayes and no nays was recorded.

Carry Forward 2013 Cases

4. Case 13-15: Revisions to MAG Sections 101, 601, 603, 615 and 618 for Rigid and Flexible Pipe. Updates to Details 200-1, 200-2 and 212.

Update pipe installation requirements. Chair Wilhite announced that he would like to move this item to be the last case discussed during the meeting, so that the committee could take action on cases ready for a vote. The case sponsor and members agreed.

5. Case 13-21: Create a new Section 742 Pre Cast Manholes. Add detail drawings for construction and installation. Update existing manhole details.

Update specifications and details for pre-cast manhole bases and other corrections.

Al Gonzales said Craig Sharp mentioned to him that an update to Detail 420-2 was made to add filter fabric when using #57 rock in wet conditions. (*Shown in the red box and related to Note 5.*) Bob Herz suggested deleting the reference to #57 rock from the detail, and make the default ABC. Jim Badowich said the rock was designed to create a leveling course so the inlets are correctly aligned. Mark Ivanich asked if the #57 rock was only to be used for wet conditions. Jim Badowich stated that if you had wet conditions the Engineer could modify the requirements. After some discussion, the committee agreed to delete the note in the red box and change Note 5 to read: ALL PRECAST MANHOLE BASES SHALL BE PLACED ON 8" MINIMUM OF ABC PER SECTION 702 COMPACTED TO 100% MAXIMUM DENSITY.

Rod Ramos asked if a dimension was needed to show how far the rock extended. Mr. Badowich said that it was typically whatever size the excavation for the base was. Mr. Ramos suggested showing the line of the trench with earth hatching extending up the sides of the ABC to make that clear. Members agreed to this modification.

On Detail 422 a note was added at the request of Phoenix to label the spacer requirements. This was added to the detail as shown in the red box on the handout. Tom Wilhite suggested

clarifying the note by using a table to specify the type of spacer based on the required thickness. The note would then look like the table below:

SPACER TYPE	REQUIRED THICKNESS
BRICK	GREATER THAN 2"
4"x2" STEEL SPACER	½" TO 2"
GROUT	LESS THAN ½"

Mr. Tyus suggested removing the concrete hatch pattern from the plan view, since it is not a section. Bob Herz moved to accept Case 13-21 with the reversions of Section 742, Details 420-1 and 421 provided in the packet, and the revised Details 420-2 as amended and 422 as amended, based on the discussions noted above. The motion was seconded by Jim Badowich. A roll call vote was taken and the case was approved: 14 yes, 0 no, 0 abstaining and 3 not present.

6. Case 13-22: Update Sections 625 and 775 to remove references to the use of bricks in manholes and remove references to manhole steps.

A final version of the case was provided in the agenda packet and included revisions based on input from Maricopa County, and the deletion of Detail 428 – Manhole Steps, as discussed at the prior meeting. Al Gonzales did not have any additional input on the case. Bob Herz had a few minor corrections to Section 625. In the fifth paragraph under 625.2 Materials, he requested to add “sanitary sewer” in front of the word “manholes.” He said this was needed because manholes are also used for storm sewers, and this specification should not apply in this case. In the next sentence he suggested clarifying it to read, “Manhole frame **and cover per** Section 787...” (*The bold words were added.*) Mr. Herz also noted that a stray comma before the second sentence in 625.3.1 should be deleted, and the stray letter “e” should be deleted from the second paragraph of this section. Finally he asked to modify the fourth paragraph in Section 625.3.1 to read, “A **cast-in-place** concrete foundation of Class A concrete shall be **constructed** in accordance with the standard details and Section 505.”

Warren White moved to accept Case 13-22 with the revisions to Section 625 as described by Mr. Herz (shown above). Mark Ivanich seconded the motion. A roll call vote was taken and the case was approved: 14 yes, 0 no, 0 abstaining and 3 not present.

New Cases for 2014

7. Case 14-01: Miscellaneous Corrections.

- A. Change "transverse" to "longitudinal" in Section 321.8.2.
- B. In section 739.1, delete the extra occurrence of the word ‘Pipe’.
- C. Delete “OR BRICK” from the title of Section 342.
- D. Change “forecast” to “for cast” in Section 750.3 JOINT REQUIREMENTS.
- E. Revise working in Section 107.11 to match “careful and prudent manner” in Section 101.2.

Since it was clear that the committee would need to meet in October to finish business on some other cases, Chair Wilhite suggested that voting on the case be postponed until October, so if any additional corrections are found in the next month, they can be added.

8. Case 14-03: Updates to Guardrail Details.

Make revisions to Section 415 and/or include guardrail details in MAG. Bob Herz said this case will carry over to 2015.

9. Case 14-06: Revisions to Section 718 Preservative Seal for Asphalt Concrete.

Update the specifications for the Type C preservative seal. Jeff Benedict said this case will be carried forward to next year.

10. Case 14-11: Delete the use of Asbestos-Cement Pipe in Valve Box Installations.

Replace ACP with PVC C900 pipe in Detail 391-2 and make associated drawing changes to Details 391-1 and 392. Also update Section 610.7. Bob Herz said the current version that was distributed has the final revised drawings which removed references to 12” riser pipe as discussed at a previous meeting. Other revisions were noted on the case cover sheet, including revising Note 1 on Detail 392. Seeing no additional comments, Mr. Herz moved to accept Case 14-11 as presented. Antonio Hernandez seconded the motion. A roll call vote was taken and the case was approved: 14 yes, 0 no, 0 abstaining and 3 not present.

11. Case 14-12: Proposed Revisions to Sections 336.3 and 336.4.

Add pavement removal criteria to prevent full depth pavement cuts from being located within a lane wheel path and to prevent creation of narrow pavement edge strips. Bob Herz said that the case would be carried forward to next year.

12. Case 14-13: Revisions to Section 321. Incorporate MCDOT Supplements.

Incorporate MCDOT enhancements to Section 321 PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT into the MAG Specifications. Mr. Herz said that the final revisions are shown in yellow (*if you have a color copy from the MAG website*). He highlighted changes including the first paragraph in 321.8 Placement which had been rewritten. Other changes were made to clarify acceptance requirements. The sentence “The contracting agency shall provide an appropriately accredited laboratory or laboratories to perform the acceptance testing” was added to Section 321.10.1. A few other minor corrections were also made to this paragraph.

Section 321.10.4 Asphalt Pavement Thickness Mr. Herz discussed testing the thickness of each layer vs. testing the total thickness, and how this related to assessed penalties for deficiencies. If the first course was a little shy, the contractor can make it up on the next layer. Mr. Hernandez asked about different material types for the different layers could affect the strength and payment. Brian Gallimore said there was not much difference in cost from the base course

and the surface course. Mr. Hernandez stated that it was the contractor's job to make sure the thicknesses were correct, and that the 1/4" tolerance currently in the MAG spec was sufficient allowance for thickness variation and the thickness penalties should apply to each individual lift not the total of all lifts. Bob Herz said that the structural number did not change with different asphalt mix designs and if the total pavement thickness is obtained, the pavement design strength is achieved and no penalty based on thickness should be assessed. In any case, he said the assessment of penalties for pavement thickness needs to be clarified as to whether it is applied to each individual course or to the overall final thickness. Jeff Benedict noted that the agency still has full control over the issue.

Mr. Herz also noted that Table 321-9 updated the penalties for air voids. This was an oversight that was missed from a previous case (13-09) that adjusted the asphalt penalties in Tables 321-5 and 321-8. Julie Christoph asked if this effected rubber asphalt. Jeff Benedict said no, asphalt-rubber was covered in Section 325. Warren White asked about adding the date to note when penalty tables were updated. Mr. Benedict preferred not to include a date.

Due to the difference in opinion during the discussion concerning how the thickness penalties should be applied, Mr. Herz suggested postponing the vote on this case until October to allow time for each agency to have internal discussions to determine the preferred method for applying the thickness penalty and to complete a final review of this case. MCDOT believes and has adjusted the text such that the thickness of each lift will be determined but the penalty is only applied to the final total thickness of all layers of the asphalt pavement.

13. Case 14-14: Consolidate all testing requirements in a new Section 611.

Create a new Section 611 and update existing specifications to delete testing specs and refer to the appropriate information in new Section 611. Jami Erickson handed out the final revised version of the case in color so members could see what final changes were highlighted. This was the same version provided in the packet. Ms. Erickson noted the final revisions highlighted in blue that included a revision to the language on Deflection Test of HDPE and PVC Pipe. Instead of just saying that if the pipe fails the deflection test it shall be corrected, the word "corrected" was deleted and replaced with "evaluated and an appropriate remedy, if any, shall be performed." This would give agencies more latitude to determine corrective measures. This same language was added to the section on Video Inspection testing as well. Jami Erickson moved to accept the case as presented. Mr. Tyus asked to clarify that this included removing and referencing all the affected text in other sections that were moved. Ms. Erickson agreed that the case included this as well. Jim Badowich seconded the motion. A roll call vote was taken and the case was approved: 14 yes, 0 no, 0 abstaining and 3 not present.

14. Case 14-15: Updates and revisions to Section 610.

Move Hydrostatic Testing from Section 610 to Section 611, update Table 610-1 to be consistent with AWWA, place Section 610 into sequential order. Jim Badowich highlighted major changes to Section 610. He said that items in red were changes, items in green just moved from another part to make the section flow more naturally. In addition to moving the testing sections into Section 611, the case made a few minor corrections and updated the polywrap table sizes. He

said the case was discussed at the last Water/Sewer Working Group meeting, where they determined to remove the text “without the appropriate use of bends or offsets” from the first sentence of 610.4.2 Laying Pipe.

Rod Ramos asked who uses C900 pipe. Antonio Hernandez said it is used by private developments. Al Gonzales said Buckeye has private water companies that have used C900 in part of the Verado development. Rod Ramos said Scottsdale has had problems with it, and is spending more than a million dollars a year to replace it. Most agencies require ductile iron pipe. Jim Badowich said Avondale has used it, but they are trying to phase it out. Seeing no further discussion, Jim Badowich moved and Bob Herz seconded a motion to accept Case 14-15 as presented. A roll call vote was taken and the case was approved: 14 yes, 0 no, 0 abstaining and 3 not present.

15. Case 14-16: Revision to Section 310 - Placement and Construction of Aggregate Base Course.

Change rock correction method to be consistent with Section 301. Brian Gallimore said he has not received any comments on the case to change the rock correction method in 310.3 to ARIZ-227C to be consistent with Section 301. Brian Gallimore moved and Bob Herz seconded a motion to accept case 14-16 as presented. A roll call vote was taken and the case was approved: 14 yes, 0 no, 0 abstaining and 3 not present.

16. Case 14-17: Create New Section 322 - Asphalt Stamping.

Provide specifications for materials and methods of Asphalt Stamping. Brian Gallimore said that he reached out to industry regarding the question of a warranty on the work done. He was also researching more information on paint and grooves. Mr. Gallimore proposed carrying the case forward to next year for additional review.

17. Case 14-18: Revise Terminology in Section 340.

Change all occurrences of the term “sidewalk ramp” in section 340 to “curb ramp” to prevent confusion. Bob Herz said this case uses terminology consistent with ADA. Other earlier proposed revisions were deleted from this case. Mr. Herz moved and Mr. White seconded the motion to accept Case 14-18 as presented. A roll call vote was taken and the case was approved: 14 yes, 0 no, 0 abstaining and 3 not present.

18. Case 14-19: Revisions to Section 325 and 717.

Add provisions for terminal-blended asphalt-rubber binder (ARB). Brian Gallimore handed out a color copy version of the case showing the changes. He said the case was discussed at the last Asphalt/Materials Working Group meeting. Essentially the case provides the provisions to conduct on-grade testing of asphalt rubber, rather than only at the facility, since only Mesa, Phoenix and MCDOT have this capability. A summary of the changes were provided on the case cover sheet. Mr. Gallimore asked members to review these proposed changes and prepare for a possible vote at the next committee meeting.

19. Case 13-15: Revisions to MAG Sections 101, 601, 603, 615, 618, and 735 for Rigid and Flexible Pipe. Updates to Details 200-1, 200-2 and 212.

Update pipe installation requirements. Warren White said that several handouts were provided at the meeting including a redlined version, a final version and a copy of comments provided by Bob Herz. Mr. White began discussion by summarizing some of the changes made based on comments from Maricopa County and the working group meeting. One of the major changes in the version handed out was to combine Sections 601 and 603 as suggested by Mr. Herz. Since much of the two sections were identical, combining them was rather straight-forward, only the trench widths, type of backfill and depth requirements were different for rigid and flexible pipe types. Mr. White said combining them would also make it easier to update in the future rather than to keep two sections in sync. Mr. Herz noted that he provided a separate handout (with a black clip) that outlined all his comments and proposed changes.

Next, Mr. White referred to the changes to a couple definitions in Section 101. He agreed with Mr. Herz to delete the Native Material listing (since native backfill material was defined in Section 601) and revise the definition of Springline so it would be valid for non-circular shaped conduits. Warren White said he also included minor revisions to Section 615 and changes to Sections 618 and 735 to take into account previously passed cases.

Warren White then discussed updates to the detail drawings based on feedback during the working group meeting and MCDOT comments. For Detail 200-1 he wanted to change the symbol for the Type “D” trench repair and correct the terminology to match by changing “Bedding” to “Initial Backfill” in Note 3. It would also delete the reference to Section 603 since it would be combined with 601. For Detail 200-2 Note 1 was revised to also only refer to Section 601 and not 603. Mr. Herz suggested removing the text (IF REQUIRED) from under the FOUNDATION note, since there would always be a foundation. Revisions to Detail 212 were also added to the case due to the changes in backfill terminology and exact Section number references.

Mr. White then continued detailed discussion on revisions to Section 601. Under Section 601.1 Description, members discussed clarifying what was considered rigid and flexible pipe types. Warren White said he could add back in the specific list of pipe types. Under 601.4.1 Foundation, Bob Herz suggested removing the word graded from the first sentence. Mr. White said the Bedding section (601.4.2) referred back to the trenching area for depth and grading requirements. Mr. Tyus suggested changing the first sentence back as it was previously because it currently was an incomplete sentence.

Next was a lengthy discussion on the default fill material for the haunching area and initial backfill. Two options were presented. The first was to use MAG ABC per Section 702 as the default fill. This is what the working group recommended, and what the majority of agencies specify. Another option was to use granular materials as it currently is defined in MAG. Bob Herz suggested this be the default, because it would be more economical if contractors could use native fill materials meeting the granular spec, rather than requiring ABC. Jim Badowich felt that the granular fill spec was too loosely defined. He also worried that the testing of the native materials may not be sufficient to assure the fill continues to meet the granular fill

requirement as soil conditions change. Brian Gallimore said typically the material is stockpiled where it can be tested. Antonio Hernandez said that native material can still be used for the final backfill material.

Mr. Tyus asked if the granular fill definition would exclude the use of recycled materials if ABC was used as the fill material. Julie Christoph was concerned about the use of recycled concrete because Mesa had problems with recycled concrete that was infused with hazardous material. Peter Kandarlis said this issue could be addressed with a separate case focused on the material spec. Jeff Hearne said Section 701.4 says any recycled material must not have any hazardous material, and 702 states that base materials must be uniformly blended. Ms. Christoph said you have to rely on the information from the plant, and said Mesa will not allow recycled materials in ABC. Jim Badowich suggested that a specification for a cleaner type of ABC could be developed for trench backfill. He said the bottom line was that most agencies currently specify MAG ABC in the pipe zone.

Next Mr. White said changes to Section 735 and Detail 212 were impacted by the RCP pipe case. Mr. Badowich, said he would schedule a Water/Sewer working group that Mr. White and Mr. Herz could attend, to discuss outstanding issues. They decided to meet on Thursday, September 11th at 1:30 p.m. Warren White said he believed they could finish a complete and agreed upon package ready for a vote at the October 1st meeting.

20. Working Group Reports

Due to the lateness of the meeting, Chair Wilhite proposed skipping the working group reports since written notes were provided in the packet.

a. **Water/Sewer Issues Working Group**

The next meeting is scheduled for Thursday, September 11, at 1:30 p.m. in the MAG office.

b. **Asphalt/Materials Working Groups**

c. **Concrete Working Group**

d. **Outside Right-of-Way Working Group**

21. General Discussion

Public Works Directors Mail List. Gordon Tyus asked agency members to review the contact list of public works director and provide any updates to him. Contacts on the mail list will receive copies of the final update packets to review prior to printing next year's edition.

22. Adjournment:

Seeing no further business the meeting was adjourned at 3:55 p.m.

2014 PROPOSED REVISIONS TO MAG SPECIFICATIONS AND DETAILS

(Updated information can be found on the website: <http://www.azmag.gov/Projects/Project.asp?CMSID=1055&CMSID2=5827>)

CASE	DESCRIPTION	PROPOSED BY	MEMBER	SUBMITTAL DATE Last Revision	VOTE DATE	VOTE	
	CARRY FORWARD CASES FROM 2013						
13-15	Case 13-15: Revisions to MAG Sections 101, 601, 603, 615, 618 and 735 for installing rigid and flexible pipe. Update Detail 200-1, 200-2 and 212.	Chandler/ Water-Sewer WG	Warren White	05/01/2013 09/18/2014	10/01/2014	0 0 0	Yes No Abstain
13-21	Case 13-21: Create a new Section 742 Pre Cast Manhole Bases. Add detail drawings for construction and installation. Update existing manhole details.	Buckeye/ Water-Sewer WG	Craig Sharp	06/05/2013 09/03/2014	Approved 09/03/2014	14 0 0	Yes No Abstain
13-22	Case 13-22: Update Sections 625 and 775 to remove references to steps and the use of bricks in manholes. Delete Detail 428 Manhole Steps.	Buckeye/ Water-Sewer WG	Craig Sharp	06/05/2013 09/03/2014	Approved 09/03/2014	14 0 0	Yes No Abstain
	NEW CASES FOR 2014						
14-01	<p>Case 14-01: Miscellaneous Corrections:</p> <p>A. Change “transverse” to “longitudinal” in Section 321.8.2.</p> <p>B. In section 739.1 delete the extra occurrence of the word ‘Pipe’.</p> <p>C. Delete “OR BRICK” from the title of Section 342.</p> <p>D. Change “forecast” to “for cast” in Section 750.3 Joint Requirements.</p> <p>E. Revise working in Section 107.11 to match “careful and prudent manner” in Section 101.2.</p> <p>F. Change “off” to “of” in Section 211.3</p> <p>G. Change “values” to “valves” in 336, 345, and 616.</p> <p>H. Remove steps from Details 429 and 522.</p>	Scottsdale	Rod Ramos Bob Herz Jami Erickson	01/08/2014 08/13/2014	10/01/2014	0 0 0	Yes No Abstain
14-02	Case 14-02: Revision to Section 405 Monuments. Update specification to match current details and requirements.	MCDOT	Bob Herz	01/08/2014 05/08/2014	Approved 06/04/2014	12 0 0	Yes No Abstain
14-03	Case 14-03: Updates to Guardrail Details. Revisions to Section 415 and/or inclusion of MCDOT guardrail details.	MCDOT	Bob Herz	01/08/2014	Carry Forward	0 0 0	Yes No Abstain

2014 PROPOSED REVISIONS TO MAG SPECIFICATIONS AND DETAILS

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CASE	DESCRIPTION	PROPOSED BY	MEMBER	SUBMITTAL DATE Last Revision	VOTE DATE	VOTE	
14-04	Case 14-04: Revision to Detail 552 Concrete Cut-off Walls. Move cut-off walls away from roadway edge and delete design related notes.	MCDOT	Bob Herz	01/08/2014 02/20/2014	Approved 05/07/2014	12 0 1	Yes No Abstain
14-05	Case 14-05: Revisions to Section 324 Portland Cement Concrete Pavement.	Concrete WG	Jeff Hearne	02/05/2014 07/09/2014	Approved 08/06/2014	12 0 0	Yes No Abstain
14-06	Case 14-06: Revisions to Section 718 Preservative Seal for Asphalt Concrete.	Asphalt WG	Jeff Benedict	02/05/2014	Carry Forward	0 0 0	Yes No Abstain
14-07	Case 14-07: Revision to Section 735 Reinforced Concrete Pipe and Section 618 Storm Drain Construction. Add Elliptical and Arch Reinforced Concrete Pipe.	MCDOT	Bob Herz	04/02/2014	Approved 06/04/2014	12 0 0	Yes No Abstain
14-08	Case 14-08: New Section 607: Trenchless Installation of Smooth Wall Jacking Pipe. Includes Revisions to Section 618: Storm Drain Construction.	Water/Sewer WG	Jim Badowich	04/02/2014 06/04/2014	Approved 06/04/2014	12 0 0	Yes No Abstain
14-09	Case 14-09: Revision to Section 726 Concrete Curing Materials. Replace discontinued AASHTO references with current ASTM standards.	MCDOT	Bob Herz	04/02/2014	Approved 06/04/2014	12 0 0	Yes No Abstain
14-10	Case 14-10: Include Language to Allow Use of Warm Mix Asphalt. Update Sections 321 and 710.	Asphalt WG	Jeff Benedict	05/07/2014 06/30/2014	Approved 08/06/2014	12 0 0	Yes No Abstain
14-11	Case 14-11: Delete the use of Asbestos-Cement Pipe in Valve Box Installations. Revise Details 391-1, 391-2 and 392.	MCDOT	Bob Herz	06/04/2014 08/14/2014	Approved 09/03/2014	14 0 0	Yes No Abstain
14-12	Case 14-12: Proposed Revisions to Sections 336.3 and 336.4. Add pavement removal criteria to prevent full depth pavement cuts from being located within a lane wheel path and to prevent creation of narrow pavement edge strips.	MCDOT	Bob Herz	06/04/2014	Carry Forward	0 0 0	Yes No Abstain

2014 PROPOSED REVISIONS TO MAG SPECIFICATIONS AND DETAILS

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CASE	DESCRIPTION	PROPOSED BY	MEMBER	SUBMITTAL DATE Last Revision	VOTE DATE	VOTE	
14-13	Case 14-13: Revisions to Section 321. Incorporate MCDOT enhancements to Section 321 PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT into the MAG Specifications.	MCDOT	Bob Herz	06/04/2014 09/10/2014	10/01/2014	0 0 0	Yes No Abstain
14-14	Case 14-14: Consolidate all testing requirements in a new Section 611.	Phoenix	Jami Erickson	06/04/2014 08/10/2014	Approved 09/03/2014	14 0 0	Yes No Abstain
14-15	Case 14-15: Move Hydrostatic Testing from Section 610 to Section 611; update Table 610-1 consistent with AWWA; place Section 610 into sequential order.	Water/Sewer WG	Jim Badowich	06/04/2014 08/26/2014	Approved 09/03/2014	14 0 0	Yes No Abstain
14-16	Case 14-16: Revision to Section 310 - Placement and Construction of Aggregate Base Course. Change rock correction method to be consistent with Section 301.	Materials WG	Brian Gallimore	07/09/2014	Approved 09/03/2014	14 0 0	Yes No Abstain
14-17	Case 14-17: Create New Section 322 Asphalt Stamping. Provide specifications for materials and methods.	Materials WG	Brian Gallimore	07/09/2014	Carry Forward	0 0 0	Yes No Abstain
14-18	Case 14-18: Change all occurrences of the term "sidewalk ramp" in Section 340 to "curb ramp" to prevent confusion.	MCDOT	Bob Herz	07/09/2014 08/06/2014	Approved 09/03/2014	14 0 0	Yes No Abstain
14-19	Case 14-19: Revisions to Section 325 and 717. Add provisions for terminal-blended asphalt-rubber binder (ARB).	Materials WG	Brian Gallimore	07/09/2014 09/18/2014	10/01/2014	0 0 0	Yes No Abstain



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MEMORANDUM

Case # 13-15

DATE: September 18, 2014

TO: MAG Specifications and Details Committee Members

FROM: Warren White, City of Chandler Representative

SUBJECT: Status Update on Proposed Revisions to MAG Sections 101, 601, 603, 615, 618, and Detail 200

Update Case description posted on MAG website for additional impacts:

Current: Revisions to MAG Sections 101, 601, 603, 615 and 618 for flexible pipe.
Update Details 200-1 and 200-2.

Revised: Revisions to MAG Sections 101, **206, 355**, 601, 603, 615, 618, **735, 739**, and **740**. Update Details 200-1, 200-2, and **212**.

It impacts the following specification sections:

- 101 ABBREVIATIONS AND DEFINITIONS – new and revised abbreviations and definitions – *Revised 9/18/14*
- 206 STRUCTURE EXCAVATION AND BACKFILL – revisions to coordinate with Table 601-2 – *Revised 9/4/14 (Bob Herz)*
- 355 UTILITY POTHOLES-KEYHOLE METHOD – revision to Section 355.3.1 for native backfill and Section 601 changes – *See Minor Revision Summary 9/18/14*
- 601 TRENCH EXCAVATION, BACKFILLING AND COMPACTION - *Revised 9/18/14*
- 603 Current Case efforts on flexible spec – Combined into 601 and then 603 is to be deleted.
- 615 SANITARY SEWER LINE CONSTRUCTION – *Revised 9/18/14*
- 618 STORM DRAIN CONSTRUCTION - *Revised 6/27/14 (Bob Herz)*
- 735 REINFORCED CONCRETE PIPE – Adjustments made due to revisions in Section 618 and changes approved by Case 14-07 - *Revised 6/27/14 (Bob Herz)*
- 739.1 – Change the 603 reference to 601 – *See Minor Revision Summary 9/18/14*
- 740.1 – Change the 603 reference to 601– *See Minor Revision Summary 9/18/14*

It impacts the following Standard Details:

- 200-1 and 200-2 BACKFILL, PAVEMENT AND SURFACE REPLACEMENT - *Revised 9/16/14*
- 212 UTILITY POTHOLE REPAIR – revisions to backfill for Section 601 changes - *Revised 9/17/14*

Case 13-15 – Minor revisions to Sections impacted by changes to Section 601

- Section 206 STRUCTURE EXCAVATION AND BACKFILL

See attached 2014-09-04 revision

- Section 355 UTILITY POTHoles-KEYHOLE METHOD

Proposed

355.3.1 Backfill Using Mechanical Compaction: Backfill shall be aggregate base per Section 702 or native backfill material soil per Section 601-4.3, placed in maximum 6 to 8-inch loose lifts.

Final

355.3.1 Backfill Using Mechanical Compaction: Backfill shall be aggregate base per Section 702 or native backfill material per Section 601, placed in maximum 6 to 8-inch loose lifts

- Section 739 STEEL REINFORCED POLYETHYLENE PIPE AND FITTINGS FOR STORM DRAIN, IRRIGATION AND SANITARY SEWER

739.1 GENERAL:

This specification covers the requirements of Steel Reinforced Polyethylene Pipe (SRPE) pipe manufactured per ASTM F2562 for storm drains, irrigation and sanitary sewer systems. When noted on the plans or in the special provisions, storm drains, irrigation and sanitary sewers may be constructed using SRPE pipe. SRPE pipe shall be designed in accordance with AASHTO LRFD Bridge Design

Specifications, Section 12. Trench excavation, backfilling and compaction for this flexible pipe shall be in accordance with Section ~~603~~ 601. Construction and installation shall be in accordance with Section 618 for storm drain and irrigation water or Section 615 for sanitary sewers.

The pipe stiffness class shall be Class 1, per Table 1 of ASTM F2562, unless otherwise specified.

- Section 740 POLYPROPYLENE PIPE AND FITTINGS FOR STORM DRAIN, IRRIGATION AND SANITARY SEWER

740.1 GENERAL:

This specification covers the requirements of profile wall (both dual wall - Type S and triple wall - Type D) polypropylene (PP) pipe manufactured per ASTM F2736 and AASHTO M330 for storm drain, or ASTM F2736 or ASTM F2764 for sanitary sewer systems. When noted on the plans or in the special provisions, storm drains, irrigation and sanitary sewers may be constructed using PP pipe. PP pipe approved sizes are 12 inch diameter through 60 inch diameter. Trench excavation, backfilling and compaction for flexible pipe shall be in accordance with Section ~~603~~ 601 and manufacturer's installation recommendations. Construction and installation shall be in accordance with Section 618 for storm drain and irrigation water or Section 615 for sanitary sewers.

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ABBREVIATIONS AND DEFINITIONS

101.1 ABBREVIATIONS:

Wherever the following abbreviations are used in these specifications, standard details or on the plans, they are to be constructed the same as the respective expressions represented.

AASHTO	American Association of State Highway and Transportation Officials
AAN	American Association of Nurserymen
AB	Aggregate base
Aban	Abandon
ABC	Aggregate base course
AC	Asphalt cement or concrete
ACB	Asphalt concrete base
ACI	American Concrete Institute
ACP	Asbestos cement pipe
ACPA	American Concrete Pipe Association
ACWS	Asphalt concrete wearing surface
AFRB	Arizona Fire Rating Bureau
AGC	Associated General Contractors of America, Inc.
Agg	Aggregate
ADOT	Arizona Department of Transportation
<u>ADA</u>	<u>Americans With Disabilities Act of 1990</u>
<u>ADEQ</u>	<u>Arizona Department of Environmental Quality</u>
Ahd	Ahead
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
APA	American Plywood Association
Approx	Approximate
APWA	American Public Works Association
AR	Aged residue
<u>ARAC</u>	<u>Asphalt-Rubber Asphalt Concrete</u>
ARIZ	Arizona Department of Transportation test method
ARS	Arizona Revised Statutes
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
Ave	Avenue
AWPA	American Wood Preservers Association
AWSC	American Welding Society Code
AWWA	American Water Works Association
Bbl	Barrel
BC	Beginning of curve
BCR	Beginning of curb return
Beg	Beginning
Bk	Book or Back
Blvd	Boulevard
BM	Bench Mark or Board Measure
Brg	Bearing

BST	Bituminous Surface Treatment
BTB	Bituminous Treated Base
BTU	British Thermal Units
BVC	Beginning of vertical curve
C	Centigrade or Curb
CB	Catch Basin
CBF&C	Catch basin frame & cover
CC or C/C	Center to Center
CE	City or County Engineer
Cem	Cement
CF	Curb face
cfs	Cubic Feet per second
CIP	Cast Iron pipe
CIPP	Cast-in-place concrete pipe
CL or C	Centerline
<u>CLR</u>	<u>Clear</u>
Cm	Centimeter
CMP	Corrugated metal pipe
CO	Clean out
Col	Column
Conc	Concrete
Const	Construct
CP	Concrete pipe (non-reinforced)
CTB	Cement Treated Base
Cu	Cubic
Deg	Degree
DF	Douglas Fir
DG	Decomposed granite
Dia	Diameter
Dim	Dimension
DIP	Ductile Iron Pipe
Div	Division
Dr	Drive
Drwg	Drawing
Dwy	Driveway
Ea	Each
Ease	Easement
E	East
EC	End of curve
ECR	End of curb return
El or Elv	Elevation
Equa or Eq	Equation
EVC	End of vertical curve
Ex or Exist	Existing
F	Fahrenheit
FB	Field book
F & C	Frame & cover
FH	Fire hydrant
FL or F	Floor line or flow line
Fl El	Floor Elevation
Fnd	Found
fps	Feet per second
FS	Finished surface
FSS	Federal Specifications and Standards
Ft	Foot or feet

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G	Gutter	NFPA	National Fire Protection Association
Ga	Gage	NP	Non-plastic
Galv	Galvanized	NPI	Non pay item
GL	Ground line	NSC	National Safety Council
Gpm	Gallons per minute	NSF	National Sanitation Foundation
Gr	Grade	<u>NTS</u>	<u>Not to Scale</u>
H	High or height	NW	Northwest
HC	House connection	No	Number
<u>HH</u>	<u>Hand hole</u>	OC	On center
Hdwl	Headwall	OD	Outside diameter
Horiz	Horizontal	Oz	Ounces
Hwy	Highway	P-C	Point of curvature
ICA	Industrial Commission of Arizona	PCC	Point of compound curve or Portland Cement
ID	Improvement District or inside diameter		
IE	Invert Elevation		Concrete
IEEE	Institute of Electrical and Electronic Engineers	PI	Point of intersection or plastic index
In	Inch	PL	Property line
Inv	Invert	POC	Point of Curve
IP	Iron Pipe	POS	Point of Spiral
IPS	Iron Pipe Size	PP	Power pole
Irrig	Irrigation	ppm	Parts per million
Jt	Joint	PRC	Point of reverse curve
JC	Junction Chamber	Prod	Produced
Jct	Junction	Prop	Proposed or property
JS	Junction Structure	psi	Pounds per square inch
L	Length	psf	Pounds per square foot
Lb	Pound	PT or POT	Point of Tangent
L&T	Lead and tack	P&TP	Power and telephone pole
LD	Local depression	Pvmt	Pavement
LF	Linear Feet	Q	Rate of flow
LH	Lamp hole	R	Radius
Lin	Linear	RC	Reinforced concrete
Long	Longitudinal	RCP	Reinforced concrete pipe
Lt	Left	Rd	Road
M	Map or maps	Rdwy	Roadway
MAG	Maricopa Association of Governments	Reinf	Reinforced, Reinforcing
Max	Maximum	Ret Wall	Retaining Wall
MCR	Maricopa County Records	RGRCP	Rubber Gasket Reinforced Concrete Pipe
Meas	Measured	rpm	Revolutions Per Minute
MH	Manhole	Rt	Right
MHF&C	Manhole frame and cover	R/W	Right-of-way
Min	Minutes or minimum	S	South or slope
Misc	Miscellaneous	SAE	Society of Automotive Engineers
ML or M	Monument line	San	Sanitary
mm	Millimeter	SC	Spiral to Curve
Mon	Monolithic or monument	SCCP	Steel cylinder concrete pipe
MTD	Multiple tile duct	SD	Storm drain or Sewer District
N	North	Sdl	Saddle
NBS	National Bureau of Standards	Sec	Seconds
NCPI	National Clay Pipe Institute	Sect	Section
NE	Northeast	SE	Southeast
NEC	National Electric Code	Sht	Sheet
NEMA	National Electrical Manufacturer's Association	Spec	Specifications
		SPR	Simplified Practice Recommendation
		Sp MH	Special manhole

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Sq Ft Yd	Square Foot, Yard
SS	Sanitary sewer
St	Street
Sta	Station
Std	Standard
Str gr	Structural grade
Struct	Structure or structural
SW	Southwest
<u>SWPPP</u>	<u>Stormwater Pollution Prevention Plan</u>
T	Tangent Distance
Tel	Telephone
Temp	Temporary
TH	Test hole
TP	Telephone pole
Tr	Tract
Trans	Transition
TS	Traffic signal or Tangent to spiral
TSC	Traffic signal conduit
Typ	Typical
UL	Underwriters' Laboratories Inc.
USC & GS	United States Coast and Geodetic Survey
USGS	United States Geological Survey
V	Velocity of flow
VC	Vertical curve
VCP	Vitrified clay pipe
Vert	Vertical
W	West or width
WI	Wrought iron
WS	Wearing surface
Wt	Weight
Yd	Yard
'	feet or minutes
"	inches or seconds
°	degrees
%	percent
#	number or pound
@	at
/	per
=	equals

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101.2 DEFINITIONS AND TERMS:

Whenever in these specifications or in other contract documents the following terms or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

Addendum: A supplement to any of the Contract Documents issued, in writing, after advertisement of but prior to the opening of bids for a contract.

Advertisement: The public announcement, as required by law, inviting bids for work to be performed or materials to be furnished.

Agency: The governmental agency for which the construction is being done, either by permit or contract.

Architect: The individual or firm who has accomplished the architectural services for the project, including his representatives.

Arizona Test Method: Arizona Department of Transportation Materials Testing Manual test method.

Award: The formal action of the governing body is accepting a proposal.

Backfill: Material placed in an excavated space to fill such space. For trenches, see definitions for Initial Backfill and Final Backfill. ~~this space will be the area from 1 foot above the top of the pipe or conduit to the existing or proposed finished grade of pavement.~~

Base Course: The upper course of the granular base of a pavement or the lower course of an asphalt concrete pavement structure.

Bedding: A material layer placed on top of the trench foundation to the bottom of the pipe, typically 4 – 6 inches in height. The bedding establishes the line and grade for a conduit and provides support that is firm, but not hard.
~~Is the material placed in the area from the bottom of the trench to 1 foot above the top of the pipe or conduit.~~

Bidder: Any qualified individual, firm, partnership, corporation or combination thereof, acting directly or through a duly authorized representative who legally submits a proposal for the advertised work.

Board of Supervisors: The Maricopa County Board of Supervisors acting under the authority of the laws of the State of Arizona.

Bond Issue Project: A project financed from bonds issued by the City or County pledging credit or a revenue resource.

Bridge: A structure, including supports, erected over a depression or an obstruction, as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads and having a length measured along the center of roadway of more than 20 feet between undercopings of abutments or extreme ends of openings for multiple boxes.

(Length) The length of a bridge structure is the over-all length measured along the line of survey stationing back to back of backwalls of abutments, if present, otherwise end to end of the bridge floor; but in no case less than the total clear opening of the structure.

(Roadway Width) The clear width measured at right angles to the longitudinal centerline of the bridge between the bottom or curbs or guard timbers or in the case of multiple heights of curbs, between the bottoms of the lower risers.

Budget Project: A project financed by funds from General Tax levies and shared revenue funds set aside in the annual budget adopted by the Council or Board of Supervisors.

Building: Any structure built for the support, shelter, or enclosure of persons, animals, chattel or movable property.

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Building Code: A regulation adopted by the governing body establishing minimum standards of construction for the protection of the public health, safety, and welfare in terms of measured performance rather than in terms of rigid specification of materials and methods.

| **Calendar Day:** Every day shown on the calendar.



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Call for Bids: The standard forms inviting proposals or bids.

“Careful and prudent manner”: means conducting excavation in such a way that when it approaches within twenty-four inches of the underground facility located and marked by the owner or operator, by stakes, paint or in some customary manner, the exact location is manually determined, and the uncovered facility is supported and protected.

Change Order: A written order issued by the Engineer to the Contractor to make changes in the work or to perform extra work, and setting forth conditions for payment and/or adjustment in time of completion.

City: A municipal corporation, organized and existing under and by virtue of the laws of the State of Arizona.

City/County Clerk: The duly authorized person who performs the duties of clerk for the Contracting Agency.

Completion Time: The number of calendar days for completion of an act, including authorized time extensions. In case a calendar date of completion is shown in the proposal in lieu of the number of calendar days, the contract shall be completed by that date. The time within which an act is to be done shall be computed by excluding the first and including the last day; and if the last day be Sunday or a legal holiday, that shall be excluded.

Conflicting Utility: An existing utility, shown or not shown on the plans is conflicting when any part of the utility falls within the dimensions of the new installation, such that it would be in physical contact with the new installation.

Construction Project: The erection, installation, remodeling, alteration, of durable facilities upon, under, or over the ground. This shall include, but is not limited to buildings, roadways and utility pipes, lines, poles or other structures.

Contingent Bid Item: This is a minor bid item which is likely, but not certain, to occur during the course of work. If the Engineer determines that this work is required, the Contractor will accomplish the work and payment will be made based on the contingent unit bid price included in the proposal. Since the quantity listed in the proposal is primarily for bid comparison, the amount of work required by the Engineer may vary materially from this.

Contract: The written instrument executed by the Contractor and the Contracting Agency by which the Contractor is bound to furnish all labor, equipment, and materials and to perform the work specified, and by which the Contracting Agency is obligated to compensate the Contractor therefore at the prices set forth therein. The Contract Documents are herewith by reference made a part of the contract as if fully set forth therein.

Contract Documents: All the integral documents of the contract, including but not limited to, Call for Bids, Plans, Standard Specifications and Details, Special Provisions, Proposal, Addenda, Performance Bond, Payment Bond, Certificates of Insurance, Ordinance, Contract, and Change Orders.

Contracting Agency: The legal entity that has contracted for the performance of the work or for whom the work is being performed.

Contractor: The individual, firm, partnership, corporation or combination thereof entering into a contract with the Contracting Agency to perform the advertised work.

Council: The City Council which by law constitutes the Legislative Department of the City.

County: Maricopa County, organized and existing under and by virtue of the laws of the State of Arizona.

Culvert: Any structure not classified as a bridge, which provides an opening under or adjacent to the roadway.

Days: Unless otherwise designated, days will be understood to mean calendar days.

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Emergency: Unforeseen occurrences and combinations of circumstances involving the public welfare or the protection of work already done under the Contract Documents, or which endanger life or property and call for immediate action or remedy.

Engineer: The person, appointed as City or County Engineer by the Council or the Board of Supervisors, acting directly or through his duly authorized representative.

Equipment: (Construction) — All machinery and equipment, together with the necessary supplies for upkeep and maintenance, and also tools and apparatus necessary for the proper construction and acceptable completion of work. (Installed) — All material or articles used in equipping a facility as furnishings or apparatus to fulfill a functional design.

Extra Work: An item of work not provided for in the contract as awarded but found essential to the satisfactory completion of the contract within its intended scope.

Final Backfill: The material placed in a trench above the initial backfill to the top of the trench or to the bottom of the road base material.

Flooding: Flooding will consist of the inundation of the entire lift with water, puddle with poles or bars to insure saturation of the entire lift.

Force Account Work: Work done by personnel of the Contracting Agency as in-house work.

Foundation: For buildings or structures, this will be the substructure. For a trench the foundation is the bottom of the required trench excavation. The foundation surface is either native material or replacement material when unsuitable material occurs and is removed and replaced at the bottom of the required trench excavation. For pipe this will be the native material or prepared material on which the pipe rests; normally, this is the bottom grade line of the trench.

Full Depth Pavement: An asphalt concrete pavement structure in which the granular base and subbase are replaced by proportionate thicknesses of asphalt concrete.

Haunching: The area of a pipe trench between the bottom of the pipe and the springline of the pipe.

Improvement District Project: A project financed by assessments against the property included in a special assessment district authorized under, or implemented by an act of the legislature of the State and/or a procedural ordinance of the City or County.

Initial Backfill: The material placed in a trench between the springline and 12 inches above the crown of the conduit.

Inspector: The Engineer's authorized representative assigned to make detailed inspections of contract performance.

Jetting: Jetting is the densification of material, using a continuous supply of water, under pressure, transmitted to the material through a rigid pipe of sufficient length to reach the bottom of the lift being densified. In all cases, the entire lift will be completely saturated working from the top to the bottom.

Laboratory: The established materials testing laboratory of the Contracting Agency's Engineering Department, or other laboratories acceptable to and/or authorized by the Engineer to test materials and work involved in the Contract.

Major Item: A major item shall be the total of any item of work and/or materials specified in the bid schedule that

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exceeds the amount established in Table [109-1](#).

Materials: Any substance specified in the project, equipment and other material used or consumed in the performance of the work.

Median: The portion of a divided highway separating the roadways used by traffic going in opposite directions.

Non Pay Item: An item of work for which no separate payment will be made under the proposal, but which must be included as an incidental cost for payment on an associated item included in the proposal.

Notice of Award: A letter from the City or County Clerk advising the Contractor that he is the successful bidder and the Council or Board of Supervisors has accepted his proposal.

Notice to Proceed: A directive issued by the Engineer, authorizing the Contractor to start the work or improvements required in the Contract.

Obligee: One to whom another is obligated.

Open Trench: The excavated area shall be considered as open trench until all the aggregate base course for pavement replacement has been placed and compacted or, if outside of a pavement area, until the excavated area is brought to finish grade or natural grade.

Owner: The City or County, acting through its legally constituted officials, officers or employees.

Pavement: Any surfacing of streets, alleys, sidewalks, courts, driveways, etc., consisting of mineral aggregate bound into a rigid or semi-rigid mass by a suitable binder such as, but not limited to, Portland cement or asphalt cement.

Pavement Structure: The combination of subbase, base course, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

Pay Item: A detail of work for which separate payments are to be made under the Contract, as specified in the proposal.

Payment Bond: The security provided by the Contractor solely for the protection of claimants, supplying labor and materials to the Contractor or his Subcontractors.

Performance Bond: The security provided by the Contractor solely for the protection of the Contracting Agency and conditioned upon the faithful performance of the contract in accordance with the plans, specifications and conditions thereof.

Permit: The license to do construction in public rights-of-way and/or easements; issued by an Agency to a Contractor working for another party.

Pipe Embedment Zone: The area of a trench consisting of the bedding, haunching, and initial backfill areas.

Plans: All approved drawings or reproductions thereof pertaining to the work and details therefore, which are made a part of the Contract Documents.

Plant: The Contractor's and/or subcontractor's facilities, including but not limited to small tools and mobile equipment, located on and/or offsite, necessary for preparation of materials and prosecution of work for the project.

Principal: The individual, firm or corporation primarily liable on an obligation, as distinguished from a surety.

Professional Engineer: A person who has a current engineering registration granted by the Arizona State Board of

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Technical Registration in one or more branches of engineering recognized by the board.

Profile Grade: The trace of a vertical plan intersecting the top surface of the proposed wearing surface, usually along the longitudinal centerline of the roadbed. Profile grade means either elevation or gradient of such trace according to the context.

Project: A specific coordinated construction or similar undertaking identified by a single project number and bid and awarded as one contract. On occasion two or more projects may be bid and awarded as a single contract.

Proposal: The offer of a bidder on the prescribed form, to perform the work and to furnish the labor and materials at the prices quoted.

Proposal Form: The approved form on which the Contracting Agency requires bids to be prepared and submitted for the work.

Proposal Guarantee: The security furnished with a bid to guarantee that the bidder will enter into the contract if his bid is accepted.

Proposal Pamphlet: The book or pamphlet pertaining to a specific project, containing proposal forms, special provisions and other information necessary for and pertinent to the preparation of the proposal or bid.

Referred Documents: On all work authorized by the Contracting Agency, any referenced documents in the specification, i.e., Bulletins, Standards, Rules, Methods of Analysis or test. Codes and Specifications of other Agencies, Engineering Societies or Industrial Associations, refer to the Latest Edition thereof, including Amendments, which are in effect and published at the time of Advertising for Bids or the issuing of a permit for the work, unless otherwise stated.

Right-of-way: A general term denoting land, property, or interest therein, usually in a strip acquired for or devoted to a street, highway, or other public improvement.

Road: A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

Roadside: A general term denoting the area adjoining the outer edge of the roadway. Extensive areas between the roadways of a divided highway may also be considered roadside.

Roadside Development: Those items necessary to the complete roadway which provide for the preservation of landscape materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching and the placing of other ground covers; such suitable planting and other improvements as may increase the effectiveness and enhance the appearance of the roadway.

Roadway: The portion of the right-of-way intended primarily for vehicular traffic, and including all appurtenant structures and other features necessary for proper drainage and protection. Where curbs exist, it is that portion of roadway between the faces of the curbs.

Sewers: Conduits and related appurtenances employed to collect and carry off water and waste matter to a suitable point of final discharge.

Shop Drawings: Drawings or reproduction of drawings, detailing; fabrication and erection of structural elements, falsework and forming for structures, fabrication of reinforcing steel, installed equipment and installation of systems, or any other supplementary plans or similar data, which the Contractor is required to submit for approval.

Shoulder: The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Sidewalk: That portion of the roadway primarily constructed for the use of pedestrians.

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Special Provisions: The special conditions, requirements, additions, and/or revisions to the Standard Specifications, applicable to the work, to cover conditions or requirements peculiar to the project under consideration.

Specifications: The descriptions, directions, provisions, and requirement for performing the work as contained in the Contract Documents.

Springline: The vertical location having a maximum horizontal dimension or in box sections, the mid-height of the vertical wall.

Standard Details: Uniform detail drawings of structures or devices adopted as Standard Details by the Engineer.

Standard Specifications: Uniform general specifications adopted as Standard Specifications by the Engineer.

Storm Drain: Any conduit and appurtenance intended for the reception and transfer of storm water.

Street: Streets, avenues, alleys, highways, crossings, lanes, intersections, courts, places, and grounds now open or dedicated or hereafter opened or dedicated to public use and public ways.

Structures: Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, end walls, sewers, service pipes underdrains foundation drains, fences, swimming pools, and other features which may be encountered in the work and not otherwise classed herein.

Subbase: The lower course of the base of a roadway, immediately above the subgrade.

Subcontractors: Those having direct contracts with the Contractor and those who furnish material worked into a special design according to the Plans and Specifications for the work, but not those who merely furnish material not so worked.

Subgrade: The supporting structures on which the pavement and its special undercourses rest.

Substructure: All of that part of the structure or building below the bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, together with the backwalls, wingwalls and wing protection railings.

Superintendent: The Contractor's authorized representative in responsible charge of the work.

Superintendent of Streets: The person duly appointed by the Council of the Contracting Agency, as provided by the Arizona Revised Statutes.

Superpave Mix: Asphalt mix in compliance with the Gyatory Mix design requirements of section 710.3.2.2.

Superstructure: The entire structure or building except the substructure.

Supplemental Specifications: Additions and revisions to the Standard Specifications that are adopted subsequent to issuance of the printed book.

Supplementary General Conditions: Requirements, or revisions, to the Standard General Conditions, applicable to the work, and to cover conditions or requirements peculiar to the project under consideration.

Surety: The individual, firm or corporation, bound with and for the Contractor for the acceptable performance, execution, and completion of the work, and for the satisfaction of all obligations incurred.

Surface Course: The finished or wearing course of an asphalt concrete pavement structure.

Title or Headings: The titles or headings of the sections and subsections herein are intended for convenience of

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reference and shall not be considered as having any bearing on their interpretation.

Township, City, Town or District: A subdivision of the County used to designate or identify the location of the proposed work.

Traveled Way: The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

“Underground Facility”: means any item which shall be buried or placed below ground for use in connection with the storage or conveyance of water, sewage, electronic, telephone or telegraphic communications, electric energy, oil, gas or other substances, and shall include, but not be limited to pipes, sewers, conduits, cables, valves, lines, wires, manholes, attachments and those portions of poles and their attachments below ground.

Utility: Pipe lines, conduits, ducts, transmission lines, overhead or underground wires, railroads, storm drains, sanitary sewers, irrigation facilities, street lighting, traffic signals, and fire alarm systems, and appurtenances of public utilities and those of private industry, businesses or individuals solely for their own use or use of their customers which are operated or maintained in, on, under, over or across public right-of-way or public or private easement.

Waterworks (Water Supply System): The reservoirs, pipe lines, wells, pumping equipment, purification works, mains, service pipes, and all related appliances and appurtenances utilized in the procurement, transportation and delivery of an adequate, safe, and palatable water supply for the Contracting Agency.

Work: Any or all of the improvements mentioned and authorized to be made, and the construction, demolition, reconstruction, and repair of all or any portion of such improvements, and all labor, services, incidental expenses, and material necessary or incidental thereto.

Working Day: A calendar day, exclusive of Saturdays, Sundays, and Contracting Agency recognized legal holidays, on which weather and other conditions not under the control of the Contractor will permit construction operations to proceed for the major part of the day with the normal working force engaged in performing the controlling item or items of work which would be in progress at that time.

101.3 In order to avoid cumbersome and confusing repetition of expressions in these specifications, it is provided that whenever anything is, or is to be, done, if, as, or, when, or where contemplated required, determined, directed, specified, authorized, ordered, given, designated, indicated, considered necessary, deemed necessary, permitted, reserved, suspended, established, approval, approved, disapproved, acceptable, unacceptable, suitable, accepted, satisfactory, unsatisfactory, sufficient, insufficient, rejected, or condemned, it shall be understood as if the expression were followed by the words by the Engineer or to the Engineer.

- End of Section -

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ABBREVIATIONS AND DEFINITIONS

101.1 ABBREVIATIONS:

Wherever the following abbreviations are used in these specifications, standard details or on the plans, they are to be constructed the same as the respective expressions represented.

AASHTO	American Association of State Highway and Transportation Officials
AAN	American Association of Nurserymen
AB	Aggregate base
Aban	Abandon
ABC	Aggregate base course
AC	Asphalt cement or concrete
ACB	Asphalt concrete base
ACI	American Concrete Institute
ACP	Asbestos cement pipe
ACPA	American Concrete Pipe Association
ACWS	Asphalt concrete wearing surface
AFRB	Arizona Fire Rating Bureau
AGC	Associated General Contractors of America, Inc.
Agg	Aggregate
ADOT	Arizona Department of Transportation
ADA	Americans With Disabilities Act of 1990
ADEQ	Arizona Department of Environmental Quality
Ahd	Ahead
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
APA	American Plywood Association
Approx	Approximate
APWA	American Public Works Association
AR	Aged residue
ARAC	Asphalt-Rubber Asphalt Concrete
ARIZ	Arizona Department of Transportation test method
ARS	Arizona Revised Statutes
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
Ave	Avenue
AWPA	American Wood Preservers Association
AWSC	American Welding Society Code
AWWA	American Water Works Association
Bbl	Barrel
BC	Beginning of curve
BCR	Beginning of curb return
Beg	Beginning
Bk	Book or Back
Bldv	Boulevard
BM	Bench Mark or Board Measure
Brg	Bearing

BST	Bituminous Surface Treatment
BTB	Bituminous Treated Base
BTU	British Thermal Units
BVC	Beginning of vertical curve
C	Centigrade or Curb
CB	Catch Basin
CBF&C	Catch basin frame & cover
CC or C/C	Center to Center
CE	City or County Engineer
Cem	Cement
CF	Curb face
cfs	Cubic Feet per second
CIP	Cast Iron pipe
CIPP	Cast-in-place concrete pipe
CL or C	Centerline
CLR	Clear
Cm	Centimeter
CMP	Corrugated metal pipe
CO	Clean out
Col	Column
Conc	Concrete
Const	Construct
CP	Concrete pipe (non-reinforced)
CTB	Cement Treated Base
Cu	Cubic
Deg	Degree
DF	Douglas Fir
DG	Decomposed granite
Dia	Diameter
Dim	Dimension
DIP	Ductile Iron Pipe
Div	Division
Dr	Drive
Drwg	Drawing
Dwy	Driveway
Ea	Each
Ease	Easement
E	East
EC	End of curve
ECR	End of curb return
El or Elv	Elevation
Equa or Eq	Equation
EVC	End of vertical curve
Ex or Exist	Existing
F	Fahrenheit
FB	Field book
F & C	Frame & cover
FH	Fire hydrant
FL or F	Floor line or flow line
Fl El	Floor Elevation
Fnd	Found
fps	Feet per second
FS	Finished surface
FSS	Federal Specifications and Standards
Ft	Foot or feet
G	Gutter
Ga	Gage

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Galv	Galvanized	NSF	National Sanitation Foundation
GL	Ground line	NTS	Not to Scale
Gpm	Gallons per minute	NW	Northwest
Gr	Grade	No	Number
H	High or height	OC	On center
HC	House connection	OD	Outside diameter
HH	Hand hole	Oz	Ounces
Hdwl	Headwall	PC	Point of curvature
Horiz	Horizontal	PCC	Point of compound curve or Portland Cement Concrete
Hwy	Highway	PI	Point of intersection or plastic index
ICA	Industrial Commission of Arizona	PL	Property line
ID	Improvement District or inside diameter	POC	Point of Curve
IE	Invert Elevation	POS	Point of Spiral
IEEE	Institute of Electrical and Electronic Engineers	PP	Power pole
In	Inch	ppm	Parts per million
Inv	Invert	PRC	Point of reverse curve
IP	Iron Pipe	Prod	Produced
IPS	Iron Pipe Size	Prop	Proposed or property
Irrig	Irrigation	psi	Pounds per square inch
Jt	Joint	psf	Pounds per square foot
JC	Junction Chamber	PT or POT	Point of Tangent
Jct	Junction	P&TP	Power and telephone pole
JS	Junction Structure	Pvmt	Pavement
L	Length	Q	Rate of flow
Lb	Pound	R	Radius
L&T	Lead and tack	RC	Reinforced concrete
LD	Local depression	RCP	Reinforced concrete pipe
LF	Linear Feet	Rd	Road
LH	Lamp hole	Rdwy	Roadway
Lin	Linear	Reinf	Reinforced, Reinforcing
Long	Longitudinal	Ret Wall	Retaining Wall
Lt	Left	RGRCP	Rubber Gasket Reinforced Concrete Pipe
M	Map or maps	rpm	Revolutions Per Minute
MAG	Maricopa Association of Governments	Rt	Right
Max	Maximum	R/W	Right-of-way
MCR	Maricopa County Records	S	South or slope
Meas	Measured	SAE	Society of Automotive Engineers
MH	Manhole	San	Sanitary
MHF&C	Manhole frame and cover	SC	Spiral to Curve
Min	Minutes or minimum	SCCP	Steel cylinder concrete pipe
Misc	Miscellaneous	SD	Storm drain or Sewer District
ML or M	Monument line	Sdl	Saddle
mm	Millimeter	Sec	Seconds
Mon	Monolithic or monument	Sect	Section
MTD	Multiple tile duct	SE	Southeast
N	North	Sht	Sheet
NBS	National Bureau of Standards	Spec	Specifications
NCPI	National Clay Pipe Institute	SPR	Simplified Practice Recommendation
NE	Northeast	Sp MH	Special manhole
NEC	National Electric Code	Sq Ft Yd	Square Foot, Yard
NEMA	National Electrical Manufacturer's Association	SS	Sanitary sewer
NFPA	National Fire Protection Association	St	Street
NP	Non-plastic	Sta	Station
NPI	Non pay item	Std	Standard
NSC	National Safety Council	Str gr	Structural grade
		Struct	Structure or structural

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SW	Southwest
SWPPP	Stormwater Pollution Prevention Plan
T	Tangent Distance
Tel	Telephone
Temp	Temporary
TH	Test hole
TP	Telephone pole
Tr	Tract
Trans	Transition
TS	Traffic signal or Tangent to spiral
TSC	Traffic signal conduit
Typ	Typical
UL	Underwriters' Laboratories Inc.
USC & GS	United States Coast and Geodetic Survey
USGS	United States Geological Survey
V	Velocity of flow
VC	Vertical curve
VCP	Vitrified clay pipe
Vert	Vertical
W	West or width
WI	Wrought iron
WS	Wearing surface
Wt	Weight
Yd	Yard
'	feet or minutes
"	inches or seconds
°	degrees
%	percent
#	number or pound
@	at
/	per
=	equals

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101.2 DEFINITIONS AND TERMS:

Whenever in these specifications or in other contract documents the following terms or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

Addendum: A supplement to any of the Contract Documents issued, in writing, after advertisement of but prior to the opening of bids for a contract.

Advertisement: The public announcement, as required by law, inviting bids for work to be performed or materials to be furnished.

Agency: The governmental agency for which the construction is being done, either by permit or contract.

Architect: The individual or firm who has accomplished the architectural services for the project, including his representatives.

Arizona Test Method: Arizona Department of Transportation Materials Testing Manual test method.

Award: The formal action of the governing body is accepting a proposal.

Backfill: Material placed in an excavated space to fill such space. For trenches, see definitions for Initial Backfill and Final Backfill.

Base Course: The upper course of the granular base of a pavement or the lower course of an asphalt concrete pavement structure.

Bedding: A material layer placed on top of the trench foundation to the bottom of the pipe, typically 4 – 6 inches in height. The bedding establishes the line and grade for a conduit and provides support that is firm, but not hard.

Bidder: Any qualified individual, firm, partnership, corporation or combination thereof, acting directly or through a duly authorized representative who legally submits a proposal for the advertised work.

Board of Supervisors: The Maricopa County Board of Supervisors acting under the authority of the laws of the State of Arizona.

Bond Issue Project: A project financed from bonds issued by the City or County pledging credit or a revenue resource.

Bridge: A structure, including supports, erected over a depression or an obstruction, as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads and having a length measured along the center of roadway of more than 20 feet between undercopings of abutments or extreme ends of openings for multiple boxes.

(Length) The length of a bridge structure is the over-all length measured along the line of survey stationing back to back of backwalls of abutments, if present, otherwise end to end of the bridge floor; but in no case less than the total clear opening of the structure.

(Roadway Width) The clear width measured at right angles to the longitudinal centerline of the bridge between the bottom or curbs or guard timbers or in the case of multiple heights of curbs, between the bottoms of the lower risers.

Budget Project: A project financed by funds from General Tax levies and shared revenue funds set aside in the annual budget adopted by the Council or Board of Supervisors.

Building: Any structure built for the support, shelter, or enclosure of persons, animals, chattel or movable property.

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Building Code: A regulation adopted by the governing body establishing minimum standards of construction for the protection of the public health, safety, and welfare in terms of measured performance rather than in terms of rigid specification of materials and methods.

Calendar Day: Every day shown on the calendar.

Call for Bids: The standard forms inviting proposals or bids.

“Careful and prudent manner”: means conducting excavation in such a way that when it approaches within twenty-four inches of the underground facility located and marked by the owner or operator, by stakes, paint or in some customary manner, the exact location is manually determined, and the uncovered facility is supported and protected.

Change Order: A written order issued by the Engineer to the Contractor to make changes in the work or to perform extra work, and setting forth conditions for payment and/or adjustment in time of completion.

City: A municipal corporation, organized and existing under and by virtue of the laws of the State of Arizona.

City/County Clerk: The duly authorized person who performs the duties of clerk for the Contracting Agency.

Completion Time: The number of calendar days for completion of an act, including authorized time extensions. In case a calendar date of completion is shown in the proposal in lieu of the number of calendar days, the contract shall be completed by that date. The time within which an act is to be done shall be computed by excluding the first and including the last day; and if the last day be Sunday or a legal holiday, that shall be excluded.

Conflicting Utility: An existing utility, shown or not shown on the plans is conflicting when any part of the utility falls within the dimensions of the new installation, such that it would be in physical contact with the new installation.

Construction Project: The erection, installation, remodeling, alteration, of durable facilities upon, under, or over the ground. This shall include, but is not limited to buildings, roadways and utility pipes, lines, poles or other structures.

Contingent Bid Item: This is a minor bid item which is likely, but not certain, to occur during the course of work. If the Engineer determines that this work is required, the Contractor will accomplish the work and payment will be made based on the contingent unit bid price included in the proposal. Since the quantity listed in the proposal is primarily for bid comparison, the amount of work required by the Engineer may vary materially from this.

Contract: The written instrument executed by the Contractor and the Contracting Agency by which the Contractor is bound to furnish all labor, equipment, and materials and to perform the work specified, and by which the Contracting Agency is obligated to compensate the Contractor therefore at the prices set forth therein. The Contract Documents are herewith by reference made a part of the contract as if fully set forth therein.

Contract Documents: All the integral documents of the contract, including but not limited to, Call for Bids, Plans, Standard Specifications and Details, Special Provisions, Proposal, Addenda, Performance Bond, Payment Bond, Certificates of Insurance, Ordinance, Contract, and Change Orders.

Contracting Agency: The legal entity that has contracted for the performance of the work or for whom the work is being performed.

Contractor: The individual, firm, partnership, corporation or combination thereof entering into a contract with the Contracting Agency to perform the advertised work.

Council: The City Council which by law constitutes the Legislative Department of the City.

County: Maricopa County, organized and existing under and by virtue of the laws of the State of Arizona.

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Culvert: Any structure not classified as a bridge, which provides an opening under or adjacent to the roadway.

Days: Unless otherwise designated, days will be understood to mean calendar days.

Emergency: Unforeseen occurrences and combinations of circumstances involving the public welfare or the protection of work already done under the Contract Documents, or which endanger life or property and call for immediate action or remedy.

Engineer: The person, appointed as City or County Engineer by the Council or the Board of Supervisors, acting directly or through his duly authorized representative.

Equipment: (Construction) — All machinery and equipment, together with the necessary supplies for upkeep and maintenance, and also tools and apparatus necessary for the proper construction and acceptable completion of work. (Installed) — All material or articles used in equipping a facility as furnishings or apparatus to fulfill a functional design.

Extra Work: An item of work not provided for in the contract as awarded but found essential to the satisfactory completion of the contract within its intended scope.

Final Backfill: The material placed in a trench above the initial backfill to the top of the trench or to the bottom of the road base material.

Flooding: Flooding will consist of the inundation of the entire lift with water, puddle with poles or bars to insure saturation of the entire lift.

Force Account Work: Work done by personnel of the Contracting Agency as in-house work.

Foundation: For buildings or structures, this will be the substructure. For a trench the foundation is the bottom of the required trench excavation. The foundation surface is either native material or replacement material when unsuitable material occurs and is removed and replaced at the bottom of the required trench excavation.

Full Depth Pavement: An asphalt concrete pavement structure in which the granular base and subbase are replaced by proportionate thicknesses of asphalt concrete.

Haunching: The area of a pipe trench between the bottom of the pipe and the springline of the pipe.

Improvement District Project: A project financed by assessments against the property included in a special assessment district authorized under, or implemented by an act of the legislature of the State and/or a procedural ordinance of the City or County.

Initial Backfill: The material placed in a trench between the springline and 12 inches above the crown of the conduit.

Inspector: The Engineer's authorized representative assigned to make detailed inspections of contract performance.

Jetting: Jetting is the densification of material, using a continuous supply of water, under pressure, transmitted to the material through a rigid pipe of sufficient length to reach the bottom of the lift being densified. In all cases, the entire lift will be completely saturated working from the top to the bottom.

Laboratory: The established materials testing laboratory of the Contracting Agency's Engineering Department, or other laboratories acceptable to and/or authorized by the Engineer to test materials and work involved in the Contract.

Major Item: A major item shall be the total of any item of work and/or materials specified in the bid schedule that exceeds the amount established in Table [109-1](#).

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Materials: Any substance specified in the project, equipment and other material used or consumed in the performance of the work.

Median: The portion of a divided highway separating the roadways used by traffic going in opposite directions.

Non Pay Item: An item of work for which no separate payment will be made under the proposal, but which must be included as an incidental cost for payment on an associated item included in the proposal.

Notice of Award: A letter from the City or County Clerk advising the Contractor that he is the successful bidder and the Council or Board of Supervisors has accepted his proposal.

Notice to Proceed: A directive issued by the Engineer, authorizing the Contractor to start the work or improvements required in the Contract.

Obligee: One to whom another is obligated.

Open Trench: The excavated area shall be considered as open trench until all the aggregate base course for pavement replacement has been placed and compacted or, if outside of a pavement area, until the excavated area is brought to finish grade or natural grade.

Owner: The City or County, acting through its legally constituted officials, officers or employees.

Pavement: Any surfacing of streets, alleys, sidewalks, courts, driveways, etc., consisting of mineral aggregate bound into a rigid or semi-rigid mass by a suitable binder such as, but not limited to, Portland cement or asphalt cement.

Pavement Structure: The combination of subbase, base course, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

Pay Item: A detail of work for which separate payments are to be made under the Contract, as specified in the proposal.

Payment Bond: The security provided by the Contractor solely for the protection of claimants, supplying labor and materials to the Contractor or his Subcontractors.

Performance Bond: The security provided by the Contractor solely for the protection of the Contracting Agency and conditioned upon the faithful performance of the contract in accordance with the plans, specifications and conditions thereof.

Permit: The license to do construction in public rights-of-way and/or easements; issued by an Agency to a Contractor working for another party.

Pipe Embedment Zone: The area of a trench consisting of the bedding, haunching, and initial backfill areas.

Plans: All approved drawings or reproductions thereof pertaining to the work and details therefore, which are made a part of the Contract Documents.

Plant: The Contractor's and/or subcontractor's facilities, including but not limited to small tools and mobile equipment, located on and/or offsite, necessary for preparation of materials and prosecution of work for the project.

Principal: The individual, firm or corporation primarily liable on an obligation, as distinguished from a surety.

Professional Engineer: A person who has a current engineering registration granted by the Arizona State Board of Technical Registration in one or more branches of engineering recognized by the board.

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Profile Grade: The trace of a vertical plan intersecting the top surface of the proposed wearing surface, usually along the longitudinal centerline of the roadbed. Profile grade means either elevation or gradient of such trace according to the context.

Project: A specific coordinated construction or similar undertaking identified by a single project number and bid and awarded as one contract. On occasion two or more projects may be bid and awarded as a single contract.

Proposal: The offer of a bidder on the prescribed form, to perform the work and to furnish the labor and materials at the prices quoted.

Proposal Form: The approved form on which the Contracting Agency requires bids to be prepared and submitted for the work.

Proposal Guarantee: The security furnished with a bid to guarantee that the bidder will enter into the contract if his bid is accepted.

Proposal Pamphlet: The book or pamphlet pertaining to a specific project, containing proposal forms, special provisions and other information necessary for and pertinent to the preparation of the proposal or bid.

Referred Documents: On all work authorized by the Contracting Agency, any referenced documents in the specification, i.e., Bulletins, Standards, Rules, Methods of Analysis or test. Codes and Specifications of other Agencies, Engineering Societies or Industrial Associations, refer to the Latest Edition thereof, including Amendments, which are in effect and published at the time of Advertising for Bids or the issuing of a permit for the work, unless otherwise stated.

Right-of-way: A general term denoting land, property, or interest therein, usually in a strip acquired for or devoted to a street, highway, or other public improvement.

Road: A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

Roadside: A general term denoting the area adjoining the outer edge of the roadway. Extensive areas between the roadways of a divided highway may also be considered roadside.

Roadside Development: Those items necessary to the complete roadway which provide for the preservation of landscape materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching and the placing of other ground covers; such suitable planting and other improvements as may increase the effectiveness and enhance the appearance of the roadway.

Roadway: The portion of the right-of-way intended primarily for vehicular traffic, and including all appurtenant structures and other features necessary for proper drainage and protection. Where curbs exist, it is that portion of roadway between the faces of the curbs.

Sewers: Conduits and related appurtenances employed to collect and carry off water and waste matter to a suitable point of final discharge.

Shop Drawings: Drawings or reproduction of drawings, detailing; fabrication and erection of structural elements, falsework and forming for structures, fabrication of reinforcing steel, installed equipment and installation of systems, or any other supplementary plans or similar data, which the Contractor is required to submit for approval.

Shoulder: The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Sidewalk: That portion of the roadway primarily constructed for the use of pedestrians.

Special Provisions: The special conditions, requirements, additions, and/or revisions to the Standard Specifications,

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applicable to the work, to cover conditions or requirements peculiar to the project under consideration.

Specifications: The descriptions, directions, provisions, and requirement for performing the work as contained in the Contract Documents.

Springline: The vertical location having a maximum horizontal dimension or in box sections, the mid-height of the vertical wall.

Standard Details: Uniform detail drawings of structures or devices adopted as Standard Details by the Engineer.

Standard Specifications: Uniform general specifications adopted as Standard Specifications by the Engineer.

Storm Drain: Any conduit and appurtenance intended for the reception and transfer of storm water.

Street: Streets, avenues, alleys, highways, crossings, lanes, intersections, courts, places, and grounds now open or dedicated or hereafter opened or dedicated to public use and public ways.

Structures: Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, end walls, sewers, service pipes underdrains foundation drains, fences, swimming pools, and other features which may be encountered in the work and not otherwise classed herein.

Subbase: The lower course of the base of a roadway, immediately above the subgrade.

Subcontractors: Those having direct contracts with the Contractor and those who furnish material worked into a special design according to the Plans and Specifications for the work, but not those who merely furnish material not so worked.

Subgrade: The supporting structures on which the pavement and its special undercourses rest.

Substructure: All of that part of the structure or building below the bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, together with the backwalls, wingwalls and wing protection railings.

Superintendent: The Contractor's authorized representative in responsible charge of the work.

Superintendent of Streets: The person duly appointed by the Council of the Contracting Agency, as provided by the Arizona Revised Statutes.

Superpave Mix: Asphalt mix in compliance with the Gyrotory Mix design requirements of section 710.3.2.2.

Superstructure: The entire structure or building except the substructure.

Supplemental Specifications: Additions and revisions to the Standard Specifications that are adopted subsequent to issuance of the printed book.

Supplementary General Conditions: Requirements, or revisions, to the Standard General Conditions, applicable to the work, and to cover conditions or requirements peculiar to the project under consideration.

Surety: The individual, firm or corporation, bound with and for the Contractor for the acceptable performance, execution, and completion of the work, and for the satisfaction of all obligations incurred.

Surface Course: The finished or wearing course of an asphalt concrete pavement structure.

Title or Headings: The titles or headings of the sections and subsections herein are intended for convenience of reference and shall not be considered as having any bearing on their interpretation.

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Township, City, Town or District: A subdivision of the County used to designate or identify the location of the proposed work.

Traveled Way: The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

“Underground Facility”: means any item which shall be buried or placed below ground for use in connection with the storage or conveyance of water, sewage, electronic, telephone or telegraphic communications, electric energy, oil, gas or other substances, and shall include, but not be limited to pipes, sewers, conduits, cables, valves, lines, wires, manholes, attachments and those portions of poles and their attachments below ground.

Utility: Pipe lines, conduits, ducts, transmission lines, overhead or underground wires, railroads, storm drains, sanitary sewers, irrigation facilities, street lighting, traffic signals, and fire alarm systems, and appurtenances of public utilities and those of private industry, businesses or individuals solely for their own use or use of their customers which are operated or maintained in, on, under, over or across public right-of-way or public or private easement.

Waterworks (Water Supply System): The reservoirs, pipe lines, wells, pumping equipment, purification works, mains, service pipes, and all related appliances and appurtenances utilized in the procurement, transportation and delivery of an adequate, safe, and palatable water supply for the Contracting Agency.

Work: Any or all of the improvements mentioned and authorized to be made, and the construction, demolition, reconstruction, and repair of all or any portion of such improvements, and all labor, services, incidental expenses, and material necessary or incidental thereto.

Working Day: A calendar day, exclusive of Saturdays, Sundays, and Contracting Agency recognized legal holidays, on which weather and other conditions not under the control of the Contractor will permit construction operations to proceed for the major part of the day with the normal working force engaged in performing the controlling item or items of work which would be in progress at that time.

101.3 In order to avoid cumbersome and confusing repetition of expressions in these specifications, it is provided that whenever anything is, or is to be, done, if, as, or, when, or where contemplated required, determined, directed, specified, authorized, ordered, given, designated, indicated, considered necessary, deemed necessary, permitted, reserved, suspended, established, approval, approved, disapproved, acceptable, unacceptable, suitable, accepted, satisfactory, unsatisfactory, sufficient, insufficient, rejected, or condemned, it shall be understood as if the expression were followed by the words by the Engineer or to the Engineer.

- End of Section -

STRUCTURE EXCAVATION AND BACKFILL**206.1 DESCRIPTION:**

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

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

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

206.2 FOUNDATION MATERIAL TREATMENT:

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

When no piles are used and footing concrete or masonry is to rest on an excavated surface other than rock, care shall be taken not to disturb the bottom of the excavation and final removal of the foundation material to grade shall not be made until just before the concrete or masonry is placed. Excavation below grade shall be replaced with the same class of concrete specified for the structure or with 1 ½ sack controlled low strength material as specified in Section 728. When the replacement material is structural concrete, the material shall be placed at the same time as the structure material. Placement of controlled low strength material shall be per Section 604 which will require a time lag between placement of the material and the structural concrete.

The placement of the additional material shall be at no cost to the Agency except when over-excavation is directed by the Engineer.

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

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

206.3 INSPECTION:

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

206.4 STRUCTURE BACKFILL:

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

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

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

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

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

(D) Shall be uniformly compacted to at least 95 percent of maximum density.

EXCEPTION: Catch basins constructed in accordance with standard details and having the outlet invert depth equal to or less than six feet may place structure backfill when the concrete has attained a minimum compressive strength of 2500 psi in compression as specified in Section 725 and in no case less than 72 hours after casting.

206.4.3 Structure Backfill for Structures Other than Earth Retaining: Structure Backfill placed against concrete structures not designed to retain earth loads:

(A) Shall not be placed until the concrete has attained a minimum compressive strength of 2500 psi in compression as specified in Section 725 and in no case less than 72 hours after casting.

(B) Shall be uniformly compacted to at least ~~90-95~~ percent of maximum density.

206.4.4 Structure Backfill for Structures within Paved Areas: Where a structure is located within an existing street, proposed street, or paved area:

(A) ~~Backfill within 2 feet of the surface~~ shall be compacted to the minimum density specified in Table 601-2, for Type I or shall be filled with ½ sack or 1 sack controlled low strength material as specified in Sections 604 and 728.

~~(B) All other structure backfill shall be compacted to the minimum density specified in Table 601-2, for Type III or shall be filled with ½ sack or 1 sack controlled low strength material as specified in Sections 604 and 728.~~

206.4.5 Structure Backfill for Precast Minor Structures: Minor structures, as defined in Section 505.1.1, when furnished as precast structures, shall be placed on a compacted layer of Structure Backfill at least 6 inches in depth that conforms to the material requirements of Section 206.4.2. The layer shall be shaped to fit the bottom surface of the precast unit and compacted to not less than 100 percent maximum density. The Structure Backfill shall be at or near optimum moisture content, as approved by the Engineer. After the unit has been initially set in place and checked for line and grade, it shall be removed, and any defects in its bearing area or line and grade shall be corrected by trimming and by placing and compacting similarly moistened Structure Backfill and the unit reset in place. If in the opinion of the Engineer the bearing area or line or grade of a set precast unit is defective, the Contractor shall remove the unit, correct the bearing area and reset the unit at no additional cost to the Agency. Precast units shall be installed on compacted, shape-conformed Structure Backfill in reasonable conformity with the lines and grades shown on the project plans.

206.4.6 Relative Compaction: Unless otherwise provided in the plans and/or special provisions the maximum density shall be determined using procedures defined in Section 301.

206.5 PAYMENT:

Unless otherwise provided in the special provisions or proposal, no payment will be made for structure excavation and backfill as such; the cost thereof shall be included in the contract price ~~bid~~ for the construction or installation of the items to which such excavation and backfill are incidental or appurtenant.

When the Special Provisions identify Structure Excavation and/or Structure Backfill as pay items, the following methods of measurement and payment shall be used

206.5.1 Measurement

(A) **Structure Excavation:** Structure Excavation will be measured by the cubic yard, based on the volumes calculated from the measurement/pay limits shown on the Project Plans. If no limits are shown, the measurement for Structure Excavation shall be in accordance with the applicable details shown on the current Arizona Department of Transportation (ADOT) Standard Drawings B-19.30 and/or B-19.50.

No reduction in measurement for payment will be made when the Contractor elects to not excavate all material between the limits of the actual structure, and the pay limits shown on the Project Plans and/or the above referenced ADOT Standard Drawings.

No additional measurement for payment will be made for excavation resulting from lack of side support for structure excavations, nor due to carelessness of the Contractor.

(B) **Structure Backfill:** Structure Backfill will be measured by the cubic yard, based on the volumes calculated from the measurement/pay limits shown on the Project Plans. If no limits are shown, the measurement for Structure Backfill shall be in accordance with the applicable details shown on the current ADOT Standard Drawings B-19.40 and/or B-19.50.

206.5.2 Payment

Structure Excavation and Structure Backfill: The accepted quantities of Structure Excavation and the accepted quantities of Structure Backfill will be paid for at their respective contract unit prices.

Hauling, placing, and compacting surplus Structure Excavation in embankments, or otherwise disposing of the material, shall be included in the contract price paid for Structure Excavation.

- End of Section -

STRUCTURE EXCAVATION AND BACKFILL**206.1 DESCRIPTION:**

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

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

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

206.2 FOUNDATION MATERIAL TREATMENT:

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

When no piles are used and footing concrete or masonry is to rest on an excavated surface other than rock, care shall be taken not to disturb the bottom of the excavation and final removal of the foundation material to grade shall not be made until just before the concrete or masonry is placed. Excavation below grade shall be replaced with the same class of concrete specified for the structure or with 1 ½ sack controlled low strength material as specified in Section 728. When the replacement material is structural concrete, the material shall be placed at the same time as the structure material. Placement of controlled low strength material shall be per Section 604 which will require a time lag between placement of the material and the structural concrete.

The placement of the additional material shall be at no cost to the Agency except when over-excavation is directed by the Engineer.

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

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

206.3 INSPECTION:

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

206.4 STRUCTURE BACKFILL:

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

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

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

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

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

(D) Shall be uniformly compacted to at least 95 percent of maximum density.

EXCEPTION: Catch basins constructed in accordance with standard details and having the outlet invert depth equal to or less than six feet may place structure backfill when the concrete has attained a minimum compressive strength of 2500 psi in compression as specified in Section 725 and in no case less than 72 hours after casting.

206.4.3 Structure Backfill for Structures Other than Earth Retaining: Structure Backfill placed against concrete structures not designed to retain earth loads:

(A) Shall not be placed until the concrete has attained a minimum compressive strength of 2500 psi in compression as specified in Section 725 and in no case less than 72 hours after casting.

(B) Shall be uniformly compacted to at least 95 percent of maximum density.

206.4.4 Structure Backfill for Structures within Paved Areas: Where a structure is located within an existing street, proposed street, or paved area shall be compacted to the minimum density specified in Table 601-2, for Type I or shall be filled with ½ sack or 1 sack controlled low strength material as specified in Sections 604 and 728.

206.4.5 Structure Backfill for Precast Minor Structures: Minor structures, as defined in Section 505.1.1, when furnished as precast structures, shall be placed on a compacted layer of Structure Backfill at least 6 inches in depth that conforms to the material requirements of Section 206.4.2. The layer shall be shaped to fit the bottom surface of the precast unit and compacted to not less than 100 percent maximum density. The Structure Backfill shall be at or near optimum moisture content, as approved by the Engineer. After the unit has been initially set in place and checked for line and grade, it shall be removed, and any defects in its bearing area or line and grade shall be corrected by trimming and by placing and compacting similarly moistened Structure Backfill and the unit reset in place. If in the opinion of the Engineer the bearing area or line or grade of a set precast unit is defective, the Contractor shall remove the unit, correct the bearing area and reset the unit at no additional cost to the Agency. Precast units shall be installed on compacted, shape-conformed Structure Backfill in reasonable conformity with the lines and grades shown on the project plans.

206.4.6 Relative Compaction: Unless otherwise provided in the plans and/or special provisions the maximum density shall be determined using procedures defined in Section 301.

206.5 PAYMENT:

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

When the Special Provisions identify Structure Excavation and/or Structure Backfill as pay items, the following methods of measurement and payment shall be used

206.5.1 Measurement

(A) **Structure Excavation:** Structure Excavation will be measured by the cubic yard, based on the volumes calculated from the measurement/pay limits shown on the Project Plans. If no limits are shown, the measurement for Structure Excavation shall be in accordance with the applicable details shown on the current Arizona Department of Transportation (ADOT) Standard Drawings B-19.30 and/or B-19.50.

No reduction in measurement for payment will be made when the Contractor elects to not excavate all material between the limits of the actual structure, and the pay limits shown on the Project Plans and/or the above referenced ADOT Standard Drawings.

No additional measurement for payment will be made for excavation resulting from lack of side support for structure excavations, nor due to carelessness of the Contractor.

(B) **Structure Backfill:** Structure Backfill will be measured by the cubic yard, based on the volumes calculated from the measurement/pay limits shown on the Project Plans. If no limits are shown, the measurement for Structure Backfill shall be in accordance with the applicable details shown on the current ADOT Standard Drawings B-19.40 and/or B-19.50.

206.5.2 Payment

Structure Excavation and Structure Backfill: The accepted quantities of Structure Excavation and the accepted quantities of Structure Backfill will be paid for at their respective contract unit prices.

Hauling, placing, and compacting surplus Structure Excavation in embankments, or otherwise disposing of the material, shall be included in the contract price paid for Structure Excavation.

- End of Section -

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Case 13-15 Section 603 added into section 601 WW 9-5-14 hybrid
 Revised by MCDOT 9-10-14
[Revised by WW 9-18-14](#)

TRENCH EXCAVATION, BACKFILLING AND COMPACTION

601.1 DESCRIPTION:

The work covered by this specification consists of furnishing all labor, equipment, appliances, materials, and performing all operations in connection with the excavation, backfilling and compaction of trenches for pipe installations.

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

The Trench Cross-Section Detail shown on Detail 200-2 illustrates the terminology used in this specification.

See Section 620 for cast-in-place concrete pipe.

Pipe materials that are considered to be rigid include reinforced concrete pipe, non-reinforced concrete pipe, reinforced concrete cylinder pipe, vitrified clay pipe, steel casings, cast iron, and ductile iron pipe.

Pipe materials that are considered to be flexible include thermoplastic pipes (HDPE, SRPE, PP, PVC) and corrugated metal pipe.

601.2 EXCAVATION:

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

601.2.2 Trench Widths: Trenches for a single pipe shall conform to the dimensions in Table [601-1, unless otherwise specified in the special provisions, indicated on the plans, and/or approved by the Engineer](#). Multiple pipe installations in a single trench shall be installed in accordance with details on the plans or in the special provisions.

Table 601-1 TRENCH WIDTHS		
Size of Pipe (Nom. Dia.)	Maximum Width At Top Of Pipe Greater Than O.D. Of Bell	Minimum Width At Springline Each Side of Pipe (±)
Rigid Pipes:		
Less than 18 inches	16 inches	6 inches
18 inches to 24 inches inclusive	19 inches	7.5 inches
27 inches to 39 inches inclusive	22 inches	9 inches
42 inches to 60 inches inclusive	30 inches	12 inches
66 inches to 78 inches inclusive	42 inches	15 inches
84 inches to 96 inches inclusive	50 inches	19 inches
102 inches to 120 inches inclusive	60 inches	24 inches
Flexible Pipes:		
Less than 18 inches	20 inches	8 inches
18 inches to 24 inches inclusive	23 inches	9.5 inches
27 inches to 39 inches inclusive	28 inches	12 inches
42 inches to 60 inches inclusive	34 inches	14 inches
66 inches to 78 inches inclusive	44 inches	16 inches
84 inches to 96 inches inclusive	48 inches	18 inches
102 inches to 120 inches inclusive	54 inches	21 inches

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~~(1) When the specified compaction cannot be obtained in the haunch area and/or initial backfill zone, the Contractor shall make necessary changes in his methods and/or equipment to obtain the desired results. The Engineer must be satisfied with the Contractor's compaction efforts and results.~~

~~Multiple pipe installations in a single trench shall be installed in accordance with details on the plans or in the special provisions.~~

The width of the trench shall not be greater than the maximum indicated in Table [601-1](#), at and below the level of the top of the pipe. The width of the trench above that level may be made as wide as necessary for sheeting and bracing, and for proper installation of the work.

If the maximum trench width as specified in Table [601-1](#) is exceeded at the top of the pipe additional load bearing capacity to compensate for the increased pipe loading may be required by the Engineer. The Contractor shall provide, at no additional cost to the Contracting Agency, the additional load bearing capacity. This may require changing the material requirements of initial backfill, a higher strength pipe, a concrete cradle, cap or encasement, or other means approved in writing by the Engineer. Where safety or undermining situations occur, a CLSM backfill may be used as needed.

601.2.3 Trench Grade: Alignment and elevation stakes shall be furnished by the Contractor at set intervals and agreed upon offsets. On water main projects, elevation stakes will be furnished only when deemed necessary by the Engineer. In all cases where elevation stakes are furnished, the ~~Engineer-Contractor~~ will also furnish the ~~Contractor-Engineer~~ with cut sheets.

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

601.2.4 Fine Grading: ~~Unless otherwise specified in the plans and/or special provisions,~~ ~~the~~ bedding or the bottom of the trench when bedding is not required shall be accurately graded to provide uniform bearing and support for each section of the pipe at every point along its entire length, except for portions of the pipe where it is necessary to excavate for bells or other joint types and for proper sealing of the pipe joints.

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

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

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

Unauthorized excavation below the specified trench grade line shall be refilled at the Contractor's expense with ABC material compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T-99 and T-191 or ASTM D6938. When AASHTO T-99, method A or B, and T-191 are used for density determination, ARIZ 227c will be used for rock correction.

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

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

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

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

601.2.7 Pavement and Concrete Cutting and Removal: Where trenches lie within the Portland cement concrete section of streets, alleys, driveways, or sidewalks, etc., such concrete shall be sawcut to neat, vertical, true lines in such a manner that the adjoining surface will not be damaged. The minimum depth of cut shall be 1 ½ inches or 1/4 of the thickness, whichever is greater.

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

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

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

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

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

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

601.2.9 Shoring and Sheeting: The Contractor shall do such trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. The bracing, sheathing, or shoring shall not be removed in one operation but shall be done in successive stages to prevent overloading of the pipe during backfilling operations. The cost of the bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price for the pipe or other item which necessitated the work.

All shoring and sheeting deemed necessary to protect the excavation and to safeguard employees, shall be installed. See Section [107](#).

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

Any excavated area shall be considered open trench until all ABC for pavement replacement has been placed and compacted. With the approval of the Engineer, pipe laying may be carried on at more than one location, the

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restrictions on open trench applying to each location. Trenches across streets shall be completely backfilled as soon as possible after pipe laying.

Substantial steel plates with adequate trench bracing shall be used to bridge across trenches at street crossings where trench backfill and temporary patches have not been completed during regular work hours. Steel plates shall be installed in accordance with Detail 211. Safe and convenient passage for pedestrians shall be provided. The Engineer may designate a passage to be provided at any point he deems necessary. Access to hospitals, fire stations and fire hydrants must be maintained at all times.

601.3 PROTECTION OF EXISTING UTILITIES:

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

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

The Contractor shall be entirely responsible for safeguarding and maintaining all conflicting utilities 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](#).

Backfill, around utilities that are exposed during trench excavation, shall be placed in accordance with the utility's haunching and initial backfill requirements.

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 location as necessary as determined by the Engineer.

601.4 FOUNDATION, BEDDING, HAUNCHING, BACKFILLING AND COMPACTION:

601.4.1 Foundation: The bottom of an excavation upon which a structure is to be placed or the bottom of a trench where the elevation is set below the pipe ~~grade elevation~~ shown on the plans or as directed by the Engineer. The elevation of the trench foundation is determined from the desired pipe elevation ~~and grade~~ by taking into account the bedding and pipe wall thicknesses. The foundation surface will consist of native material or replacement material required due to over-excavation.

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601.4.2 Bedding: Bedding is the granular material upon which a pipe or structure is to be placed. Bedding shall be accurately finished to the grade or dimensions shown on the plans or as directed by the Engineer. Depth and grading requirements shall be per Subsections 601.2.3 and 601.2.4.

The granular bedding material type shall be ABC per Section 702, ~~except where unless~~ otherwise specified in the project plans or project specifications.

601.4.3 Haunching: The granular material placed between the bedding and springline, ~~shall be constructed using the specified material and compacted for the full length of the pipe so as to distribute the load bearing reaction uniformly to the bedding.~~ If placed in lifts, the lift thickness shall not exceed 2 feet (1 foot for flexible pipe) and shall be deposited and compacted to the specified density uniformly on each side of the pipe to prevent lateral displacement of the pipe. ~~Compaction requirements shall be per Section 601.4.6. The moisture content shall be such that the specified compaction can be obtained.~~

The granular haunching material type shall be ABC per Section 702. ~~With Agency approval an alternate granular material or CLSM may be used,; except where unless otherwise specified in the project plans or project specifications. With agency approval, native or CLSM may be used as an option.~~

601.4.4 Initial Backfill: The granular material placed between the springline to 12 inches above top of pipe. Initial backfill (minimum) shall be placed in lifts the height of which that shall not exceed 2 feet (1 foot for flexible pipe) ~~or that and~~ which can be effectively compacted depending on the type of material, type of equipment, and methods used. ~~Compaction requirements shall be per Section 601.4.6. The moisture content shall be such that the specified compaction can be obtained.~~

~~The granular material type Initial backfill material for flexible pipe shall be ABC per Section 702. With Agency approval an alternate granular material or CLSM may be used,; and with agency approval n-Native backfill with no piece larger than 1½ inches may be allowed used for concrete pipe. Initial backfill for rigid pipe shall be sound earthen material with no piece larger than 1½ inches and be free from broken concrete, broken pavement, wood or other deleterious material,; except where otherwise specified in the project plans or project specifications. With agency approval, native or CLSM may be used as an option.~~

601.4.5 Final Backfill: ~~Unless otherwise specified the mMaterial~~ material placed above the initial backfill to the top of the trench or to the bottom of the road base material. Final backfill shall be placed in lifts that shall not exceed 2 feet and the lift height shall not be more than can be compacted to the required density with the equipment and methods being used.

Final backfill shall be ABC per Section 702 or sound earthen material with no piece larger than 4 inches and be free from broken concrete, broken pavement, wood or other deleterious material. ~~Final backfill shall be placed in lifts that shall not exceed 2 feet and the lift height shall not be more than can be compacted to the required density with the equipment and methods being used. Compaction requirements shall be per Section 601.4.6.~~

Backfill under street pavement shall be constructed per Detail 200-1 with the type of replacement noted on the plans or in the special provisions. Unless otherwise noted, backfill under single curb, curb and gutter, sidewalk, driveways, valley gutters, etc. shall be the same as the adjacent street pavement.

601.4.6 Compaction Densities: ~~Unless otherwise provided in the plans and/or special provisions, the tTrench~~ backfill shall be thoroughly compacted to not less than the densities shown in Table 601-2 when tested and determined by AASHTO T-99 and T-191 or ASTM D6938. When AASHTO T-99, method A or B, and T-191 are used for density determination, ARIZ-227c shall be used for rock correction.

~~Unless otherwise noted in the plans or special provisions the bB~~ackfill material shall be within 2 percentage points of its optimum moisture content while being compacted.

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~~The required density shall be as identified in Table 601-2 unless otherwise noted in the plans or special provisions.~~ When backfill material is CLSM and it is placed in accordance with ~~section-Section~~ 604 no compaction testing is required, the compaction density shall be deemed acceptable.

TABLE 601-2				
MINIMUM TRENCH COMPACTION DENSITIES				
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 Pipe
I	Under any existing or proposed pavement, curb, gutter, attached sidewalk, roadway shoulders, and other areas within right-of-way subject to vehicular traffic, or when any part of the trench excavation is within 2-feet of the existing pavement, curb, or gutter.	100% for granular 95% for non-granular	95%	95%
II	On any utility easement or right-of-way outside limits of Type I backfill.	85%	85%	90%
III	Around any structures (manholes, etc.) or exposed utilities outside limits of Type I backfill.	95% in all cases		

601.4.7 Water Consolidation: ~~Unless otherwise specified by plans or special provisions j~~etting is the only acceptable water consolidation method and its use is restricted. Jetting may only be used in the haunching and initial backfill zones and within ~~the~~ Type II Backfill locations as defined in Table 601-2.

Water consolidation by jetting shall use a 1 ½ inches pipe of sufficient length to reach the bottom of the lift being settled and shall have a water pressure of not less than 30 psi. All jetting shall be accomplished transversely across the trench at intervals of not more than 6 feet with the jetting locations on one side of the trench offset to the jetting locations on the other side of the trench. The entire lift shall be leveled and completely saturated working from the top to the bottom.

When jetting is used within the haunching and initial backfill zones, the Contractor shall be responsible for establishing each lift depth so as to avoid floating the pipe being placed and shall make any needed repair or replacement at no cost to the Contracting Agency. For pipes larger than 24 inches I.D. the first lift shall not exceed the springline of the pipe and subsequent lifts shall not exceed 3 feet.

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

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

If jetting does not obtain the required compaction density, mechanical compaction methods shall be used to meet the compaction requirements. Water consolidated backfill material may need to be removed and replaced.

Jetting within Type I backfill locations shall not be used unless the material in which the trench is located and the backfill are both granular material. No exception shall be made for construction within new developments.

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

Native material used for backfill shall be sound earthen material free from broken concrete, broken pavement, wood or other deleterious material with no piece larger than 4 inches.

601.4.9 Rights-Of-Way Belonging to Others: Backfill and compaction for irrigation lines of the Salt River Valley Water Users' Association and Roosevelt Irrigation Districts and for trenches in State of Arizona or another entity's right-of-way outside the limits of the Contracting Agency shall be accomplished in accordance with their permit and/or specifications.

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

601.4.10-11 Bedding and Backfilling for Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines: The bedding and backfill for these underground facilities shall be native material or sand which conforms to the grading requirement of ASTM C33 for fine aggregate. When backfill material consists of aggregate base course, crushed stone, or other material containing stones, only sand will be used within the bedding, haunching, and initial backfill zones. The bedding depth shall be six inches. Compaction ~~will~~ shall be in accordance with Section [601](#).

601.5 CONTRACTOR CERTIFICATION OF INSTALLATION PROCEDURES:

When requested in the Special Provisions or by the Engineer prior to installation, the Contractor shall furnish to the Contracting Agency an affidavit (certification) from the pipe manufacturer (or his designee) stating that the Contractor is familiar with the manufacturer's suggested installation methods and procedures and the manufacturer's suggested installation methods and procedures are consistent with MAG requirements.

When required by the Special Provisions, the pipe manufacturer or his designee will review the Contractor's methods and procedures for pipe installation in the field. The Contractor will make any adjustments in the installation as recommended by the manufacturer or his representative. If necessary, the Contractor may be required to reinstall or provide corrections to pipe installed prior to the field review at no cost to the Agency. Once the manufacturer or his representative has reviewed the Contractor's installation methods and the Contractor has adjusted his installation methods as recommended by the same, the manufacturer or his representative shall furnish to the Contracting Agency an affidavit (certification) that the Contractor's installation methods and procedures, at the time of the review, complied with the manufacturer's installation practices. The affidavit must provide the name of the manufacturer's representative witnessing the pipe installation.

601.6 PAVEMENT REPLACEMENT AND SURFACE RESTORATION:

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

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

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

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

601.7 PAYMENT:

No pay item will be included in the proposal, ~~or~~ or direct payment made for trench excavation, backfilling, compaction, or placement of temporary pavement. The cost of these features of the work shall be included in the unit price per linear foot for furnishing and laying pipe.

- End of Section -



STRUCTURE EXCAVATION AND BACKFILL**206.1 DESCRIPTION:**

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

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

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

206.2 FOUNDATION MATERIAL TREATMENT:

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

When no piles are used and footing concrete or masonry is to rest on an excavated surface other than rock, care shall be taken not to disturb the bottom of the excavation and final removal of the foundation material to grade shall not be made until just before the concrete or masonry is placed. Excavation below grade shall be replaced with the same class of concrete specified for the structure or with 1 ½ sack controlled low strength material as specified in Section 728. When the replacement material is structural concrete, the material shall be placed at the same time as the structure material. Placement of controlled low strength material shall be per Section 604 which will require a time lag between placement of the material and the structural concrete.

The placement of the additional material shall be at no cost to the Agency except when over-excavation is directed by the Engineer.

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

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

206.3 INSPECTION:

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

206.4 STRUCTURE BACKFILL:

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

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

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

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

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

(D) Shall be uniformly compacted to at least 95 percent of maximum density.

EXCEPTION: Catch basins constructed in accordance with standard details and having the outlet invert depth equal to or less than six feet may place structure backfill when the concrete has attained a minimum compressive strength of 2500 psi in compression as specified in Section 725 and in no case less than 72 hours after casting.

206.4.3 Structure Backfill for Structures Other than Earth Retaining: Structure Backfill placed against concrete structures not designed to retain earth loads:

(A) Shall not be placed until the concrete has attained a minimum compressive strength of 2500 psi in compression as specified in Section 725 and in no case less than 72 hours after casting.

(B) Shall be uniformly compacted to at least 95 percent of maximum density.

206.4.4 Structure Backfill for Structures within Paved Areas: Where a structure is located within an existing street, proposed street, or paved area shall be compacted to the minimum density specified in Table 601-2, for Type I or shall be filled with ½ sack or 1 sack controlled low strength material as specified in Sections 604 and 728.

206.4.5 Structure Backfill for Precast Minor Structures: Minor structures, as defined in Section 505.1.1, when furnished as precast structures, shall be placed on a compacted layer of Structure Backfill at least 6 inches in depth that conforms to the material requirements of Section 206.4.2. The layer shall be shaped to fit the bottom surface of the precast unit and compacted to not less than 100 percent maximum density. The Structure Backfill shall be at or near optimum moisture content, as approved by the Engineer. After the unit has been initially set in place and checked for line and grade, it shall be removed, and any defects in its bearing area or line and grade shall be corrected by trimming and by placing and compacting similarly moistened Structure Backfill and the unit reset in place. If in the opinion of the Engineer the bearing area or line or grade of a set precast unit is defective, the Contractor shall remove the unit, correct the bearing area and reset the unit at no additional cost to the Agency. Precast units shall be installed on compacted, shape-conformed Structure Backfill in reasonable conformity with the lines and grades shown on the project plans.

206.4.6 Relative Compaction: Unless otherwise provided in the plans and/or special provisions the maximum density shall be determined using procedures defined in Section 301.

206.5 PAYMENT:

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

When the Special Provisions identify Structure Excavation and/or Structure Backfill as pay items, the following methods of measurement and payment shall be used

206.5.1 Measurement

(A) **Structure Excavation:** Structure Excavation will be measured by the cubic yard, based on the volumes calculated from the measurement/pay limits shown on the Project Plans. If no limits are shown, the measurement for Structure Excavation shall be in accordance with the applicable details shown on the current Arizona Department of Transportation (ADOT) Standard Drawings B-19.30 and/or B-19.50.

No reduction in measurement for payment will be made when the Contractor elects to not excavate all material between the limits of the actual structure, and the pay limits shown on the Project Plans and/or the above referenced ADOT Standard Drawings.

No additional measurement for payment will be made for excavation resulting from lack of side support for structure excavations, nor due to carelessness of the Contractor.

(B) **Structure Backfill:** Structure Backfill will be measured by the cubic yard, based on the volumes calculated from the measurement/pay limits shown on the Project Plans. If no limits are shown, the measurement for Structure Backfill shall be in accordance with the applicable details shown on the current ADOT Standard Drawings B-19.40 and/or B-19.50.

206.5.2 Payment

Structure Excavation and Structure Backfill: The accepted quantities of Structure Excavation and the accepted quantities of Structure Backfill will be paid for at their respective contract unit prices.

Hauling, placing, and compacting surplus Structure Excavation in embankments, or otherwise disposing of the material, shall be included in the contract price paid for Structure Excavation.

- End of Section -

SECTION 615

SANITARY SEWER LINE CONSTRUCTION

615.1 DESCRIPTION:

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

615.2 MATERIALS:

Pipe used for sewer line construction, including specials, joints, and gaskets, shall be according to the following Sections, or as modified by the special provisions.

- Reinforced Concrete Pipe (RCP), see Section 735
- High Density Polyethylene (HDPE) Pipe, see Section 738
- Steel Reinforced Polyethylene (SRPE) Pipe, see Section 739
- Polypropylene Pipe (PP), see Section 740
- Vitrified Clay Pipe (VCP), see Section 743
- Polyvinylchloride (~~PVC~~) Pipe (PVC), see Section 745
- Ductile Iron (~~DI~~) Pipe (DIP), see Section 750

615.3 TRENCHING:

Trench excavation shall be accomplished in accordance with Sections [601 for rigid pipe](#) and [603 for flexible pipe](#), except as specified below, or as modified by special provisions.

The Engineer shall furnish the Contractor alignment and elevation stakes at agreed-upon intervals and offset together with cut sheets showing the difference in elevation from the top of the stakes to the flow line of the pipe.

The trench shall be dry when the fine grading of the trench bedding is accomplished. Before placement of pipe the fine grade shall be carefully checked by use of a string line, laser beam, or other means so that when in final position the pipe will be true to line and grade, ± 0.05 feet for 12 inch and smaller diameter pipe and ± 0.10 feet for 15 inch and larger diameter pipe.

615.4 SEPARATION:

To protect water lines from contamination by sewer lines, separation and extra protection shall be in accordance with Section [610](#).

Sewer lines that are constructed of ductile iron pipe for extra protection shall be internally lined for sewer service.

615.5 PIPE INSTALLATION:

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

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

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

At all times when work is not in progress, open ends of the pipe and fittings shall be securely closed to the satisfaction of the Engineer, so that no water, earth or other substance will enter the pipe or fittings.

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615.6 FITTINGS:

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

615.7 JOINTING:

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

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

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

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

615.7.2 Water Stops: Water stops will be required when connecting ~~PVC or HDPE~~ pipes other than VCP or RCP to concrete structures, manholes, etc. The water stop shall comply with Section 738 and ~~will~~ shall be installed per manufacturer recommendations.

615.8 SANITARY SEWER SERVICE TAPS:

Sanitary sewer service taps shall be constructed in accordance with standard details.

~~To maintain structural integrity of the pipe, service taps connections into an existing for flexible pipe shall be constructed~~ made in accordance with the pipe manufacturer's recommendations.

When any damage occurs to the pipe, the Contractor shall perform repairs, as recommended by the manufacturer at no cost to the Contracting Agency. Damage to the pipe will include but not be limited to gouging, marring, and scratching forming a clear depression in the pipe.

The locations of the service tap for each property shall be in the downstream $\frac{1}{3}$ of the lot, or as requested by the property owner. Sewer service taps shall not be covered until they have been plugged and marked in accordance with standard details and their location has been recorded by the Engineer. Electronic markers shall be placed at no greater depth than electronic locating devices can locate them (typically 2'-4').

615.9 SANITARY SEWER CLEANOUTS:

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

615.10 MANHOLES:

Manholes shall be constructed to conform with the requirements of Sections ~~625, Section 505~~ and standard details.

615.11 BACKFILLING:

Backfilling and compaction shall be accomplished in accordance with Sections ~~601 for rigid pipe and 603 for flexible pipe~~ except as modified by special provisions.

615.12 TRENCHLESS INSTALLATIONS/JACKING PIPE:

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~~Pipe jacking~~ Trenchless installation of pipe shall be in accordance with Section 602 or Section 607.

615.13 INSPECTION AND TESTING:

Testing and inspection shall be in accordance with Section 611.

615.14 PAVEMENT AND SURFACING REPLACEMENT:

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

615.15 CLEANUP:

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

615.16 MEASUREMENT AND PAYMENT:

(A) Sanitary Sewer Pipe and Fittings:

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

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

(B) Sanitary Sewer Service Lines and Taps:

Measurement ~~of will be~~ the number of taps installed will only be made when pay items for sanitary sewer taps are contained in the contract.

When pay items for sanitary sewer taps are contained in the contract, pPayment for sanitary sewer service taps will be made at the contract unit price and shall be compensation in full for furnishing and installing pipe and fittings needed to connect to the main, complete in place, as specified and called for on the plans and standard details, including all cost for furnishing and installing electronic markers, and all cost of excavation, removal of obstructions, shoring and bracing, backfilling, compaction, pavement replacement, maintenance of traffic, and all work incidental thereto.

The length of pipe required for the service lines shall be measured and payment made as ~~indicated for~~ Sanitary Sewer Pipe and Fittings. If no ~~bid-pay~~ item is provided for the sanitary sewer taps, the connection cost including all costs for furnishing and installing electronic markers shall be included in the unit cost of the sanitary sewer pipe.

(C) Sanitary Sewer Cleanouts:

Measurement will be the number and type of cleanout installed.

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

- End of Section -

SECTION 615

SANITARY SEWER LINE CONSTRUCTION

615.1 DESCRIPTION:

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

615.2 MATERIALS:

Pipe used for sewer line construction, including specials, joints, and gaskets, shall be according to the following Sections, or as modified by the special provisions.

- Reinforced Concrete Pipe (RCP), see Section 735
- High Density Polyethylene (HDPE) Pipe, see Section 738
- Steel Reinforced Polyethylene (SRPE) Pipe, see Section 739
- Polypropylene Pipe (PP), see Section 740
- Vitrified Clay Pipe (VCP), see Section 743
- Polyvinylchloride Pipe (PVC), see Section 745
- Ductile Iron Pipe (DIP), see Section 750

615.3 TRENCHING:

Trench excavation shall be accomplished in accordance with Section [601](#), except as specified below, or as modified by special provisions.

The Engineer shall furnish the Contractor alignment and elevation stakes at agreed-upon intervals and offset together with cut sheets showing the difference in elevation from the top of the stakes to the flow line of the pipe.

The trench shall be dry when the fine grading of the trench bedding is accomplished. Before placement of pipe the fine grade shall be carefully checked by use of a string line, laser beam, or other means so that when in final position the pipe will be true to line and grade, ± 0.05 feet for 12 inch and smaller diameter pipe and ± 0.10 feet for 15 inch and larger diameter pipe.

615.4 SEPARATION:

To protect water lines from contamination by sewer lines, separation and extra protection shall be in accordance with Section [610](#).

Sewer lines that are constructed of ductile iron pipe for extra protection shall be internally lined for sewer service.

615.5 PIPE INSTALLATION:

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

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

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

At all times when work is not in progress, open ends of the pipe and fittings shall be securely closed to the satisfaction of the Engineer, so that no water, earth or other substance will enter the pipe or fittings.

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615.6 FITTINGS:

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

615.7 JOINTING:

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

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

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

615.7.2 Water Stops: Water stops will be required when connecting pipes other than VCP or RCP to concrete structures, manholes, etc. The water stop shall comply with Section [738](#) and shall be installed per manufacturer recommendations.

615.8 SANITARY SEWER SERVICE TAPS:

Sanitary sewer service taps shall be constructed in accordance with standard details.

To maintain structural integrity of the pipe, service tap connections into an existing flexible pipe shall be made in accordance with the pipe manufacturer's recommendations.

When any damage occurs to the pipe, the Contractor shall perform repairs, as recommended by the manufacturer at no cost to the Contracting Agency. Damage to the pipe will include but not be limited to gouging, marring, and scratching forming a clear depression in the pipe.

The locations of the service tap for each property shall be in the downstream $\frac{1}{3}$ of the lot, or as requested by the property owner. Sewer service taps shall not be covered until they have been plugged and marked in accordance with standard details and their location has been recorded by the Engineer. Electronic markers shall be placed at no greater depth than electronic locating devices can locate them (typically 2'-4').

615.9 SANITARY SEWER CLEANOUTS:

Cleanouts shall be constructed at locations shown on the plans, in accordance with the standard details.

615.10 MANHOLES:

Manholes shall be constructed to conform with the requirements of Section [625](#) and standard details.

615.11 BACKFILLING:

Backfilling and compaction shall be accomplished in accordance with Section [601](#) except as modified by special provisions.

615.12 TRENCHLESS INSTALLATIONS:

Trenchless installation of pipe shall be in accordance with Section 602 or Section 607.

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615.13 INSPECTION AND TESTING:

Testing and inspection shall be in accordance with Section 611.

615.14 PAVEMENT AND SURFACING REPLACEMENT:

Pavement and surfacing replacement shall be in accordance with Section [336](#).

615.15 CLEANUP:

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

615.16 MEASUREMENT AND PAYMENT:

(A) Sanitary Sewer Pipe and Fittings:

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

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

(B) Sanitary Sewer Service Lines and Taps:

Measurement of the number of taps installed will only be made when pay items for sanitary sewer taps are contained in the contract.

When pay items for sanitary sewer taps are contained in the contract, payment for sanitary sewer service taps will be made at the contract unit price and shall be compensation in full for furnishing and installing pipe and fittings needed to connect to the main, complete in place, as specified and called for on the plans and standard details, including all cost for furnishing and installing electronic markers, and all cost of excavation, removal of obstructions, shoring and bracing, backfilling, compaction, pavement replacement, maintenance of traffic, and all work incidental thereto.

The length of pipe required for the service lines shall be measured and payment made as Sanitary Sewer Pipe and Fittings. If no pay item is provided for the sanitary sewer taps, the connection cost including all costs for furnishing and installing electronic markers shall be included in the unit cost of the sanitary sewer pipe.

(C) Sanitary Sewer Cleanouts:

Measurement will be the number and type of cleanout installed.

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

- End of Section -

SECTION 618

Case 13-15 revisions 06-27-14
Revised by MCDOT 08-26-14

STORM DRAIN CONSTRUCTION

618.1 DESCRIPTION:

This section covers ~~rigid and flexible~~ pipe line construction used for the conveyance of irrigation water and storm drainage in streets, easements, and alley right of ways, under low hydrostatic heads.

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

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

Installation of pipe under railways shall conform to the specifications and permit of the respective railway agency.

618.2 MATERIALS:

Pipe used for storm drain construction, including specials, joints, and gaskets, shall be according to the following Sections, or as modified by special provisions.

- Cast-in-Place Concrete Pipe (CIPP), see Section 620.
- Reinforced Concrete Pipe (RCP), see Section 735. For permitted construction reinforced concrete pipe strength shall be equal to or higher than Class III, A-III, HE-III, or VE-III.
- Non-Reinforced Concrete Pipe, see Section 736.
- High Density Polyethylene (HDPE), see Section 738.
- Steel Reinforced Polyethylene (SRPE) Pipe, see Section 739.
- Polypropylene Pipe, see Section 740.
- Corrugated Metal Pipe, see Section 760.

Comment [RTH1]: Case 14-07 Revision.

The size, type, and minimum strength of pipe shall be as shown on the plans, or as specified. Pipe stronger than that specified may be furnished at the Contractor's option and at no additional cost to the Contracting Agency.

When specified in the special provisions pipe line layout drawings shall be furnished to the Engineer prior to the manufacture of the concrete pipe. Catch basin connector pipe need not be included in the pipe line layout; however, special prefabricated pipe connections to the main line shall be included. In lieu of including catch basin connector pipe in the pipe layout, a list of catch basin connector pipes shall accompany the layout. The connector pipe list shall contain the following information.

(A) Size and Class of pipe.

(B) Station at which pipe joins main line.

(C) Number of section of pipe, length of section, type of sections (straight, horizontal bevel, vertical bevel, etc.).

The pipe layouts will be used by the Contracting Agency for reference only, but their use shall in no way relieve the Contractor of the responsibility for the correctness of the layout.

Comment [RTH2]: Case 14-07 Revision.

618.3 CONSTRUCTION METHODS:

Trench excavation, backfilling, and compaction shall be accomplished in accordance with Sections ~~601 for rigid pipe and 603 for flexible pipe~~, except as specified below, or as modified by special provisions.

Comment [RTH3]: This adjustment is only valid if Section 601 combines requirements for both rigid and flexible pipe.

The laying of the pipe shall be in finished trenches free from water or debris, and shall be commenced at the lowest point, with the spigot ends pointing in the direction of the flow. Each pipe shall be laid firmly and true to line and grade, in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden off-sets of

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the flow line. Any adjustment to line and grade shall be made by scraping away or filling in under the body of the pipe, never by wedging or blocking under the pipe ends.

Trenchless installations of piping pipe shall be in accordance with Section 602 or conform to the requirements of Section 607.

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

~~618.4 JACKING PIPE:~~

~~Pipe jacking shall be in accordance with Section 602.~~

618.5.4 POST INSTALLATION INSPECTION AND TESTING:

Post installation Testing and inspection and testing shall be in accordance with Section 611.4.

618.6.5 MEASUREMENT:

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

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

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

618.7.6 PAYMENT:

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

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

- End of Section -

Comment [RTH4]: Combined with the trenchless installation paragraph in section 618.3.

Comment [RTH5]: Revised title to be consistent with section 611.4 and to eliminate the misconception that there is no testing or inspection during installation.

STORM DRAIN CONSTRUCTION**618.1 DESCRIPTION:**

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

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

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

Installation of pipe under railways shall conform to the specifications and permit of the respective railway agency.

618.2 MATERIALS:

Pipe used for storm drain construction, including specials, joints, and gaskets, shall be according to the following Sections, or as modified by special provisions.

- Cast-in-Place Concrete Pipe (CIPP), see Section 620.
- Reinforced Concrete Pipe (RCP), see Section 735. For permitted construction reinforced concrete pipe strength shall be equal to or higher than Class III, A-III, HE-III, or VE-III.
- Non-Reinforced Concrete Pipe, see Section 736.
- High Density Polyethylene (HDPE), see Section 738.
- Steel Reinforced Polyethylene (SRPE) Pipe, see Section 739.
- Polypropylene Pipe, see Section 740.
- Corrugated Metal Pipe, see Section 760.

The size, type, and minimum strength of pipe shall be as shown on the plans, or as specified. Pipe stronger than that specified may be furnished at the Contractor's option and at no additional cost to the Contracting Agency.

When specified in the special provisions pipe line layout drawings shall be furnished to the Engineer prior to the manufacture of the concrete pipe. Catch basin connector pipe need not be included in the pipe line layout; however, special prefabricated pipe connections to the main line shall be included. In lieu of including catch basin connector pipe in the pipe layout, a list of catch basin connector pipes shall accompany the layout. The connector pipe list shall contain the following information.

- (A) Size and Class of pipe.
- (B) Station at which pipe joins main line.
- (C) Number of section of pipe, length of section, type of sections (straight, horizontal bevel, vertical bevel, etc.).

The pipe layouts will be used by the Contracting Agency for reference only, but their use shall in no way relieve the Contractor of the responsibility for the correctness of the layout.

618.3 CONSTRUCTION METHODS:

Trench excavation, backfilling, and compaction shall be accomplished in accordance with Section [601](#), except as specified below, or as modified by special provisions.

The laying of the pipe shall be in finished trenches free from water or debris, and shall be commenced at the lowest point, with the spigot ends pointing in the direction of the flow. Each pipe shall be laid firmly and true to line and grade, in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden off-sets of

SECTION 618

the flow line. Any adjustment to line and grade shall be made by scraping away or filling in under the body of the pipe, never by wedging or blocking under the pipe ends.

Trenchless installation of pipe shall be in accordance with Section 602 or Section 607.

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

618.4 POST INSTALLATION INSPECTION AND TESTING:

Post installation inspection and testing shall be in accordance with Section 611.4.

618.5 MEASUREMENT:

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

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

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

618.6 PAYMENT:

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

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

- End of Section -

REINFORCED CONCRETE PIPE**735.1 GENERAL:**

These specifications cover reinforced concrete pipe and related structures intended to be used for conveyance of sewage, industrial waste, and storm and irrigation water.

Except as modified herein reinforced concrete pipe shall be manufactured and tested in conformance with the requirements of ASTM C76 for circular pipe, ASTM C506 for arch pipe, and ASTM C507 for elliptical pipe.

Whatever struts or other protective methods proved necessary to furnish and install the pipe to meet the limitation of cracks as specified herein, shall be provided and maintained throughout pipe handling and transportation.

735.2 BELL JOINTS REINFORCEMENT:

Bell Reinforcement: All reinforced concrete pipes less than 36 inch inside diameter and the same approximate equivalent size shall include an area of reinforcing steel in the bell not less than the area required for the circumferential reinforcement in the wall of the pipe.

~~(D) – Rubber gaskets shall be in accordance with ASTM C443.~~

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

735.3 FABRICATED SPECIALS – WYES, TEES, CURVES, BENDS AND CLOSURES:

Fabricated pipe specials shall be made equal in strength, diameter, and other physical characteristics to the standard straight pipe lengths by the use of extra concrete, extra reinforcing, or steel items.

Horizontal and vertical long-radius curves shall be formed by bevel adapters or by beveling the straight pipe joint. The bevel of the pipe shall not exceed 5 degrees and the total angular deflection, for beveled pipe, shall not exceed 10 degrees. Small angular changes may be made with straight pipe provided that the joint opening does not exceed 3/4 inch. Short radius curves and closures shall be formed with fabricated specials; however, the angular deflection of any segment of the fabricated section shall not exceed 10 degrees.

735.4 MATERIALS:

Except when otherwise permitted by the Engineer, no materials other than water, Portland cement, Pozzolanic materials, mineral aggregates and steel shall be used in the manufacturing of the pipe with the following exceptions:

(A) Portland Cement: Portland cement shall comply with ASTM C150, Type II, and low alkali. The pipe manufacturer shall supply a cement mill certificate in triplicate for each load of cement delivered, showing the specification, type, chemical analysis, and quantity. In lieu of the above, on stockpiled pipe the manufacturer shall certify that the type of cement used meets this specification. The pipe manufacturer shall also certify in writing that the cement content of the concrete complies with the specifications as to yield per cubic yard of concrete poured.

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

(C) Steel Reinforcement: The pipe manufacturer shall supply three copies of mill certificates showing heat numbers, chemical analysis, and physical tests on reinforcing steel. In lieu of the above, on stockpiled pipe the manufacturer shall certify that the type of steel used meets this specification.

~~(D) – Rubber gaskets shall be in accordance with ASTM C443.~~

735.5 MANUFACTURER'S QUALIFICATIONS AND EQUIPMENT REQUIREMENTS:

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

Comment [RTH1]: Revised section to address Joint requirements.

Comment [RTH2]: Relocated requirement from section 618.2 (D). Requirement deleted from section 618.

Comment [RTH3]: Relocated requirement from section 618.2 (A). Requirement deleted from section 618.

REINFORCED CONCRETE PIPE**735.1 GENERAL:**

These specifications cover reinforced concrete pipe and related structures intended to be used for conveyance of sewage, industrial waste, and storm and irrigation water.

Except as modified herein reinforced concrete pipe shall be manufactured and tested in conformance with the requirements of ASTM C76 for circular pipe, ASTM C506 for arch pipe, and ASTM C507 for elliptical pipe.

Whatever struts or other protective methods proved necessary to furnish and install the pipe to meet the limitation of cracks as specified herein, shall be provided and maintained throughout pipe handling and transportation.

735.2 JOINTS:

Bell Reinforcement: All reinforced concrete pipes less than 36 inch inside diameter and the same approximate equivalent size shall include an area of reinforcing steel in the bell not less than the area required for the circumferential reinforcement in the wall of the pipe.

Rubber gaskets shall be in accordance with ASTM C443.

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

735.3 FABRICATED SPECIALS – WYES, TEES, CURVES, BENDS AND CLOSURES:

Fabricated pipe specials shall be made equal in strength, diameter, and other physical characteristics to the standard straight pipe lengths by the use of extra concrete, extra reinforcing, or steel items.

Horizontal and vertical long-radius curves shall be formed by bevel adapters or by beveling the straight pipe joint. The bevel of the pipe shall not exceed 5 degrees and the total angular deflection, for beveled pipe, shall not exceed 10 degrees. Small angular changes may be made with straight pipe provided that the joint opening does not exceed 3/4 inch. Short radius curves and closures shall be formed with fabricated specials; however, the angular deflection of any segment of the fabricated section shall not exceed 10 degrees.

735.4 MATERIALS:

Except when otherwise permitted by the Engineer, no materials other than water, Portland cement, Pozzolanic materials, mineral aggregates and steel shall be used in the manufacturing of the pipe with the following exceptions:

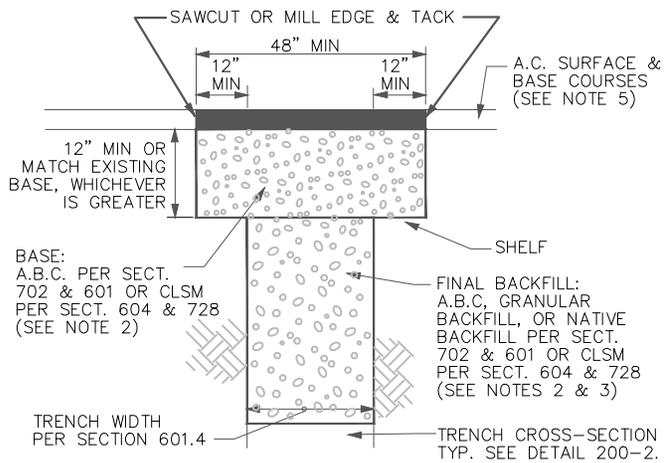
(A) **Portland Cement:** Portland cement shall comply with ASTM C150, Type II, and low alkali. The pipe manufacturer shall supply a cement mill certificate in triplicate for each load of cement delivered, showing the specification, type, chemical analysis, and quantity. In lieu of the above, on stockpiled pipe the manufacturer shall certify that the type of cement used meets this specification. The pipe manufacturer shall also certify in writing that the cement content of the concrete complies with the specifications as to yield per cubic yard of concrete poured.

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

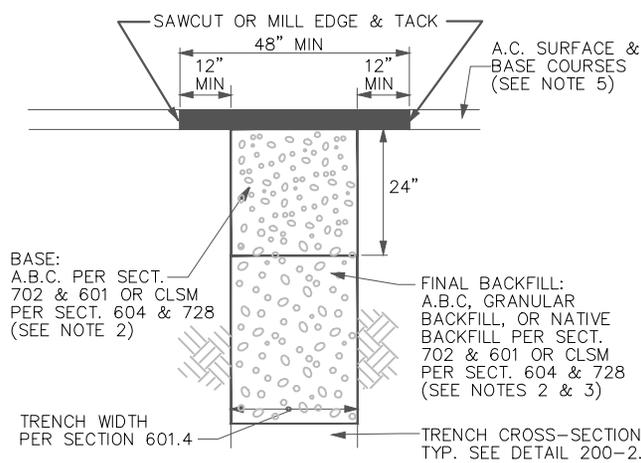
(C) **Steel Reinforcement:** The pipe manufacturer shall supply three copies of mill certificates showing heat numbers, chemical analysis, and physical tests on reinforcing steel. In lieu of the above, on stockpiled pipe the manufacturer shall certify that the type of steel used meets this specification.

735.5 MANUFACTURER'S QUALIFICATIONS AND EQUIPMENT REQUIREMENTS:

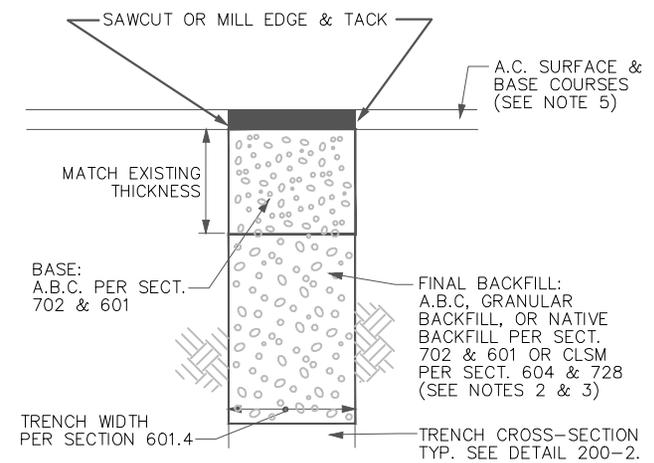
The manufacturer shall be competent to manufacture the type, size and quality of pipe; in addition, the manufacturer shall have satisfactory curing and storage facilities, and satisfactory financial resources.



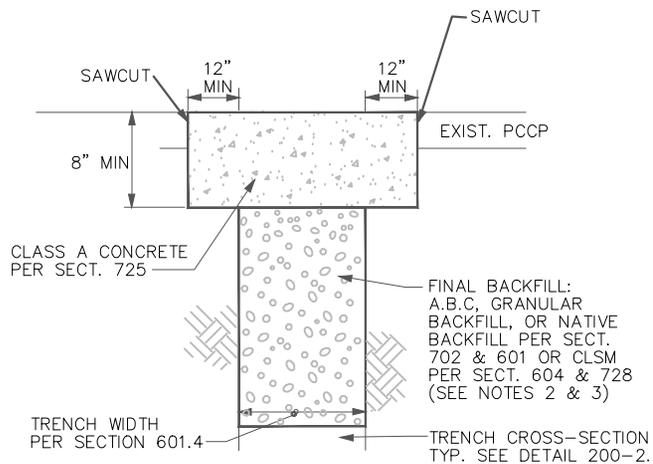
"T TOP" TRENCH REPAIR



TYPE "A" TRENCH REPAIR

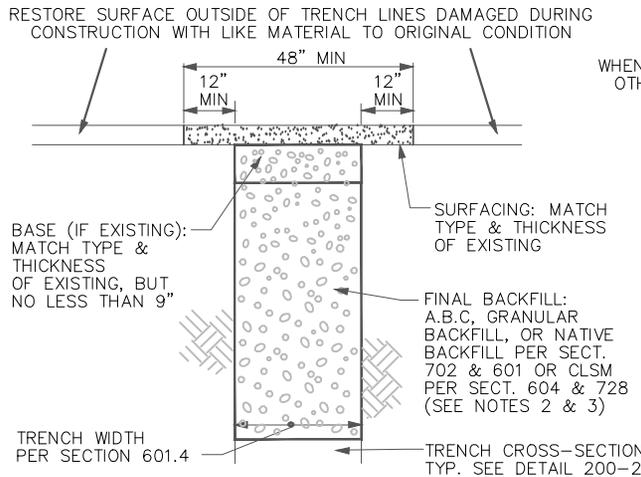


TYPE "B" TRENCH REPAIR



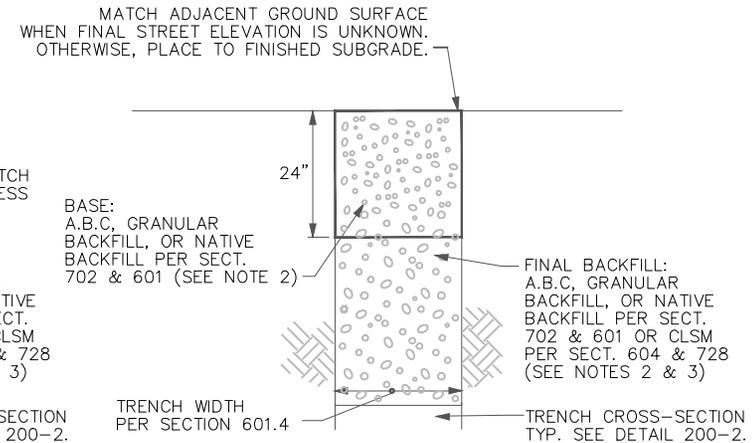
TYPE "C" TRENCH REPAIR

(TRENCH IN PORTLAND CEMENT CONCRETE PAVEMENT)



TYPE "D" TRENCH REPAIR

(TRENCH NOT UNDER CONCRETE OR ASPHALT PAVEMENT)



TYPE "E" TRENCH REPAIR

(TRENCH IN FUTURE ROADWAY PRISM OR ALLEY)

NOTES:

1. PAVEMENT MATCHING AND SURFACE REPLACEMENT SHALL BE IN ACCORDANCE WITH SECTION 336.
2. TYPE OF BACKFILL AND BASE (IF APPLICABLE) SHALL BE AS NOTED HEREIN UNLESS OTHERWISE SPECIFIED IN CONTRACT DOCUMENTS. IF NOT SPECIFIED, CLSM SHALL BE 1/2-SACK PER SECTIONS 604 AND 728.
3. TRENCHES LESS THAN 24" WIDE SHALL BE BACKFILLED FROM TOP OF INITIAL BACKFILL TO BOTTOM OF SURFACING MATERIALS WITH 1/2-SACK CLSM PER SECTIONS 604 AND 728.
4. BASE, FINAL BACKFILL, AND PIPE EMBEDMENT ZONE COMPACTION REQUIREMENTS SHALL BE IN ACCORDANCE WITH SECTION 601.
5. ASPHALT CONCRETE SURFACE AND BASE COURSES SHALL COMPLY WITH SECTION 336.2.4.1 UNLESS OTHERWISE SPECIFIED IN CONTRACT DOCUMENTS.
6. USE TYPE "A" FOR LONGITUDINAL TRENCH REPAIR AND USE "T-TOP" FOR TRANSVERSE TRENCH REPAIR (SEE DETAIL 200-2) UNLESS OTHERWISE SPECIFIED IN CONTRACT DOCUMENTS. TYPE "B" TRENCH REPAIR MAY BE USED FOR TRANSVERSE TRENCH REPAIR IF SPECIFIED BY THE AGENCY.
7. PROVIDE MINIMUM 12" WIDE SHELF AS SHOWN IN "T-TOP" TRENCH REPAIR AT ENDS OF TYPE "A" TRENCH REPAIR EXCEPT WHERE EDGE ABUTS EXISTING CONCRETE.
8. USE "T-TOP" PAVEMENT REPLACEMENT WHERE A TRENCH IS NOT PARALLEL TO A STREET OR GOES THROUGH AN INTERSECTION.
9. SEE DETAIL 200-2 FOR REMNANT PAVEMENT REMOVAL REQUIREMENTS.
10. EXPOSED COPPER OR POLYETHYLENE WATER PIPE UP TO 2" IN DIAMETER IN TRENCHES TO BE BACKFILLED WITH CLSM SHALL BE WRAPPED WITH MINIMUM 3/4" THICK PREFORMED PIPE-COVERING FOAM INSULATION BEFORE PLACING CLSM.

DETAIL NO.
200-1



STANDARD DETAIL
ENGLISH

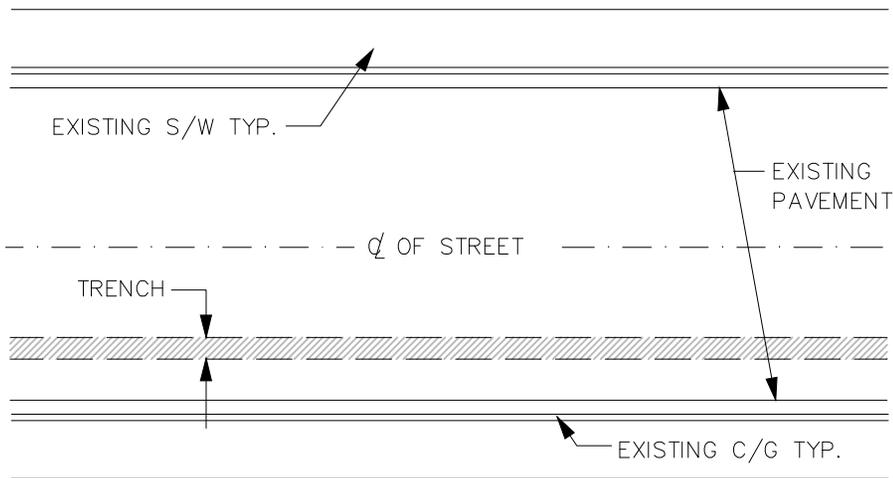
**BACKFILL, PAVEMENT
AND SURFACE REPLACEMENT**

PROPOSED
01-01-2015

DETAIL NO.
200-1

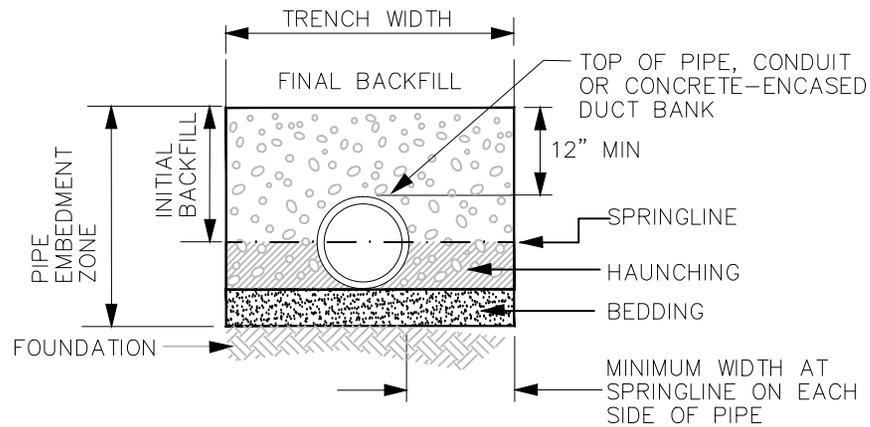
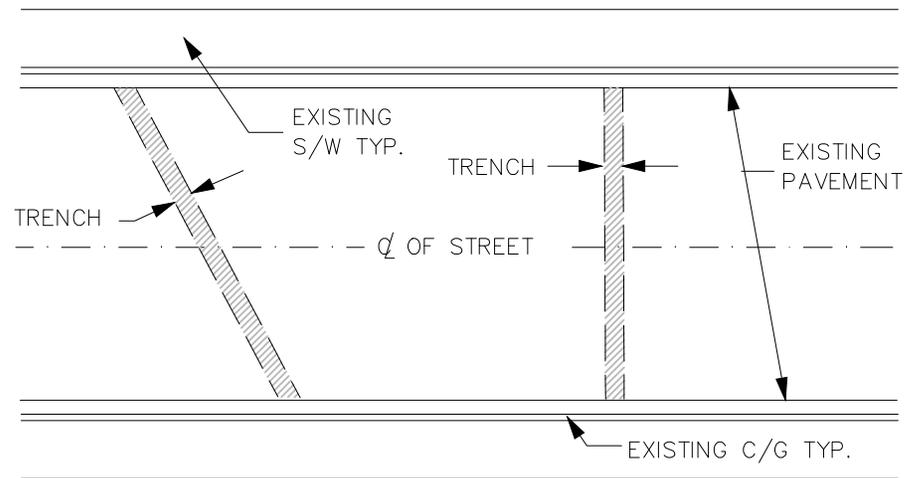
LONGITUDINAL TRENCH

(TRENCH IN PAVEMENT PARALLEL TO TRAFFIC)

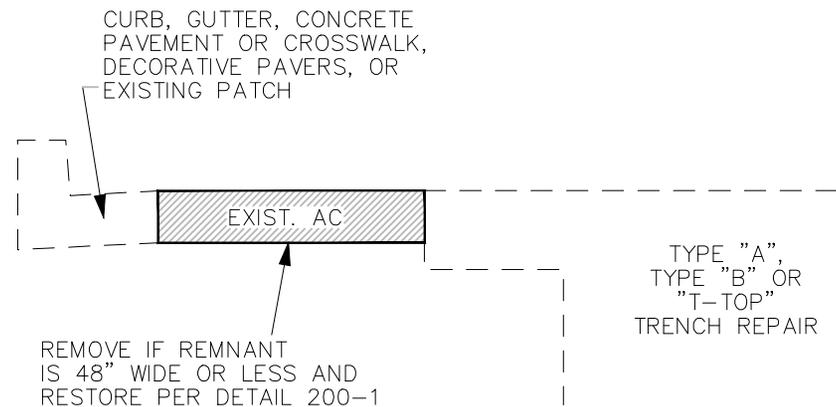


TRANSVERSE TRENCH

(TRENCH IN PAVEMENT NOT PARALLEL TO TRAFFIC)



TRENCH CROSS-SECTION DETAIL



REMNANT PAVEMENT REMOVAL

NOTES:

1. SEE SECTION 601 FOR TRENCH EXCAVATION, BACKFILLING AND COMPACTION REQUIREMENTS.
2. SEE MAG DETAIL 200-1 FOR DETAILED TRENCH REPAIR REQUIREMENTS FOR TRENCH TYPES NOTED HEREIN.
3. SEE MAG DETAIL 211 FOR REQUIREMENTS REGARDING THE USE OF PLATING TRANSVERSE TRENCHES. USE OF STEEL PLATES SHALL NOT EXCEED 72 HOURS AFTER COMPLETION OF BACKFILL AND PRIOR TO FINAL PATCHING.

DETAIL NO.
200-2



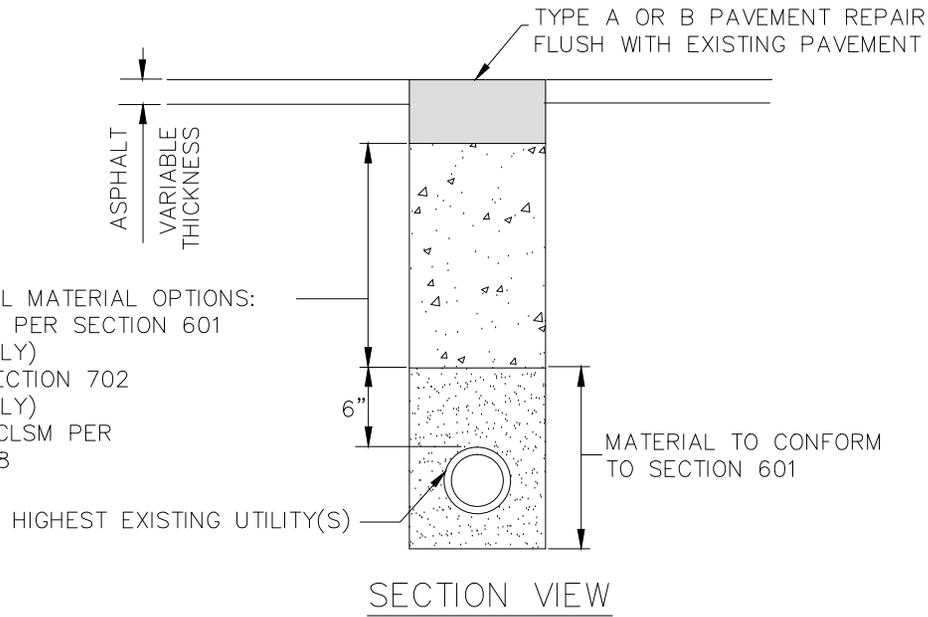
STANDARD DETAIL
ENGLISH

BACKFILL, PAVEMENT AND
SURFACE REPLACEMENT

PROPOSED
01-01-2015

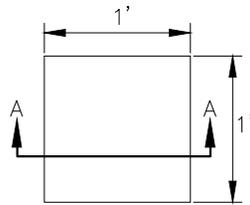
DETAIL NO.
200-2

CASE 13-15 DRAFT 9-16-2014



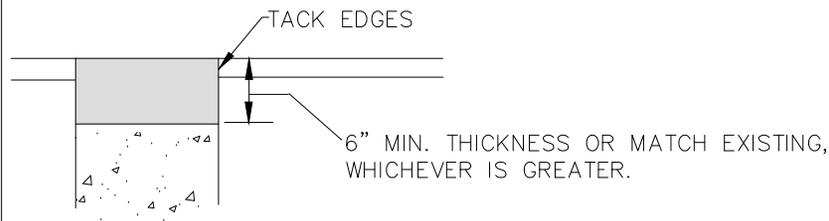
- FINAL BACKFILL MATERIAL OPTIONS:
- NATIVE SOIL PER SECTION 601 (TYPE B ONLY)
 - ABC PER SECTION 702 (TYPE B ONLY)
 - 1/2-SACK CLSM PER SECTION 728

TYPE A PAVEMENT REPAIR



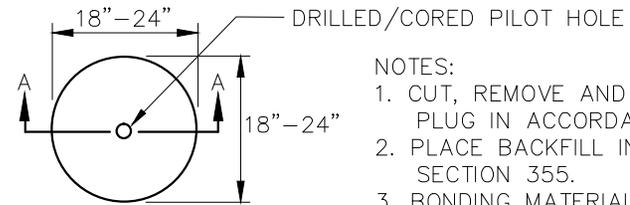
PLAN VIEW

- NOTES:
1. DIMENSIONS ARE NOMINAL.
 2. EDGES SHALL BE CUT TO A NEAT VERTICAL FACE.
 3. PLACE CLSM BACKFILL IN ACCORDANCE WITH SECTION 604.
 4. PLACE AGENCY-APPROVED ASPHALT CONCRETE IN MAXIMUM 2" LIFTS.



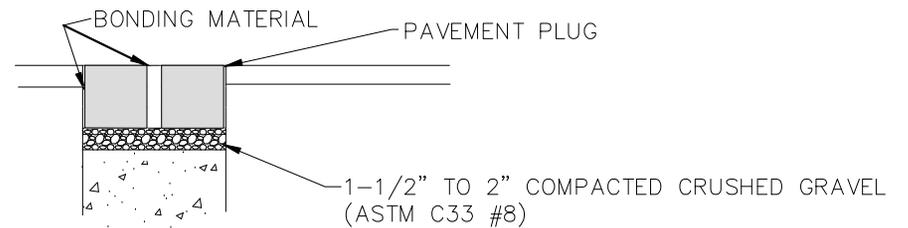
SECTION A-A

TYPE B PAVEMENT REPAIR



PLAN VIEW

- NOTES:
1. CUT, REMOVE AND REPLACE PAVEMENT. PLUG IN ACCORDANCE WITH SECTION 355.
 2. PLACE BACKFILL IN ACCORDANCE WITH SECTION 355.
 3. BONDING MATERIAL SHALL BE AS SPECIFIED IN SECTION 708.



SECTION A-A

DETAIL NO.

212



STANDARD DETAIL
ENGLISH

UTILITY POTHOLE REPAIR

REVISED

01-01-2015

DETAIL NO.

212

CASE 13-15 DRAFT 9-17-2014

SECTION 321

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

Should this be "longitudinal"

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

321.8.4 Compaction; Asphalt Base Course and Surface Course: It is the contractor's responsibility to perform any desired Quality Control monitoring and/or testing during compaction operations to achieve the required compaction. The temperature of the asphalt concrete immediately behind the laydown machine shall meet the minimum requirements of Table 321-2. A probe type electronic thermometer with a current calibration sticker attached will be used to measure the temperature of the asphalt concrete mixture. When measuring the temperature of the mat, the probe shall be inserted at mid-depth and as horizontal as possible to the mat.

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

(1) Base on which mix is to be placed

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

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

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

321.8.5 Smoothness: The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than one-fourth (¼) inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway.

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

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



MARICOPA COUNTY
Department of Transportation

MEMORANDUM

Date: May 20, 2014

To: MAG Specifications and Details Committee

From: Robert Herz, MCDOT Representative

Subject: Miscellaneous Corrections

Case 14-01B

PURPOSE: Eliminate extraneous word.

REVISION:

In section 739.1 delete the extra occurrence of the word 'Pipe'.

SECTION 739

**STEEL REINFORCED POLYETHYLENE PIPE AND FITTINGS FOR
STORM DRAIN, IRRIGATION AND SANITARY SEWER**

739.1 GENERAL:

This specification covers the requirements of Steel Reinforced Polyethylene **Pipe** (SRPE) pipe manufactured per ASTM F2562 for storm drains, irrigation and sanitary sewer systems. When noted on the plans or in the special provisions, storm drains, irrigation and sanitary sewers may be constructed using SRPE pipe. SRPE pipe shall be designed in accordance with AASHTO LRFD Bridge Design Specifications, Section 12. Trench excavation, backfilling and compaction for this flexible pipe shall be in accordance with Section [603](#). Construction and installation shall be in accordance with Section [618](#) for storm drain and irrigation water or Section [615](#) for sanitary sewers.



MARICOPA COUNTY
Department of Transportation

MEMORANDUM

Date: June 4, 2014

To: MAG Specifications and Details Committee

From: Robert Herz, MCDOT Representative

Subject: Miscellaneous Corrections

Case 14-01C

PURPOSE: Revise section title to match section content. Section 342 only addresses concrete pavers, it does not address brick. Detail 225 uses this specification and it only addresses concrete pavers.

REVISION:

Delete "OR BRICK" from the title of Section 342.

SECTION 342

**DECORATIVE PAVEMENT
CONCRETE PAVING STONE ~~OR BRICK~~**

342.1 GENERAL:

The Contractor shall furnish all necessary labor, material, tools and equipment to complete the proper installation of decorative concrete pavers used in medians, crosswalks, intersections or as otherwise noted in the Contract Documents. This includes furnishing a 10-foot straightedge to accomplish the level test when required by this specification.

The decorative pavement shall be true in line and grade and installed to coincide and align with the adjacent work elevation. All edges shall be retained to secure the pavers and sand laying course.

The Contractor shall construct a sample panel 10-feet by 10-feet for inspection and approval by the Engineer, prior to the actual installation for the project. Once approved, the panel shall be used as a standard for the remainder of the work. The panel shall remain undisturbed throughout the construction of the pavers and final approval by the Engineer.

342.2 MATERIALS:

342.2.1 Aggregate Base Course: Aggregate Base Course shall be per Table [702-1](#).

342.2.2 Portland Cement Concrete: When the pavers are subject to vehicular traffic, Portland Cement Concrete shall be Class A per Section [725](#). All other locations, the Portland Cement Concrete shall be a minimum of Class B per Section [725](#).

342.2.3 Sand: Sand used for laying course shall conform to ASTM C33 except for the gradation. The gradation shall comply with Table [342-1](#).

Case 14-01D

750.3 JOINT REQUIREMENTS:

- | Push-on joints for e_{cast} iron or ductile iron water pipe shall conform to AWWA C-111 and shall include synthetic rubber gaskets and lubricant.
- | Mechanical joints for e_{cast} iron or ductile iron water pipe shall conform to AWWA C-111 and shall include cast iron glands, synthetic rubber gaskets, and T-head bolts and nuts.
- | Flanged joints for e_{cast} iron or ductile iron water pipe shall be as detailed on the plans or as designated in the special provisions.

Restrained Joints:

When noted on plans or approved by the Engineer, joints for push-on or mechanical jointed ductile pipe may be modified to provide a fully restrained joint. These modifications to push-on and mechanical joints, including but not limited to segmented or special glands and split sleeves, shall conform to AWWA C-111. The Engineer shall review and/or approve each manufacturer's modifications to the joint. Upon request of the Engineer, the manufacturer of the modified joint shall provide test data showing compliance with AWWA C-111.



MARICOPA COUNTY
Department of Transportation

MEMORANDUM

Date: August 13, 2014
To: MAG Specifications and Details Committee
From: Robert Herz, MCDOT Representative
Subject: Miscellaneous Corrections

Case 14-01 E

PURPOSE: Revise wording in Section 107.11 to match the definition of “**Careful and prudent manner**” as found in section 101.2.

REVISION: *(Delete the comma and add ‘and’)*

107.11 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES:

At points where the Contractor's operations are adjacent to properties of utility firms or other property, damage to which might result in considerable expense, loss, or inconvenience, work shall not commence until all arrangements necessary for the protection thereof have been made.

The Contractor shall cooperate with the owners of any underground or overhead utilities in their removal and rearrangement operations in order that these operations may progress in a reasonable manner, that duplication of work may be reduced to a minimum, and that services rendered by those parties will not be unnecessarily interrupted.

If any utility service is interrupted as a result of accidental breakage, the Contractor shall promptly notify the proper authority and shall cooperate with the said authority in the restoration of service. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority.

The Contractor shall expose all underground utilities and structures which might interfere with the construction of the project, in order to permit survey location prior to construction.

The Contractor shall assume full responsibility for damages to any underground facility/utility as a result of failing to obtain information as to its location, failing to excavate in a careful-~~and~~ prudent manner or failing to take measures for protection of the facilities/utilities. The Contractor is liable to the owner of the underground facility/utility for the total cost of the repair.

REFERENCE Section 101.2 DEFINITIONS AND TERMS:

“**Careful and prudent manner**”: means conducting excavation in such a way that when it approaches within twenty-four inches of the underground facility located and marked by the owner or operator, by stakes, paint or in some customary manner, the exact location is manually determined, and the uncovered facility is supported and protected.

SECTION 211

FILL CONSTRUCTION

211.1 DESCRIPTION:

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

211.2 PLACING:

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

When fill is to be made and compacted on hillsides or where new fill is to be compacted against existing fill or where embankment is built ½ width at a time, the slopes of original hillsides and old or new fills shall be benched a minimum of 4 feet horizontally as the fill is placed. A new bench shall be started where ever the vertical cut of the next lower bench intersects the existing ground. Material thus cut out shall be recompacted along with the new embankment material by the Contractor at no additional cost to the Contracting Agency, unless the width of the bench required exceeds 4 feet, in which case the excavated material in excess of 4 feet will be measured and paid for as excavation.

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

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

211.3 COMPACTING :

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

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

Unless specified herein, or in the special provisions, the construction of dikes, the placing and compacting of approved material within the right-of-way where unsuitable material has been removed, and the filling of holes, pits and other depressions within the right-of-way, shall conform to all of the requirements herein specified for compacting fills. Trenches, holes, depressions and pits outside of areas where fills are to be constructed shall be graded to provide a presentable and well-drained area.

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

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

2 OF

SECTION 336

Laying a single course or the base course(s) of the asphalt concrete pavement replacement shall never be more than 600 feet behind the ABC placement for the pavement replacement.

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

For cuts greater than 300 feet in length the entire area shall then be slurry seal coated in accordance with Section [332](#) 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.

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.

336.2.4.2 Adjustments: When new or existing manholes, ~~values~~ **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 200-1 and 200-2. If a type is not noted on the plans or specified in the special provisions, the following criteria will govern:

Type A trench repair will be utilized on all streets where the excavation is essentially longitudinal or parallel to traffic.

T-Top trench repair will be utilized on all streets where the excavation is essentially transverse or not parallel to traffic, including trenches that go through an intersection. Type B trench repair may be used to repair transverse trenches if specified by the Agency.

Type C trench repair will be used to repair existing Portland cement concrete pavement.

Type D trench repair will be utilized to repair surfaces other than asphalt concrete or Portland cement concrete pavement. It may also be used when the condition of the existing pavement does not justify construction of Type A, Type B or T-Top trench repair. Prior written approval of the Engineer is required for this condition.

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](#).

SECTION 345

After removal of the temporary asphalt pavement in the area of adjustment, and prior to placement of the final concrete collar ring (as shown on Details 270 and 422) the asphalt pavement in proximity of the adjustment shall be rolled with a self-propelled steel wheel roller if requested by the Engineer.

345.4 ADJUSTING VALVE BOXES:

Valve boxes shall be adjusted to the new elevations indicated on the plans, or as established by the Engineer.

Adjustable valve boxes shall, if possible, be brought to grade by adjustment of the upper movable section. Any excavated area shall be filled with Class AA concrete to the level of the existing pavement, or as directed by the Engineer.

Concrete pipe valve boxes in areas not subject to vehicular traffic shall be adjusted to grades by installing a suitable length of metal or concrete pipe, of the same inside diameter as the present valve box, and reinforcing the outside with a concrete collar extending from at least 2 inches below the joint up to and flush with the top of the valve box extension. This collar shall be of Class AA concrete. The dimension from the outside of the box to the outside of the collar shall not be less than 2 inches. This adjustment will be known as Type B.

In areas subject to vehicular traffic and where the existing valve box is a Type B, the adjustment to the new elevation shall be made using the old cover and installing a new 8 inch frame in accordance with the standard detail for installation of valve boxes in vehicular traffic areas. This adjustment shall be known as Type BA.

Adjustment of existing Type A valve boxes to the new elevations shall be as described in Subsection 345.2. This adjustment shall be known as Type A.

345.5 ADJUSTING MANHOLE AND VALVE COVERS WITH ADJUSTMENT RINGS:

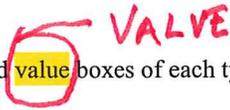
Adjusting rings may be used to raise manhole covers in asphalt pavements when deemed acceptable by the Engineer. The amount of adjustment, thickness of seal or overlay, and cross slope will be considered when using adjusting rings. Each location where an adjusting ring is used must have a sufficient depth of asphalt to assure the proper installation and operation of the ring. The rings shall be made of a concrete, non-metallic, polypropylene or fiberglass material and installed per the manufacturer's specifications. The rings shall be approved by the Engineer.

The concrete collar ring around the frame or valve box shall be circular, and shall be a minimum of eight (8) inches thick, placed flush with the adjacent new pavement surface. Concrete shall be a minimum of Class AA on all paved streets. All concrete shall be obtained from plants approved by the Engineer.

If required by the Contracting Agencies specifications or details, a single No. 4 rebar hoop will be placed in each adjustment collar. The hoop diameter shall be such that its placement is centered between the edge of the manhole frame or valve box, and the outer edge of the concrete collar, the depth of the hoop shall be centered in the thickness of the collar. Each concrete ring shall be scored radially at quarter-circle points. Score lines shall be ¼ -inch wide by ½ - inch deep. The concrete collar surface shall be rough broom finished. (See Details 270 and 422).

Traffic shall not be allowed on the concrete collars until the concrete had reached a minimum compressive strength of 2500 psi on residential and 3000 psi on collector and major streets. On major streets the contractor shall use "high-early" in the concrete mix, approved by the Engineer, to minimize delay in reopening the street(s) to traffic.

345.6 MEASUREMENT:

The quantities measured will be the actual number of frames, covers and  boxes of each type, adjusted and accepted.

345.7 PAYMENT:

Accepted quantities, will be paid for at the contract unit price. Payment shall be compensation in full for all materials, labor, equipment and incidentals necessary to complete the work.

- End of Section -

SECTION 616

RECLAIMED WATER LINE CONSTRUCTION

616.1 GENERAL:

This specification prescribes standards for utility water mains for the purpose of conveying, under pressure, reclaimed water for permitted reuse. Installation of reclaimed water mains shall be constructed in accordance with these specifications for materials, installation, and identification.

616.2 MATERIALS:

Pipe materials shall be in accordance with Section [610](#).

Valves shall be in accordance with Sections [610](#) and [630](#).

Valve boxes shall be in accordance with Section [345](#), this Section and Detail 391-1 and 391-2. Manholes shall be in accordance with Section [625](#), [787](#) and this Section, and applicable Details.

616.3 INSTALLATION:

Pipe shall be installed in accordance with Sections [601](#), [610](#), and this Section.

Valves and risers shall be installed in accordance with this section.

Valve box debris caps shall be installed in accordance with this Section and Detail 392.

When a reclaimed water main is adjacent to or crosses a potable water main, the reclaimed water main shall be considered a pressure or force sanitary sewer and comply with Details 404-1, 404-2 and 404-3 for separation and/or protection. When reclaimed water main is adjacent to or crosses a gravity, pressure or force sanitary sewer, the reclaimed water main shall be considered a potable water main and comply to Detail 404-1, 404-2 and 404-3 for separation and/or protection.

616.4 IDENTIFICATION:

The color purple shall be used for identifying all pipes, values, and other equipment used for conveying reclaimed water. VALVES

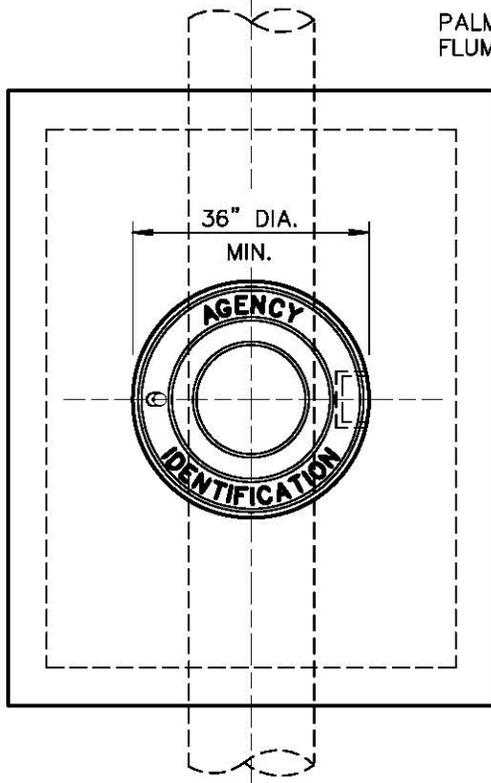
Reclaimed water identification tape shall be an inert polyethylene plastic impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. The tape shall be a minimum of 4.0 mils thick and no less than 3 inches wide. The tape shall be purple and shall have the words, "CAUTION: RECLAIMED WATER LINE" or similar wording printed in black lettering continuously along the entire length. Lettering shall be a minimum 1 ½ inches high. Spacing between the individual words of the message shall not exceed three inches.

Reclaimed water identification sleeving (pipe socks) shall be an inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. The sleeving shall be a minimum of 4.0 mils thick. The sleeving shall be purple and shall have the words, "CAUTION: RECLAIMED WATER LINE" or similar wording printed in black lettering continuously along the entire length. Lettering shall be a minimum 1 ½ inches high. Spacing between the individual words of the message shall not exceed three inches.

Reclaimed water identification decals shall be made of inert material resistant to cracking, peeling, and fading due to sunlight and heat. Decals shall have an aggressive adhesive to ensure permanent bonding to the surface that is being identified. The decals shall have the words, "CAUTION: RECLAIMED WATER - DO NOT DRINK" or similar wording printed in black lettering on a purple background. Lettering shall be a minimum 1 inch high. Spacing between the individual words of the message shall not exceed three inches.

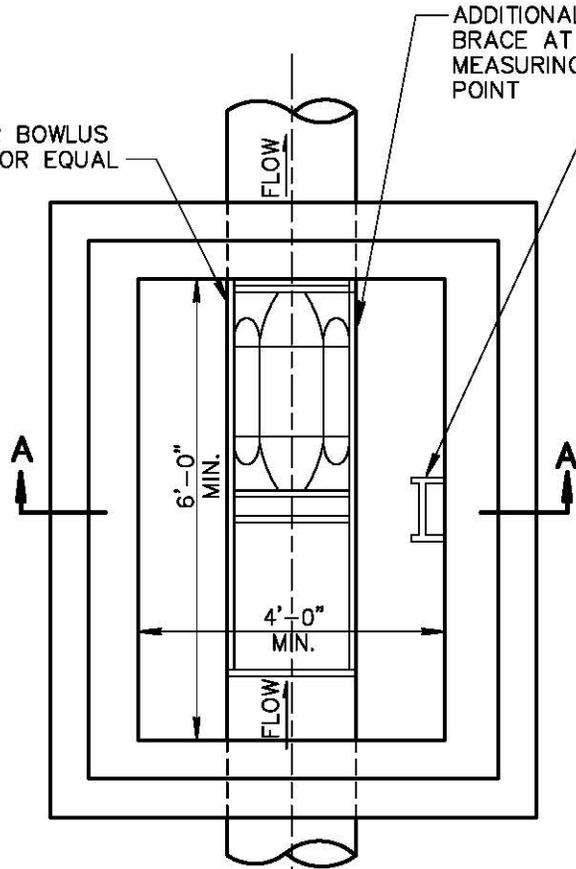
Reclaimed water pipe identified by stenciling shall use paint or ink resistive to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil. Stenciled pipe shall have the words, "CAUTION: RECLAIMED WATER - DO NOT DRINK" or similar wording printed in black or white lettering on a purple background continuously along the entire length.

MANHOLE FRAME AND COVER PER DETAIL NO. 423



MANHOLE & COVER SLAB

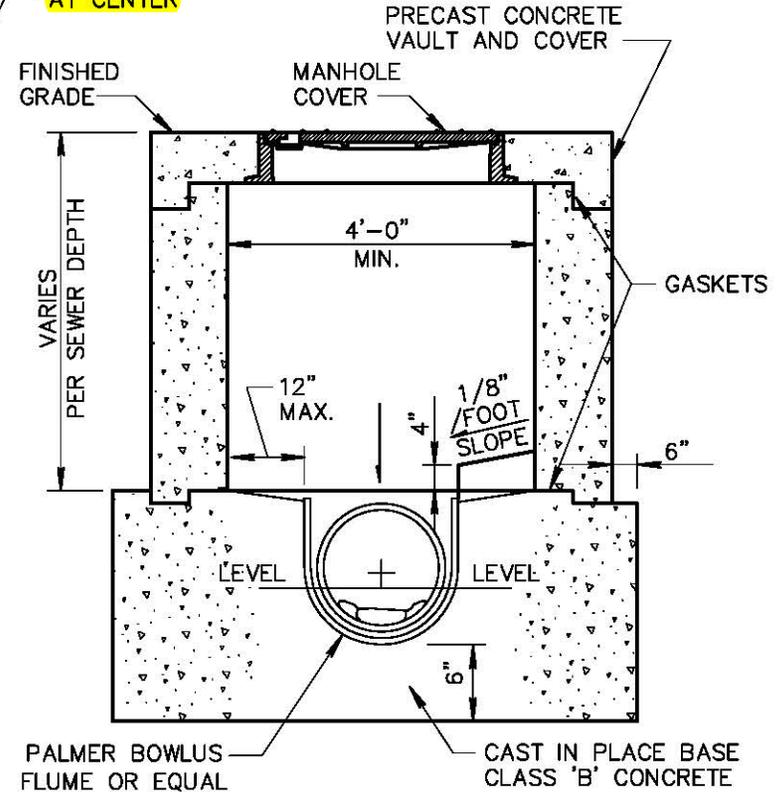
PALMER BOWLUS FLUME OR EQUAL



PLAN VIEW

NOTE: WITH COVER REMOVED.

M.H. STEPS PER DETAIL NO. 428 AT CENTER



SECTION A-A

NOTE: LADDER NOT SHOWN IN SECTION VIEW. SECTION SHOWN WITH COVER IN PLACE.

NOTES:

1. THIS CONTROL VAULT WITH MANHOLE AND COVER SHALL BE USED ON 6" AND 8" DIAMETER SEWER WITH FLOWS IN THE RANGE OF 40 TO 340 GPM.
2. VAULT TO BE CONSTRUCTED ON STRAIGHT RUN OF BUILDING SEWER. ACCESSIBLE AND SAFELY LOCATED ON THE OWNERS PROPERTY ADJACENT TO A PUBLIC RIGHT-OF-WAY.
3. THE PALMER BOWLUS FLUME SHALL BE INSTALLED PER THE MANUFACTURERS RECOMMENDATIONS.
4. THE PRE-CAST CONCRETE VAULT SHALL BE RECTANGULAR WITH MINIMUM INSIDE DIMENSIONS OF 4" WIDE AND 6" LONG AND AT A DEPTH OF THE DESIGN OF THE BUILDING SEWER.
5. A SHOP DRAWING SHALL BE SUBMITTED TO THE CONTRACTING AGENCY FOR APPROVAL BEFORE INSTALLATION OF THE VAULT AND THE PALMER BOWLUS FLUME WILL BE ALLOWED.

DETAIL NO.

429



STANDARD DETAIL
ENGLISH

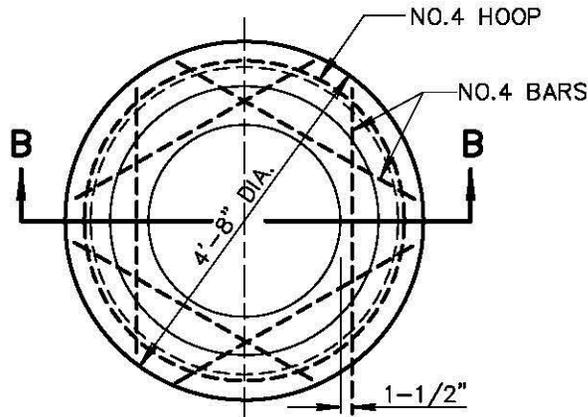
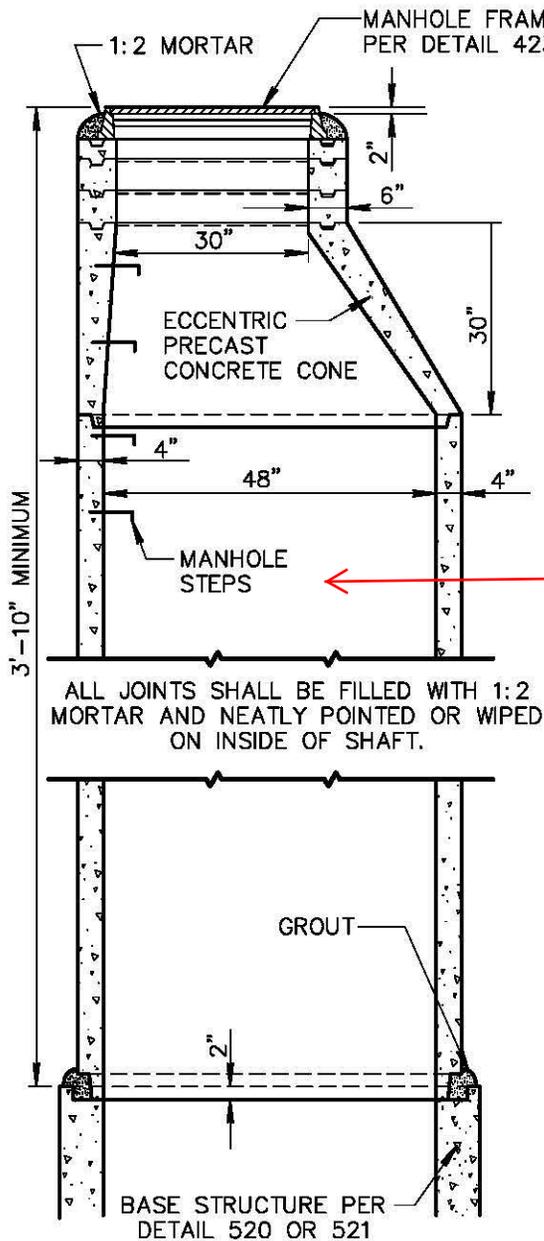
**INDUSTRIAL WASTE CONTROL
VAULT WITH MANHOLE**

REVISED

01-01-1998

DETAIL NO.

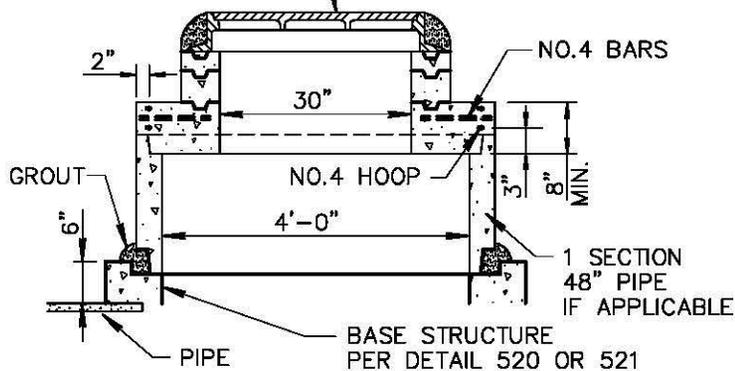
429



PLAN

USE WHERE THERE IS 3'-10" OR LESS COVER OVER PIPE

MANHOLE FRAME AND COVER PER DETAIL 423 AND 424

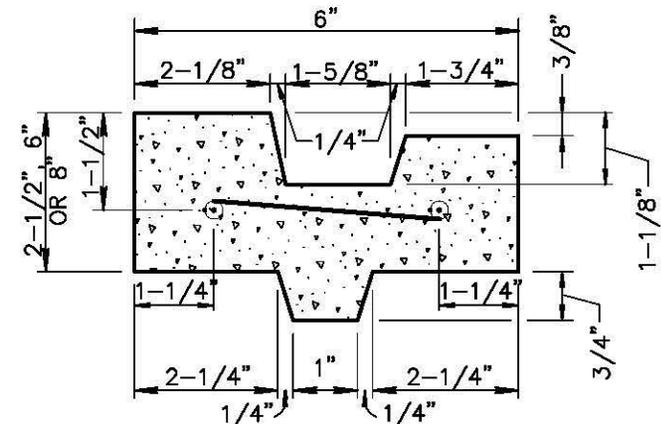


SECTION B-B

SHALLOW MANHOLE

NOTES:

1. PRECAST CONCRETE CONES AND SECTIONS TO BE A.S.T.M. C-478.
2. BRICK MAY BE USED IN LIEU OF OR IN COMBINATION WITH CONCRETE ADJUSTING RINGS.
3. PRECAST CONCRETE SECTIONS 48" DIA PIPE MAY BE FURNISHED IN STANDARD LENGTHS.
4. UNLESS OTHERWISE SHOWN ON PLANS, USE (2) 2-1/2" PRECAST CONCRETE ADJUSTING RINGS ON IMPROVED STREETS AND (4) 2-1/2" RINGS ON UNIMPROVED STREETS.
5. **MANHOLE STEPS SHALL BEGIN 2'-0" BELOW FINISHED GRADE AND CONTINUE AT 12" INTERVALS TO APPROXIMATELY 2' ABOVE MANHOLE SHELF. (AS REQUIRED BY AGENCY.)**
6. CONCRETE SHALL BE CLASS A PER SECTION 725 AND 505.



2-1/2" RINGS SHALL BE REINFORCED WITH TWO 1/4" ROUND STEEL HOOPS; 6" AND 8" RINGS SHALL BE REINFORCED WITH FOUR 1/4" HOOPS, TIED WITH NO. 14 A.S.& W. GAUGE WIRE 8" O.C.

REINFORCED CONCRETE ADJUSTING RING

DETAIL NO.

522



STANDARD DETAIL
ENGLISH

STORM DRAIN MANHOLE SHAFT

REVISED

01-01-1998

DETAIL NO.

522



MARICOPA COUNTY
Department of Transportation

MEMORANDUM

Date: June 4, 2014 Revised 2014-09-10
To: MAG Specifications and Details Committee
From: Robert Herz, MCDOT Representative
Subject: Revisions to Section 321 from MCDOT Supplement **Case 14-13**

PURPOSE: Incorporate MCDOT enhancements to Section 321 PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT into the MAG Specifications.

REVISIONS:

- 321.8 – Added requirement for adjacent facilities to be in acceptable condition prior to commencing with asphalt paving operations.
- 321.8.2 – Added tack coat requirement for traverse joints with existing pavement.
– Adjusted requirements for longitudinal construction joints to not deviate more than ¼ inch from a 12-foot straightedge positioned in any direction.
- 321.8.4 – Added disclaimer: The minimum temperatures in Table 321-2 do not guarantee that the asphalt mix will be compacted to the required density. The contractor is responsible to achieve the required compaction.
- 321.8.10 – Added new section for the protection of asphalt base courses on arterial roadways.
- 321.9 – Referee Testing requests are required to be based on valid Quality Control Test results.
- 321.10.1 – Revised the definition for subplot and
– Clarified that the Acceptance Laboratory is to be provided by the contracting agency.
– **Added the following technician requirement for acceptance laboratories: *The laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications).***
- ~~321.10.3 – Added pavement removal criteria that prevents full depth pavement cuts to be located within a lane wheel path and prevents creation of narrow pavement edge strips. PROPOSED CHANGE DELETED~~
- 321.10.4 – Added corrective measures to be taken when total pavement thickness deficiency is 0.50 inches or greater for agency contracted work.
– The existing specification is unclear as to if the thickness penalty is to be applied to each individual layer of a multi-layer pavement or if the acceptance and penalty provisions are to be applied to the total composite asphalt section. The text and Table 321-6 have been adjusted such that the penalty is only applied to the total final asphalt pavement thickness not to individual layers.
- 321.10.6 – Adjusted Table 321-9 to correspond with the 2014 revisions made to Tables 321-5 and 321-8.
- 321.11 – Revised requirements for referee testing.
- 321.14.3 & 321.14.4 – Revised ASTM D5361-05 to ASTM D5361. The 2005 version had been superseded in 2006 and then again updated in 2014.**

Changes in section 321 made after the September 3, 2014 committee meeting are shown above as bolded.

PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT**321.1 DESCRIPTION:**

This section is to provide specifications for furnishing all materials, mixing at a plant, hauling and placing a mixture of aggregate materials, mineral admixture and asphalt binder to form a pavement course for placement upon a previously prepared base or sub base.

321.2 MATERIALS AND MANUFACTURE:

The materials shall conform to Section [710](#) for the type specified. The specific required mix type shall be called out in the contract documents or as directed by the Engineer.

321.3 WEATHER AND MOISTURE CONDITIONS:

Asphalt concrete shall be placed only when the surface is dry, and when the atmospheric temperature in the shade is 40 degrees F. (50 degrees F for Asphalt Concrete lift less than 2 inch thick) or above. No asphalt concrete shall be placed when the weather is foggy or rainy, or when the base or sub base on which the material is to be placed is unstable. Asphalt concrete shall be placed only when the Engineer determines that weather conditions are suitable.

321.4 APPLICATION OF TACK COAT:

A tack coat shall be applied to all existing and to each new course of asphalt concrete prior to the placing of a succeeding lift of asphalt concrete. The tack coat may be deleted when a succeeding layer of asphalt concrete is being applied over a freshly laid course that has been subjected to very little traffic when approved by the Engineer.

The application of the tack coat shall comply with Section [329](#). The grade of emulsified asphalt shall be SS-1-h or CSS-1-h as specified in Section [713](#).

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

The surface to be covered may require repair or patching as directed by the Engineer. This shall be addressed in the project specifications prior to the bidding of the project.

321.5 MIX DESIGN

The mix design shall be submitted to the Engineer at least five working days prior to the start of asphalt concrete production. Mix designs provided by the agency may be utilized on projects at the Engineer's discretion. The Engineer will review and approve the mix design to assure it contains all of the required information as outlined in Section [710.3.1](#). The target values for gradations, binder contents, and air voids will be established as the accepted Job Mix Formula (JMF) based upon the mix design. Mix designs not containing all of the information will be returned within five working days of receipt of all mix design information, for action and resubmission by the contractor.

Once the mix design has been approved by the agency and the mixing plant selected, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer.

If the contractor elects to change its source of material, the contractor shall furnish the Engineer with a new mix design, which meets the requirements of Section [710](#), as amended by the Project Specifications.

The contractor may make self-directed target changes to the approved mix design within the limits shown below. Requests for self-directed target changes shall be made in writing and acknowledged by the Engineer prior to the start of production of a lot and will remain in effect until such time as any additional changes are implemented. The self-directed target changes must meet the contract requirements for mix design criteria and gradation limits.

TABLE 321-1 ALLOWABLE SELF-DIRECTED TARGET CHANGES	
MEASURED CHARACTERISTICS	ALLOWABLE SELF-DIRECTED TARGET CHANGES
Gradation (Sieve Size)	
3/8 inch	± 4% from mix design target value
No 8	± 4% from mix design target value
No 40	± 2% from mix design target value
No 200	+0.5% from mix design target value
Binder Content	± 0.2% from mix design target value
Effective Air Voids	None

The contractor may propose target changes, other than self-directed changes, to the approved mix design for the approval of the Engineer. The Engineer will determine if the proposed target change will result in mix production that meets the contract requirements for mix design criteria and gradation limits. The target changes will not be retroactive for the purpose of acceptance.

321.6 MIX PRODUCTION:

All materials shall be proportioned by weight in a hot mix asphalt plant in the proportions required by the mix design to provide a homogeneous and workable mass. Each hot mix asphalt plant shall be inspected in accordance with the provisions contained in the 'Hot Mix Asphalt Production Facilities' by the Arizona Rock Products Association and shall have a current inspection certificate. All measuring devices shall be calibrated at least annually by a technician licensed by the Arizona Bureau of Weights & Measures. Mixing plants shall conform to the requirements of AASHTO M-156, except as modified herein.

In drum mix plants the mineral admixture shall be added and thoroughly mixed with the mineral aggregate by means of a mechanical mixing device prior to the mineral aggregate and mineral admixture entering the dryer. The moisture content of the combined mineral aggregate shall be a minimum of three percent by weight of the aggregate during the mixing process.

For drum-mix plants, the mineral admixture shall be weighed across a weight belt, or other approved alternative weighing system, with a weight totalizer prior to entry into the mechanical mixing device. The mechanical mixing device shall be a pugmill type mixer that is in good working condition. The rate of the aggregate feed shall not exceed the mixing device's capacity in ton per hour. The mixer shall be constructed to minimize the loss of mineral admixture and shall be located in the aggregate delivery system at a location where the mixed material can be readily inspected. The mixing device shall be capable of effective mixing in the full range of the asphalt concrete production rates.

The hot plant and equipment shall be constructed and operated to prevent loss of mineral admixture through the dust collection system of the plant.

A positive signal system shall be provided and utilized during production whereby the mixing shall automatically be stopped if the mineral admixture is not introduced into the mineral aggregate. The plant will not be permitted to operate unless the signal system is in good working condition.

The introduction of bituminous material shall be controlled by an automated system fully integrated with the controls or the mineral aggregate and mineral admixture. The production of the plant shall be controlled by the rate required to obtain a uniform mixture of all components. Drying and heating shall be accomplished in such a manner as to preclude the mineral admixture from becoming coated with un-spent fuel. The completed asphalt concrete may be held in storage for up to 12 hours in insulated or heated silos, providing the minimum temperature noted herein for placement and compaction is met behind the placement device. If the Engineer determines that there is an

excessive amount of heat, heat loss, drain down, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

The temperature of the asphalt concrete, with unmodified binders, upon discharge from the mixer shall not exceed 335 degrees F. The discharge temperature may be increased on the recommendation of the binder supplier, when approved by the Engineer. If the asphalt concrete is discharged from the mixer into a hopper, the hopper shall be constructed so that segregation of the asphalt concrete will be minimized.

321.7 TRANSPORTATION:

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

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

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

321.8 PLACEMENT:

Placement of asphalt concrete pavement shall not commence until authorized by the Engineer. The Engineer's authorization to allow commencement of asphalt concrete paving will generally require all newly constructed valley gutters, curbing, and curb and gutters which new pavement is to be placed against to be in-place and in an acceptable condition. While it is preferred to have all newly constructed concrete items against which new pavement is to be placed be in an acceptable condition, the Engineer may allow paving to commence based on weather, the amount of defective concrete, or other considerations.

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

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

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

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

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

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

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

Self-propelled paving machines shall spread the mixture without segregation or tearing, true to line, grade and crown indicated on the Project plans. Pavers shall be equipped with hoppers and augers that will distribute the mixture uniformly in front of an adjustable floating screed. The raising of the hopper wings must be minimized and

the paving machine will not be operated when in an empty condition.

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

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

321.8.2 Joints: Transverse joints, before a surface course is placed in contact with a cold transverse construction joint, the cold existing asphalt concrete shall be trimmed to a vertical face for its full depth ~~and~~ exposing a fresh face. The fresh face shall be tack coated prior to placement of the new asphalt concrete. After placement and finishing the new asphalt concrete, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, parallel to the centerline.

Longitudinal joints of each asphalt course shall be staggered a minimum of 6 inches with relation to the longitudinal joint of the immediate underlying course's cold ~~transverse-longitudinal~~ construction joint.

Longitudinal joints with the cold existing or cold (more than 32 hours old) asphalt concrete shall require the existing pavement to be trimmed to a vertical face for its full depth and exposing a fresh face. The fresh face shall be tacked prior to placement of the adjacent course. Longitudinal joints with an existing asphalt pavement that is less than 32 hours old that has had its edge protected from damage may have adjacent new asphalt concrete placed after applying the required tack coat. After placement and finishing ~~the new asphalt concrete of longitudinal joints~~, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, ~~parallel to the centerline in any direction. The joint will be tack coated if required by the Engineer.~~

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

321.8.4 Compaction; Asphalt Base Course and Surface Course: It is the contractor's responsibility to perform ~~any desired~~ Quality Control monitoring and/or testing during compaction operations to achieve the required compaction. The temperature of the asphalt concrete immediately behind the laydown machine shall meet the minimum requirements of Table [321-2](#). A probe type electronic thermometer with a current calibration sticker attached will be used to measure the temperature of the asphalt concrete mixture. When measuring the temperature of the mat, the probe shall be inserted at mid-depth and as horizontal as possible to the mat. The minimum temperatures in Table 321-2 do not guarantee that the asphalt mix will be compacted to the required density. The contractor is responsible to achieve the required compaction.

Base ⁽¹⁾ Temp (°F)	Mat Thickness (inches)					
	1/2	3/4	1	1 1/2	2	3 and greater
40 – 50	---	---	310	300	285	275
50 – 60	---	310	300	295	280	270
60 – 70	310	300	290	285	275	265
70 – 80	300	290	285	280	270	265
80 – 90	290	280	270	270	265	260

+90	280	275	265	265	260	255
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- (1) Base on which mix is to be placed

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

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

The Engineer will determine the acceptability of the pavement compaction in accordance with Section [321.10](#).

321.8.5 Smoothness: The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than one-fourth (1/4) inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway.

321.8.6 Asphalt Concrete Overlay: Asphalt concrete overlay consists of the placing and compacting plant mix asphalt concrete over existing pavement. The mix design and thickness of the overlay shall be as shown on the plans or as specified in the special provisions.

Except when the existing asphalt surface is to be preheated and remixed, pavement surfaces shall be prepared as follows:

- (a) Areas designated for pavement repair by the contract documents (which may include severely raveled areas, severely cracked areas, over-asphalted areas, and other defects) shall be cut out and replaced. Pavement repairs shall be completed and approved before placing asphalt concrete overlay.
- (b) Before placing asphalt concrete overlay, milling shall be done as shown on the plans or specified in the special provisions and shall be in accordance with Section [317](#).
- (c) After pavement repairs and milling have been completed the entire surface shall be cleaned with a power broom.
- (d) After surfaces have been prepared to the satisfaction of the Engineer, they shall receive a tack coat per Section [321.4](#). Traffic will not be permitted to travel over surfaces which have received a tack coat, except when tack coat is applied to milled surfaces in compliance with Section [317.2](#) for dust control purposes. When the overlay is to extend onto a concrete gutter, the gutter shall be thoroughly cleaned of loose dust and cement particles and shall be tack coated.

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

Frames and covers of manholes, survey monuments, valve boxes, clean-outs and other existing structures shall be adjusted in accordance with Section [345](#) to set flush with the finished surface of the new pavement. During adjustment if pavement or base materials are removed or disturbed, they shall be replaced with approved materials installed in a manner acceptable to the Engineer.

On roads without curb and gutter, the existing unpaved shoulder elevation shall be adjusted by the Contractor to match the elevation at the edge of the new overlay and slope away from the new pavement surface at a rate that the existing quantity of shoulder material will allow. Shoulder material shall be compacted to a minimum of 95% of maximum density, determined in accordance with Section [301.3](#). Shoulder adjustment to match the new pavement surface elevation shall not be measured. The cost of shoulder adjustment shall be included in the price paid for the asphalt concrete overlay or other related pay items. When the Engineer determines an insufficient amount of

material is available for shoulder adjustment, the Engineer may require the Contractor to provide additional material. Acceptable material for shoulders includes the existing shoulder material, millings, untreated base materials, or a granular material approved by the Engineer. Engineer requested imported material for shoulder adjustment is not included in the price paid for the asphalt concrete overlay.

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

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

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

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

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

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

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

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

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

321.8.8 Thickened Edge: When the depth of the thickened edge extends four inches or more below the bottom of the asphalt pavement, the portion of the thickened edge extending below the asphalt pavement shall be placed and compacted prior to placement of the asphalt pavement. Placement of tack coat on the surface of the compacted thickened edge asphalt may be omitted when additional asphalt pavement is placed on the same day and the Engineer agrees that the surface of the thickened edge asphalt has remained clean.

When the depth of the thickened edge extends less than four inches below the bottom of the asphalt pavement, the portion below the asphalt pavement may be placed and compacted with the asphalt pavement in a single operation.

321.8.9 Safety Edge: The finished safety edge slope shall be planar forming a $30^\circ \pm 5^\circ$ angle with the adjacent roadway surface and extend a minimum of five inches (5") below the roadway pavement's finished surface.

The safety edge shall be constructed with the top or final paving lift of a new pavement or overlay using a device that is mounted to or is a part of the screed portion of the laydown machine. The safety edge device shall be capable of constraining the asphalt concrete material to increase density of the extruded profile by reducing the volume. A conventional single strike-off plate is not acceptable. Compaction obtained from the extruded safety edge shall be acceptable when the extruded shape conforms to the specified shape.

During laydown operations if the extruded safety edge does not conform to the specified shape, the Contractor shall take immediate actions to correct the deficiency and to repair all non-compliant sections of safety edge. The Contractor shall stop paving operations until corrections to the laydown operation have been made and resumption of paving is approved by the Engineer or his designated representative.

321.8.10 Protection for Asphalt Base Course: Arterial roadway traffic shall not be allowed on a new asphalt base course that is less than five inches (5") in thickness without the written consent of the Engineer.

321.9 QUALITY CONTROL:

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

The asphalt concrete produced shall conform to the requirements of the production tolerances established in section [321.10](#). When the asphalt concrete does not conform to the production tolerances, it shall be reported to the Engineer, and corrective quality control measures shall be implemented, or production shall cease immediately at no additional cost to the contracting Agency ~~or Engineer~~.

Requests for Referee Testing as described in 321.11 will only be considered based on quality control test results performed by a laboratory accredited by the AASHTO Accreditation Program (AAP) for the tests being performed or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories for the set of tests in question. The laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications).

321.10 ACCEPTANCE:

321.10.1 Acceptance Criteria: ~~Unless otherwise specified, a~~ asphalt concrete will be divided into lots for the purpose of acceptance. A lot shall be ~~considered to be~~ one day's production. ~~When the quantity of asphalt concrete placed in a day exceeds 500 tons but is less than 2000 tons, the~~ Each lot shall be divided into ~~sublots of 500 ton sublots~~ or fraction thereof. ~~Where the quantity of asphalt concrete placed in a day exceeds 2000 tons, the day's production will be divided into four (4) approximately equal sublots. A minimum of one sample will be obtained from each lot.~~ Tests used to determine acceptance will be performed by ~~the Engineer or~~ a laboratory ~~employed by the Engineer. In either case the laboratory shall be~~ accredited by the AASHTO Accreditation Program (AAP), for the tests being performed. The contracting agency shall provide an appropriately accredited laboratory or laboratories to perform the acceptance testing. Laboratories shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications). The acceptance laboratory will take representative samples of the asphalt concrete from each subplot to allow for testing of gradation, binder content, air voids, pavement thickness and compaction of base and surface courses. Acceptance of eEach subplot will be ~~accepted~~ based ~~up~~ upon the test data from the sample(s) from that subplot. All acceptance samples shall be taken using random locations

or times designated by the Engineer in accordance with ASTM D3665.

321.10.2 Gradation, Binder Content and Air Voids: The acceptance laboratory will take a sample of the asphalt concrete in accordance with the requirements of Section 2 or 4 of Arizona Test Methods 104 or AASHTO T-168 from each subplot. The minimum weight of the sample shall be 45 pounds. Asphalt binder content and gradation shall be determined in accordance with AASHTO T-308 using the ignition furnace for each subplot. The acceptance laboratory is responsible for obtaining the necessary materials and performing an ignition furnace calibration as outlined in AASHTO T-308 for each asphalt concrete mixture utilized on the project. The correction factor used for each test shall be clearly indicated on the report. The bulk density for Marshall Mix designs shall be tested in accordance with AASHTO T-245. The bulk density for Gyratory mix designs shall be determined in accordance with AASHTO T-312. The maximum theoretical density shall be determined in accordance with the requirements of AASHTO T-209 including fan drying per AASHTO T209 Section 15. Effective voids of the laboratory compacted specimens will be determined at a minimum of once per lot in accordance with the requirements of AASHTO T-269. Should the testing for effective air voids not meet the “Full Payment” or “No Corrective Action” requirements of Table [321-5](#), additional testing for laboratory air voids on the remaining sublots will be performed as necessary to determine the extent of the deficiency. Acceptance testing results will be furnished to the contractor and the supplier within five working days of receipt of samples by the acceptance laboratory.

During production, the allowable deviations from the mix design gradation targets are listed in the tables below. The allowable production tolerances may fall outside of the mix design gradation bands.

TABLE 321-3A				
GRADATION ACCEPTANCE LIMITS FOR MARSHALL MIXES				
Sieve Size	3/8 inch Mix	1/2 inch Mix	3/4 inch Mix	Base Mix
1 inch	---	---	---	±7%
3/4 inch	---	---	±7%	±6%
1/2 inch	---	±7%	---	---
3/8 inch	±7%	±6%	±6%	±6%
No. 8	±6%	±6%	±6%	±6%
No. 40	±4%	±4%	±4%	±4%
No. 200	±2%	±2%	±2%	±2%

TABLE 321-3B			
GRADATION ACCEPTANCE LIMITS FOR GYRATORY MIXES			
Sieve Size	3/8 inch Mix	1/2 inch Mix	3/4 inch Mix
3/4 inch	---	---	±7%
1/2 inch	---	±7%	±6%
3/8 inch	±7%	±6%	---
No. 8	±6%	±6%	±6%
No. 40	±4%	±4%	±4%
No. 200	±2%	±2%	±2%

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

If the asphalt binder content is within ± 0.40% of the mix design target value, the asphalt concrete will be paid for at the contract unit price. If the asphalt binder content deviates by more than ± 0.40% from the mix design target value, the deficient area will be evaluated within the subplot by coring at maximum intervals of 100 feet from the deficient

sample. The asphalt content of the original deficient sample will be averaged with the asphalt binder content of the cores taken for re-evaluation to determine compliance with the acceptance requirements. If the resulting average of the asphalt binder content deviates by more than $\pm 0.40\%$ from the mix design target value, then Table [321-4](#) shall apply to the subplot. Additional cores may be required to define the limits of the deficient area, and shall not be used for re-evaluating acceptance.

TABLE 321-4		
ASPHALT BINDER CONTENT ACCEPTANCE AND PENALTIES		
	When the contracting agency is the owner: Payment Reduction (\$ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
Deviation from that permitted		
Over 0.2% <u>above</u> that permitted	Removal* or EA	Removal* or EA
Over 0.1% to 0.2% <u>above</u> that permitted	\$6.00	EA
Over 0.0% to 0.1% <u>above</u> that permitted	\$2.00	EA
Within permitted range	Full Payment	No Corrective Action
Over 0.0% to 0.1% <u>below</u> that permitted	\$2.00	EA
Over 0.1% to 0.2% <u>below</u> that permitted	\$6.00	EA
Over 0.2% <u>below</u> that permitted	Removal* or EA	Removal* or EA

NOTES: *The Contractor shall remove and replace the entire subplot that is deficient.

EA = Engineering Analysis per Section 321.10.6

If the laboratory air voids fall within a range of 2.8% to 6.2%, the asphalt concrete will be paid for at the contract unit price. If the laboratory air voids are outside of this range, the deficient area will be evaluated within the subplot by coring at maximum intervals of 100 feet from the deficient sample. The laboratory air voids of the original deficient sample will be averaged with the laboratory air voids obtained from each of the cores taken for re-evaluation to determine compliance with the acceptance requirements. If the resulting average of the laboratory air voids is outside the indicated range, then Table [321-5](#) shall apply to the subplot. Additional cores may be required to define the limits of the deficient area, and shall not be used for re-evaluating acceptance.

TABLE 321-5		
LABORATORY VOIDS ACCEPTANCE AND PENALTIES		
Laboratory Air Voids (Measured at N_{des} or 75 blows as applicable)	When the contracting agency is the owner: Payment Reduction (\$ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
Less than 1.5%	Removal* or EA	Removal* or EA
1.5-2.0%	\$5.00	EA
2.1-2.7%	\$2.00	EA
2.8-6.2%	Full Payment	No Corrective Action
6.3-6.9%	\$2.00	EA
7.0-8.0%	\$5.00	EA
Greater than 8.0%	Removal* or EA	Removal* or EA

NOTES: *The Contractor shall remove and replace the entire subplot that is deficient

EA = Engineering Analysis per Section [321.10.6](#)

Removal for In-place Air Voids Greater than 11.0% is not eligible for Section [321.10.6](#).

If an agency or Engineer is purchasing asphalt concrete directly from a commercial material supplier, the agency or Engineer will use Section [321.10](#), and specifically Tables [321-3A](#) or [321-3B](#) as applicable, [321-4](#) and [321-5](#) from Section [321.10](#), when determining the acceptance of the asphalt concrete with the material supplier.

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

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

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

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

Acceptance or assessment of penalties for asphalt pavement thickness will be based on the combined total thickness of all asphalt concrete layers omitting all layers of asphalt-rubber asphalt concrete. If the final total pavement thickness exclusive of all ARAC layers is deficient from the target thickness by 0.25 inches or less, it will be paid for at the contract unit price.

If the pavement thickness deficiency is greater than 0.25 inches and the contracting agency is not the owner (i.e. permits) the following steps will apply:

- (1) If the thickness deficiency of the pavement exceeds 0.25 inch, the limits of the deficient area will be evaluated by coring at maximum intervals of 100 feet from the deficient core. The thicknesses of the original deficient core will be averaged with the thicknesses of the cores taken from 100 feet on each side of it to determine compliance with the acceptance requirements. If the resulting average thickness deficiency is greater than 0.25 inch, additional cores may be required to define the limits of the deficient area, and shall not be used

for re-evaluating acceptance.

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

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

If the Contracting Agency is the owner and the pavement thickness deficiency is greater than 0.25 inches but less than 0.50 inches and the contracting agency is the owner, Table 321-6 will apply. If the pavement thickness deficiency is greater than 0.5 inches the deficient area shall be overlaid with no less than a 1-inch thick lift for the full width of the pavement to meet or exceed the designed thickness using an asphalt mixture approved by the Engineer. The Contractor shall provide appropriate end and edge milling. The overlay and milling shall be accomplished by the Contractor at no additional cost to the Contracting Agency.

TABLE 321-6	
ASPHALT PAVEMENT THICKNESS PAYMENT REDUCTION	
For Thickness Deficiency of More Than 0.25 inches and less than 0.50 inches	
<u>Total Specified Asphalt Pavement Thickness exclusive of ARAC (if any)</u>	<u>Reduction in Payment or Corrective Action applied to asphalt concrete except ARAC layers (if any)</u>
Less than 1.5 inches	50%
1.50 inches to 1.99 inches	33%
2.00 inches to 2.49 inches	25%
2.50 inches to 2.99 inches	20%
3.00 inches and over	17%

321.10.5 Density:

321.10.5.1 Pavement 1-1/2 Inches or Less in Nominal Thickness:

Compaction shall consist of a "Rolling Method Procedure" using an established sequence of coverage with specified types of compactors. A pass shall be defined as one movement of a compactor in either direction. Coverage shall be the number of passes as are necessary to cover the entire width being paved.

The rolling sequence, the type of compactor to be used, and the number of coverages required shall be as shown in Table 321-7.

TABLE 321-7				
ROLLING SEQUENCE FOR LIFT THICKNESS 1½" OR LESS				
Rolling Sequence	Type of Compactor		No. of Coverages	
	Option No. 1	Option No. 2	Option No. 1	Option No. 2
Initial	Static Steel	Vibrating Steel	1	1
Intermediate	Pneumatic Tired	Vibrating Steel	4	2- 4*
Finish	Static Steel	Static Steel	1-3	1-3
* Based on the roller pattern which exhibits the best performance.				

The Contractor shall select the option for compaction and, when pneumatic-tired compactors are used will designate the tire pressure. Steel wheel compactors shall not be used in the vibratory mode for courses of one inch or less in thickness nor when the temperature of the asphaltic concrete falls below 180 degree F. Initial and intermediate compaction shall be accomplished before the temperature of the asphaltic concrete falls below 200 degree F.

Compaction will be deemed to be acceptable on the condition that the asphaltic concrete is compacted using the type of compactors specified, ballasted and operated as specified, and with the number of coverages of the compactors as specified.

321.10.5.2 Pavement Greater than 1-1/2 Inches in Nominal Thickness:

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

In-place air voids shall be determined in accordance with AASHTO T-269 utilizing cores taken from the finished pavement. The maximum theoretical density used in the determination of in-place air voids will be the average value from the acceptance samples determined for the Lot as outlined in [321.10.1](#).

The Engineer will designate one random test location for each subplot and the acceptance laboratory will obtain one core from that location. Regardless of subplot quantities or boundaries, a minimum of one core will be obtained per residential street and a minimum of one core per travel lane for collector and arterial streets. The outside one foot of each pass of the pavement course or any unconfined edge will be excluded from testing. The Engineer may exclude areas from the compaction lot that are not accessible by normal compaction equipment.

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

Cores will be taken per the Asphalt Concrete Coring Method. This method can be found in Section [321.14](#). Acceptance testing results will be furnished to the contractor within five working days of receipt of samples by the acceptance laboratory.

If the pavement density has in-place voids of 8.0% or less, the asphalt concrete will be paid for at the contract unit price. If the pavement density has in-place voids greater than 8.0%, the deficient area will be evaluated within the subplot by coring at maximum intervals of 100 feet from the deficient core(s). If both cores in a subplot are deficient, 3 to 4 additional cores may be necessary to re-evaluate acceptance. The in-place voids of all the original core(s), whether deficient or acceptable, will be averaged with the in-place voids of the cores taken for re-evaluation to determine compliance with the acceptance requirements. If the average of the in-place voids is greater than 8.0% then Table [321-8](#) shall apply to the subplot. Additional cores may be required to define the limits of the deficient area, and shall not be used for re-evaluating acceptance.

TABLE 321-8		
PAVEMENT DENSITY PENALTIES		
Limits of In-place Air Voids for design lift thicknesses 1.5 inches and greater	When the contracting agency is the owner: Payment Reduction (\$ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
Below 3.0%	Removal* or EA	Removal* or EA
3.0% to below 4.0%	\$10.00	EA and Type II Surry Seal
4.0% to 8.0%	Full Payment	No Corrective Action
Greater than 8.0% to less than 9.0%	\$6.00	EA
9.0% to 10.0%	\$10.00	EA and Type II Surry Seal
Greater than 10.0%	Removal* or EA	Removal* or EA

NOTES: *The Contractor shall remove and replace the entire subplot that is deficient.

EA = Engineering Analysis per Section [321.10.6](#)

Removal for In-place Air Voids greater than 11.0% is not eligible for Section [321.10.6](#).

321.10.6 Engineering Analysis (EA): Within 10 working days after receiving notice that a lot or subplot of asphalt concrete is deficient and is found to fall within the “Removal or EA” band per Table(s) [321-4](#), [321-5](#), and/or [321-8](#) the contractor may submit a written proposal (Engineering Analysis) to accept the material in place at the applicable penalties along with possible remediation(s) listed in the “Removal or EA” category. Engineering Analysis can also be proposed for non-removal categories of “Corrective actions” when the contracting agency is not the owner (i.e. permits).

The Engineering Analysis shall contain an analysis of the anticipated performance of the asphalt concrete if left in place. The Engineering Analysis shall also detail the effect of any proposed corrective action to the material(s) in place as it relates to the in-place material’s performance. The Engineering Analysis shall be performed by a professional engineer experienced in asphalt concrete testing and mix designs.

If ~~the a~~ lot or subplot is ~~submitted-accepted~~ for referee testing ~~by and the referee test results still show a deficiency,~~ the contractor ~~shall have the~~ ten working days ~~allowed to~~ ~~prepare-submit~~ an engineering ~~analysis will-beginning~~ upon notification of referee test results.

When an Engineering Analysis recommends that a specific lot or subplot should not be removed, the Engineering Analysis will recommend that the following penalties (Table [321-9](#)) be paid when the contracting agency is the owner, for the specific criteria being reviewed by the EA.

TABLE 321-9		
ENGINEERING ANALYSIS PENALTIES for REMOVAL* LOTS/SUBLOTS LEFT IN-PLACE		
Acceptance Criteria	Acceptance Limits	Penalty When Contracting Agency is the Owner (\$/Ton)
Asphalt Binder Content	Over 0.2% points from that Permitted	\$9.00
Laboratory Air Voids (Measured at N _{des} or 75 blows as applicable)	Less than 1.5% or Greater Than 8.0%	\$3.75 <u>\$7.50</u>
Limits of In-place Air Voids	Less than 10.0% to 11.0% <u>Less than 3% or Greater than 10.1%</u>	\$15.00 <u>\$9.00</u>

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

321.11 REFEREE:

~~If the Contractor has reason to question the validity of any of the acceptance test results, the Contractor may request that the Engineer consider referee tests for final acceptance. In the event the contractor elects to question the acceptance test results for either asphalt binder content, laboratory air voids, density or a combination thereof for a subplot, the Contractor may make a written request for additional testing of that subplot. Any request for referee testing must describe the contractor's reasons for questioning the validity of the original acceptance test results and must clearly describe which set of acceptance tests are in question. The engineer may either accept or reject the request for referee testing. When referee testing is accepted, the Contractor (at the Contractors own expense) will engage an independent laboratory (at the Contractors own expense) who is accredited by the AAP or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories as appropriate in all of for the acceptance tests that are being questioned methods. The independent laboratory shall be The independent referee laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications). acceptable to the Engineer and For the set of test results in question the referee laboratory shall perform a new set of acceptance tests (as required by Section 321.10 representing the area for the set of tests in question). The referee tests will replace the original acceptance tests that were in question. The results of these determinations will be binding on both the contractor and the agency.~~

These tests may include asphalt binder content, aggregate gradation, Marshall or Gyratory unit weight, maximum theoretical unit weight, laboratory air voids and in-place air voids (compaction). Samples for referee testing shall come from representative samples obtained from the completed pavement, as directed by the Engineer.

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

321.12 MEASUREMENT:

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

321.13 PAYMENT:

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

adjusted per Section [321.10](#), which price shall be full compensation for the item complete, as herein described and specified.

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

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

Agency required repairs of existing pavement prior to roadway overlay operations will be paid for as a separate pay item.

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

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

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

321.14.2 Core Drilling Device: The core drilling device will be powered by an electrical motor, or by an acceptable gasoline engine. Either device used shall be capable of applying enough effective rotational velocity to secure a drilled specimen. The specimen shall be cored perpendicularly to the surface of pavement, and that the sides of the core are cut in a manner to minimize sample distortion or damage. The machinery utilized for the procedure shall be on a mounted base, have a geared column and carriage that will permit the application of variable pressure to the core head and carriage throughout the entire drilling operation. The carriage and column apparatus shall be securely attached to the base of the apparatus; and the base will be secured with a mechanical fastener or held in place by the body weight of the operator. The core drilling apparatus shall be equipped with a water spindle to allow water to be introduced inside of the drill stem while operating. The cutting edge of the core drill bit shall be of hardened steel or other suitable material with embedded diamond chips in the cutting surface. The core barrel shall be of sufficient diameter to secure a specimen that is a minimum of four or six inches or whichever is prescribed for necessary testing. The core barrel shall not be missing more than one of the teeth used for cutting; if so it shall be discarded and another barrel shall be used. The core barrel shall also be a minimum of two inches longer than the anticipated depth of pavement in accordance with project paving plans.

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

Miscellaneous hand tools to remove the drilled specimen from the drill hole or the core barrel taking great care in not disturbing the specimen more than necessary (refer to fig. 1 in ASTM D5361-05).

321.14.4 Process: The pavement surface at the time of coring shall not exceed a temperature of 90° F; the pavement shall be conditioned with ice or dry ice to ensure that this requirement is met. Immediately after it has been ensured that the pavement has dropped to the required temperature, core drilling shall begin. The operator will then apply an even and continuous pressure (Note 2) to penetrate through the full depth of the pavement. The operator will concurrently ensure that enough water is moving over the core surface as to adequately remove any and all cuttings that could damage the drilled core. After the pavement thickness has been penetrated the core shall be carefully removed from either the drill hole or the core barrel and be immediately transferred to an ice chest or other suitable container. Each individual core shall be placed on a shelf in the cooler with the exposed side of the specimen facing down, or the “top side” down. If the specimen is a two lift core, the only acceptable means of separating lifts is with a power or other acceptable wet saw type of equipment (conforming to ASTM D5361-05); however, at no time shall cores be split using a mallet and screwdriver or metal straight edge when being tested for bulk density. Perpendicularity of the specimen shall be checked in the field after the specimen has been extracted from the surface. The core operator shall hold the core up to eye level and place the core top side down in a “speed square” or small carpenters square. The specimen placed in the square shall not depart from perpendicular to the axis more than 0.5° (approximately equivalent to 1/16 of an inch in 6 inches). If the specimen is outside of this distance from square it shall be discarded in the field and another sample cored that falls within tolerance. The cores upon arriving at the laboratory for testing shall be carefully cleaned and measured for thickness in accordance with ASTM D3549. A speed square shall be utilized to measure perpendicularity as compared to a 90° degree angle and shall not depart from perpendicular to the axis more than 0.5° (approximately equivalent to 1/16 of an inch in 6 inches). All remaining testing shall be done within the parameters of the current project and / or agency required specification.

~~-End of Section-~~

*Note 1 – It should be noted that when the material to be cored is a rubberized asphalt mixture a wetting agent such as liquid dish soap shall be added to the water barrel to hinder the material from sticking or allowing the binder to spread during coring.

*Note 2 – This refers to pressure exerted on the core barrel and machine during the coring process. Too much pressure can cause damage to the core barrel and the motor; and too little pressure can cause a glazing of the diamonds, reducing cutting efficiency and premature wear of the barrel

- End of Section -

PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT**321.1 DESCRIPTION:**

This section is to provide specifications for furnishing all materials, mixing at a plant, hauling and placing a mixture of aggregate materials, mineral admixture and asphalt binder to form a pavement course for placement upon a previously prepared base or sub base.

321.2 MATERIALS AND MANUFACTURE:

The materials shall conform to Section [710](#) for the type specified. The specific required mix type shall be called out in the contract documents or as directed by the Engineer.

321.3 WEATHER AND MOISTURE CONDITIONS:

Asphalt concrete shall be placed only when the surface is dry, and when the atmospheric temperature in the shade is 40 degrees F. (50 degrees F for Asphalt Concrete lift less than 2 inch thick) or above. No asphalt concrete shall be placed when the weather is foggy or rainy, or when the base or sub base on which the material is to be placed is unstable. Asphalt concrete shall be placed only when the Engineer determines that weather conditions are suitable.

321.4 APPLICATION OF TACK COAT:

A tack coat shall be applied to all existing and to each new course of asphalt concrete prior to the placing of a succeeding lift of asphalt concrete. The tack coat may be deleted when a succeeding layer of asphalt concrete is being applied over a freshly laid course that has been subjected to very little traffic when approved by the Engineer.

The application of the tack coat shall comply with Section [329](#). The grade of emulsified asphalt shall be SS-1h or CSS-1h as specified in Section [713](#).

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

The surface to be covered may require repair or patching as directed by the Engineer. This shall be addressed in the project specifications prior to the bidding of the project.

321.5 MIX DESIGN

The mix design shall be submitted to the Engineer at least five working days prior to the start of asphalt concrete production. Mix designs provided by the agency may be utilized on projects at the Engineer's discretion. The Engineer will review and approve the mix design to assure it contains all of the required information as outlined in Section [710.3.1](#). The target values for gradations, binder contents, and air voids will be established as the accepted Job Mix Formula (JMF) based upon the mix design. Mix designs not containing all of the information will be returned within five working days of receipt of all mix design information, for action and resubmission by the contractor.

Once the mix design has been approved by the agency and the mixing plant selected, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer.

If the contractor elects to change its source of material, the contractor shall furnish the Engineer with a new mix design, which meets the requirements of Section [710](#), as amended by the Project Specifications.

The contractor may make self-directed target changes to the approved mix design within the limits shown below. Requests for self-directed target changes shall be made in writing and acknowledged by the Engineer prior to the start of production of a lot and will remain in effect until such time as any additional changes are implemented. The self-directed target changes must meet the contract requirements for mix design criteria and gradation limits.

TABLE 321-1	
ALLOWABLE SELF-DIRECTED TARGET CHANGES	
MEASURED CHARACTERISTICS	ALLOWABLE SELF-DIRECTED TARGET CHANGES
Gradation (Sieve Size)	
3/8 inch	± 4% from mix design target value
No 8	± 4% from mix design target value
No 40	± 2% from mix design target value
No 200	+0.5% from mix design target value
Binder Content	± 0.2% from mix design target value
Effective Air Voids	None

The contractor may propose target changes, other than self-directed changes, to the approved mix design for the approval of the Engineer. The Engineer will determine if the proposed target change will result in mix production that meets the contract requirements for mix design criteria and gradation limits. The target changes will not be retroactive for the purpose of acceptance.

321.6 MIX PRODUCTION:

All materials shall be proportioned by weight in a hot mix asphalt plant in the proportions required by the mix design to provide a homogeneous and workable mass. Each hot mix asphalt plant shall be inspected in accordance with the provisions contained in the 'Hot Mix Asphalt Production Facilities' by the Arizona Rock Products Association and shall have a current inspection certificate. All measuring devices shall be calibrated at least annually by a technician licensed by the Arizona Bureau of Weights & Measures. Mixing plants shall conform to the requirements of AASHTO M-156, except as modified herein.

In drum mix plants the mineral admixture shall be added and thoroughly mixed with the mineral aggregate by means of a mechanical mixing device prior to the mineral aggregate and mineral admixture entering the dryer. The moisture content of the combined mineral aggregate shall be a minimum of three percent by weight of the aggregate during the mixing process.

For drum-mix plants, the mineral admixture shall be weighed across a weight belt, or other approved alternative weighing system, with a weight totalizer prior to entry into the mechanical mixing device. The mechanical mixing device shall be a pugmill type mixer that is in good working condition. The rate of the aggregate feed shall not exceed the mixing device's capacity in ton per hour. The mixer shall be constructed to minimize the loss of mineral admixture and shall be located in the aggregate delivery system at a location where the mixed material can be readily inspected. The mixing device shall be capable of effective mixing in the full range of the asphalt concrete production rates.

The hot plant and equipment shall be constructed and operated to prevent loss of mineral admixture through the dust collection system of the plant.

A positive signal system shall be provided and utilized during production whereby the mixing shall automatically be stopped if the mineral admixture is not introduced into the mineral aggregate. The plant will not be permitted to operate unless the signal system is in good working condition.

The introduction of bituminous material shall be controlled by an automated system fully integrated with the controls of the mineral aggregate and mineral admixture. The production of the plant shall be controlled by the rate required to obtain a uniform mixture of all components. Drying and heating shall be accomplished in such a manner as to preclude the mineral admixture from becoming coated with un-spent fuel. The completed asphalt concrete may be held in storage for up to 12 hours in insulated or heated silos, providing the minimum temperature noted herein for placement and compaction is met behind the placement device. If the Engineer determines that there is an excessive amount of heat, heat loss, drain down, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

The temperature of the asphalt concrete, with unmodified binders, upon discharge from the mixer shall not exceed 335 degrees F. The discharge temperature may be increased on the recommendation of the binder supplier, when approved by the Engineer. If the asphalt concrete is discharged from the mixer into a hopper, the hopper shall be constructed so that segregation of the asphalt concrete will be minimized.

321.7 TRANSPORTATION:

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

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

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

321.8 PLACEMENT:

Placement of asphalt concrete pavement shall not commence until authorized by the Engineer. The Engineer's authorization to allow commencement of asphalt concrete paving will generally require all newly constructed valley gutters, curbing, and curb and gutters which new pavement is to be placed against to be in-place and in an acceptable condition. While it is preferred to have all newly constructed concrete items against which new pavement is to be placed be in an acceptable condition, the Engineer may allow paving to commence based on weather, the amount of defective concrete, or other considerations.

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

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

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

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

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

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

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

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

Screeds shall include any strike-off device operated by tamping or vibrating action which is effective, without

tearing, shoving or gouging the mixture and which produces a course with a uniform texture and density for the full width being paved. Screeds shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required. In the case of the screed, auger extensions and vibrators shall be installed wherever the screed is extended more than one (1) foot beyond the end of the base auger or auger extension. However, when placing material against an extremely uneven curb or edge over a short distance, the Engineer may waive the auger extensions and vibrators.

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

321.8.2 Joints: Transverse joints, before a surface course is placed in contact with a cold transverse construction joint, the cold existing asphalt concrete shall be trimmed to a vertical face for its full depth exposing a fresh face. The fresh face shall be tack coated prior to placement of the new asphalt concrete. After placement and finishing the new asphalt concrete, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint, parallel to the centerline.

Longitudinal joints of each asphalt course shall be staggered a minimum of 6 inches with relation to the longitudinal joint of the immediate underlying course's cold longitudinal construction joint.

Longitudinal joints with existing or cold (more than 32 hours old) asphalt concrete shall require the existing pavement to be trimmed to a vertical face for its full depth exposing a fresh face. The fresh face shall be tacked prior to placement of the adjacent course. Longitudinal joints with an existing asphalt pavement that is less than 32 hours old that has had its edge protected from damage may have adjacent new asphalt concrete placed after applying the required tack coat. After placement and finishing of longitudinal joints, both sides of the joint shall be dense and the joint shall be smooth and tight. The surface in the area of the joint shall not deviate more than 1/4 inch from a 12-foot straightedge, when tested with the straightedge placed across the joint in any direction.

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

321.8.4 Compaction; Asphalt Base Course and Surface Course: It is the contractor's responsibility to perform Quality Control monitoring and/or testing during compaction operations to achieve the required compaction. The temperature of the asphalt concrete immediately behind the laydown machine shall meet the minimum requirements of Table [321-2](#). A probe type electronic thermometer with a current calibration sticker attached will be used to measure the temperature of the asphalt concrete mixture. When measuring the temperature of the mat, the probe shall be inserted at mid-depth and as horizontal as possible to the mat. The minimum temperatures in Table 321-2 do not guarantee that the asphalt mix will be compacted to the required density. The contractor is responsible to achieve the required compaction.

MINIMUM ASPHALT CONCRETE PLACEMENT TEMPERATURE						
Base ⁽¹⁾ Temp (°F)	Mat Thickness (inches)					
	1/2	3/4	1	1 1/2	2	3 and greater
40 – 50	---	---	310	300	285	275
50 – 60	---	310	300	295	280	270
60 – 70	310	300	290	285	275	265
70 – 80	300	290	285	280	270	265
80 – 90	290	280	270	270	265	260
+90	280	275	265	265	260	255

(1) Base on which mix is to be placed

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

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

The Engineer will determine the acceptability of the pavement compaction in accordance with Section [321.10](#).

321.8.5 Smoothness: The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross-section and free from ruts, humps, depressions or irregularities. An acceptable surface shall not vary more than one-fourth ($\frac{1}{4}$) inch from the lower edge of a 12-foot straightedge when the straightedge is placed parallel to the centerline of the roadway.

321.8.6 Asphalt Concrete Overlay: Asphalt concrete overlay consists of the placing and compacting plant mix asphalt concrete over existing pavement. The mix design and thickness of the overlay shall be as shown on the plans or as specified in the special provisions.

Except when the existing asphalt surface is to be preheated and remixed, pavement surfaces shall be prepared as follows:

- (a) Areas designated for pavement repair by the contract documents (which may include severely raveled areas, severely cracked areas, over-asphalted areas, and other defects) shall be cut out and replaced. Pavement repairs shall be completed and approved before placing asphalt concrete overlay.
- (b) Before placing asphalt concrete overlay, milling shall be done as shown on the plans or specified in the special provisions and shall be in accordance with Section [317](#).
- (c) After pavement repairs and milling have been completed the entire surface shall be cleaned with a power broom.
- (d) After surfaces have been prepared to the satisfaction of the Engineer, they shall receive a tack coat per Section [321.4](#). Traffic will not be permitted to travel over surfaces which have received a tack coat, except when tack coat is applied to milled surfaces in compliance with Section [317.2](#) for dust control purposes. When the overlay is to extend onto a concrete gutter, the gutter shall be thoroughly cleaned of loose dust and cement particles and shall be tack coated.

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

Frames and covers of manholes, survey monuments, valve boxes, clean-outs and other existing structures shall be adjusted in accordance with Section [345](#) to set flush with the finished surface of the new pavement. During adjustment if pavement or base materials are removed or disturbed, they shall be replaced with approved materials installed in a manner acceptable to the Engineer.

On roads without curb and gutter, the existing unpaved shoulder elevation shall be adjusted by the Contractor to match the elevation at the edge of the new overlay and slope away from the new pavement surface at a rate that the existing quantity of shoulder material will allow. Shoulder material shall be compacted to a minimum of 95% of maximum density, determined in accordance with Section [301.3](#). Shoulder adjustment to match the new pavement surface elevation shall not be measured. The cost of shoulder adjustment shall be included in the price paid for the asphalt concrete overlay or other related pay items. When the Engineer determines an insufficient amount of material is available for shoulder adjustment, the Engineer may require the Contractor to provide additional material. Acceptable material for shoulders includes the existing shoulder material, millings, untreated base materials, or a granular material approved by the Engineer. Engineer requested imported material for shoulder adjustment is not included in the price paid for the asphalt concrete overlay.

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

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

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

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

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

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

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

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

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

321.8.8 Thickened Edge: When the depth of the thickened edge extends four inches or more below the bottom of the asphalt pavement, the portion of the thickened edge extending below the asphalt pavement shall be placed and compacted prior to placement of the asphalt pavement. Placement of tack coat on the surface of the compacted thickened edge asphalt may be omitted when additional asphalt pavement is placed on the same day and the Engineer agrees that the surface of the thickened edge asphalt has remained clean.

When the depth of the thickened edge extends less than four inches below the bottom of the asphalt pavement, the portion below the asphalt pavement may be placed and compacted with the asphalt pavement in a single operation.

321.8.9 Safety Edge: The finished safety edge slope shall be planar forming a $30^{\circ} \pm 5^{\circ}$ angle with the adjacent roadway surface and extend a minimum of five inches (5") below the roadway pavement's finished surface.

The safety edge shall be constructed with the top or final paving lift of a new pavement or overlay using a device that is mounted to or is a part of the screed portion of the laydown machine. The safety edge device shall be capable of constraining the asphalt concrete material to increase density of the extruded profile by reducing the volume. A conventional single strike-off plate is not acceptable. Compaction obtained from the extruded safety edge shall be acceptable when the extruded shape conforms to the specified shape.

During laydown operations if the extruded safety edge does not conform to the specified shape, the Contractor shall take immediate actions to correct the deficiency and to repair all non-compliant sections of safety edge. The Contractor shall stop paving operations until corrections to the laydown operation have been made and resumption of paving is approved by the Engineer or his designated representative.

321.8.10 Protection for Asphalt Base Course: Arterial roadway traffic shall not be allowed on a new asphalt base course that is less than five inches (5") in thickness without the written consent of the Engineer.

321.9 QUALITY CONTROL:

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

The asphalt concrete produced shall conform to the requirements of the production tolerances established in section [321.10](#). When the asphalt concrete does not conform to the production tolerances, it shall be reported to the Engineer, and corrective quality control measures shall be implemented, or production shall cease immediately at no additional cost to the contracting Agency.

Requests for Referee Testing as described in 321.11 will only be considered based on quality control test results performed by a laboratory accredited by the AASHTO Accreditation Program (AAP) for the tests being performed or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories for the set of tests in question. The laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications).

321.10 ACCEPTANCE:

321.10.1 Acceptance Criteria: Asphalt concrete will be divided into lots for the purpose of acceptance. A lot shall be one day's production. Each lot shall be divided into sublots of 500 ton or fraction thereof. Tests used to determine acceptance will be performed by a laboratory accredited by the AASHTO Accreditation Program (AAP) for the tests being performed. The contracting agency shall provide an appropriately accredited laboratory or laboratories to perform the acceptance testing. Laboratories shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications). The acceptance laboratory will take representative samples of the asphalt concrete from each subplot to allow for testing of gradation, binder content, air voids, pavement thickness and compaction of base and surface courses. Acceptance of each subplot will be based on the test data from the sample(s) from that subplot. All acceptance samples shall be taken using random locations or times designated by the Engineer in accordance with ASTM D3665.

321.10.2 Gradation, Binder Content and Air Voids: The acceptance laboratory will take a sample of the asphalt concrete in accordance with the requirements of Section 2 or 4 of Arizona Test Methods 104 or AASHTO T-168 from each subplot. The minimum weight of the sample shall be 45 pounds. Asphalt binder content and gradation shall be determined in accordance with AASHTO T-308 using the ignition furnace for each subplot. The acceptance laboratory is responsible for obtaining the necessary materials and performing an ignition furnace calibration as outlined in AASHTO T-308 for each asphalt concrete mixture utilized on the project. The correction factor used for

each test shall be clearly indicated on the report. The bulk density for Marshall Mix designs shall be tested in accordance with AASHTO T-245. The bulk density for Gyrotory mix designs shall be determined in accordance with AASHTO T-312. The maximum theoretical density shall be determined in accordance with the requirements of AASHTO T-209 including fan drying per AASHTO T209 Section 15. Effective voids of the laboratory compacted specimens will be determined at a minimum of once per lot in accordance with the requirements of AASHTO T-269. Should the testing for effective air voids not meet the "Full Payment" or "No Corrective Action" requirements of Table [321-5](#), additional testing for laboratory air voids on the remaining sublots will be performed as necessary to determine the extent of the deficiency. Acceptance testing results will be furnished to the contractor and the supplier within five working days of receipt of samples by the acceptance laboratory.

During production, the allowable deviations from the mix design gradation targets are listed in the tables below. The allowable production tolerances may fall outside of the mix design gradation bands.

TABLE 321-3A				
GRADATION ACCEPTANCE LIMITS FOR MARSHALL MIXES				
Sieve Size	3/8 inch Mix	1/2 inch Mix	3/4 inch Mix	Base Mix
1 inch	---	---	---	±7%
3/4 inch	---	---	±7%	±6%
1/2 inch	---	±7%	---	---
3/8 inch	±7%	±6%	±6%	±6%
No. 8	±6%	±6%	±6%	±6%
No. 40	±4%	±4%	±4%	±4%
No. 200	±2%	±2%	±2%	±2%

TABLE 321-3B			
GRADATION ACCEPTANCE LIMITS FOR GYRATORY MIXES			
Sieve Size	3/8 inch Mix	1/2 inch Mix	3/4 inch Mix
3/4 inch	---	---	±7%
1/2 inch	---	±7%	±6%
3/8 inch	±7%	±6%	---
No. 8	±6%	±6%	±6%
No. 40	±4%	±4%	±4%
No. 200	±2%	±2%	±2%

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

If the asphalt binder content is within $\pm 0.40\%$ of the mix design target value, the asphalt concrete will be paid for at the contract unit price. If the asphalt binder content deviates by more than $\pm 0.40\%$ from the mix design target value, the deficient area will be evaluated within the subplot by coring at maximum intervals of 100 feet from the deficient sample. The asphalt content of the original deficient sample will be averaged with the asphalt binder content of the cores taken for re-evaluation to determine compliance with the acceptance requirements. If the resulting average of the asphalt binder content deviates by more than $\pm 0.40\%$ from the mix design target value, then Table [321-4](#) shall apply to the subplot. Additional cores may be required to define the limits of the deficient area, and shall not be used for re-evaluating acceptance.

TABLE 321-4		
ASPHALT BINDER CONTENT ACCEPTANCE AND PENALTIES		
Deviation from that permitted	When the contracting agency is the owner: Payment Reduction (\$ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
Over 0.2% <u>above</u> that permitted	Removal* or EA	Removal* or EA
Over 0.1% to 0.2% <u>above</u> that permitted	\$6.00	EA
Over 0.0% to 0.1% <u>above</u> that permitted	\$2.00	EA
Within permitted range	Full Payment	No Corrective Action
Over 0.0% to 0.1% <u>below</u> that permitted	\$2.00	EA
Over 0.1% to 0.2% <u>below</u> that permitted	\$6.00	EA
Over 0.2% <u>below</u> that permitted	Removal* or EA	Removal* or EA

NOTES: *The Contractor shall remove and replace the entire subplot that is deficient.
EA = Engineering Analysis per Section 321.10.6

If the laboratory air voids fall within a range of 2.8% to 6.2%, the asphalt concrete will be paid for at the contract unit price. If the laboratory air voids are outside of this range, the deficient area will be evaluated within the subplot by coring at maximum intervals of 100 feet from the deficient sample. The laboratory air voids of the original deficient sample will be averaged with the laboratory air voids obtained from each of the cores taken for re-evaluation to determine compliance with the acceptance requirements. If the resulting average of the laboratory air voids is outside the indicated range, then Table 321-5 shall apply to the subplot. Additional cores may be required to define the limits of the deficient area, and shall not be used for re-evaluating acceptance.

TABLE 321-5		
LABORATORY VOIDS ACCEPTANCE AND PENALTIES		
Laboratory Air Voids (Measured at N _{des} or 75 blows as applicable)	When the contracting agency is the owner: Payment Reduction (\$ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
Less than 1.5%	Removal* or EA	Removal* or EA
1.5-2.0%	\$5.00	EA
2.1-2.7%	\$2.00	EA
2.8-6.2%	Full Payment	No Corrective Action
6.3-6.9%	\$2.00	EA
7.0-8.0%	\$5.00	EA
Greater than 8.0%	Removal* or EA	Removal* or EA

NOTES: *The Contractor shall remove and replace the entire subplot that is deficient
EA = Engineering Analysis per Section 321.10.6
Removal for In-place Air Voids Greater than 11.0% is not eligible for Section 321.10.6.

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

321.10.3 Surface Testing: If directed by the Engineer surface drainage test shall be performed. The completed

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

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

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

321.10.4 Asphalt Pavement Thickness: Asphalt Pavement thickness will be determined from cores secured from each lift of each subplot. Such cores will be taken and measured by the Asphalt Concrete Coring Method. This method can be found in Section [321.14](#). Each core location will be patched by the party responsible for the testing.

Acceptance or assessment of penalties for asphalt pavement thickness will be based on the combined total thickness of all asphalt concrete layers omitting all layers of asphalt-rubber asphalt concrete. If the final total pavement thickness exclusive of all ARAC layers is deficient from the target thickness by 0.25 inches or less, it will be paid for at the contract unit price.

If the pavement thickness deficiency is greater than 0.25 inches and the contracting agency is not the owner (i.e. permits) the following steps will apply:

- (1) If the thickness deficiency of the pavement exceeds 0.25 inch, the limits of the deficient area will be evaluated by coring at maximum intervals of 100 feet from the deficient core. The thicknesses of the original deficient core will be averaged with the thicknesses of the cores taken from 100 feet on each side of it to determine compliance with the acceptance requirements. If the resulting average thickness deficiency is greater than 0.25 inch, additional cores may be required to define the limits of the deficient area, and shall not be used for re-evaluating acceptance.
- (2) If the pavement thickness from step one above deviates from the target thickness by more than 0.25 inch but not more than 0.50 inch, corrective action will be required. This corrective action will consist of application of a Type II slurry seal coat in accordance to Section [715](#). The Contractor may present an engineering analysis outlining other proposed remedial measures for the consideration of the Engineer. The Engineer will review the engineering analysis and decide within 30 working days whether to accept the proposed remedial measures.
- (3) If the pavement thickness from step one above deviates from the target thickness by more than 0.50 inch, corrective action will be required. The deficient area shall be overlaid with no less than a 1 inch thick lift, for the full width of the pavement to meet or exceed the designed thickness, with appropriate end and edge milling, with a mixture approved by the Engineer. The Contractor may present an engineering analysis outlining other proposed remedial measures for the Engineer's consideration. The Engineer will review the engineering analysis and decide within 10 working days whether to accept the proposed remedial measures. If the Engineer chooses to reject the engineering analysis, the indicated overlay will be constructed by the Contractor at no additional cost to the Owner.

If the Contracting Agency is the owner and the pavement thickness deficiency is greater than 0.25 inches but less than 0.50 inches Table [321-6](#) will apply. If the pavement thickness deficiency is greater than 0.5 inches the deficient area shall be overlaid with no less than a 1-inch thick lift for the full width of the pavement to meet or exceed the designed thickness using an asphalt mixture approved by the Engineer. The Contractor shall provide appropriate end and edge milling. The overlay and milling shall be accomplished by the Contractor at no additional cost to the Contracting Agency.

TABLE 321-6	
ASPHALT PAVEMENT THICKNESS PAYMENT REDUCTION	
For Thickness Deficiency of More Than 0.25 inches and less than 0.50 inches	
Total Specified Asphalt Pavement Thickness exclusive of ARAC (if any)	Reduction in Payment applied to asphalt concrete except ARAC layers (if any)
Less than 1.5 inches	50%
1.50 inches to 1.99 inches	33%
2.00 inches to 2.49 inches	25%
2.50 inches to 2.99 inches	20%
3.00 inches and over	17%

321.10.5 Density:**321.10.5.1 Pavement 1-1/2 Inches or Less in Nominal Thickness:**

Compaction shall consist of a “Rolling Method Procedure” using an established sequence of coverage with specified types of compactors. A pass shall be defined as one movement of a compactor in either direction. Coverage shall be the number of passes as are necessary to cover the entire width being paved.

The rolling sequence, the type of compactor to be used, and the number of coverages required shall be as shown in Table [321-7](#).

TABLE 321-7				
ROLLING SEQUENCE FOR LIFT THICKNESS 1½” OR LESS				
Rolling Sequence	Type of Compactor		No. of Coverages	
	Option No. 1	Option No. 2	Option No. 1	Option No. 2
Initial	Static Steel	Vibrating Steel	1	1
Intermediate	Pneumatic Tired	Vibrating Steel	4	2- 4*
Finish	Static Steel	Static Steel	1-3	1-3

* Based on the roller pattern which exhibits the best performance.

The Contractor shall select the option for compaction and, when pneumatic-tired compactors are used will designate the tire pressure. Steel wheel compactors shall not be used in the vibratory mode for courses of one inch or less in thickness nor when the temperature of the asphaltic concrete falls below 180 degree F. Initial and intermediate compaction shall be accomplished before the temperature of the asphaltic concrete falls below 200 degree F.

Compaction will be deemed to be acceptable on the condition that the asphaltic concrete is compacted using the type of compactors specified, ballasted and operated as specified, and with the number of coverages of the compactors as specified.

321.10.5.2 Pavement Greater than 1-1/2 Inches in Nominal Thickness:

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

In-place air voids shall be determined in accordance with AASHTO T-269 utilizing cores taken from the finished pavement. The maximum theoretical density used in the determination of in-place air voids will be the average value from the acceptance samples determined for the Lot as outlined in [321.10.1](#).

The Engineer will designate one random test location for each subplot and the acceptance laboratory will obtain one

core from that location. Regardless of subplot quantities or boundaries, a minimum of one core will be obtained per residential street and a minimum of one core per travel lane for collector and arterial streets. The outside one foot of each pass of the pavement course or any unconfined edge will be excluded from testing. The Engineer may exclude areas from the compaction lot that are not accessible by normal compaction equipment.

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

Cores will be taken per the Asphalt Concrete Coring Method. This method can be found in Section [321.14](#). Acceptance testing results will be furnished to the contractor within five working days of receipt of samples by the acceptance laboratory.

If the pavement density has in-place voids of 8.0% or less, the asphalt concrete will be paid for at the contract unit price. If the pavement density has in-place voids greater than 8.0%, the deficient area will be evaluated within the subplot by coring at maximum intervals of 100 feet from the deficient core(s). If both cores in a subplot are deficient, 3 to 4 additional cores may be necessary to re-evaluate acceptance. The in-place voids of all the original core(s), whether deficient or acceptable, will be averaged with the in-place voids of the cores taken for re-evaluation to determine compliance with the acceptance requirements. If the average of the in-place voids is greater than 8.0% then Table [321-8](#) shall apply to the subplot. Additional cores may be required to define the limits of the deficient area, and shall not be used for re-evaluating acceptance.

TABLE 321-8		
PAVEMENT DENSITY PENALTIES		
Limits of In-place Air Voids for design lift thicknesses 1.5 inches and greater	When the contracting agency is the owner: Payment Reduction (\$ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
Below 3.0%	Removal* or EA	Removal* or EA
3.0% to below 4.0%	\$10.00	EA and Type II Surry Seal
4.0% to 8.0%	Full Payment	No Corrective Action
Greater than 8.0% to less than 9.0%	\$6.00	EA
9.0% to 10.0%	\$10.00	EA and Type II Surry Seal
Greater than 10.0%	Removal* or EA	Removal* or EA

NOTES: *The Contractor shall remove and replace the entire subplot that is deficient.

EA = Engineering Analysis per Section [321.10.6](#)

Removal for In-place Air Voids greater than 11.0% is not eligible for Section [321.10.6](#).

321.10.6 Engineering Analysis (EA): Within 10 working days after receiving notice that a lot or subplot of asphalt concrete is deficient and is found to fall within the “Removal or EA” band per Table(s) [321-4](#), [321-5](#), and/or [321-8](#) the contractor may submit a written proposal (Engineering Analysis) to accept the material in place at the applicable penalties along with possible remediation(s) listed in the “Removal or EA” category. Engineering Analysis can also be proposed for non-removal categories of “Corrective actions” when the contracting agency is not the owner (i.e. permits).

The Engineering Analysis shall contain an analysis of the anticipated performance of the asphalt concrete if left in

place. The Engineering Analysis shall also detail the effect of any proposed corrective action to the material(s) in place as it relates to the in-place material's performance. The Engineering Analysis shall be performed by a professional engineer experienced in asphalt concrete testing and mix designs.

If a lot or subplot is accepted for referee testing and the referee test results still show a deficiency, the contractor shall have ten working days to submit an engineering analysis beginning upon notification of referee test results.

When an Engineering Analysis recommends that a specific lot or subplot should not be removed, the Engineering Analysis will recommend that the following penalties (Table [321-9](#)) be paid when the contracting agency is the owner, for the specific criteria being reviewed by the EA.

TABLE 321-9		
ENGINEERING ANALYSIS PENALTIES for REMOVAL* LOTS/SUBLOTS LEFT IN-PLACE		
Acceptance Criteria	Acceptance Limits	Penalty When Contracting Agency is the Owner (\$/Ton)
Asphalt Binder Content	Over 0.2% points from that Permitted	\$9.00
Laboratory Air Voids (Measured at N_{des} or 75 blows as applicable)	Less than 1.5% or Greater Than 8.0%	\$7.50
Limits of In-place Air Voids	Less than 3% or Greater than 10.0%	\$15.00

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

321.11 REFEREE:

If the Contractor has reason to question the validity of any of the acceptance test results, the Contractor may request that the Engineer consider referee tests for final acceptance. Any request for referee testing must describe the contractor's reasons for questioning the validity of the original acceptance test results and must clearly describe which set of acceptance tests are in question. The engineer may either accept or reject the request for referee testing. When referee testing is accepted, the Contractor (at the Contractors own expense) will engage an independent laboratory accredited by the AAP or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories as appropriate for the acceptance tests that are being questioned. The independent referee laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications). For the set of test results in question the referee laboratory shall perform a new set of acceptance tests (as required by Section [321.10](#) representing the area for the set of tests in question). The referee tests will replace the original acceptance tests that were in question.

These tests may include asphalt binder content, aggregate gradation, Marshall or Gyratory unit weight, maximum theoretical unit weight, laboratory air voids and in-place air voids (compaction). Samples for referee testing shall come from representative samples obtained from the completed pavement, as directed by the Engineer.

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

321.12 MEASUREMENT:

Asphalt concrete pavement will be measured by the ton, or by the square yard, for the mixture actually used as

allowed above, which shall include the required quantities of mineral aggregates, asphalt binder, and mineral admixture. Measurement shall include any tonnage used to construct intersections, roadways, streets, or other miscellaneous surfaces indicated on the plans or as directed by the Engineer.

321.13 PAYMENT:

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

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

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

Agency required repairs of existing pavement prior to roadway overlay operations will be paid for as a separate pay item.

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

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

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

321.14.2 Core Drilling Device: The core drilling device will be powered by an electrical motor, or by an acceptable gasoline engine. Either device used shall be capable of applying enough effective rotational velocity to secure a drilled specimen. The specimen shall be cored perpendicularly to the surface of pavement, and that the sides of the core are cut in a manner to minimize sample distortion or damage. The machinery utilized for the procedure shall be on a mounted base, have a geared column and carriage that will permit the application of variable pressure to the core head and carriage throughout the entire drilling operation. The carriage and column apparatus shall be securely attached to the base of the apparatus; and the base will be secured with a mechanical fastener or held in place by the body weight of the operator. The core drilling apparatus shall be equipped with a water spindle to allow water to be introduced inside of the drill stem while operating. The cutting edge of the core drill bit shall be of hardened steel or other suitable material with embedded diamond chips in the cutting surface. The core barrel shall be of sufficient diameter to secure a specimen that is a minimum of four or six inches or whichever is prescribed for necessary testing. The core barrel shall not be missing more than one of the teeth used for cutting; if so it shall be discarded and another barrel shall be used. The core barrel shall also be a minimum of two inches longer than the anticipated depth of pavement in accordance with project paving plans.

321.14.3 Accessory Equipment: A sufficient supply of ice and dry ice shall be provided to sufficiently cool the pavement prior to securing the samples from the designated areas in the pavement. The ice should also be used to adjust the temperature of the water used to cool the core bit. A water supply (usually a plastic 35 – 55 gal drum) with sufficient hose to introduce the water into and through the spindle of the coring device by gravity feed. The drum should be white or light in color to minimize excessive thermal heating of the water (*for coring of asphalt rubber cores see Note 1*). At no time shall the water utilized in the coring operation exceed 65° F during the coring operation. Ice shall be utilized to ensure the temperature control of the water being introduced during the cutting

operation. An ice chest or other suitably insulated container that can maintain a temperature of less than 70° F shall be used to secure the specimens during transport. The container will be equipped with flat shelving that will support the drilled cores throughout the entire specimen dimension during transport back to the testing facility.

Miscellaneous hand tools to remove the drilled specimen from the drill hole or the core barrel taking great care in not disturbing the specimen more than necessary (refer to fig. 1 in ASTM D5361).

321.14.4 Process: The pavement surface at the time of coring shall not exceed a temperature of 90° F; the pavement shall be conditioned with ice or dry ice to ensure that this requirement is met. Immediately after it has been ensured that the pavement has dropped to the required temperature, core drilling shall begin. The operator will then apply an even and continuous pressure (Note 2) to penetrate through the full depth of the pavement. The operator will concurrently ensure that enough water is moving over the core surface as to adequately remove any and all cuttings that could damage the drilled core. After the pavement thickness has been penetrated the core shall be carefully removed from either the drill hole or the core barrel and be immediately transferred to an ice chest or other suitable container. Each individual core shall be placed on a shelf in the cooler with the exposed side of the specimen facing down, or the “top side” down. If the specimen is a two lift core, the only acceptable means of separating lifts is with a power or other acceptable wet saw type of equipment (conforming to ASTM D5361); however, at no time shall cores be split using a mallet and screwdriver or metal straight edge when being tested for bulk density. Perpendicularity of the specimen shall be checked in the field after the specimen has been extracted from the surface. The core operator shall hold the core up to eye level and place the core top side down in a “speed square” or small carpenters square. The specimen placed in the square shall not depart from perpendicular to the axis more than 0.5° (approximately equivalent to 1/16 of an inch in 6 inches). If the specimen is outside of this distance from square it shall be discarded in the field and another sample cored that falls within tolerance. The cores upon arriving at the laboratory for testing shall be carefully cleaned and measured for thickness in accordance with ASTM D3549. A speed square shall be utilized to measure perpendicularity as compared to a 90° degree angle and shall not depart from perpendicular to the axis more than 0.5° (approximately equivalent to 1/16 of an inch in 6 inches). All remaining testing shall be done within the parameters of the current project and / or agency required specification.

*Note 1 – It should be noted that when the material to be cored is a rubberized asphalt mixture a wetting agent such as liquid dish soap shall be added to the water barrel to hinder the material from sticking or allowing the binder to spread during coring.

*Note 2 – This refers to pressure exerted on the core barrel and machine during the coring process. Too much pressure can cause damage to the core barrel and the motor; and too little pressure can cause a glazing of the diamonds, reducing cutting efficiency and premature wear of the barrel

- End of Section -

Date: September 19, 2014

To: MAG Specifications and Details Committee

From: Brian Gallimore, Chairman MAG Materials Working Group

Subject: Revisions to Sections 325 & 717 **Case # 14-19 Rev 9-19-14**

PURPOSE: Incorporate revisions to Section 325, "*PLACEMENT AND CONSTRUCTION OF ASPHALT-RUBBER ASPHALT CONCRETE*" and Section 717, "*ASPHALT-RUBBER ASPHALT CONCRETE*" into the MAG Specifications.

REVISIONS:

- 325.2.1 - Added provisions for terminal-blended asphalt-rubber binder (ARB). Added and revised wording to improve clarity. The word "terminal" was replaced with "facility" to differentiate wet process ARB from "Terminal Blend" modified binder (PG 76-22 TR+).
- 325.2.2 - Corrected wording to improve clarity.
- 325.5 - Added and revised wording to improve clarity.
- 325.7.2 - Minor wording revisions. Specified end dumps as the default truck type. Added language that will allow the Engineer to approve Belly dumps in certain circumstances.
- 325.7.3 - Correction of referenced Section number.
- 325.8 - Removed redundant wording and revised wording for clarity.
- 325.9.1 - Incorporated MCDOT's language for Acceptance Criteria section introduction.
- 325.9.2 - Added wording to address additional means of performing acceptance testing (allow grade samples to be used for acceptance testing) to provide flexibility to agencies. Current specification is not workable for most agencies or for smaller projects; e.g. City of Scottsdale. The section was divided into 2 subsections; one for plant obtained samples, one for grade obtained samples. Removed Air Void criteria from this section because air void testing is independent of where the sample was obtained. Gradation table moved to this section.
- 325.9.2.1 - This section addresses sampling from the plant and testing of ARAC via nuclear method.
- 325.9.2.2 - This section is new and addresses sampling from the grade and testing of ARAC via ignition method and adding language for ignition calibration protocol. The allowable ARB range is the same as plant based samples, however an ARB penalty table was included to address ARB deficiencies since the plant can't be adjusted during production (as is done with plant-based sampling). The penalties were modeled after table 321-4.
- 325.9.3 - Added and revised wording to improve clarity. Updated table number reference.
- 325.9.4 - Added language for referee testing the requirements associated.
- 325.9.5.2.1 - Added and revised wording to improve clarity. Added sentence that provides the Engineer with the option to core.
- 325.9.5.2.2 - Removed requirement that the nuclear gauge used be a thin lift style. Added sentence that provides the Engineer with the option to core.

- 717.2.1 - Added and revised wording to improve clarity. The word “terminal” was replaced with “facility” to differentiate wet process ARB from “Terminal Blend” modified binder (PG 76-22 TR+).
- 717.2.1.2 - The term “asphalt-rubber binder” was replaced with “ARB”. There are several similar occurrences in the document.
- 717.2.1.4 - Added and revised wording to improve clarity.
- 717.3.2 - Wording revised and/or added to improve clarity.

DRAFT

PLACEMENT AND CONSTRUCTION OF ASPHALT-RUBBER ASPHALT CONCRETE

325.1 DESCRIPTION:

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

325.2 MATERIALS:

ARAC shall consist of a mixture of aggregate, mineral admixture and asphalt-rubber binder (ARB) as specified in Section [717](#).

325.2.1 Mixing of Asphalt-Rubber Binder: ~~Mixing of asphalt-rubber binder (ARB) may take place in a dedicated blending and storage unit connected to the hot plant or at the asphalt binder supplier's facility-terminal. In either case, the~~ temperature of the asphalt cement shall be between 375° F and 425° F prior to the addition of crumb rubber. No agglomerations of crumb rubber particles in excess of 2 inches in the least dimension shall be allowed in the mixing chamber. The crumb rubber and asphalt cement shall be accurately proportioned in accordance with the ARB design, [as identified in 717.2.1.4](#), and thoroughly mixed prior to the beginning of the one hour reaction period. Reaction time may be decreased to 45-minutes if documentation is provided that the physical properties of the mix design requirements are consistently met using a 45-minute reaction period. The Contractor or supplier shall document that the proportions are accurate and that the crumb rubber has been uniformly incorporated into the mixture. Additionally, the Contractor or supplier shall demonstrate that the crumb rubber particles have been thoroughly mixed into the base asphalt cement. The occurrence of crumb rubber floating on the surface or agglomerations of crumb rubber particles shall be evidence of insufficient mixing. The temperature of the ARB immediately after mixing shall be between 350° F and 400° F. Reaction time shall start after all of the material for the batch has been mixed and the minimum reaction temperature of 350° F has been achieved.

Prior to use, the viscosity of the ARB shall be tested by the use of a rotational viscometer, which is to be furnished by the Contractor or supplier. The Contractor or supplier shall provide a qualified person to perform the testing.

325.2.2 Handling of ARB: Once the ARB has been mixed, it shall be kept thoroughly agitated during periods of [transport and](#) use to prevent settling of the crumb rubber particles. During the production of ARAC the temperature of the ARB shall be maintained between 325° F (163°C) and 400° F (204°C). However, in no case shall the ARB be held for more than 10 hours at these temperatures. It ~~shall~~ [may](#) be allowed to cool to a temperature of 250° F (121°C) or ~~less~~ [lower](#) and held at that temperature for not more than four days. The process of cooling and reheating shall not be allowed more than one time for a batch of ARB.

For each load or batch of ARB, the Contractor or supplier shall provide the Engineer with the following documentation:

- (A) The source, grade, amount and temperature of the asphalt cement prior to the addition of crumb rubber.
- (B) The source, type and amount of crumb rubber and the rubber content expressed as percent by the weight of total ARB.
- (C) Times and dates of the crumb rubber additions, resultant viscosity test, and the [elapsed](#) reaction time at which the viscosity test was taken.
- (D) A record of the temperature, with time and date reference for each load or batch. The record shall begin at the time of the addition of crumb rubber and continue until the load or batch is completely used. Readings and recordings shall be made at every temperature change in excess of 20° F, and as needed to document other events which are significant to batch use and quality.

325.3 WEATHER AND MOISTURE CONDITIONS:

ARAC shall be placed only when the surface is dry, and when the atmospheric temperature in the shade is 55° F or higher. No ARAC shall be placed when the weather is foggy or rainy. ARAC shall be placed only when the Engineer determines other conditions are suitable.

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325.4 APPLICATION OF TACK COAT:

A tack coat shall be applied to all existing and to each new course of ARAC prior to the placing of a succeeding lift of ARAC. The tack coat may be deleted when a succeeding layer of ARAC is being applied over a freshly laid course that has been subjected to very little traffic when approved by the Engineer.

The application of the tack coat shall comply with Section [329](#). The grade of emulsified asphalt shall be SS-1h or CSS-1h as specified in Section [713](#).

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

The surface to be covered may require repair or patching as directed by the Engineer. This shall be addressed in the project specifications prior to the bidding of the project.

325.5 MIX PRODUCTION:

All materials shall be proportioned by weight in a hot mix asphalt plant in the proportions required by the mix design to provide a homogeneous and workable mass. Each hot mix asphalt plant shall be inspected in accordance with the provisions contained in the 'Hot Mix Asphalt Production Facilities' by the Arizona Rock Products Association and shall have a current inspection certificate. All measuring devices shall be calibrated at least annually by a technician licensed by the Arizona Bureau of Weights & Measures. Mixing plants shall conform to the requirements of AASHTO M-156, except as modified herein.

In drum mix plants the mineral admixture shall be added and thoroughly mixed with the mineral aggregate by means of a mechanical mixing device prior to the mineral aggregate and mineral admixture entering the dryer. The moisture content of the combined mineral aggregate shall be a minimum of three percent by weight of the aggregate during the mixing process.

For drum-mix plants, the mineral admixture shall be weighed across a weigh belt, or other approved alternative weighing system, with a weight totalizer prior to entry into the mechanical mixing device. The mechanical mixing device shall be a pugmill type mixer that is in good working condition. The rate of the aggregate feed shall not exceed the mixing device's capacity in ton per hour. The mixer shall be constructed to minimize the loss of mineral admixture and shall be located in the aggregate delivery system at a location where the mixed material can be readily inspected. The mixing device shall be capable of effective mixing in the full range of the ARAC production rates.

The hot plant and equipment shall be constructed and operated to prevent loss of mineral admixture through the dust collection system of the plant.

A positive signal system shall be provided and utilized during production whereby the mixing shall automatically be stopped if the mineral admixture is not introduced into the mineral aggregate. The plant will not be permitted to operate unless the signal system is in good working condition.

The introduction of ARB shall be controlled by an automated system fully integrated with the controls ~~or for~~ the mineral aggregate and mineral admixture. The production of the plant shall be controlled by the rate required to obtain a uniform mixture of all components. Drying and heating shall be accomplished in such a manner as to preclude the aggregate or mineral admixture from becoming coated with un-spent fuel. The completed ARAC may be held in storage for up to 12 hours in insulated or heated silos, providing the minimum temperature noted herein for placement and compaction is met behind the placement device. If the Engineer determines that there is an excessive amount of heat, heat loss, drain down, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

The temperature of the ARAC, with unmodified binders, upon discharge from the mixer shall not exceed 350° F. The discharge temperature may be increased, when approved by the Engineer. If the ARAC is discharged from the mixer into a hopper, the hopper shall be constructed so that segregation of the ARAC will be minimized.

325.6 TRANSPORTATION:

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

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

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

325.7 PLACEMENT:**325.7.1 Surface Preparation:**

Before placing ARAC on existing pavements, severely raveled areas or cracked areas that are depressed more than 3/4" from the adjoining pavement shall be cut out and patched at least 48 hours prior to the resurfacing operation. Over-asphalted (bleeding or flushing) 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 surface cleaning requirements are included as part of the ARAC paving operations, and the cost thereof shall be included in the ARAC pay item. Pavement repairs and crack sealing when required are to be compensated for by other appropriate contract pay items.

Prior to placing the ARAC on milled surfaces, pot-holes left by the milling operation shall be repaired by the Contractor, as a related non-pay item and as required by the Engineer. The milled area shall be swept.

After surfaces have been prepared to the satisfaction of the Engineer, they shall receive a tack coat as specified in Section [325.4](#).

Traffic will not be permitted over surfaces which have received a tack coat. When the overlay is to extend onto a concrete surface, the concrete surface shall be thoroughly cleaned of loose dust and cement particles and shall be tack coated.

325.7.2 Placing and Construction Methods:

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

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

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

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

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

~~If~~ The ARAC ~~is shall be~~ dumped from the hauling vehicles directly into the paving machine unless otherwise approved by the Engineer.

~~e~~Care shall be taken to avoid jarring the machine or moving it out of alignment. No vertical load shall be exerted on the paving machine by the truck.

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If ARAC is dumped upon the surface being paved and subsequently loaded in the paving machine, the loading equipment shall be self-supporting and shall not exert any vertical load on the paving machine. Substantially all of the ARAC shall be picked up and loaded into the paving machine. If ARAC is placed in a windrow during paving, the windrow shall not exceed a distance greater than 150 feet in front of the paving machine.



~~and loaded into the paving machine. If ARAC is placed in a windrow during paving, the windrow shall not exceed a distance greater than 150 feet in front of the paving machine.~~

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

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

325.7.3 Compaction: It is the contractor's responsibility to perform any desired Quality Control monitoring and/or testing during compaction operations to achieve the required compaction. The temperature of the ARAC immediately behind the laydown machine shall be at least 275° F. A probe type electronic thermometer with a current calibration sticker attached will be used to measure the temperature of the asphalt concrete mixture. When measuring the temperature of the mat, the probe shall be inserted at mid-depth and as horizontal as possible to the mat. When the pavement lift is less than 1.5-inches, the temperature of the material shall be measured in the truck by inserting a calibrated probe type electronic thermometer, or other approved measuring device, to a point at least 6" below the surface of material.

Asphalt compaction equipment shall be of sufficient size and weight to accomplish the required compaction. All compaction equipment shall be operated and maintained in accordance with the manufacturer's recommendations and the project requirements. Pneumatic tired compactors shall not be used.

The Engineer will determine the acceptability of the pavement compaction in accordance with Section ~~325.10325.9~~. At any place not accessible to the roller, the mixture shall be thoroughly compacted with tampers to provide a uniform and smooth layer over the entire area compacted in this manner.

325.7.4 Lime Water: An application of lime water shall be applied by the Contractor to the compacted ARAC surface after final compaction, prior to opening the roadway to traffic, or when requested by the Engineer to cool the pavement to prevent tracking and pick-up. The lime water solution shall be applied at the rate of approximately ½ gallon/square yard. The lime shall be mixed using a minimum of one (1) 50-pound bag per 3,000 gallons of water.

325.7.5 Adjustments: After installation of an overlay course all necessary frame and cover adjustments for manholes, valve boxes, survey monuments, sewer clean-outs, etc., shall be completed by the Contractor within the given segments being surfaced.

On roads without curb and gutter, the existing shoulder elevation shall be adjusted by the Contractor to match the elevation at the edge of new overlay and slope away from the new pavement surface at a rate that the existing quantity of shoulder material will allow. Shoulder material includes the existing shoulder, millings, untreated base materials, or a granular material approved by the Engineer. Shoulder material shall be compacted to a minimum of 95% of maximum density, determined in accordance with Section 301.3.

325.8 QUALITY CONTROL:

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

The ARAC produced shall conform to the requirements of the production tolerances established in Section 325.9. When the ARAC does not conform to the production tolerances, it shall be reported to the Engineer, and corrective quality control

measures shall be implemented, or production shall cease immediately at no additional cost to the contracting Agency or Engineer.

325.9 ACCEPTANCE:

325.9.1 Acceptance Criteria: The ARAC will be divided into lots for the purpose of acceptance. A lot shall be one day's production. Each lot shall be divided into sublots of 500 tons or fraction thereof. Tests used to determine acceptance will be performed by a laboratory accredited by the AASHTO Accreditation Program (AAP), for the tests being performed. The contracting agency shall provide an appropriately accredited laboratory or laboratories to perform the acceptance testing. The acceptance laboratory will take representative samples of the ARAC from each subplot to allow for determination of gradation, binder content, and air voids. Each subplot will be accepted based on the test data from the sample(s) from that subplot. All acceptance samples shall be taken using random locations or times designated by the Engineer in accordance with ASTM D3665. The laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications). Unless otherwise specified, ARAC will be divided into 500-ton increments for the purpose of acceptance. Generally, a minimum of one sample will be obtained from each 500 tons of production or fraction thereof for determination of binder content and gradation. Tests used to determine acceptance will be performed by the Engineer or a laboratory employed by the Engineer. In either case the laboratory shall be accredited by the AASHTO Accreditation Program (AAP), for the tests being performed. All acceptance samples shall be taken using random tonnages, locations or times as designated by the Engineer in accordance with ASTM D 3665. Acceptance testing results will be furnished to the contractor within five working days of receipt of samples by the acceptance laboratory.

325.9.2 Gradation and Binder Content and Air Voids: Acceptance testing for gradation and binder content will be performed in one of the following ways; A) Plant-based testing of the mineral aggregate and binder content using cold feed samples and a nuclear asphalt content gauge or B) End-product testing of the ARAC using an ignition furnace with the gradation being performed on the resulting aggregate. The specifics of these methods and the determination of Marshall air voids are detailed in the following subsections.

During production, the allowable deviations from the mix design gradation targets are listed in Table 325-1 below. The allowable production tolerances may fall outside of the mix design gradation bands.

TABLE 325-1		
GRADATION ACCEPTANCE LIMITS FOR ASPHALT-RUBBER MIXES		
Sieve Size	1" & 1 1/2" Lift Thickness	2" Lift Thickness
<u>1 inch</u>	<u>100%</u>	<u>100%</u>
<u>3/4 inch</u>	<u>100%</u>	<u>92-100%</u>
<u>1/2 inch</u>	<u>92-100%</u>	<u>±6%</u>
<u>3/8 inch</u>	<u>±6%</u>	<u>±6%</u>
<u>No. 4</u>	<u>±6%</u>	<u>±6%</u>
<u>No. 8</u>	<u>±6%</u>	<u>±6%</u>
<u>No. 30</u>	<u>±4%</u>	<u>±4%</u>
<u>No. 200</u>	<u>±2%</u>	<u>±2%</u>

325.9.2.1 Plant-Based Sampling and Testing

325.9.2.1.1 Mineral Aggregate Gradation: The acceptance laboratory will take a sample of the mineral aggregate in For each approximate 500 tons of ARAC produced, at least one sample of mineral aggregate will be taken. Samples will be taken in accordance with the requirements of Arizona Test Method 105 on a random basis for each subplot. For batch plants, the sample shall be taken from the hot bins. For plants other than batch plants, the sample shall be taken from the cold feed belt. Samples will be taken by means of a sampling device which is capable of obtaining representative samples. The device, which shall be approved by the Engineer, shall be furnished by the contractor. In any shift that the production of ARAC is less than 500 tons, at least one sample will be taken.

Samples will be tested for conformance with the mix design gradation, with or without mineral admixture as appropriate, in accordance with the requirements of Arizona Test Method 201. ~~If the results from a single acceptance sample fall outside of the acceptance limits in Table 325-1 a second sample shall be taken and if the second acceptance sample is also outside of the acceptance limits in Table 325-1 the Contractor shall cease production of asphalt concrete. Production shall not begin again until calibration test results verify that adjustments made to materials or proportions yield a gradation that falls within acceptance limits in Table 325-1.~~

~~During production, the allowable deviations from the mix design gradation targets are listed in Table 325-1 below. The allowable production tolerances may fall outside of the mix design gradation bands.~~

TABLE 325-1		
GRADATION ACCEPTANCE LIMITS FOR ASPHALT RUBBER MIXES		
Sieve Size	1" & 1 1/2" Lift Thickness	2" Lift Thickness
1 inch	±00%	±00%
3/4 inch	±00%	92-100%
1/2 inch	92-100%	±6%
3/8 inch	±6%	±6%
No. 4	±6%	±6%
No. 8	±6%	±6%
No. 30	±4%	±4%
No. 200	±2%	±2%

~~If the results from a single acceptance sample fall outside of the acceptance limits in Table 325-1 a second sample shall be taken and if the second acceptance sample is also outside of the acceptance limits in Table 325-1 the Contractor shall cease production of asphalt concrete. Production shall not begin again until calibration test results verify that adjustments made to materials or proportions yield a gradation that falls within acceptance limits in Table 325-1.~~

325.9.2.1.2 Binder Content: During production of ARAC, the contractor shall maintain at the plant site a nuclear asphalt content gauge calibrated and operated in accordance with Arizona Test Method 421. At the discretion of the Engineer, the Owner may choose to prepare the calibration samples for use by the contractor. Under the observation of the Engineer, the contractor shall determine the ARB content by means of the nuclear asphalt content gauge a minimum of four times per full shift. The Engineer shall determine the times that the samples are taken. The contractor's technicians performing the testing, including the calibration of the nuclear gauge, shall meet the technician requirements given in the Arizona Department of Transportation (ADOT) System for the Evaluation of Testing Laboratories. The requirements may be obtained from ADOT Materials Group, 1221 North 21st Avenue, Phoenix, AZ 85009.

Production of ARAC shall cease immediately and the plant and/or the nuclear asphalt content gauges re-calibrated if any single test result varies by an amount greater than $\pm 0.60\%$, or the average of three consecutive test results varies by an amount greater than $\pm 0.40\%$, from the mix design target. Material that has already been produced may be used on the project if the single test value representative of that material varies by an amount from $\pm 0.61\%$ to $\pm 0.75\%$, inclusive, from the mix design target. Material that has already been produced may not be used on the project if the single test value representative of that material varies by an amount greater than $\pm 0.75\%$ from the mix design target unless, by retesting, the material is found to be acceptable.

When there is cause to question the ARB content being obtained via nuclear asphalt content gauge, or if approved by the Engineer, the ARB content may be determined using inventory data provided by the supplier as detailed in the following paragraphs. This will only apply for plants providing ARAC exclusively for the subject project or if an asphalt cement tank is dedicated for the shift of ARAC production.

The determination of the actual ARB content by inventory methods may include weighing of asphalt cement deliveries, invoice quantities, volumetric tank measurements using a calibrated rod (tank stickings) corrected for temperature, computerized mass-flow meter, and accounting for wasted materials. If a computerized mass-flow meter is used, documentation of its calibration shall be submitted to the Engineer prior to ARAC production. At any time during ARAC production, the Engineer may require that a new calibration of the mass-flow meter be performed.

If there is a difference of greater than 0.2% ARB between the ARB content measured by nuclear asphalt content gauge testing and the actual ARB content as determined by inventory, the contractor may request that the ARB content be determined by inventory. The contractor must make such a request in writing within two working days after receiving the test results for the first day of ARAC production.

325.9.2.2 End Product Sampling and Testing

325.9.2.2.1 Mineral Aggregate Gradation and Binder Content: The acceptance laboratory will take a sample of the asphalt concrete in accordance with the requirements of Section 2 or 4 of Arizona Test Methods 104 or AASHTO T-168 from each subplot. The minimum weight of the sample shall be 45 pounds. Asphalt binder content and gradation shall be determined in accordance with AASHTO T-308 using the ignition furnace for each subplot. The acceptance laboratory is responsible for obtaining the necessary materials and performing an ignition furnace calibration as outlined in AASHTO T-308 for each asphalt concrete mixture utilized on the project. The correction factor used for each test shall be clearly indicated on the report.

During production, the allowable deviations from the mix design gradation targets are listed in Table 325-1 above. The allowable production tolerances may fall outside of the mix design gradation bands.

If the results from a single acceptance sample fall outside of the acceptance limits in Table 325-1 a second sample shall be taken and if the second acceptance sample is also outside of the acceptance limits in Table 325-1 the Contractor shall cease production of asphalt concrete. Production shall not begin again until calibration test results verify that adjustments made to materials or proportions yield a gradation that falls within acceptance limits in Table 325-1.

If the asphalt binder content is within $\pm 0.60\%$ of the mix design target value, the asphalt concrete will be paid for at the contract unit price. If the asphalt binder content deviates by more than $\pm 0.60\%$ from the mix design target value, the deficient area will be evaluated within the subplot by coring at maximum intervals of 100 feet from the deficient sample. The asphalt content of the original deficient sample will be averaged with the asphalt binder content of the cores taken for re-evaluation to determine compliance with the acceptance requirements. If the resulting average of the asphalt binder content deviates by more than $\pm 0.60\%$ from the mix design target value, then Table 325-2 shall apply to the subplot. Additional cores may be required to define the limits of the deficient area, and shall not be used for re-evaluating acceptance.

<u>TABLE 325-2</u>	
<u>ARB CONTENT ACCEPTANCE AND PENALTIES</u>	
<u>Deviation from that permitted</u>	<u>(\$ per ton of asphalt concrete)</u>
<u>Over 0.2% above that permitted</u>	<u>Removal* or EA</u>

<u>Over 0.1% to 0.2% above that permitted</u>	<u>\$6.00</u>
<u>Over 0.0% to 0.1% above that permitted</u>	<u>\$2.00</u>
<u>Within permitted range</u>	<u>Full Payment</u>
<u>Over 0.0% to 0.1% below that permitted</u>	<u>\$2.00</u>
<u>Over 0.1% to 0.2% below that permitted</u>	<u>\$6.00</u>
<u>Over 0.2% below that permitted</u>	<u>Removal* or EA</u>

NOTES: *The Contractor shall remove and replace the entire subplot that is deficient.

EA = Engineering Analysis per Section 325.9.6

325.9.2.3 Marshall Air Voids: For purposes of determining Marshall air voids, the acceptance laboratory will ~~take designate~~ one sample of the ARAC in accordance with the requirements of Section 2(h) of Arizona Test Methods 104 or AASHTO T-168 for each day's production or as directed by the Engineer's. The minimum weight of the sample shall be 45 pounds. The bulk density shall be tested in accordance with AASHTO T-245. The maximum theoretical density shall be tested in accordance with the requirements of AASHTO T-209, including fan drying per AASHTO T-209 Section 11. Effective voids determined on the laboratory compacted specimens will be determined in accordance with the requirements of AASHTO T-269. Should the testing for effective air voids not meet the "Full Payment" or "No Corrective Action" requirements of Table 325-23, additional testing for laboratory air voids on additional samples will be performed as necessary to determine the extent of the deficiency.

TABLE 325-32		
LABORATORY VOIDS ACCEPTANCE AND PENALTIES		
Marshall Air Voids (Measured at 75 blows) Deviation from Mix Design Target	When the contracting agency is the owner: Payment Reduction (\$ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
± 0% to 2.0%	Full Payment	No corrective action
± 2.1% to 2.9%	\$1.00	EA (see <u>325.9.51-10.6</u>)
± 3.0% to 4.0%	\$2.50	EA (see <u>325.9.51-10.6</u>)
± Greater than 4.0%	Removal* or EA per 325.10.4	Removal* or EA per 325. <u>9.510.4</u>

325.9.4 Requests for Referee Testing as described in 325.10 will only be considered based on quality control test results performed by a laboratory accredited by the AASHTO Accreditation Program (AAP) for the tests being performed or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories for the set of tests in question. The laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications).

325.9.53 Density: The temperature of ARAC just prior to compaction shall be at least 275° F. The Engineer may change the rolling procedure if in the Engineer's judgment the change is necessary to prevent picking up of the ARAC.

325.9.53.1 Equipment: Asphalt compaction equipment shall be of sufficient size and weight to accomplish the required compaction. All compaction equipment shall be operated and maintained in accordance with the manufacturer's recommendations and the project requirements. The compactors shall be self-propelled and shall be operated with the drive wheel in the forward position. The compactors shall weigh not less than eight tons. Compactors shall not be used in the vibratory mode for courses of one inch or less in nominal thickness. The wheels of compactors shall be wetted with water, or if necessary soapy water, or a product approved by the Engineer to prevent the ARAC from sticking to the steel wheels during _____ ro

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325.9.53.2 Compaction Procedures

325.9.53.2.1 Pavement Lift Thickness 1 ½ Inches or Less: Achieving the required compaction is the responsibility of the contractor. A minimum of three static steel-wheel compactors shall be provided; however, sufficient compactors must be provided so that the drums of the compactors when staggered will cover the entire width of the paving machine on the initial forward pass while a static compactor remains to complete final rolling. The roller(s) for final compaction shall follow as closely behind the initial breakdown as practical, such that a uniformly smooth surface is achieved. As many passes as are possible shall be made with the compactors before the temperature of the ARAC falls below 220° F.

At the Engineer's discretion, cores may be taken and used to evaluate thickness.

325.9.53.2.2 Pavement Lift Thickness Greater than 1 ½ Inches: Achieving the required compaction is the responsibility of the contractor. The number and types of rollers is the contractor's responsibility and shall be sufficient to meet these requirements. Initial breakdown rollers shall follow as closely behind the paving machine as practical. The roller(s) for final compaction shall follow as closely behind the initial breakdown as practical, such that a uniformly smooth surface is achieved.

Compaction will be determined using a correlated ~~thin lift~~ nuclear density gauge and will be monitored for acceptability continuously during construction. The density of the compacted mixture shall not be less than 95% of the laboratory unit weight composed of the same mixture compacted by the 75 blow method of AASHTO T-245 at the job mix design specified compaction temperature. The outside one foot of each pass of the pavement course or any unconfined edge will be excluded from testing. The Engineer may exclude areas from the compaction lot that are not accessible by normal compaction equipment.

Nuclear Density Gauge Correlation - During placement of the test strip or on the first day of paving, the pavement surface shall be tested with a ~~thin lift~~ nuclear density gauge at a minimum of four locations. These same locations shall then be cored, using a 4-inch diameter core barrel, and tested for bulk density (AASHTO T-166A, or T-275) and a correlation value developed between the nuclear density gauge and the asphalt cores.

At the Engineer's discretion, cores may be taken and used to evaluate density and/or thickness.

325.9.35.3 Compacting Miscellaneous Items and Surfaces: ARAC used in the construction of miscellaneous items and surfaces shall be compacted using compactors, hot-hand tampers, smoothing irons, mechanical vibrating hand tampers, or with other devices to the extent considered necessary by the Engineer.

325.9.64 Engineering Analysis (EA): Within 10 working days after receiving notice that a lot or subplot of ARAC is deficient and is found to fall within the "Removal or EA" band per Table(s) 325-2 or 325-3, the contractor may submit a written proposal (Engineering Analysis) to accept the material in place at the applicable penalties along with possible remediation(s) listed in the "Removal or EA" category. An Engineering Analysis can also be proposed for non-removal categories of "Corrective actions" when the contracting agency is not the owner (i.e. permits).

The Engineering Analysis shall contain an analysis of the anticipated performance of the ARAC if left in place. The Engineering Analysis shall also detail the effect of any proposed corrective action to the material(s) in place as it relates to the in-place material's performance. The Engineering Analysis shall be performed by a professional engineer experienced in asphalt concrete testing and mix designs. If the lot or subplot is submitted for referee testing by the contractor, the ten working days allowed to prepare an engineering analysis will begin upon notification of referee test results.

When an Engineering Analysis recommends that a specific lot or subplot should not be removed, the Engineering Analysis will recommend that the following penalties (Table 325-34) be paid when the contracting agency is the owner, for the specific criteria being reviewed by the EA.

TABLE 325-43		
ENGINEERING ANALYSIS PENALTIES for REMOVAL* LOTS/SUBLOTS LEFT IN-PLACE		
Acceptance Criteria	Acceptance Limits	Penalty When Contracting Agency is the Owner (\$/Ton)

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Laboratory Air Voids (Measured at 75 blows)	Deviation from Target Greater Than $\pm 4.0\%$	\$3.75
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Within 15 working days, the Engineer will determine whether or not to accept the contractor's proposed Engineering Analysis.

325.10 REFEREE:

In the event the contractor elects to question the acceptance test results for laboratory air voids, the Contractor may make a written request for additional testing of the affected material. Any request for referee testing must describe the contractor's reasons for questioning the validity of the original acceptance results and must clearly describe which set of acceptance tests are in question. The Contractor will engage an independent laboratory (at the Contractor's own expense) who is accredited by AAP in all of the acceptance test methods. The independent laboratory shall be acceptable to the Engineer and shall perform a new set of acceptance tests as required by Section [325.9.2.3](#) representing the area or set of tests in question. The results of these determinations will be binding on both the contractor and the agency.

These tests will include Marshall unit weight, maximum theoretical unit weight, and laboratory air voids. Samples for referee testing shall come from representative samples obtained from the completed pavement, as directed by the Engineer.

The number of samples taken will be the same as specified in Section [325.9.2.3](#). The independent laboratory shall compile the test results and transmit them to both the Engineer and the contractor. The independent laboratory shall include a report signed by an Engineer registered in the State of Arizona, who is experienced in asphalt concrete testing and mix design development. The signed report shall give an opinion that the material evaluated either does or does not comply with project specifications, shall clearly describe any deficiencies, and the results will be binding between all parties.

325.11 MEASUREMENT:

ARAC shall be measured by the ton, for the mixture actually used, which shall include the required quantities of mineral aggregates, filler material, asphalt-rubber binder and admixture.

Application of Lime Water shall be measured by the square yard. The measured area shall be the area of ARAC pavement to which the lime water is applied. The measured area shall only be counted one time regardless of the number of applications applied to the ARAC pavement section.

Shoulder adjustment to match the new pavement surface elevation shall not be measured. The cost of this work shall be included in the price paid for ARAC or other related pay items.

325.12 PAYMENT:

Payment for Asphalt Milling will be as specified in Section [317](#).

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

Payment for ARAC will be at the contract unit price, complete in place.

Application of Lime Water as approved by the Engineer will be paid at the contract unit price.

Payment for frame and cover adjustments will be at the contract unit prices specified in the proposal.

- End of Section -

PLACEMENT AND CONSTRUCTION OF ASPHALT-RUBBER ASPHALT CONCRETE**325.1 DESCRIPTION:**

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

325.2 MATERIALS:

ARAC shall consist of a mixture of aggregate, mineral admixture and asphalt-rubber binder (ARB) as specified in Section [717](#).

325.2.1 Mixing of Asphalt-Rubber Binder: Mixing of asphalt-rubber binder (ARB) may take place in a dedicated blending and storage unit connected to the hot plant or at the asphalt binder supplier's facility. In either case, the temperature of the asphalt cement shall be between 375° F and 425° F prior to the addition of crumb rubber. No agglomerations of crumb rubber particles in excess of 2 inches in the least dimension shall be allowed in the mixing chamber. The crumb rubber and asphalt cement shall be accurately proportioned in accordance with the ARB design, as identified in 717.2.1.4, and thoroughly mixed prior to the beginning of the one hour reaction period. Reaction time may be decreased to 45-minutes if documentation is provided that the physical properties of the mix design requirements are consistently met using a 45-minute reaction period. The Contractor or supplier shall document that the proportions are accurate and that the crumb rubber has been uniformly incorporated into the mixture. Additionally, the Contractor or supplier shall demonstrate that the crumb rubber particles have been thoroughly mixed into the base asphalt cement. The occurrence of crumb rubber floating on the surface or agglomerations of crumb rubber particles shall be evidence of insufficient mixing. The temperature of the ARB immediately after mixing shall be between 350° F and 400° F. Reaction time shall start after all of the material for the batch has been mixed and the minimum reaction temperature of 350° F has been achieved.

Prior to use, the viscosity of the ARB shall be tested by the use of a rotational viscometer, which is to be furnished by the Contractor or supplier. The Contractor or supplier shall provide a qualified person to perform the testing.

325.2.2 Handling of ARB: Once the ARB has been mixed, it shall be kept thoroughly agitated during periods of transport and use to prevent settling of the crumb rubber particles. During the production of ARAC the temperature of the ARB shall be maintained between 325° F (163°C) and 400° F (204°C). However, in no case shall the ARB be held for more than 10 hours at these temperatures. It may be allowed to cool to a temperature of 250° F (121°C) or lower and held at that temperature for not more than four days. The process of cooling and reheating shall not be allowed more than one time for a batch of ARB.

For each load or batch of ARB, the Contractor or supplier shall provide the Engineer with the following documentation:

- (A) The source, grade, amount and temperature of the asphalt cement prior to the addition of crumb rubber.
- (B) The source, type and amount of crumb rubber and the rubber content expressed as percent by the weight of total ARB.
- (C) Times and dates of the crumb rubber additions, resultant viscosity test, and the elapsed reaction time at which the viscosity test was taken.
- (D) A record of the temperature, with time and date reference for each load or batch. The record shall begin at the time of the addition of crumb rubber and continue until the load or batch is completely used. Readings and recordings shall be made at every temperature change in excess of 20° F, and as needed to document other events which are significant to batch use and quality.

325.3 WEATHER AND MOISTURE CONDITIONS:

ARAC shall be placed only when the surface is dry, and when the atmospheric temperature in the shade is 55° F or higher. No ARAC shall be placed when the weather is foggy or rainy. ARAC shall be placed only when the Engineer determines that weather conditions are suitable.

325.4 APPLICATION OF TACK COAT:

A tack coat shall be applied to all existing and to each new course of ARAC prior to the placing of a succeeding lift of ARAC. The tack coat may be deleted when a succeeding layer of ARAC is being applied over a freshly laid course that has been subjected to very little traffic when approved by the Engineer.

The application of the tack coat shall comply with Section [329](#). The grade of emulsified asphalt shall be SS-1h or CSS-1h as specified in Section [713](#).

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

The surface to be covered may require repair or patching as directed by the Engineer. This shall be addressed in the project specifications prior to the bidding of the project.

325.5 MIX PRODUCTION:

All materials shall be proportioned by weight in a hot mix asphalt plant in the proportions required by the mix design to provide a homogeneous and workable mass. Each hot mix asphalt plant shall be inspected in accordance with the provisions contained in the 'Hot Mix Asphalt Production Facilities' by the Arizona Rock Products Association and shall have a current inspection certificate. All measuring devices shall be calibrated at least annually by a technician licensed by the Arizona Bureau of Weights & Measures. Mixing plants shall conform to the requirements of AASHTO M-156, except as modified herein.

In drum mix plants the mineral admixture shall be added and thoroughly mixed with the mineral aggregate by means of a mechanical mixing device prior to the mineral aggregate and mineral admixture entering the dryer. The moisture content of the combined mineral aggregate shall be a minimum of three percent by weight of the aggregate during the mixing process.

For drum-mix plants, the mineral admixture shall be weighed across a weigh belt, or other approved alternative weighing system, with a weight totalizer prior to entry into the mechanical mixing device. The mechanical mixing device shall be a pugmill type mixer that is in good working condition. The rate of the aggregate feed shall not exceed the mixing device's capacity in ton per hour. The mixer shall be constructed to minimize the loss of mineral admixture and shall be located in the aggregate delivery system at a location where the mixed material can be readily inspected. The mixing device shall be capable of effective mixing in the full range of the ARAC production rates.

The hot plant and equipment shall be constructed and operated to prevent loss of mineral admixture through the dust collection system of the plant.

A positive signal system shall be provided and utilized during production whereby the mixing shall automatically be stopped if the mineral admixture is not introduced into the mineral aggregate. The plant will not be permitted to operate unless the signal system is in good working condition.

The introduction of ARB shall be controlled by an automated system fully integrated with the controls for the mineral aggregate and mineral admixture. The production of the plant shall be controlled by the rate required to obtain a uniform mixture of all components. Drying and heating shall be accomplished in such a manner as to preclude the aggregate or mineral admixture from becoming coated with un-spent fuel. The completed ARAC may be held in storage for up to 12 hours in insulated or heated silos, providing the minimum temperature noted herein for placement and compaction is met behind the placement device. If the Engineer determines that there is an

excessive amount of heat, heat loss, drain down, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

The temperature of the ARAC, with unmodified binders, upon discharge from the mixer shall not exceed 350° F. The discharge temperature may be increased, when approved by the Engineer. If the ARAC is discharged from the mixer into a hopper, the hopper shall be constructed so that segregation of the ARAC will be minimized.

325.6 TRANSPORTATION:

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

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

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

325.7 PLACEMENT:

325.7.1 Surface Preparation:

Before placing ARAC on existing pavements, severely raveled areas or cracked areas that are depressed more than 3/4" from the adjoining pavement shall be cut out and patched at least 48 hours prior to the resurfacing operation. Over-asphalted (bleeding or flushing) 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 surface cleaning requirements are included as part of the ARAC paving operations, and the cost thereof shall be included in the ARAC pay item. Pavement repairs and crack sealing when required are to be compensated for by other appropriate contract pay items.

Prior to placing the ARAC on milled surfaces, pot-holes left by the milling operation shall be repaired by the Contractor, as a related non-pay item and as required by the Engineer. The milled area shall be swept.

After surfaces have been prepared to the satisfaction of the Engineer, they shall receive a tack coat as specified in Section [325.4](#).

Traffic will not be permitted over surfaces which have received a tack coat. When the overlay is to extend onto a concrete surface, the concrete surface shall be thoroughly cleaned of loose dust and cement particles and shall be tack coated.

325.7.2 Placing and Construction Methods:

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

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

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

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

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

The ARAC shall be dumped from the hauling vehicles directly into the paving machine unless otherwise approved by the Engineer.

Care shall be taken to avoid jarring the machine or moving it out of alignment. No vertical load shall be exerted on the paving machine by the truck.

If ARAC is dumped upon the surface being paved and subsequently loaded in the paving machine, the loading equipment shall be self-supporting and shall not exert any vertical load on the paving machine. Substantially all of the ARAC shall be picked up and loaded into the paving machine. If ARAC is placed in a windrow during paving, the windrow shall not exceed a distance greater than 150 feet in front of the paving machine.

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

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

325.7.3 Compaction: It is the contractor's responsibility to perform any desired Quality Control monitoring and/or testing during compaction operations to achieve the required compaction. The temperature of the ARAC immediately behind the laydown machine shall be at least 275° F. A probe type electronic thermometer with a current calibration sticker attached will be used to measure the temperature of the asphalt concrete mixture. When measuring the temperature of the mat, the probe shall be inserted at mid-depth and as horizontal as possible to the mat. When the pavement lift is less than 1.5-inches, the temperature of the material shall be measured in the truck by inserting a calibrated probe type electronic thermometer, or other approved measuring device, to a point at least 6" below the surface of material.

Asphalt compaction equipment shall be of sufficient size and weight to accomplish the required compaction. All compaction equipment shall be operated and maintained in accordance with the manufacturer's recommendations and the project requirements. Pneumatic tired compactors shall not be used.

The Engineer will determine the acceptability of the pavement compaction in accordance with Section [325.9](#). At any place not accessible to the roller, the mixture shall be thoroughly compacted with tampers to provide a uniform and smooth layer over the entire area compacted in this manner.

325.7.4 Lime Water: An application of lime water shall be applied by the Contractor to the compacted ARAC surface after final compaction, prior to opening the roadway to traffic, or when requested by the Engineer to cool the pavement to prevent tracking and pick-up. The lime water solution shall be applied at the rate of approximately ½ gallon/square yard. The lime shall be mixed using a minimum of one (1) 50-pound bag per 3,000 gallons of water.

325.7.5 Adjustments: After installation of an overlay course all necessary frame and cover adjustments for manholes, valve boxes, survey monuments, sewer clean-outs, etc., shall be completed by the Contractor within the given segments being surfaced.

On roads without curb and gutter, the existing shoulder elevation shall be adjusted by the Contractor to match the

elevation at the edge of new overlay and slope away from the new pavement surface at a rate that the existing quantity of shoulder material will allow. Shoulder material includes the existing shoulder, millings, untreated base materials, or a granular material approved by the Engineer. Shoulder material shall be compacted to a minimum of 95% of maximum density, determined in accordance with Section [301.3](#).

325.8 QUALITY CONTROL:

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

The ARAC produced shall conform to the requirements of the production tolerances established in Section [325.9](#). When the ARAC does not conform to the production tolerances, it shall be reported to the Engineer, and corrective quality control measures shall be implemented, or production shall cease immediately at no additional cost to the contracting Agency or Engineer.

325.9 ACCEPTANCE:

325.9.1 Acceptance Criteria: The ARAC will be divided into lots for the purpose of acceptance. A lot shall be one day's production. Each lot shall be divided into sublots of 500 tons or fraction thereof. Tests used to determine acceptance will be performed by a laboratory accredited by the AASHTO Accreditation Program (AAP), for the tests being performed. The contracting agency shall provide an appropriately accredited laboratory or laboratories to perform the acceptance testing. The acceptance laboratory will take representative samples of the ARAC from each subplot to allow for determination of gradation, binder content, and air voids. Each subplot will be accepted based on the test data from the sample(s) from that subplot. All acceptance samples shall be taken using random locations or times designated by the Engineer in accordance with ASTM D3665. The laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications).

325.9.2 Gradation and Binder Content: Acceptance testing for gradation and binder content will be performed in one of the following ways; A) Plant-based testing of the mineral aggregate and binder content using cold feed samples and a nuclear asphalt content gauge or B) End-product testing of the ARAC using an ignition furnace with the gradation being performed on the resulting aggregate. The specifics of these methods are detailed in the following subsections.

During production, the allowable deviations from the mix design gradation targets are listed in Table [325-1](#) below. The allowable production tolerances may fall outside of the mix design gradation bands.

TABLE 325-1		
GRADATION ACCEPTANCE LIMITS FOR ASPHALT-RUBBER MIXES		
Sieve Size	1" & 1 ½" Lift Thickness	2" Lift Thickness
1 inch	100%	100%
¾ inch	100%	92-100%
½ inch	92-100%	±6%
⅜ inch	±6%	±6%
No. 4	±6%	±6%
No. 8	±6%	±6%
No. 30	±4%	±4%
No. 200	±2%	±2%

325.9.2.1 Plant-Based Sampling and Testing

325.9.2.1.1 Mineral Aggregate Gradation: The acceptance laboratory will take a sample of the mineral aggregate in accordance with the requirements of Arizona Test Method 105 on a random basis for each subplot. For batch plants, the sample shall be taken from the hot bins. For plants other than batch plants, the sample shall be taken from the cold feed belt. Samples will be taken by means of a sampling device which is capable of obtaining representative samples. The device, which shall be approved by the Engineer, shall be furnished by the contractor. In any shift that the production of ARAC is less than 500 tons, at least one sample will be taken.

Samples will be tested for conformance with the mix design gradation, with or without mineral admixture as appropriate, in accordance with the requirements of Arizona Test Method 201. If the results from a single acceptance sample fall outside of the acceptance limits in Table [325-1](#) a second sample shall be taken and if the second acceptance sample is also outside of the acceptance limits in Table [325-1](#) the Contractor shall cease production of asphalt concrete. Production shall not begin again until calibration test results verify that adjustments made to materials or proportions yield a gradation that falls within acceptance limits in Table [325-1](#).

325.9.2.1.2 Binder Content: During production of ARAC, the contractor shall maintain at the plant site a nuclear asphalt content gauge calibrated and operated in accordance with Arizona Test Method 421. At the discretion of the Engineer, the Owner may choose to prepare the calibration samples for use by the contractor. Under the observation of the Engineer, the contractor shall determine the ARB content by means of the nuclear asphalt content gauge a minimum of four times per full shift. The Engineer shall determine the times that the samples are taken. The contractor's technicians performing the testing, including the calibration of the nuclear gauge, shall meet the technician requirements given in the Arizona Department of Transportation (ADOT) System for the Evaluation of Testing Laboratories. The requirements may be obtained from ADOT Materials Group, 1221 North 21st Avenue, Phoenix, AZ 85009. Production of ARAC shall cease immediately and the plant and/or the nuclear asphalt content gauges re-calibrated if any single test result varies by an amount greater than $\pm 0.60\%$, or the average of three consecutive test results varies by an amount greater than $\pm 0.40\%$, from the mix design target. Material that has already been produced may be used on the project if the single test value representative of that material varies by an amount from $\pm 0.61\%$ to $\pm 0.75\%$, inclusive, from the mix design target. Material that has already been produced may not be used on the project if the single test value representative of that material varies by an amount greater than $\pm 0.75\%$ from the mix design target unless, by retesting, the material is found to be acceptable.

When there is cause to question the ARB content being obtained via nuclear asphalt content gauge, or if approved by the Engineer, the ARB content may be determined using inventory data provided by the supplier as detailed in the following paragraphs. This will only apply for plants providing ARAC exclusively for the subject project or if an asphalt cement tank is dedicated for the shift of ARAC production.

The determination of the actual ARB content by inventory methods may include weighing of asphalt cement deliveries, invoice quantities, volumetric tank measurements using a calibrated rod (tank stickings) corrected for temperature, computerized mass-flow meter, and accounting for wasted materials. If a computerized mass-flow meter is used, documentation of its calibration shall be submitted to the Engineer prior to ARAC production. At any time during ARAC production, the Engineer may require that a new calibration of the mass-flow meter be performed.

If there is a difference of greater than 0.2% ARB between the ARB content measured by nuclear asphalt content gauge testing and the actual ARB content as determined by inventory, the contractor may request that the ARB content be determined by inventory. The contractor must make such a request in writing within two working days after receiving the test results for the first day of ARAC production.

325.9.2.2 End Product Sampling and Testing

325.9.2.2.1 Mineral Aggregate Gradation and Binder Content: The acceptance laboratory will take a sample of the asphalt concrete in accordance with the requirements of Section 2 or 4 of Arizona Test Methods 104 or AASHTO T-168 from each subplot. The minimum weight of the sample shall be 45 pounds. Asphalt binder content and gradation shall be determined in accordance with AASHTO T-308 using the ignition furnace for each subplot. The acceptance laboratory is responsible for obtaining the necessary materials and performing an ignition furnace

calibration as outlined in AASHTO T-308 for each asphalt concrete mixture utilized on the project. The correction factor used for each test shall be clearly indicated on the report.

During production, the allowable deviations from the mix design gradation targets are listed in Table [325-1](#) above. The allowable production tolerances may fall outside of the mix design gradation bands.

If the results from a single acceptance sample fall outside of the acceptance limits in Table [325-1](#) a second sample shall be taken and if the second acceptance sample is also outside of the acceptance limits in Table [325-1](#) the Contractor shall cease production of asphalt concrete. Production shall not begin again until calibration test results verify that adjustments made to materials or proportions yield a gradation that falls within acceptance limits in Table [325-1](#).

If the asphalt binder content is within $\pm 0.60\%$ of the mix design target value, the asphalt concrete will be paid for at the contract unit price. If the asphalt binder content deviates by more than $\pm 0.60\%$ from the mix design target value, the deficient area will be evaluated within the subplot by coring at maximum intervals of 100 feet from the deficient sample. The asphalt content of the original deficient sample will be averaged with the asphalt binder content of the cores taken for re-evaluation to determine compliance with the acceptance requirements. If the resulting average of the asphalt binder content deviates by more than $\pm 0.60\%$ from the mix design target value, then Table [325-2](#) shall apply to the subplot. Additional cores may be required to define the limits of the deficient area, and shall not be used for re-evaluating acceptance.

TABLE 325-2	
ARB CONTENT ACCEPTANCE AND PENALTIES	
Deviation from that permitted	(\$ per ton of asphalt concrete)
Over 0.2% <u>above</u> that permitted	Removal* or EA
Over 0.1% to 0.2% <u>above</u> that permitted	\$6.00
Over 0.0% to 0.1% <u>above</u> that permitted	\$2.00
Within permitted range	Full Payment
Over 0.0% to 0.1% <u>below</u> that permitted	\$2.00
Over 0.1% to 0.2% <u>below</u> that permitted	\$6.00
Over 0.2% <u>below</u> that permitted	Removal* or EA

NOTES: *The Contractor shall remove and replace the entire subplot that is deficient.

EA = Engineering Analysis per Section 325.9.6

325.9.3 Marshall Air Voids: For purposes of determining Marshall air voids, the acceptance laboratory will designate one sample of the ARAC in accordance with the requirements of Section 2(h) of Arizona Test Methods 104 or AASHTO T-168 for each day's production or as directed by the Engineer's. The minimum weight of the sample shall be 45 pounds. The bulk density shall be tested in accordance with AASHTO T-245. The maximum theoretical density shall be tested in accordance with the requirements of AASHTO T-209, including fan drying per AASHTO T-209 Section 11. Effective voids determined on the laboratory compacted specimens will be determined in accordance with the requirements of AASHTO T-269. Should the testing for effective air voids not meet the "Full Payment" or "No Corrective Action" requirements of Table [325-3](#), additional testing for laboratory air voids on additional samples will be performed as necessary to determine the extent of the deficiency.

TABLE 325-3		
LABORATORY VOIDS ACCEPTANCE AND PENALTIES		
Marshall Air Voids (Measured at 75 blows) Deviation from Mix Design Target	When the contracting agency is the owner: Payment Reduction (\$ per ton of asphalt concrete)	When the contracting agency is not the owner (i.e. permits): Corrective Action
± 0% to 2.0%	Full Payment	No corrective action
± 2.1% to 2.9%	\$1.00	EA (see 325.9.5)
± 3.0% to 4.0%	\$2.50	EA (see 325.9.5)
± Greater than 4.0%	Removal* or EA per 325.10.4	Removal* or EA per 325.9.5

325.9.4 Requests for Referee Testing as described in 325.10 will only be considered based on quality control test results performed by a laboratory accredited by the AASHTO Accreditation Program (AAP) for the tests being performed or a laboratory listed in the current ADOT Directory of Approved Materials Testing Laboratories for the set of tests in question. The laboratory shall use properly certified technicians in accordance with ASTM D3666, Section 7 (Personnel Qualifications).

325.9.5 Density: The temperature of ARAC just prior to compaction shall be at least 275° F. The Engineer may change the rolling procedure if in the Engineer's judgment the change is necessary to prevent picking up of the ARAC.

325.9.5.1 Equipment: Asphalt compaction equipment shall be of sufficient size and weight to accomplish the required compaction. All compaction equipment shall be operated and maintained in accordance with the manufacturer's recommendations and the project requirements. The compactors shall be self-propelled and shall be operated with the drive wheel in the forward position. The compactors shall weigh not less than eight tons. Compactors shall not be used in the vibratory mode for courses of one inch or less in nominal thickness. The wheels of compactors shall be wetted with water, or if necessary soapy water, or a product approved by the Engineer to prevent the ARAC from sticking to the steel wheels during rolling.

325.9.5.2 Compaction Procedures

325.9.5.2.1 Pavement Lift Thickness 1 ½ Inches or Less: Achieving the required compaction is the responsibility of the contractor. A minimum of three static steel-wheel compactors shall be provided; however, sufficient compactors must be provided so that the drums of the compactors when staggered will cover the entire width of the paving machine on the initial forward pass while a static compactor remains to complete final rolling. The roller(s) for final compaction shall follow as closely behind the initial breakdown as practical, such that a uniformly smooth surface is achieved. As many passes as are possible shall be made with the compactors before the temperature of the ARAC falls below 220° F.

At the Engineer's discretion, cores may be taken and used to evaluate thickness.

325.9.5.2.2 Pavement Lift Thickness Greater than 1 ½ Inches: Achieving the required compaction is the responsibility of the contractor. The number and types of rollers is the contractor's responsibility and shall be sufficient to meet these requirements. Initial breakdown rollers shall follow as closely behind the paving machine as practical. The roller(s) for final compaction shall follow as closely behind the initial breakdown as practical, such that a uniformly smooth surface is achieved.

Compaction will be determined using a correlated nuclear density gauge and will be monitored for acceptability continuously during construction. The density of the compacted mixture shall not be less than 95% of the laboratory unit weight composed of the same mixture compacted by the 75 blow method of AASHTO T-245 at the job mix design specified compaction temperature. The outside one foot of each pass of the pavement course or any unconfined edge will be excluded from testing. The Engineer may exclude areas from the compaction lot that are not accessible by normal compaction equipment.

Nuclear Density Gauge Correlation - During placement of the test strip or on the first day of paving, the pavement surface shall be tested with a nuclear density gauge at a minimum of four locations. These same locations shall then be cored, using a 4-inch diameter core barrel, and tested for bulk density (AASHTO T-166A, or T-275) and a correlation value developed between the nuclear density gauge and the asphalt cores.

At the Engineer's discretion, cores may be taken and used to evaluate density and/or thickness.

325.9.5.3 Compacting Miscellaneous Items and Surfaces: ARAC used in the construction of miscellaneous items and surfaces shall be compacted using compactors, hot-hand tampers, smoothing irons, mechanical vibrating hand tampers, or with other devices to the extent considered necessary by the Engineer.

325.9.6 Engineering Analysis (EA): Within 10 working days after receiving notice that a lot or subplot of ARAC is deficient and is found to fall within the "Removal or EA" band per Table(s) [325-2](#) or [325-3](#), the contractor may submit a written proposal (Engineering Analysis) to accept the material in place at the applicable penalties along with possible remediation(s) listed in the "Removal or EA" category. An Engineering Analysis can also be proposed for non-removal categories of "Corrective actions" when the contracting agency is not the owner (i.e. permits).

The Engineering Analysis shall contain an analysis of the anticipated performance of the ARAC if left in place. The Engineering Analysis shall also detail the effect of any proposed corrective action to the material(s) in place as it relates to the in-place material's performance. The Engineering Analysis shall be performed by a professional engineer experienced in asphalt concrete testing and mix designs. If the lot or subplot is submitted for referee testing by the contractor, the ten working days allowed to prepare an engineering analysis will begin upon notification of referee test results.

When an Engineering Analysis recommends that a specific lot or subplot should not be removed, the Engineering Analysis will recommend that the following penalties (Table [325-4](#)) be paid when the contracting agency is the owner, for the specific criteria being reviewed by the EA.

TABLE 325-4		
ENGINEERING ANALYSIS PENALTIES for REMOVAL* LOTS/SUBLOTS LEFT IN-PLACE		
Acceptance Criteria	Acceptance Limits	Penalty When Contracting Agency is the Owner (\$/Ton)
Laboratory Air Voids (Measured at 75 blows)	Deviation from Target Greater Than $\pm 4.0\%$	\$3.75

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

325.10 REFEREE:

In the event the contractor elects to question the acceptance test results for laboratory air voids, the Contractor may make a written request for additional testing of the affected material. Any request for referee testing must describe the contractor's reasons for questioning the validity of the original acceptance results and must clearly describe which set of acceptance tests are in question. The Contractor will engage an independent laboratory (at the Contractor's own expense) who is accredited by AAP in all of the acceptance test methods. The independent laboratory shall be acceptable to the Engineer and shall perform a new set of acceptance tests as required by Section [325.9.2.3](#) representing the area or set of tests in question. The results of these determinations will be binding on both the contractor and the agency.

These tests will include Marshall unit weight, maximum theoretical unit weight, and laboratory air voids. Samples for referee testing shall come from representative samples obtained from the completed pavement, as directed by the Engineer.

The number of samples taken will be the same as specified in Section [325.9.2.3](#). The independent laboratory shall compile the test results and transmit them to both the Engineer and the contractor. The independent laboratory shall include a report signed by an Engineer registered in the State of Arizona, who is experienced in asphalt concrete testing and mix design development. The signed report shall give an opinion that the material evaluated either does or does not comply with project specifications, shall clearly describe any deficiencies, and the results will be binding between all parties.

325.11 MEASUREMENT:

ARAC shall be measured by the ton, for the mixture actually used, which shall include the required quantities of mineral aggregates, filler material, asphalt-rubber binder and admixture.

Application of Lime Water shall be measured by the square yard. The measured area shall be the area of ARAC pavement to which the lime water is applied. The measured area shall only be counted one time regardless of the number of applications applied to the ARAC pavement section.

Shoulder adjustment to match the new pavement surface elevation shall not be measured. The cost of this work shall be included in the price paid for ARAC or other related pay items.

325.12 PAYMENT:

Payment for Asphalt Milling will be as specified in Section [317](#).

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

Payment for ARAC will be at the contract unit price, complete in place.

Application of Lime Water as approved by the Engineer will be paid at the contract unit price.

Payment for frame and cover adjustments will be at the contract unit prices specified in the proposal.

- End of Section -

ASPHALT-RUBBER ASPHALT CONCRETE

717.1 DESCRIPTION:

The work under this section shall consist of furnishing, proportioning and mixing all the ingredients necessary to produce an asphalt-rubber Asphalt Concrete (ARAC) material. ARAC mixes may be used for low or high traffic conditions, as determined by the agency. Low traffic conditions are conditions where the asphalt mix will be subject to low volume and low weight vehicle usage. Examples of this condition are residential streets, most parking lots and residential minor collector streets. High traffic conditions are conditions where the asphalt mix will be subject to high volume and/or heavy weight vehicle usage as found on major collector, arterial and commercial streets. Street classifications (i.e. minor collector and major collector) shall be determined by the specifying agency.

717.2 MATERIALS:

717.2.1 Asphalt-Rubber Binder (ARB): The blended ARB shall meet the criteria listed below. The ARB may be blended in a dedicated blending and storage unit connected to the hot plant or at the asphalt binder supplier's facility.

717.2.1.1 Asphalt Cement: Asphalt cement shall conform to the requirements of Section [711](#).

717.2.1.2 Crumb Rubber: Crumb Rubber shall meet the gradation requirements as shown in Table [717-1](#) below when tested in accordance with Arizona Test Method 714.

TABLE 717-1	
GRADATION REQUIREMENTS OF CRUMB RUBBER	
Sieve Size	Percent Passing Type B
2.36 mm (#8)	
2.00 mm (#10)	100
1.18 mm (#16)	65 - 100
600 µm (#30)	20 - 100
300 µm (#50)	0 - 45
75 µm (#200)	0 - 5

The crumb rubber shall have a specific gravity of 1.15 ± 0.05 and shall be free of wire or other contaminating materials, and shall contain not more than 0.5 percent fabric. Calcium carbonate, up to four percent by weight of the crumb rubber, may be added to prevent the particles from sticking together.

Certificates of Compliance conforming to Arizona State Department of Transportation Standard Specifications for Road and Bridge Construction Section 106.05 shall be submitted. In addition, the Certificates shall confirm that the rubber is a crumb rubber, derived from processing at ambient temperature, whole scrap tires or shredded tire materials; and the tires from which the crumb rubber is produced is taken from automobiles, trucks, or other equipment owned and operated in the United States. The Certificates shall also verify that the processing does not produce, as a waste product, casings or other round tire material that can hold water when stored or disposed of above the ground. The crumb rubber to be used in ~~asphalt-rubber-binder~~ ARB shall be the type produced through a process of mechanical grinding at ambient temperature. Use of crumb rubber granules produced from a cryogenic process is prohibited.

717.2.1.3 Asphalt-Rubber ARB Proportions and Properties: Ground crumb rubber in ARB shall be a minimum of 18 percent by weight of total binder,

ARB shall be Type 1 unless otherwise specified and conform to the requirements of Table [717-2](#) below:

TABLE 717-2			
PHYSICAL PROPERTIES OF ASPHALT RUBBER BINDER ARB			
Property	Requirement		
	Type I	Type 2	Type 3
Grade of base asphalt cement	PG 64-16	PG 58-22	PG 52-28
Rotational Viscosity*; 350° F, Pascal seconds	1.5-4.0	1.5-4.0	1.5-4.0
Penetration; 39° F (4° C), 200g, 60 sec. (ASTM D5); dmm, min	10	15	25
Softening Point; (ASTM D36); °F, min.	135	130	125
Resilience; 77°F (ASTM D3407); %,min	25	20	15
* The Viscometer used must be a hand held rotational viscometer, such as a Rion (formerly Haake) Model VT – 04, or an equivalent, using Rotor No. 1. The rotor, while in the off position, shall be completely immersed in the binder at a temperature from 350° to 355° F for a minimum heat equilibrium period of 60 seconds, and an average viscosity determined from three separate constant readings (± 0.5 pascal-seconds) taken within a 30 second time frame with the viscotester level during testing and turned off between readings. Continuous rotation of the rotor may cause thinning of the material immediately in contact with the rotor, resulting in erroneous results.			

717.2.1.4 ~~Asphalt Rubber Binder~~ **ARB Design:** At least two weeks prior to paving, the Contractor shall submit an ARB design prepared by an ADOT approved laboratory. Such design shall meet the requirements specified herein. The design shall show the values obtained from the required tests, along with the following information: percent, grade and source of the asphalt cement used; and percent, gradation and source(s) of the crumb rubber used, as well as the ARB blending location; on-site or at the asphalt binder supplier's facility.

717.2.2 Aggregate: Coarse and fine aggregates shall conform to the applicable requirements of Tables [717-3](#) and [717-4](#) below. Coarse mineral aggregate shall consist of crushed gravel, crushed rock, or other approved inert material with similar characteristics, or a combination thereof, conforming to the requirements of these specifications.

Coarse aggregate is material retained above the Number 8 sieve and fine aggregate is material passing the Number 8 sieve. Aggregates shall be free of deleterious materials, clay balls, and adhering films or other material that prevent thorough coating with the asphalt cement. Mineral aggregate shall conform to the following requirements when tested in accordance with the applicable test methods.

TABLE 717-3		
MIX DESIGN GRADATION REQUIREMENTS		
Overlay Thickness	1" & 1- 1/2"	2"
Sieve Size	Percent Passing	Percent Passing
1" (25 mm)	100	100
3/4" (19 mm)	100	95-100
1/2" (12.5 mm)	95-100	78-92
3/8" (9.5 mm)	78-92	61-75
No. 4 (4.75 mm)	28-45	30-40
No. 8 (2.36 mm)	15-25	15-25
No. 30 (600 μ m)	5-15	5-15
No. 200 (75 μ m)	3.0-7.0	2.0-6.0

The combined aggregate properties shall conform to the requirements of Table [717-4](#) below.

Characteristics	Test Method	Requirements
Fractured Faces, % (Plus No. 8)	ARIZ-212	85, 1 fracture 80, 2 or more
Uncompacted Voids, %	ARIZ-247	45.0 (High Traffic Volume) 42.0 (Low Traffic Volume)
Sand Equivalent (Minus No. 4)	AASHTO T-176	65 minimum
Plasticity Index	AASHTO T-89 & T-90	Non Plastic
L.A. Abrasion, % Loss	AASHTO T-96	9 max. @ 100 Rev. 40 max. @ 500 Rev.
Combined Bulk Specific Gravity	AI MS-2	2.35-2.85
Combined Water Absorption, %	AI MS-2	0-2.5

717.2.3 Mineral Admixture: Mineral admixture used in ARAC shall be dry hydrated lime conforming to the requirements of ASTM C1097 or Portland cement conforming to ASTM C150 for Type II, or ASTM C595 for Type IP. The minimum mineral admixture content will be 1.0percent, by weight of total aggregate.

717.3 MIX DESIGN REQUIREMENT:

717.3.1 General: The mix design for ARAC shall be prepared by a laboratory that is accredited through the AASHTO Accreditation Program (AAP) in Hot Mix Asphalt Aggregates and Hot Mix Asphalt. The laboratory shall be under the direct supervision of a Civil Engineer, registered by the State of Arizona, and who is listed by ADOT as a “Qualified Asphalt Concrete Mix Design Engineer” within ADOT’s latest list of approved laboratories. The latest list of approved laboratories is available on ADOT’s web page: http://www.azdot.gov/highways/materials/quality_assurance.asp.

The date of the design shall not be older than two years from the date of submittal, unless supportive documentation is provided and approved by the Engineer.

The mix design method used shall be in accordance with the Marshall Mix procedure, 75 blows, as described in Arizona Test Method 832 “Marshall Mix Design Method for Asphaltic Concrete (Asphalt Rubber) [AR-AC]”. Mix designs are subject to approval by the Engineer.

717.3.2 Mix Design Criteria: The mix shall comply with the criteria in Table [717-5](#) below.

Criteria	Low Volume Traffic	High Volume Traffic
Asphalt Rubber Binder ARB Content		
1” and 1-1/2” Overlay Thickness	8.4% minimum	8.0% minimum
2” Overlay Thickness	N/A	7.0% minimum
Mixture Air Voids, %	3.5-4.5	4.5-5.5
Voids in Mineral Aggregate, %	19.0 min	19.0 min
Tensile Strength Ratio, AASHTO T-283	65% minimum	65% minimum
Marshall Stability, pounds minimum	800	800
Marshall Flow, 0.01 inch minimum	16	16

The mix design report shall include the following elements as a minimum.

- (1) The name and address of the testing organization and the person responsible for the mix design report.
- (2) The mix plant identification and/or location, as well as the supplier or producer name.
- (3) The traffic condition (low or high traffic) and lift thickness.
- (4) A description of all products that are incorporated in the ARAC along with the sources of all products, including the base asphalt binder cement, crumb rubber, mineral aggregate, and admixtures.

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(5) The results of all testing, determinations, etc., such as: specific gravity and gradation, water absorption, sand equivalent, loss on abrasion, fractured coarse aggregate particles, Tensile Strength Ratio (AASHTO T-283), Marshall bulk density, stability and flow, asphalt absorption, percent air voids, voids in mineral aggregate. Historical abrasion values may be supplied on existing sources. The submittal should include a plot of the gradation on the Federal Highway Administration's 0.45 Power Gradation Chart and plots of the compaction curves.

(6) The laboratory mixing and compaction temperature ranges for the ~~supplier and grade of asphalt rubber binder-ARB~~ used within the mix design.

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

(8) The supplier's product code, the laboratory Engineer's seal (signed and dated), and the date the design was completed.

(9) The ARB ~~blend binder~~ design.

The mix design shall be submitted to the Agency or Engineer by the Contractor/Supplier for which it was developed as part of his project submittals. Once the mix design has been approved by the agency or Engineer, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer. Any changes in the plant operation, the producer's pit, the ~~asphalt binder, including modifiers in the asphalt binder-ARB~~, or any other item that will cause an adjustment in the mix, shall be justification for a new mix design to be submitted.

- End of Section -

ASPHALT-RUBBER ASPHALT CONCRETE

717.1 DESCRIPTION:

The work under this section shall consist of furnishing, proportioning and mixing all the ingredients necessary to produce an asphalt-rubber Asphalt Concrete (ARAC) material. ARAC mixes may be used for low or high traffic conditions, as determined by the agency. Low traffic conditions are conditions where the asphalt mix will be subject to low volume and low weight vehicle usage. Examples of this condition are residential streets, most parking lots and residential minor collector streets. High traffic conditions are conditions where the asphalt mix will be subject to high volume and/or heavy weight vehicle usage as found on major collector, arterial and commercial streets. Street classifications (i.e. minor collector and major collector) shall be determined by the specifying agency.

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- (3) The traffic condition (low or high traffic) and lift thickness.
- (4) A description of all products that are incorporated in the ARAC along with the sources of all products, including the base asphalt cement, crumb rubber, mineral aggregate, and admixtures.

(5) The results of all testing, determinations, etc., such as: specific gravity and gradation, water absorption, sand equivalent, loss on abrasion, fractured coarse aggregate particles, Tensile Strength Ratio (AASHTO T-283), Marshall bulk density, stability and flow, asphalt absorption, percent air voids, voids in mineral aggregate. Historical abrasion values may be supplied on existing sources. The submittal should include a plot of the gradation on the Federal Highway Administration's 0.45 Power Gradation Chart and plots of the compaction curves.

(6) The laboratory mixing and compaction temperature ranges for the ARB used within the mix design.

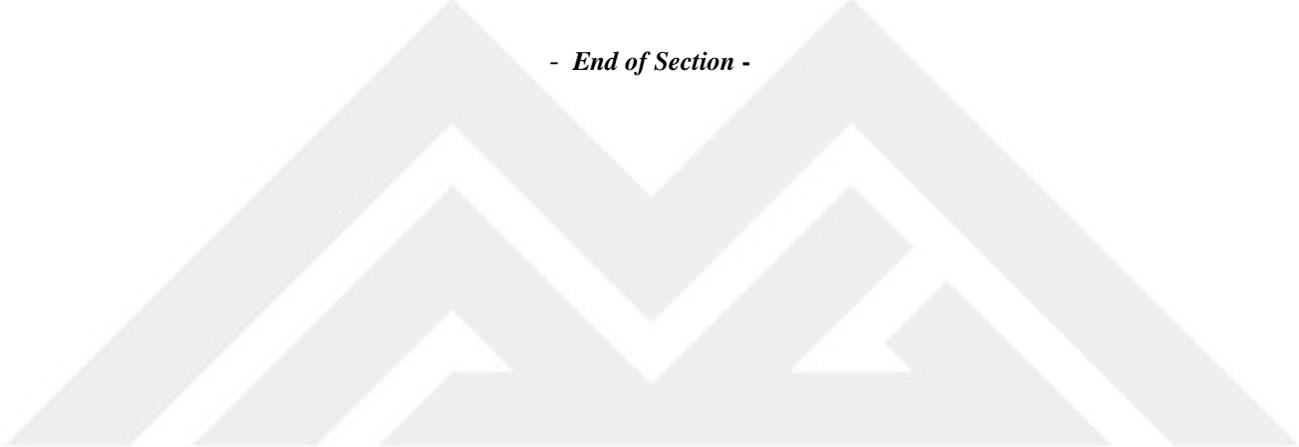
(7) A specific recommendation for design ARB content and any limiting conditions that may be associated with the use of the design, such as minimum percentages of crushed or washed fine aggregate.

(8) The supplier's product code, the laboratory Engineer's seal (signed and dated), and the date the design was completed.

(9) The ARB design.

The mix design shall be submitted to the Agency or Engineer by the Contractor/Supplier for which it was developed as part of his project submittals. Once the mix design has been approved by the agency or Engineer, the Contractor and/or his supplier shall not change plants nor utilize additional mixing plants without prior approval of the Engineer. Any changes in the plant operation, the producer's pit, the ARB, or any other item that will cause an adjustment in the mix, shall be justification for a new mix design to be submitted.

- *End of Section* -



Water/Sewer Working Group Meeting

Meeting Notes
September 11, 2014

Opening:

A meeting of the Specifications and Details Water/Sewer Working Group was called to order by Jim Badowich on September 11, 2014, at 1:37 p.m. in the MAG Cottonwood Room.

1. Introductions/Attendance

Jim Badowich (Avondale), Arturo Chavarria (Hanson), Julie Christoph (Mesa), Bob Herz (MCDOT), Craig Sharp (Buckeye), Gordon Tyus (MAG), Stew Waller (Rinker), Warren White (Chandler)

2. Manhole Revisions/Update (Cases 13-21 and 13-22)

Craig Sharp handed out updated versions of Section 625 and Details 420-2 and 422 based on the changes made to the cases prior to approval as recorded in the minutes of the Specs and Details committee meeting. Members reviewed the updated Detail 420-2. Bob Herz noted the numbers of the notes need to be realigned with the text. Gordon Tyus suggested removing the arrows at the bottom of the detail. Detail 422 added the table for the spacers note. Suggestions included making the titles bold and making the table font consistent. There were also a couple missing extension lines. After reviewing the final version of Section 625, members suggested a few formatting corrections for paragraph spacing. Mr. Sharp said he would make the final corrections and send the case materials to Mr. Tyus.

3. Revisions to Rigid and Flexible Pipe Installation (Case 13-15)

Bob Herz handed out comments for the revised Section 601 that combined Sections 601 and 603. Industry representative Stew Waller agreed with the process of combining the two sections. Mr. White handed out a memo outlining the final changes to the case. He also provided updated Details 200-1, 200-2 and 212. The case will also add minor changes to Sections 206, 355, 735, 739 and 740 to correct references, and coordinate changes in Section 601. Warren White discussed the changes to Detail 200-1 including fixing the references in the notes and changing the hatch pattern for the Type "D" Trench Repair. The group decided to change the reference in the section view of Detail 212 Utility Pothole Repair, to refer to Section 601 generally, rather than a specific sub-section since it would cover all applications depending on the utility, such as when sand is used around gas lines.

Next the group went through Mr. Herz comments on Section 601. On the trench widths section, the group agreed to delete the "unless otherwise specified..." line, and also delete Note #1 after Table 601-1. Next the group discussed who typically was responsible for construction staking in 601.2.3. Mr. Herz said this was inconsistent with Section 105.8. Mr. Badowich said they still have the contractor set the stakes, and wanted to keep it as Contractor, not Engineer. Mr. Herz said that it was inconsistent with the rest of the paragraph, so members agreed to switch the terms "Engineer" and "Contractor" in the last sentence of 601.2.3. Mr. Badowich said they may want to revisit Section 105.8 next year.

Mr. Herz suggested deleting the “unless otherwise shown...” phrase from 601.3.1 Utilities; however, since it was not uncommon for agencies to turn off utilities on some projects, Mr. Badowich thought it should be left in. The consensus was to leave it as is.

Next the group had a lengthy discussion fine tuning the language for Section 601.4 FOUNDATION, BEDDING, HANCHED, BACKFILLING AND COMPACTION. In summary, the group decided to use ABC per Section 702 as the default fill material for the Bedding, Haunching, and Initial Backfill areas. To provide options for these areas, a sentence stating, “With Agency approval, other granular fill materials or CLSM may be used.” Based on feedback from industry representatives Stew Waller and Arturo Chavarria, in the Initial Backfill area, the group decided to allow the option of native backfill material for concrete pipe only.

For the Final Backfill, Julie Christoph noted that it currently says that it is “sound earthen material with no piece larger than 4 inches and free from broken concrete, broken pavement or other deleterious material.” However, if MAG ABC was used, per Section 702 it could include recycled pavement, creating a conflict. Mr. Badowich was also concerned about using native material under the streets, so he suggested adding “ABC per Section 702 or” in front of the “sound earthen material...” He also wanted to leave in the reference to Detail 200-1 for final backfill under street pavement, so contractors would know that they would need to follow a trench repair detail.

The working group agreed with the other comments in Section 601. Warren White said he would make these final corrections and prepare the final case files. Members thought both the red-lined and final versions should be in the packet. Mr. Tyus said the final version for the vote should include all the sections that changed, although if it is a minor change to sentence, only that part would need to be included in the case outline.

6. Horizontal Drilling Directional Drilling (New Section 608)

Sponsor Arvid Veidmark was not present; however, the latest copy of Section 608 and a potential detail drawing were provided. Jim Badowich said he thinks this will be a good spec to have in the future. Ms. Christoph said Mesa is putting in a large amount of cable. This will likely be a case next year.

8. Future Case Items

Mr. Badowich asked the group for suggestions of additional cases for next year. In addition to catching minor updates and corrections that were missed for the cases that passed, he said they can look at the granular fill definition and options in more detail. Mr. Tyus suggested reviewing Detail 502-2: Trash Rack.

9. Next Meeting Date

The Water/Sewer working group will take a break until January of next year.

The meeting was adjourned at 4:09 p.m.