

August 27, 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, September 3, 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
September 3, 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.

2. Information.

3. Approval of August 6, 2014, Meeting Minutes

3. **Review and approve minutes of the August 6, 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.
5. Case 13-21:
Create a new Section 742 Pre Cast Manhole Bases. Add details for construction and installation. Update existing manhole details.
6. Case 13-22:
Update Sections 625 and 775 to remove references to steps and the use of bricks in manholes.

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

5. **Information, discussion and possible action.**
Sponsor: Craig Sharp, Buckeye
Updated

6. **Information, discussion and possible action.**
Sponsor: Craig Sharp, Buckeye
Updated

New Cases for 2014

7. 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'.

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

- 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.
8. Case 14-03: Updates to Guardrail Details
Revisions to Section 415 and/or inclusion of MCDOT guardrail details.
8. Information and discussion.
Sponsor: Bob Herz, MCDOT
9. Case 14-06: Revisions to Section 718 Preservation Seal for Asphalt Concrete
Update specifications for current preservative seal products.
9. Information and discussion.
Sponsor: Jeff Benedict, Asphalt Working Group
10. Case 14-11: Delete the use of Asbestos-Cement Pipe in Valve Box Installations.
Update Section 610.7, Details 391-1, 391-2, and 392.
10. **Information, discussion and possible action.**
Sponsor: Bob Herz, MCDOT
Updated
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.
11. Information and discussion.
Sponsor: Bob Herz, MCDOT
12. Case 14-13: Revisions to Section 321.
Incorporate MCDOT enhancements to Section 321 PLACEMENT AND CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT into the MAG Specifications.
12. **Information, discussion and possible action.**
Sponsor: Bob Herz, MCDOT
Updated
13. Case 14-14: Consolidate all testing requirements in a new Section 611.
Also delete and reference appropriate section in places where testing moved.
13. **Information, discussion and possible action.**
Sponsor: Jami Erickson, Phoenix
Updated
14. Case 14-15: Revisions to Section 610.
Move Hydrostatic Testing from Section 610 to Section 611; update Table 610-1 consistent with AWWA; place Section 610 into sequential order.
14. **Information, discussion and possible action.**
Sponsor: Jim Badowich, Avondale
Updated

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| <p>15. <u>Case 14-16: Revision to Section 310</u> Placement of Construction of Aggregate Base Course. Change rock correction method to be consistent with Section 301.</p> | <p>15. Information, discussion and possible action. Sponsor: Brian Gallimore, Materials WG</p> |
| <p>16. <u>Case 14-17: Create New Section 322</u> Provide specifications for Asphalt Stamping - materials and methods.</p> | <p>16. Information, discussion and possible action. Sponsor: Brian Gallimore, Materials WG</p> |
| <p>17. <u>Case 14-18: Terminology in Section 340</u> Change all occurrences of the term "sidewalk ramp" in Section 340 to "curb ramp" to prevent confusion.</p> | <p>17. Information, discussion and possible action. Sponsor: Bob Herz, MCDOT <i>Updated</i></p> |
| <p>18. <u>Case 14-19: Revisions to Section 325 and 717</u> Add provisions for terminal-blended asphalt-rubber binder (ARB).</p> | <p>18. Information, discussion and possible action. Sponsor: Brian Gallimore, Materials WG <i>Updated</i></p> |

General Discussion

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| <p>19. <u>Working Group Reports</u></p> | <p>19. Information and discussion. Water/Sewer Chair: Jim Badowich 08/14/14 Meeting</p> <p>Asphalt Chair: Jeff Benedict 08/21/14 Meeting</p> <p>Materials Chair: Brian Gallimore</p> <p>Concrete Chair: Jeff Hearne</p> <p>Outside ROW: Peter Kandarlis</p> |
| <p>20. <u>General Discussion</u> Staff Report: Public Works Directors mail list.</p> | <p>20. Information and discussion.</p> |
| <p>21. <u>Request for Future Agenda Items</u></p> | <p>21. Information and discussion.</p> |

Adjournment

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

August 6, 2014

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

AGENCY MEMBERS

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

ADVISORY MEMBERS

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

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

Vice Chair Jim Badowich called the meeting to order at 1:32 p.m.

2. Call to the Audience

Vice Chair Badowich opened the call to the audience. No members of the audience requested to speak.

3. Approval of Minutes

The members reviewed the July 9, 2014 meeting minutes. Warren White noted that it should show that he was not present at the last meeting. He then moved to accept the minutes with this correction. Dan Nissen 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 and 200-2.

Update pipe installation requirements. Warren White said complete final and redlined versions of the case were included in the agenda packet. A one-page addendum was passed out during the meeting that changed the maximum lift depth from 4' to 2' in the final backfill sections 601.4.5 and 603.4.5. Bob Herz recommended an 8" maximum lift prior to compaction in keeping with requirements of section 211 Fill Construction, and he believed Phoenix had a maximum of 12". Jeff Hearne said the language also requires that the lift thickness can't be more than whatever can be effectively compacted. Mr. Herz said the county currently requires CLSM and was okay with the 2' change since it will not affect them.

Jim Badowich said that the update does leave jetting in as an option, but with more restrictions. Warren White said this method is only allowed in the pipe zone area. No jetting is allowed for final backfill. Mr. Badowich said flooding is not allowed. He added that CLSM is an option in the table for allowable backfills – this includes options to just the spring line if preferred. Mr. White added that detail 200 shows the backfill options. Mr. Kandaris asked if the 2' lift requirement was included in Section 603. Mr. White noted that the addendum includes the change to Section 603 as well. Jim Badowich thanked Warren White and industry representatives for their work on this case and said they planned to vote on the case at the next meeting.

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. Craig Sharp said he received comments from the county and discussed them with Bob Herz. A handout provided summarized the comments received. Mr. Sharp went through the comments

to get feedback from other committee members. The first was to change the wording in Section 742.1 to make it applicable for all manholes.

Mr. Sharp said he agreed to reorder the ASTM references in Section 742.2.3. Bob Herz agreed to leave Section 742.3 MANHOLE PENETRATIONS as is. Paul Nebeker asked about the requirement for the coating to be applied by the manufacturer. Craig Sharp said that the modifications discussed in the section are done at the plant, and the coating is also applied at this time. This was also shown in the details. Peter Kandaris questioned the water tightness requirement for dry utilities. After discussion, the committee decided to leave this in since most manholes the cities specify are for sewer and storm drain where water-tightness is required, and utilities such as SRP already have their own details for dry utilities.

Craig Sharp agreed to accept the changes to Section 742.4 REINFORCING, and to add “type” for the reference in Section 742.5 to 316 stainless steel. Dan Shafer pointed out a grammar error where “of” and “for” were next to each other. Mr. Sharp agreed to make the changes to the specification as discussed.

The committee then began discussing the detail drawings. First there were questions about the adjustment rings including the size and process of installing them. Mr. Sharp said that typically larger rings are on the bottom, with smaller rings on top. Bob Herz suggested clarifying the notes and dimensions for the adjustment rings. Rod Ramos said the note conflated two issues, and could be broken up to show the dimension (and note) for the rings on one side, and the overall dimension to the top of grade on the other. This issue also needed to be corrected on the flattop option and on Detail 421.

On Detail 422 MANHOLE FRAME AND COVER ADJUSTMENT, Bob Herz suggested showing a larger radius on the concrete collar so that it would be less likely to be disturbed by graders. Rod Ramos said Scottsdale’s detail shows the edge tapered instead of rounded and could supply their detail for an example. He also suggested changing the note referencing the reinforcing steel to state, “If required by agency...” Members also discussed if the size of the adjustment rings should be noted on the detail.

Jim Badowich asked where the cast-in-place base was shown. Mr. Sharp said it still was shown on Detail 420-1 and included notes about the base in #2 and #3. There was also discussion about Detail 420-3. Members believed the drawing should show a 12” straight section before there are any bends or change in radius. It was also suggested to remove the note “CHANNEL FORMED WITH PRECAST BASE” since the drawing could be applicable for cast-in-place bases as well. The word “PRECAST” could also be deleted from the title.

Mr. Sharp said he would work with Bob Herz after the meeting to make the changes to the details as discussed, and then prepare a final version to be voted on at the next meeting.

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.

Craig Sharp said comments on Sections 625 and 775 were provided by Bob Herz prior to the meeting. He began discussing the comments that were provided on a handout. Mr. Sharp said he would accept the changes to the title and description to make the specification more generally applicable. Bob Herz suggested adding back in language for manhole steps with the correct ASTM specifications since Scottsdale has a detail that references them. Antonio Hernandez said they want to get rid of steps for safety reasons. Most members agreed. It was suggested that Scottsdale update their supplemental detail rather than MAG including specs for it. It was also recommended to delete the step detail 428. Mr. Herz suggested removing the reference to smooth mortared surfaces in section 625.3.1 since concrete did not require a mortared surface and the invert channels were already required to be smooth in the paragraph above it.

Jim Badowich suggested that Craig Sharp and Bob Herz get together after the meeting to work on the changes needed. He could then prepare a new cover sheet summarizing the changes and have a final version ready for a vote at the next meeting.

New Cases for 2014

7. Case 14-01: Miscellaneous Corrections.

One new correction case (D) was introduced.

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.

Jami Erickson said this update should be included in the packet. Paul Nebeker noticed that it still referenced rubber gaskets, and suggested they be changed to elastometric. Ms. Erickson said that was beyond the scope of a corrections case, and suggested making a new case to take care of all rubber gasket references next year. Bob Herz requested a vote on Case 14-01 at the next meeting.

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

Make revisions to Section 415 and/or include guardrail details in MAG. Bob Herz said the county will still have the existing details in their supplement. MCDOT plans to add new Midwest Guardrail System details to the County's supplement when ready, and said this case can carry over to 2015.

9. Case 14-05: Revisions to Section 324 Portland Cement Concrete Pavement (PCCP).

Use compressive rather than tensile strength tests, modernize and reorganize section as needed. Jeff Hearne said there have been no additional changes and he believed the case was

ready for a vote. Bob Herz moved to accept the case as presented. Syd Anderson seconded the motion. A roll call vote was taken and the case was approved: 12 yes, 0 no, 0 abstaining and 5 not present.

10. 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 until next year, and was planned to be discussed at the next Asphalt Working Group meeting scheduled for August 21st at noon.

11. Case 14-10: Include Language to Allow Use of Warm Mix Asphalt.

Update Sections 321 and 710. Jeff Benedict said he received and incorporated comments from Maricopa County in a final version that was handed out at the meeting. He noted the changes were shown in yellow in Section 710.3.1 (11). Bob Herz said the last yellow paragraph should be shown as a bullet like the previous one. Mr. Herz asked if any member felt they needed to bring it back for review. Seeing none he moved to accept the case with the changes discussed and shown in the revised Section 710 as well as the revisions shown in Section 321 that was in the packet. Syd Anderson seconded the motion. A roll call vote was taken and the case was approved: 12 yes, 0 no, 0 abstaining and 5 not present.

12. 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. Since Bob Herz was not in attendance at the last meeting, he asked for clarification for the changes suggested in the meeting minutes. For Detail 391-1 it was discussed that the base was precast and the pipe fits straight into it. Paul Nebeker had a question about the frame and cover clearance and suggested showing the dimensions. For Detail 391-2 members noted that you only need the option of the 8" pipe. Mr. Herz said he found where Phoenix used a 12" version. Jami Erickson confirmed that Phoenix got rid of the 12" size and that 8" was fine. Mr. Herz asked for a vote at the next meeting.

13. 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 asked for comments. Jeff Benedict said most of the comments originated in the Asphalt Working Group. They felt there was a problem with the wording not being clear. Jim Badowich said they have been having similar discussions about this issue in Avondale between their engineers and CIP personnel. He believed that it was more of a design issue, and that it would be difficult for contractors in the field to determine where the wheel paths would be. He also thought that this change would require more material replacement and higher costs. Bob Herz said the wheel paths are based on the striping plan. Rod Ramos also thought it was more of a design or permitting issue, and wondered how milling operations would be effected. Mr. Herz said the case was dealing with full depth cuts. He said he could drop it as a case in MAG, but that MCDOT will still have it as a supplement. Jeff Benedict said there would be more discussion

on the case at the working group meeting. Mr. Herz suggested that the case be carried forward to next year.

14. 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 asked for comments. Jeff Benedict said it was discussed at the last working group meeting and that they were okay with everything except for an issue in the acceptance section 321.10.3. Bob Herz said there are issues with the existing acceptance requirements for pavement thickness. Peter Kandaris said there was the problem of the wheel path location as discussed in the previous case. Jim Badowich wanted to know what was meant by “acceptable conditions” for the curb and gutters and wanted to know if a problem would require a change order. He was also not clear on whether this was for new curb and gutter or any existing material. Mr. Herz explained that it was for new curb and gutter only and would try to clarify the language. Rod Ramos was still concerned that a contractor may have to delay his work based on scheduling issues caused by another contractor. Brian Gallimore wanted to know if contractors could get permission to go ahead with their work. Mr. Herz said he would make the final revisions and wants to vote on the case at next month’s meeting.

15. 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 a revised version of the case that incorporated comments from Maricopa County. Some sections were moved from 610 to 611 while others were moved from 611 to 610 based on if they were related to testing procedures. The numbering was also adjusted accordingly. Jami Erickson said she will make final corrections and prepare the case for a vote next month. Jim Badowich reminded members to consider that this case was mainly to reorganize the testing into one place and that future changes to the text, additional testing options, and so on, would be considered in future cases.

16. 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 provided an updated version of Section 610 based on feedback and comments from Maricopa County. He went on to summarize the changes. The items in red were new changes or additions. Item in green were not changed, but moved around in the spec to make the process better ordered sequentially. The testing sections were moved into the new Section 611. Section 610.3 added the option for cast iron pipe. Section 610.4 was broken into subparagraphs with headings. Section 610.4.4 (pipe cleaning) was moved from 611. The testing subsection now refers to the tests in Section 611. Another change to Section 610 was updating Table 610-1 for the polywrap sizes to match the current AWWA table. Finally, Mr. Badowich said that references to “bid” were changed to “contract price” at the request of Bob Herz, and sections were renumbered as needed.

There was some discussion about the paragraph that begins “A contingent item for fittings not shown on the plans...” in Section 610.16 regarding “Payment will be made at the unit bid per pound on the theoretical weight of the fittings installed.” Members agreed to delete this paragraph since it was confusing and not needed, and then renumber the paragraphs afterwards as #3 and #4. Mr. Badowich asked members to provide any final comments so that he could prepare the final version of the case to be voted on at the next meeting.

17. Case 14-16: Revision to Section 310 - Placement of 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. He called for a vote at the next meeting.

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

Provide specifications for materials and methods of Asphalt Stamping. Brian Gallimore said the case is based on the asphalt stamping supplement from Gilbert. He said he recently took photos and video of the process for a job in Peoria. Warren White said that people in Chandler’s street department wanted some kind of a warranty period. Rod Ramos questioned whether the text on being prequalified was necessary, since such prequalification was not required in other areas. Mr. Gallimore said he wanted to make sure the contractor was able to do the job correctly. He said this process was typically used for crosswalks and in private developments. Rod Ramos said stamping is used often in Scottsdale, and would try to find their specifications for comparison. Other comments included concerns about the age of the pavement to be stamped and the potential for oil to streak onto the painted surface on newly paved roads. Mr. Gallimore said this case would be reviewed again at the next working group meeting and would like to vote on it at the next meeting.

19. 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 to match that used by ADA. Jim Badowich had a question about the payment calculation for curb through an apron. Mr. Herz said MAG currently measures the curb through aprons, driveways, etc. Rod Ramos said Scottsdale requires thicker concrete in those areas. Several members commented that the driveways and ramps are bid on unit price for the whole thing including the aprons for example. Rod Ramos thinks that how the price of the curb is calculated should be changed based on the changes to how the individual items are bid, and that you shouldn’t have to pay for curb, where there isn’t any. He thinks there should be separate pay items for all components including the actual curb and sidewalk built.

Since there was agreement on the first revision to change “sidewalk ramp” to “curb ramp”, but no consensus on how to determine the payment for increased curb depth, Mr. Herz said he would adjust the case to include item 1 of the case, but delete the changes proposed in item 2 to modify Section 340.5. He said he would prepare the changes and asked to vote on the case at the next meeting.

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

Add provisions for terminal-blended asphalt-rubber binder (ARB). Brian Gallimore handed out a revised version of the case at the meeting. He said he received some comments and asked for more. He said the case was necessary because terminal-blended rubber is being used, but the testing requirements are not correct. Section 325 addresses binder content at the plant, but there is no way to test the final product in the field. He said he expected additional comments from the county. Mr. Ramos said Scottsdale wants it tested and the air voids test is not right. Mr. Gallimore asked members to take it back and review it. The case will be discussed at the Asphalt Working Group meeting on the 21st. He said industry members will be present and asked agency members to attend so they can work out a final version. He hoped it could be ready for next month, but thought that it was important enough to have a meeting in October to get it through if it was not ready by next month.

21. Working Group Reports

Mr. Badowich began reports from the working group chairs.

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

Mr. Badowich said he missed the meeting due to a conflict; however, the group did meet and review the current cases. (The notes from the meeting were in the agenda packet.) In order for Mr. Badowich and Mr. Herz to attend the next meeting, it was decided to reschedule it for next Thursday, August 14, at 1:30 p.m. in the MAG office.

b. **Asphalt/Materials Working Groups**

Jeff Benedict said their next meeting is scheduled for August 21st at noon at the ARPA offices.

c. **Concrete Working Group**

Jeff Hearne said they are done meeting for the year.

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

Peter Kandaris said he has nothing to report at this time.

22. General Discussion

ADA Requirements. Warren White said Chandler's consultant, Cole, says they expect the latest ADA requirements (PROWAG) will likely to go into effect in October of this year. He said Rule 207.2 of the ADA requirements will only allow a diagonal ramp in certain alteration situations, and Rule 304.1 intentionally does not include the diagonal ramp for new construction and that future accessible ramps will need to be directional. Bob Herz agreed that MAG needs to add dual directional ramps to the set of details. Dan Nissen of Peoria said they have worked on details and wondered if any working group is currently working on the issue. In the past the Concrete Working Group reviewed them, but not currently. Mr. Herz said the county is aware of the changed requirement and had started to develop dual ramp details.

23. Adjournment:

Seeing no further business the meeting was adjourned at 4:32 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 and 618 for installing rigid and flexible pipe. Update Detail 200-1, 200-2 and 212. | Chandler/ Water-Sewer WG | Warren White | 05/01/2013 08/26/2014 | 09/03/2014 | 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 08/25/2014 | 09/03/2014 | 0 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. | Buckeye/ Water-Sewer WG | Craig Sharp | 06/05/2013 08/13/2014 | 09/03/2014 | 0 0 0 | Yes No Abstain |
| | NEW CASES FOR 2014 | | | | | | |
| 14-01 | 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. | Scottsdale | Rod Ramos Bob Herz Jami Erickson | 01/08/2014 08/13/2014 | 09/03/2014 | 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 |
| 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 |

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 | |
|-------|---|----------------|---------------|---------------------------------|------------------------|--------------|----------------------|
| 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. | MCDOT | Bob Herz | 06/04/2014 08/14/2014 | 09/03/2014 | 0 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 |
| 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 08/21/2014 | 09/03/2014 | 0 0 0 | Yes No Abstain |

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 |
|-------|--|----------------|-----------------|---------------------------------|---------------|----------------------------|
| 14-14 | Case 14-14: Consolidate all testing requirements in a new Section 611. | Phoenix | Jami Erickson | 06/04/2014 08/10/2014 | 09/03/2014 | 0 Yes 0 No 0 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 08/06/2014 | 09/03/2014 | 0 Yes 0 No 0 Abstain |
| 14-16 | Case 14-16: Revision to Section 310 - Placement of Construction of Aggregate Base Course. Change rock correction method to be consistent with Section 301. | Materials WG | Brian Gallimore | 07/09/2014 | 09/03/2014 | 0 Yes 0 No 0 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 Yes 0 No 0 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 | 09/03/2014 | 0 Yes 0 No 0 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 08/06/2014 | 09/03/2014 | 0 Yes 0 No 0 Abstain |

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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 | BST | Bituminous Surface Treatment |
| AAN | American Association of Nurserymen | BTB | Bituminous Treated Base |
| AB | Aggregate base | BTU | British Thermal Units |
| Aban | Abandon | | |
| ABC | Aggregate base course | BVC | Beginning of vertical curve |
| AC | Asphalt cement or concrete | C | Centigrade or Curb |
| ACB | Asphalt concrete base | CB | Catch Basin |
| ACI | American Concrete Institute | CBF&C | Catch basin frame & cover |
| ACP | Asbestos cement pipe | CC or C/C | Center to Center |
| ACPA | American Concrete Pipe Association | CE | City or County Engineer |
| ACWS | Asphalt concrete wearing surface | Cem | Cement |
| AFRB | Arizona Fire Rating Bureau | CF | Curb face |
| AGC | Associated General Contractors of America, Inc. | cfs | Cubic Feet per second |
| Agg | Aggregate | CIP | Cast Iron pipe |
| ADOT | Arizona Department of Transportation | CIPP | Cast-in-place concrete pipe |
| <u>ADA</u> | <u>Americans With Disabilities Act of 1990</u> | CL or C | Centerline |
| <u>ADEQ</u> | <u>Arizona Department of Environmental Quality</u> | <u>CLR</u> | <u>Clear</u> |
| Ahd | Ahead | Cm | Centimeter |
| AIA | American Institute of Architects | CMP | Corrugated metal pipe |
| AIEE | American Institute of Electrical Engineers | CO | Clean out |
| AISC | American Institute of Steel Construction | Col | Column |
| ANSI | American National Standards Institute | Conc | Concrete |
| APA | American Plywood Association | Const | Construct |
| Approx | Approximate | CP | Concrete pipe (non-reinforced) |
| APWA | American Public Works Association | CTB | Cement Treated Base |
| AR | Aged residue | Cu | Cubic |
| <u>ARAC</u> | <u>Asphalt-Rubber Asphalt Concrete</u> | Deg | Degree |
| ARIZ | Arizona Department of Transportation test method | DF | Douglas Fir |
| ARS | Arizona Revised Statutes | DG | Decomposed granite |
| ASCE | American Society of Civil Engineers | Dia | Diameter |
| ASME | American Society of Mechanical Engineers | Dim | Dimension |
| ASTM | American Society for Testing Materials | DIP | Ductile Iron Pipe |
| Ave | Avenue | Div | Division |
| AWPA | American Wood Preservers Association | Dr | Drive |
| AWSC | American Welding Society Code | Drwg | Drawing |
| AWWA | American Water Works Association | Dwy | Driveway |
| Bbl | Barrel | Ea | Each |
| BC | Beginning of curve | Ease | Easement |
| BCR | Beginning of curb return | E | East |
| Beg | Beginning | EC | End of curve |
| Bk | Book or Back | ECR | End of curb return |
| Bldv | Boulevard | El or Elv | Elevation |
| BM | Bench Mark or Board Measure | Equa or Eq | Equation |
| Brg | Bearing | 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.

Native Material: A sound earthen material free from broken concrete, broken pavement, wood or other deleterious material with no piece larger than 4 inches.

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.

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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.

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.

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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, 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 horizontal centerline of the pipe or in box section, 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.

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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.

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 -

SECTION 601

RIGID PIPE TRENCH EXCAVATION, BACKFILLING AND COMPACTION**601.1 DESCRIPTION:**

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

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

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

See Section 603 for trench excavation, backfilling, and compaction of flexible pipe.

See Section 620 for cast-in-place concrete 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.

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

601.2.2 Trench Widths: Trenches ~~for a single pipe for other than cast in place concrete pipe~~ shall conform to the dimensions in Table 601-1, unless otherwise specified in the special provisions, indicated on the plans, and/or approved by the Engineer. 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 (I.D.) | Maximum Width At Top Of Pipe Greater Than O.D. Of Barrel | Minimum Width At Springline Each Side Of Pipe (1) |
| <u>Less than 18 inches</u> | <u>16 inches</u> | <u>6 inches</u> |
| <u>18 inches to 24 inches inclusive</u> | <u>19 inches</u> | <u>7 1/2 inches</u> |
| <u>27 inches to 39 inches inclusive</u> | <u>22 inches</u> | <u>9 inches</u> |
| <u>42 inches to 60 inches inclusive</u> | <u>1/2 O.D.</u> | <u>12 inches</u> |
| <u>Over 60 inches</u> | <u>36 inches</u> | <u>12 inches</u> |

| Table 601-1 | | |
|---|---|--|
| 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 (1) |
| <u>Less than 18 inches</u> | <u>16 inches</u> | <u>6 inches</u> |
| <u>18 inches to 24 inches inclusive</u> | <u>19 inches</u> | <u>7.5 inches</u> |
| <u>27 inches to 39 inches inclusive</u> | <u>22 inches</u> | <u>9 inches</u> |
| <u>42 inches to 60 inches inclusive</u> | <u>30 inches</u> | <u>12 inches</u> |
| <u>66 inches to 78 inches inclusive</u> | <u>42 inches</u> | <u>15 inches</u> |
| <u>84 inches to 96 inches inclusive</u> | <u>50 inches</u> | <u>19 inches</u> |

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| | | |
|------------------------------------|-----------|-----------|
| 102 inches to 120 inches inclusive | 60 inches | 24 inches |
|------------------------------------|-----------|-----------|

Comment [WW1]: ASTM trench widths.

(1) When the specified compaction cannot be obtained in the haunch area and/or bedding-initial backfill zone, the Contractor shall make necessary changes in his methods and/or equipment to obtain the desired results. In some instances, the Minimum Width at Springline shall may be adjusted wider to assist the Contractor in obtaining the compaction. The Engineer must be satisfied with the Contractor's compaction effort, concur with the change and approve the revised distance. There shall be no additional cost to the Agency for the extra trench width.

~~For multiple pipe installations in a single trench shall be installed in accordance with details, the Engineer shall provide details on the plans or in the Special/Technical Provisions provisions as to the layout, pipe configuration, distances between pipes and trench walls, the type of backfill, bedding and foundation materials, etc.~~

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 necessary additional load bearing capacity. This may require changing the material requirements by means of beddinginitial backfill, having a higher bedding factor than that specified, a higher strength pipe, a concrete cradle, cap or encasement, or by other means approved in writing by the Engineer. Where safety or undermining situations occur, a CLSM backfill may be used as needed.~~

Comment [WW2]: Working Group perspective is to keep as-is since this is the cost of doing business and typically this is the embankment condition. If trench widths fall outside the table maximum, then should be designed by a structural engineer. Added CLSM statement on 6/27.

601.2.3 Trench Grade: Alignment and elevation stakes shall be furnished the Contractor at set intervals and agreed upon offsets. On water main projects, elevation stakes will be furnished only when deemed necessary by

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the Engineer. In all cases where elevation stakes are furnished, the Engineer will also furnish the Contractor with cut sheets.

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

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

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

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

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

Unauthorized excavation below the specified grade line shall be refilled at the Contractor's expense with ABC material compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T-99 and T-191 or ASTM 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 ~~bed~~rock is encountered in the trench bottom, it shall be overexcavated to a minimum depth of six inches below the O.D. of the pipe. This overexcavation 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 overexcavation and the granular fill required.

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

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

601.2.7 Pavement and Concrete Cutting and Removal: Where trenches lie within the Portland cement concrete section of streets, alleys, driveways, or sidewalks, etc., such concrete shall be 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.

[See Detail 200-1 and 200-2 for further requirements.](#)

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

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

The Contractor shall, prior to ~~final acceptance~~ 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 as determined by the Engineer to prevent overloading of the pipe during backfilling operations. The cost of the bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price for the pipe.

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

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

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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](#).



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

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

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

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

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

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

~~The Contractor shall avoid damaging the plastic pipe, pipeways or conduits during trench backfilling and during foundation and bedding placement.~~

~~There will be no measurement or payment for this work. The Contractor will include all associated costs in the unit price for the conduit installation.~~

601.4 FOUNDATION, BEDDING, HAUNCHING, BACKFILLING AND COMPACTION:

601.4.1 Foundation: ~~The native or prepared material (when required) upon which the bedding material is placed.~~

601.4.1-2 Foundation Bedding: The material upon which the conduit or structure is to be placed shall be accurately finished to the grade or dimensions shown on the plans or as directed by the Engineer. The bottom portion of the trench shall be brought to grade so that the conduit or structure will be continuously in contact with the material on which it is being placed. If rocky or unsuitable soil is encountered, Subsection [601.2.5](#) applies.

~~Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702.~~

601.4.2-3 Bedding Haunching: ~~Bedding—The 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 thickness shall not exceed 2 feet 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. All consist of granular material containing no pieces larger than 1 1/2 inches and free of broken concrete, broken pavement, wood or other deleterious material. Open graded rock will not be used without the written approval of the Engineer.~~

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

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

Comment [WW3]: Working Group perspective is to remove this section. It is covered by other governing procedures.

Comment [WW4]: 4/29 revision from "granular".

Comment [WW5]: Working group perspective that 2 feet vs 4 feet is more realistic to meet compaction requirements.

Comment [WW6]: This is stated in the compaction methods section.

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Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702. With agency approval, native or CLSM may be used as an option.

Comment [WW7]: 4/29 revision from "granular".

~~601.4.3-4 Backfill~~**Initial Backfill:** The material placed between the springline to 12 inches above top of pipe (minimum) Backfill shall be sound earthen material free from broken concrete, broken pavement, wood or other deleterious material. Unless otherwise specified, this may be native material with no piece larger than 4 inches, select material or aggregate base course. shall be placed in lifts the height of which shall not exceed 2 feet or that 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. 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.

Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702. With agency approval, native or CLSM may be used as an option.

Comment [WW8]: 4/29 revision from "granular".

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

Comment [WW9]: Move to other area in Spec?

601.4.5 Final Backfill: The material placed above the initial backfill shall be placed in lifts the height of which shall not exceed 2 feet or that 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. All backfill 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. ~~Where water consolidation is used, backfill will be placed in lifts as required in the following table prior to settlement.~~

Comment [WW10]: 4/29 revision

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| <u>Trench Width</u> | <u>Backfill Lifts</u> |
|---------------------|-----------------------|
| 18" to 24" | Not to exceed 4' |
| 25" to 36" | Not to exceed 6' |
| Over 36" | Not to exceed 8' |

The above backfill lift limitations are not applicable when water saturation is done by the jetting method.

Where mechanical compaction is used, backfill shall be placed in lifts the height of which shall not exceed that which can be effectively compacted depending on the type of material, type of equipment and methods used, and under no circumstances shall exceed 4 feet.

601.4.4-g Compaction Densities: Unless otherwise provided in the plans and/or special provisions, the trench backfill shall be thoroughly compacted to not less than the densities in Table 601-2 when tested and determined by AASHTO T-99 and T-191 or ASTM 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. All compaction discussed within this section shall be performed within 2 percentage points of optimum moisture content unless otherwise noted in the project plans or project specifications.

The density required will depend on the Type shown on the plans and/or called for in the special provisions. Density required for each type shall comply with Table 601-2.

| Backfill Type | Location | From Surface To 2 feet Below Surface | From 2 feet Below Surface To 1 foot Above Top of Pipe | From 1 foot Above Top of Pipe to Bottom of <u>Trench</u>Pipe |
|----------------------|--|---|--|---|
| I | Under any existing or proposed pavement, curb, gutter, <u>attached sidewalk, roadway shoulders, and other areas within right-of-way subject to vehicular traffic or such construction included in the contract,</u> or when any part of the trench excavation is within 2-feet of the <u>existing pavement, curb, or gutter above.</u> | 100% for granular 95% for non-granular | <u>90</u> 95% | <u>90</u> 95% |
| II | On any utility easement <u>street, road or alley</u> right-of-way outside limits of <u>Type I backfill (4).</u> | <u>85</u> 95% | <u>85</u> 95% | <u>90</u> 95% |
| III | Around any structures <u>(manholes, etc.)</u> or exposed utilities. | 95% <u>for A.B.C., 100% for native in all cases or CLSM</u> | | |

Comment [WW11]: Discussion is to replace this with "Pipe". Pipe reps have concern that they do not want rock hard bedding.

Comment [WW12]: 5/30 revision

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

A consideration in determining the backfill Types as shown on the plans, is based on the trench widths as shown in the Contract Documents. If these trench widths increase beyond those widths referred to above and fall within the 2-foot limit of paved surfaces and other improvements due to construction exigencies, the backfill designation for that portion within the 2-foot limit of such improvements shall be Type I even though Type II backfill is shown on the plans.

601.4.5-7 Compaction Methods: Unless otherwise specified in the plans and/or special provisions, the backfill material shall be uniformly compacted using mechanical work methods. When allowed by the agency, consolidation by jetting is also an acceptable compaction method; however, testing requirements shall be increased (100% increase per lift). Care will be taken to prevent damage to or movement of the conduit by the compaction method or equipment used.

Water consolidation by jetting shall be accomplished with a 1 ½ inches pipe of sufficient length to reach the bottom of the lift being settled with adequate hose attached and a water pressure of not less than 30 psi. All jetting shall be accomplished transversely across the trench at intervals of not more than 6 feet with the jetting locations on one side of the trench offset to

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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 shall be used within the haunching and initial backfill zones, as the consolidation method for all conduit bedding.~~ The Contractor shall be entirely responsible for establishing each lift depth so as to avoid floating the conduit being placed and shall make any repair or replacement at no cost to the Contracting Agency. However, for conduit larger than 24 inches I.D. the first lift shall not exceed the springline of the conduit and subsequent lifts shall not exceed 3 feet.



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

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

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

If water consolidation is not successful, mechanical compaction methods shall be used to meet the compaction requirements. Backfill material may need to be removed and replaced.

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

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

No exception shall be made for construction within new developments.

601.4.6-8 Specifications for Granular Material and Native Backfill Material: For purposes of this specification, granular material shall mean material for which the sum of the plasticity index and the percent of the material passing a No. 200 sieve shall not exceed 23. The plasticity index shall be tested in accordance with AASHTO T-146 Method A (Wet Preparation), T-89 and T-90.

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.

601.4.7-9 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 and Maricopa County right-of-way outside the limits of the Contracting Agency shall be accomplished in accordance with their permit and/or specifications.

601.4.8-10 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.

601.4.9-10 Foundation and Bedding and Backfilling for Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines: ~~Foundation and 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 for foundation, and bedding. The ~~foundation bedding~~ depth shall be six inches and bedding backfill depth shall be one foot above the top of the facility. Compaction will 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 installation complies with those

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procedures and is consistent with MAG requirements.

Also, when required in the Special/Technical Provisions or requested by the Engineer, 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.

Comment [WW13]: Considering removal or moving to install specs?



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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.

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, nor 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 -

SECTION 603

FLEXIBLE PIPE TRENCH EXCAVATION, BACKFILLING AND COMPACTION

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603.1 DESCRIPTION:

The work covered by this specification consists of furnishing all plant, labor, equipment, appliances and materials, and performing all operations in connection with the trench excavation, backfilling and compaction for a single flexible pipe installation in accordance with the plans and special provisions. Pipe materials that are considered to be flexible include thermoplastic pipes and corrugated metal pipe and arches. See Section 601 for rigid pipe trench excavation, backfilling and compaction.

For the purpose of this specification, flexible pipe shall include 8 inches through 120 inches nominal diameter.

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

See Section 615 for sewer line construction procedures.

See Section 618 for storm drain construction procedures.

HDPE pipe and fittings shall conform to Section 738. SRPE pipe and fittings shall conform to Section 739. Polypropylene pipe and fittings shall conform to Section 740. PVC pipe and fittings shall conform to Section 745. Corrugated metal pipe and arches shall conform to Section 760.

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.

See Section 602 for trenchless installations.

603.2 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.

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

603.2.2 Trench Widths: Trenches for flexible pipe ~~other than profile HDPE pipe, meeting ASTM F894,~~ shall conform to the dimensions in Table 603-1, unless otherwise specified in the special provisions, indicated on the plans, and/or approved by the Engineer. ~~Trench widths for profile HDPE pipe, meeting ASTM F894, will be designed by the Engineer and included on the plans or in the special provisions.~~

| FLEXIBLE PIPE – TRENCH WIDTHS | | |
|--------------------------------------|---|--|
| Size of Pipe (Nom. Dia.) | Maximum Width At Top Of Pipe Greater Than O.D. Of Barrel | Minimum Width At Springline Each Side of Pipe (1) |
| Less than 18 inches | 20 inches | 8 inches |
| 18 inches to 24 inches inclusive | 23 inches | 9.5 inches |
| 27 inches to 36 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 |

(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. In some

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instances, the Minimum Width at springline shall be adjusted wider to assist the Contractor in obtaining the compaction. The Engineer must be satisfied with the Contractor's compaction effort, concur with the change and approve the revised distance. There shall be no additional cost to the Agency for the extra trench width.

For multiple pipe installations in a single trench, the Engineer shall provide details on the plans or in the Special/Technical Provisions as to the layout, pipe configuration, distances between pipes and trench walls, the type of backfill and bedding materials, etc.

The width of the trench shall not be greater than the maximum indicated in Table 603-1, 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 603-1 is exceeded at the top of the pipe the Contractor shall provide, at no additional cost to the Contracting Agency, the necessary additional load bearing capacity by means of bedding/initial backfill, having a higher bedding factor than that specified, higher strength pipe, a concrete cradle, cap or encasement, or by other means approved in writing by the Engineer. Where safety or undermining situations occur, a CLSM backfill may be used as needed.

Comment [WW1]: See 601 notes.

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

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

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

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

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

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

Unauthorized excavation below the specified grade line shall be refilled at the Contractor's expense with ABC material compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T-99 and T-191 or ASTM 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 bedrock is encountered in the trench bottom, it shall be overexcavated to a minimum depth of six inches below the O.D. of the pipe. This overexcavation 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 overexcavation and the granular fill required.

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

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

603.2.7 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.

| See Detail [200-1](#) and [200-2](#) for further requirements.

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

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

| The Contractor shall, prior to ~~final acceptance 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.

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

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

603.2.10 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 separate location, the 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

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maintained at all times.

603.3 PROTECTION OF EXISTING UTILITIES:

603.3.1 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](#).

603.3.2 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.

603.3.3 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.

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

~~603.3.5 Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines: These underground facilities shall be adequately supported by the Contractor. Support for plastic pipes shall be continuous along the bottom of the pipe. Support for metal pipe and electrical conduit may be continuous or nylon webbing may be used for suspension at no greater than ten-foot intervals.~~

~~The Contractor shall avoid damaging the plastic pipe, pipeways or conduits during trench backfilling and during foundation and bedding placement.~~

~~There will be no measurement or payment for this work. The Contractor will include all associated costs in the unit price for the conduit installation.~~

Comment [WW2]: See 601 comments

603.4 FOUNDATION, BEDDING, HAUNCHING, BACKFILLING AND COMPACTION:

603.4.1 Foundation: The native or prepared material (when required) upon which the bedding material is placed.

603.4.2 Bedding: The material upon which the conduit or structure is to be placed shall be accurately finished to the grade or dimensions shown on the plans or as directed by the Engineer. The bottom portion of the trench shall be brought to grade so that the conduit or structure will be continuously in contact with the material on which it is being placed. If rocky or unsuitable soil is encountered, Subsection [603.2.5](#) applies.

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~~Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702.~~

Comment [WW3]: 4/29 revision from "granular".

~~603.4.2-3 Haunching: The 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 thickness shall not exceed 1 foot 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 603.4.6.~~

Comment [WW4]: Working group perspective that 1 foot for flexible pipes is more appropriate.

~~The moisture content shall be such that the specified compaction can be obtained. Extreme care will be taken to prevent damage to or movement of the conduit by the compaction equipment.~~

~~Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702. With agency approval, native or CLSM may be used as an option.~~

~~603.4.3-4 Initial Backfill: The material placed between the springline to 12 inches above top of pipe (minimum) shall be placed in lifts the height of which shall not exceed 1 foot or that which can be effectively compacted depending on the type of material, type of equipment and methods used. Extreme care will be taken to prevent damage to or movement of the conduit by the compaction equipment. Compaction requirements shall be per Section 603.4.6.~~

Comment [WW5]: See above comment.

~~The moisture content shall be such that the specified compaction can be obtained. backfill shall be placed in lifts the height of which shall not exceed that which can be effectively compacted depending on the type of material, type of equipment and methods used, and under no circumstances shall exceed 4 feet. Extreme care will be taken to prevent damage to or movement of the conduit by the compaction equipment.~~

~~Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702. With agency approval, native or CLSM may be used as an option.~~

Comment [WW6]: 4/29 revision from "granular".

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

~~603.4.4-5 Final Backfill: The material placed above the initial backfill shall be placed in lifts the height of which shall not exceed that which can be effectively compacted depending on the type of material, type of equipment and methods used, and under no circumstances shall exceed 4 feet. Compaction requirements shall be per Section 601.4.6. All backfill 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.~~

~~Backfill shall be placed in lifts the height of which shall not exceed that which can be effectively compacted depending on the type of material, type of equipment and methods used, and under no circumstances shall exceed 4 feet.~~

~~603.4.5-6 Compaction Densities: Unless otherwise provided in the plans and/or special provisions, the trench backfill shall be thoroughly compacted to not less than the densities in Table 603-2 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 will be used for rock correction. All compaction discussed within this section shall be performed within 2 percentage points of optimum moisture content unless otherwise noted in the project plans or project specifications.~~

The density required will depend on the Type shown on the plans and/or called for in the special provisions. Density required for each type shall comply with Table 603-2.

| TABLE 601 603-2 | | | | |
|-------------------------------------|----------|--------------------------------------|---|---|
| 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 Trench Pipe |
| | | | | |

Comment [WW7]: Discussion is to replace this with "Pipe". Pipe reps have concern that they do not want rock hard bedding.

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| | | | | |
|-----|--|---|-------------------|-------------------|
| 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 such construction included in the contract, or when any part of the trench excavation is within 2-feet of the existing pavement, curb, or gutter above. | 100% for granular 95% for non-granular | 90 95% | 90 95% |
| II | On any utility easement street, road or alley right-of-way outside limits of Type I backfill. (4) | 85 | 85 95% | 90 95% |
| III | Around any structures (manholes, etc.) or exposed utilities. | 95% for A.B.C., 100% for native in all cases or CLSM | | |

Comment [WW8]: 5/30 revision

Note: The type required will generally be shown on the plans and the plans will govern. Where no type is shown on the plans, the type shall comply with Table 603-2.

A consideration in determining the backfill Types as shown on the plans, is based on the trench widths as shown in the Contract Documents. If these trench widths increase beyond those widths referred to above and fall within the 2-foot limit of paved surfaces and other improvements due to construction exigencies, the backfill designation for that portion within the 2-foot limit of such improvements shall be Type I even though Type II backfill is shown on the plans.

603.4.6-7 Compaction Methods: Unless otherwise specified in the plans and/or special provisions, the backfill material shall be uniformly compacted using mechanical work methods. When allowed by the agency, consolidation by jetting is also an acceptable compaction method; however, testing requirements shall be increased (100% increase per lift). Care will be taken to prevent damage to or movement of the conduit by the compaction method or equipment used.

Water consolidation by jetting shall be accomplished with a 1 1/2 inches pipe of sufficient length to reach the bottom of the lift being settled with adequate hose attached and a water pressure of not less than 30 psi. All jetting shall be accomplished 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 entirely responsible for establishing each lift depth so as to avoid floating the conduit being placed and shall make any repair or replacement at no cost to the Contracting Agency. However, for conduit larger than 24 inches I.D. the first lift shall not exceed the springline of the conduit and subsequent lifts shall not exceed 3 feet.

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

Where jetting or flooding is utilized and the surrounding material is such that it does not permit proper drainage, the Contractor shall provide, at his expense a pump 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 water consolidation is not successful, mechanical compaction methods shall be used to meet the compaction requirements. Backfill material may need to be removed and replaced. No exception shall be made for construction within new developments.

Where Type I backfill is required, water consolidation shall only be permitted when the material in which the trench is located and the backfill are both granular material.

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603.4.7-8 Specifications for Granular Material: For purposes of this specification, granular material shall mean material for which the sum of the plasticity index and the percent of the material passing a No. 200 sieve shall not exceed 23. The plasticity index shall be tested in accordance with AASHTO T-146 Method A (Wet Preparation), T-89 and T-90. Coarse aggregate shall consist of crushed rock as defined in Section 701.2 with 100 percent of the specified size of aggregate having one fractured face tested in accordance with ARIZ 212, and having the gradation complying with ASTM D448, Table 1, Size Numbers 6, 67, 68, 7, 78, or 8 as recommended by the Engineer. The gradation size number to be furnished shall be shown on the plans or in the project specifications.

603.4.8-9 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 and Maricopa County right-of-way outside the limits of the Contracting Agency shall be accomplished in accordance with their permit and/or specifications.

603.4.9-10 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.

603.4.10-11 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 for foundation, and bedding. The bedding depth shall be six inches and backfill depth shall be one foot above the top of the facility. Compaction will be in accordance with Section 603.

603.5 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 installation complies with those procedures and is consistent with MAG requirements.

Also, when required in the Special/Technical Provisions or requested by the Engineer, 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.

Comment [WW9]: Considering removal or moving to install specs?

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603.6 PAVEMENT REPLACEMENT AND SURFACE RESTORATION:

603.6.1 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.

603.6.2 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](#).

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

603.6.4 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.

603.7 PAYMENT:

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

- End of Section -

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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.

~~Concrete pipe shall conform to Section 735. High density polyethylene (HDPE) pipe shall conform to Section 738. Vitriified clay pipe shall conform to Section 743. Polyvinylchloride (PVC) pipe and fittings shall conform to Section 745.~~

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
- Vitriified Clay Pipe (VCP), see Section 743
- Polyvinylchloride (PVC) Pipe, see Section 745
- Ductile Iron (DI) Pipe, see Section 750

615.2.3 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.

~~Excavation of trenches shall be accomplished in accordance with Sections 601, and 603 for HDPE pipe.~~

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 bottom~~ 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 8 inches through for~~ 12 inch and smaller diameter pipe and es, ± 0.10 feet for 15 inches and larger diameter pipe.

~~For PVC pipe installation the width of trench as listed in Table 601.1 or as given in the contract documents may be increased to provide sufficient space for the installation of fittings or for compaction of the bedding. For HDPE pipe installation, the width of the trench will be per Subsection 603.2. The adjusted maximum width at the top of the pipe must be approved by the Engineer. The adjustment of the trench width to accomplish the above shall be done at no additional cost to the Contracting Agency.~~

615.3.4 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.

615.4.5 LAYING PIPE 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 ~~finished~~ trenches free from water or debris, and shall ~~be commenced~~ at the lowest point,

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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.

~~HDPE and PVC pipe and fittings shall be installed in accordance with ASTM D2321. HDPE pipe bedding shall comply with Subsection 603.4. The PVC pipe bedding shall be placed in two lifts. The first lift will be from the bottom of the trench to the spring line of the pipe. The second lift will be from the spring line to one foot above the top of pipe. Separate inspections will be required on each lift. The Contractor shall place the first lift in a manner that will insure uniform support under the haunches and proper alignment of the pipe.~~



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615.5-6 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.

615.6-7 JOINTING:

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

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

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

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

615.67.2 Water Stops: Water stops will be required when connecting PVC or HDPE pipe to concrete structures, manholes, etc. The water stop shall comply with Section 738 and will be installed per manufacturer recommendations.

615.7-8 SANITARY SEWER SERVICE TAPS:

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

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

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

The 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').

615.8-9 SANITARY SEWER CLEANOUTS:

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

615.9-10 MANHOLES:

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

615.10-11 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. Backfilling and compaction shall be done in accordance with Sections 601 and 603, for HDPE pipe.~~

615.12 JACKING PIPE:

Pipe jacking shall be in accordance with Section 602 or Section 607.

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615.11-13 INSPECTION AND TESTING:

Testing and inspection shall be in accordance with Section 611.

~~Pressure testing of force mains shall be done in accordance with Section 610.15.~~

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



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

(A) Low Pressure Air Test:

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

Test Procedure:

- ~~(1) Before testing, the pipe shall be thoroughly cleaned.~~
- ~~(2) The Contractor shall seal off the section of pipe to be tested at each manhole connection. Test plugs must be securely braced within the manholes.~~
- ~~(3) A minimum of two connecting hoses to link the air inlet test plug with an above ground test monitoring panel must be provided.

 - ~~(a) One hose is to induce air through the test plug and into the test chamber.~~
 - ~~(b) The second hose is for the purpose of monitoring the test pressure from within the enclosed pipe.~~~~
- ~~(4) UNDER NO CIRCUMSTANCES ARE WORKERS TO BE ALLOWED IN THE CONNECTING MANHOLES WHILE A PRESSURE TEST IS BEING CONDUCTED.~~
- ~~(5) Add air slowly into the test section. After an internal pressure of 4.0 psi is obtained, allow internal air temperature to stabilize.~~
- ~~(6) After stabilization period, adjust the internal air pressure to 3.5 psi, disconnect the air supply and begin timing the test.~~
- ~~(7) Refer to Table 615-1 to determine the length of time (minutes) the section under test must sustain while not losing in excess of 1 psi as monitored by the test gauge. If the section of line to be tested includes more than one pipe size, calculate the test time for each size and add the test times to arrive at the total test time for the section.~~
- ~~(8) Sections so determined to have lost 1 psi or less during the test period will have passed the leakage test. Those sections losing in excess of 1 psi during the test period will have failed the leakage test.~~
- ~~(9) Appropriate repairs must then be completed and the line retested for acceptance.~~

| TABLE 615-1 | | | |
|---|----------------------|------------------------|-----------------------|
| SANITARY SEWER AIR TEST | | | |
| Minimum Test Time for Various Pipe Sizes* | | | |
| Nominal Pipe Size, in. | T (time), min/100 ft | Nominal Pipe Size, in. | T (time), min/100 ft. |
| 3 | 0.2 | 21 | 3.0 |
| 4 | 0.3 | 24 | 3.6 |
| 6 | 0.7 | 27 | 4.2 |
| 8 | 1.2 | 30 | 4.8 |
| 10 | 1.5 | 33 | 5.4 |
| 12 | 1.8 | 36 | 6.0 |
| 15 | 2.1 | 39 | 6.6 |
| 18 | 2.4 | 42 | 7.3 |

* The time has been established using the formulas contained in ASTM C828, Appendix.

(B) Hydrostatic Test:

Exfiltration Testing (water):

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

Testing Procedure:

- ~~(1) The Contractor shall furnish all equipment for testing.~~

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

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

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

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

~~(C) Deflection Test for HDPE and PVC Pipe:~~

~~In addition to the tests prescribed above, the Contractor shall perform a deflection test on the system as directed by the Engineer. Any part of the installation which shows deflection in excess of 5% of the nominal inside diameter per Section 738 for HDPE pipe or in excess of 5% of the average inside diameter per ASTM D3034 for PVC pipe, shall be corrected.~~

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

~~(D) Closed Circuit T.V. Inspection:~~

~~The Contracting Agency reserves the right to visually inspect the interior of the sewer line using a television camera. Any defects in the pipe or construction methods revealed shall be corrected by the Contractor at no additional cost to the Contracting Agency.~~

~~The Contracting Agency will pay for the initial T.V. inspection. Any additional inspection(s) required, due to the failure of the initial inspection, shall be paid for by the Contractor.~~

615.12-14 PAVEMENT AND SURFACING REPLACEMENT:

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

615.13-15 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.

615.14-16 MEASUREMENT AND PAYMENT:

(A) Sanitary Sewer Pipe and Fittings: ~~(Vitrified clay, cast iron and other approved types of pipe.)~~

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

Payment for the various sizes and types of pipe will be made at the contract unit price ~~bid~~ 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, ~~water settling~~, compaction, sheeting and bracing, testing, and all incidental work not specifically covered in other pay items.

(B) Sanitary Sewer Service Taps:

Measurement will be the number of taps installed.

Payment will be made at the contract unit price ~~bid~~ 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,

SECTION 615

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 serviceline shall be measured and payment made as indicated for Sanitary Sewer Pipe and Fittings. If no bid item is provided for the sanitary sewer taps, the connection cost shall be included in the unit cost of the sanitary sewer pipe.

(C) Sanitary Sewer Cleanouts:

Measurement will be the number and type of cleanouts installed.

Payment will be made at the contract unit price ~~bid~~ 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

STORM DRAIN CONSTRUCTION

618.1 DESCRIPTION:

This section covers ~~rigid and flexible concrete pipe line and high density polyethylene (HDPE) 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. All pipes installed under railroad tracks shall be reinforced concrete pipe, ASTM C76, Class V and the minimum cover over all pipes shall be as specified in the railroad permit and/or special provisions. Bedding shall be in accordance with standard details.~~

618.2 MATERIALS:

~~The concrete pipe and HDPE pipe used for storm drain construction, including specials, joints, and gaskets, and testing shall be according to the following Sections, 620 or 735, 736 and 738, except as specified below or as modified by special provisions.~~

- ~~• Cast-in-Place Concrete Pipe, see Section 620~~
- ~~• Reinforced Concrete Pipe (RCP), see Section 735~~
- ~~• 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~~

~~(A) Specials: Pipe specials such as closure pieces, wyes, tees, bends, and manhole shafts shall be provided as indicated on the plans, and such 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. Drawings of specials shall be submitted to the Engineer for approval before their fabrication.~~

~~(B) Rubber Gasket Joints: When rubber gasket pipe is used, the joint shall be sealed with a continuous ring gasket made of a special composition rubber of such size and cross section as to fill the annular space provided for it. The gasket shall be the sole element depended upon to make the joint watertight, and shall have smooth surfaces, free from pits, blisters, porosity, and other imperfections.~~

~~(1) Rubber Gaskets for RCP shall be in accordance with ASTM C443 or AASHTO M-315.~~

~~(2) Rubber Gaskets for HDPE pipe shall be in accordance with Subsection 738.2.3.~~

~~(C) Water Stops: Water stops will be required when connecting HDPE pipe to concrete structures, manholes, etc. The water stop shall comply with Section 738 and will be installed per manufacturer recommendations.~~

~~(D) Cement Mortar Joints for RCP will be in accordance with Subsection 736.3.~~

618.3 CONSTRUCTION METHODS:

SECTION 618

~~Trench Excavation, bedding, backfilling, and compaction or consolidation of backfill and bedding of trenches shall be accomplished in accordance with Sections 601 for rigid pipe and 603 for flexible for HDPE pipe, except as specified below, or as modified by special provisions.~~

~~The Contractor shall over-excavate the trench and fill with select materials in accordance with standard details.~~

~~Where the cover over the top of the pipe is less than 10 feet, the maximum trench width is unrestricted. The pay width, however, for pavement replacement shall remain in accordance with Section 336. For pipe, with 10 feet or more cover, the maximum trench width shall be as required by Sections 601 and 603 for HDPE 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 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.

Trenchless installations of piping shall 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.

~~All pipe, for permit construction, shall be reinforced concrete pipe, ASTM C76 Class III or HDPE pipe in accordance with ASTM F894, AASHTO 252 or AASHTO 294. For reinforced concrete pipe, the minimum cover from the top of the pipe to the finished grade shall be 2 feet and the maximum cover shall be 12 feet. The minimum and maximum cover for HDPE pipe shall be as specified in the special provisions or the manufacturer's recommendations.~~

~~All pipes installed under railroad tracks shall be reinforced concrete pipe, ASTM C76, Class V and the minimum cover over all pipes shall be as specified in the railroad permit and/or special provisions. Bedding shall be in accordance with standard details.~~

~~The allowable water loss for irrigation lines shall not exceed 2 gallons per hour per 100 feet of pipe per inch of diameter of pipe, under a minimum test head of 1 foot above the top of the pipe at the upper end when tested in accordance with the procedures of Section 615.~~

618.4 JACKING PIPE:

Pipe jacking shall be in accordance with Section 602.

~~At locations where jacking is required, the storm drain line shall be installed by jacking to the lengths indicated on the plans, in accordance with the following. The methods and equipment used in jacking reinforced concrete pipe conduit shall be optional with the Contractor, provided that the proposed method is first approved in writing by the Engineer. Such approval, however, shall in no way relieve the Contractor of the responsibility for damages of any nature which might occur as a result of the methods used.~~

~~Only workmen experienced in the operation of jacking concrete conduit shall be used.~~

~~The driving ends of the conduit shall be properly protected and the conduit shall be driven true to alignment and grade. The deviation from true line and grade at any single point within the jacked portion shall be limited to 0.5 feet horizontal deviation from line and ± 0.2 feet vertical deviation from grade.~~

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~~Any section of conduit which may show signs of failure shall be removed and replaced with a new section of precast conduit or with a cast in place section, which in the opinion of the Engineer is adequate to carry the loads imposed upon it. In this respect it shall be understood that where pipe is specified on the drawings to be jacked into place the jacked pipe shall be reinforced concrete of the strength specified in these specifications and the design of such pipe is based upon superimposed loads and not upon loads which may be placed upon the pipe as a result of jacking operation. Any increase in pipe strength required in order to withstand jacking loads shall be the responsibility of the Contractor. The reinforcing shall be circular and of either single or double cage design.~~

~~Spacer blocks shall be placed in the inside circular space which will allow sufficient width for point mortaring when jacking is completed and to equalize pressures during jacking. Three grout holes per 8 foot section of pipe shall be made during manufacturing.~~

~~Double rubber gaskets and band type joints shall be provided for 36 inches diameter and larger pipe.~~

~~One hole shall be made on the top midway between the ends. Two additional holes, each approximately 1.5 feet from each end and approximately midway between the springline and top on opposite sides shall be made.~~

~~Where the nature of the soil, or the structure under which the conduit is being jacked is such that, there is increased danger of a cave in or damage to said structure, the method of jacking the conduit shall be as specified below.~~

~~The leading section of conduit shall be equipped with a jacking head securely anchored thereto to prevent any wobble or alignment variation during jacking operations. The length and details of the jacking head shall be subject to the written approval of the Engineer. Excavation shall be carried out entirely within the jacking head and no excavation in advance thereof will be permitted. Every effort shall be made to avoid any loss of earth outside of the jacking head. Excavated material shall be removed from the conduit as excavation progresses, and no accumulation of such material within the conduit will be permitted.~~

~~Upon completion of the jacking operations, all voids around the outside face of the conduit shall be filled by grouting through each of the previously constructed grout holes to the satisfaction of the Engineer. The grout shall be a mixture of one part cement to three parts sand and a mixture by volume.~~

~~Grouting equipment and material shall be on the job before jacking operations are started in order that grouting around the jacked conduit may be started immediately after the jacking operation. After grouting, the holes in the conduit shall be repaired to the satisfaction of the Engineer.~~

618.5 VIDEO INSPECTION AND TESTING OF NEW MAINLINE STORM DRAINS:

~~Testing and inspection shall be in accordance with Section 611.~~

~~The Contractor shall provide the Engineer with an annotated video inspection record (either VHS or DVD format) of the new mainline storm drain pipeline. The video shall clearly show all joints, seals, connecting pipes, and manholes. This video shall be provided to the Engineer, and reviewed and approved by the Engineer prior to the Contractor being allowed to place the final pavement over the storm drain line. No separate payment will be made for this inspection; the cost of the video inspection shall be included in the cost of the pipe.~~

618.6 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.

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~~(C) Jacked Pipe: Shall be made at the ground surface and shall be the number of linear feet of ground surface undisturbed by the cut and cover construction on either side of the jacked section.~~

618.7 PAYMENT:

(A) Main Line Pipe: Will be paid at the 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 unit price bid per linear foot, to the nearest foot for each 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.

~~(C) Jacked Pipe: Will be paid the same as for main line pipe.~~

- End of Section -



SECTION 101

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 | BST | Bituminous Surface Treatment |
| AAN | American Association of Nurserymen | BTB | Bituminous Treated Base |
| AB | Aggregate base | BTU | British Thermal Units |
| Aban | Abandon | BVC | Beginning of vertical curve |
| ABC | Aggregate base course | C | Centigrade or Curb |
| AC | Asphalt cement or concrete | CB | Catch Basin |
| ACB | Asphalt concrete base | CBF&C | Catch basin frame & cover |
| ACI | American Concrete Institute | CC or C/C | Center to Center |
| ACP | Asbestos cement pipe | CE | City or County Engineer |
| ACPA | American Concrete Pipe Association | Cem | Cement |
| ACWS | Asphalt concrete wearing surface | CF | Curb face |
| AFRB | Arizona Fire Rating Bureau | cfs | Cubic Feet per second |
| AGC | Associated General Contractors of America, Inc. | CIP | Cast Iron pipe |
| Agg | Aggregate | CIPP | Cast-in-place concrete pipe |
| ADOT | Arizona Department of Transportation | CL or C | Centerline |
| ADA | Americans With Disabilities Act of 1990 | CLR | Clear |
| ADEQ | Arizona Department of Environmental Quality | Cm | Centimeter |
| Ahd | Ahead | CMP | Corrugated metal pipe |
| AIA | American Institute of Architects | CO | Clean out |
| AIEE | American Institute of Electrical Engineers | Col | Column |
| AISC | American Institute of Steel Construction | Conc | Concrete |
| ANSI | American National Standards Institute | Const | Construct |
| APA | American Plywood Association | CP | Concrete pipe (non-reinforced) |
| Approx | Approximate | CTB | Cement Treated Base |
| APWA | American Public Works Association | Cu | Cubic |
| AR | Aged residue | Deg | Degree |
| ARAC | Asphalt-Rubber Asphalt Concrete | DF | Douglas Fir |
| ARIZ | Arizona Department of Transportation test method | DG | Decomposed granite |
| ARS | Arizona Revised Statutes | Dia | Diameter |
| ASCE | American Society of Civil Engineers | Dim | Dimension |
| ASME | American Society of Mechanical Engineers | DIP | Ductile Iron Pipe |
| ASTM | American Society for Testing Materials | Div | Division |
| Ave | Avenue | Dr | Drive |
| AWPA | American Wood Preservers Association | Drwg | Drawing |
| AWSC | American Welding Society Code | Dwy | Driveway |
| AWWA | American Water Works Association | Ea | Each |
| Bbl | Barrel | Ease | Easement |
| BC | Beginning of curve | E | East |
| BCR | Beginning of curb return | EC | End of curve |
| Beg | Beginning | ECR | End of curb return |
| Bk | Book or Back | El or Elv | Elevation |
| Bldv | Boulevard | Equa or Eq | Equation |
| BM | Bench Mark or Board Measure | EVC | End of vertical curve |
| Brg | Bearing | 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 |

SECTION 101

| | |
|----------|---|
| 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.

Native Material: A sound earthen material free from broken concrete, broken pavement, wood or other deleterious material with no piece larger than 4 inches.

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.

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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.

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.

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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, 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 horizontal centerline of the pipe or in box section, 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.

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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.

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 -

SECTION 601

RIGID PIPE TRENCH EXCAVATION, BACKFILLING AND COMPACTION

601.1 DESCRIPTION:

The work covered by this specification consists of furnishing all labor, equipment, appliances and materials, and performing all operations in connection with the trench excavation, backfilling and compaction of trenches for rigid pipe installations in accordance with the plans and special provisions. 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, and ductile iron pipe.

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

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

See Section 603 for trench excavation, backfilling, and compaction of flexible pipe.

See Section 620 for cast-in-place concrete 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.

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

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 | | |
|------------------------------------|--|---|
| 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 (1) |
| 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 |

(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. In some instances, the Minimum Width at Springline may be adjusted wider to assist the Contractor in obtaining the compaction. The Engineer must be satisfied with the Contractor's compaction effort, concur with the change and approve the revised distance. There shall be no additional cost to the Agency for the extra trench width.

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.

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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 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 will also furnish the Contractor with cut sheets.

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

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

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

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

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

Unauthorized excavation below the specified grade line shall be refilled at the Contractor's expense with ABC material compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T-99 and T-191 or ASTM 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 bedrock is encountered in the trench bottom, it shall be overexcavated to a minimum depth of six inches below the O.D. of the pipe. This overexcavation 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 overexcavation and the granular fill required.

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

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

601.2.7 Pavement and Concrete Cutting and Removal: Where trenches lie within the Portland cement concrete section of streets, alleys, driveways, or sidewalks, etc., such concrete shall be 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

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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.

See Detail 200-1 and 200-2 for further requirements.

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

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

The Contractor shall, prior to 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 as determined by the Engineer to prevent overloading of the pipe during backfilling operations. The cost of the bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price for the pipe.

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

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

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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](#).

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

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

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

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

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

601.4 FOUNDATION, BEDDING, HAUNCHING, BACKFILLING AND COMPACTION:

601.4.1 Foundation: The native or prepared material (when required) upon which the bedding material is placed.

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

Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702.

601.4.3 Haunching: The 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 thickness shall not exceed 2 feet 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.

Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702. With agency approval, native or CLSM may be used as an option.

601.4.4 Initial Backfill: The material placed between the springline to 12 inches above top of pipe (minimum) shall be placed in lifts the height of which shall not exceed 2 feet or that 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.

Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702. With agency approval, native or CLSM may be used as an option.

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

601.4.5 Final Backfill: The material placed above the initial backfill shall be placed in lifts the height of which shall not

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exceed 2 feet or that 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. All backfill 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 trench backfill shall be thoroughly compacted to not less than the densities in Table 601-2 when tested and determined by AASHTO T-99 and T-191 or ASTM 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. All compaction discussed within this section shall be performed within 2 percentage points of optimum moisture content unless otherwise noted in the project plans or project specifications.

The density required will depend on the Type shown on the plans and/or called for in the special provisions. Density required for each type shall comply with Table 601-2.

| 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. | 95% | 95% | 95% |
| III | Around any structures (manholes, etc.) or exposed utilities. | 95% for A.B.C., 100% for native or CLSM | | |

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

A consideration in determining the backfill Types as shown on the plans, is based on the trench widths as shown in the Contract Documents. If these trench widths increase beyond those widths referred to above and fall within the 2-foot limit of paved surfaces and other improvements due to construction exigencies, the backfill designation for that portion within the 2-foot limit of such improvements shall be Type I even though Type II backfill is shown on the plans.

601.4.7 Compaction Methods: Unless otherwise specified in the plans and/or special provisions, the backfill material shall be uniformly compacted using mechanical work methods. When allowed by the agency, consolidation by jetting is also an acceptable compaction method; however, testing requirements shall be increased (100% increase per lift). Care will be taken to prevent damage to or movement of the conduit by the compaction method or equipment used.

Water consolidation by jetting shall be accomplished with a 1 ½ inches pipe of sufficient length to reach the bottom of the lift being settled with adequate hose attached and a water pressure of not less than 30 psi. All jetting shall be accomplished 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 entirely responsible for establishing each lift depth so as to avoid floating the conduit being placed and shall make any repair or replacement at no cost to the Contracting Agency. However, for conduit larger than 24 inches I.D. the first lift shall not exceed the springline of the conduit and subsequent lifts shall not exceed 3 feet.

Flooding is not acceptable as a water consolidation method unless authorized in the specification or by a written change

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order. It will consist of the inundation of the entire lift with water and then puddle with poles or bars to insure saturation of the entire lift.

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

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

If water consolidation is not successful, mechanical compaction methods shall be used to meet the compaction requirements. Backfill material may need to be removed and replaced.

Where Type I backfill is required, water consolidation shall only be permitted when 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.

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

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 and Maricopa County 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 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 for foundation, and bedding. The bedding depth shall be six inches and backfill depth shall be one foot above the top of the facility. Compaction will 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 installation complies with those procedures and is consistent with MAG requirements.

Also, when required in the Special/Technical Provisions or requested by the Engineer, 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.

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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.

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, nor 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.

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SECTION 603

FLEXIBLE PIPE TRENCH EXCAVATION, BACKFILLING AND COMPACTION

603.1 DESCRIPTION:

The work covered by this specification consists of furnishing all plant, labor, equipment, appliances and materials, and performing all operations in connection with the trench excavation, backfilling and compaction for a single flexible pipe installation in accordance with the plans and special provisions. Pipe materials that are considered to be flexible include thermoplastic pipes and corrugated metal pipe and arches. See Section [601](#) for rigid pipe trench excavation, backfilling and compaction.

For the purpose of this specification, flexible pipe shall include 8 inches through 120 inches nominal diameter.

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

See Section [615](#) for sewer line construction procedures.

See Section 618 for storm drain construction procedures.

HDPE pipe and fittings shall conform to Section [738](#). SRPE pipe and fittings shall conform to Section [739](#). Polypropylene pipe and fittings shall conform to Section 740. PVC pipe and fittings shall conform to Section [745](#). Corrugated metal pipe and arches shall conform to Section 760.

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.

See Section 602 for trenchless installations.

603.2 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.

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

603.2.2 Trench Widths: Trenches for flexible pipe shall conform to the dimensions in Table [603-1](#), unless otherwise specified in the special provisions, indicated on the plans, and/or approved by the Engineer.

| Table 603-1 | | |
|--------------------------------------|---|--|
| FLEXIBLE PIPE – TRENCH WIDTHS | | |
| Size of Pipe (Nom. Dia.) | Maximum Width At Top Of Pipe Greater Than O.D. Of Barrel | Minimum Width At Springline Each Side of Pipe (1) |
| Less than 18 inches | 20 inches | 8 inches |
| 18 inches to 24 inches inclusive | 23 inches | 9.5 inches |
| 27 inches to 36 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 |

(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. In some instances, the Minimum Width at springline shall be adjusted wider to assist the Contractor in obtaining the

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compaction. The Engineer must be satisfied with the Contractor's compaction effort, concur with the change and approve the revised distance. There shall be no additional cost to the Agency for the extra trench width.

For multiple pipe installations in a single trench, the Engineer shall provide details on the plans or in the Special/Technical Provisions as to the layout, pipe configuration, distances between pipes and trench walls, the type of backfill and bedding materials, etc.

The width of the trench shall not be greater than the maximum indicated in Table [603-1](#), 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 [603-1](#) is exceeded at the top of the pipe the Contractor shall provide, at no additional cost to the Contracting Agency, the necessary additional load bearing capacity by means of initial backfill, having a higher bedding factor than that specified, higher strength pipe, a concrete cradle, cap or encasement, or by other means approved in writing by the Engineer. Where safety or undermining situations occur, a CLSM backfill may be used as needed.

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

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

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

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

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

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

Unauthorized excavation below the specified grade line shall be refilled at the Contractor's expense with ABC material compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T-99 and T-191 or ASTM 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 bedrock is encountered in the trench bottom, it shall be overexcavated to a minimum depth of six inches below the O.D. of the pipe. This overexcavation 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 overexcavation and the granular fill required.

603.2.6 Excavation for Manholes, Valves, Inlets, Catch Basins and Other Accessories: The Contractor may excavate to place the concrete structure directly against the excavated surface, provided that the faces of the excavation are firm and unyielding and are at all points outside the structure lines shown on the plans. If the native material is such that it will not stand without sloughing or if precast structures are used, the Contractor shall overexcavate to place the structure and this overexcavation shall be backfilled with the same material required for the adjoining pipe line trench and compacted per Table [603-2](#).

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

603.2.7 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.

See Detail 200-1 and 200-2 for further requirements.

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

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

The Contractor shall, prior to 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.

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

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

603.2.10 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 separate location, the 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.

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603.3 PROTECTION OF EXISTING UTILITIES:

603.3.1 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](#).

603.3.2 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.

603.3.3 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.

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

603.4 FOUNDATION, BEDDING, HAUNCHING, BACKFILLING AND COMPACTION:

603.4.1 Foundation: The native or prepared material (when required) upon which the bedding material is placed.

603.4.2 Bedding: The material upon which the conduit or structure is to be placed shall be accurately finished to the grade or dimensions shown on the plans or as directed by the Engineer. The bottom portion of the trench shall be brought to grade so that the conduit or structure will be continuously in contact with the material on which it is being placed. If rocky or unsuitable soil is encountered, Subsection [603.2.5](#) applies.

Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702.

603.4.3 Haunching: The 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 thickness shall not exceed 1 foot 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 603.4.6. The moisture content shall be such that the specified compaction can be obtained.

Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702. With agency approval, native or CLSM may be used as an option.

603.4.4 Initial Backfill: The material placed between the springline to 12 inches above top of pipe (minimum) shall be

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placed in lifts the height of which shall not exceed 1 foot or that which can be effectively compacted depending on the type of material, type of equipment and methods used. Extreme care will be taken to prevent damage to or movement of the conduit by the compaction equipment. Compaction requirements shall be per Section 603.4.6. The moisture content shall be such that the specified compaction can be obtained.

Unless otherwise specified in the project plans or project specifications, the minimum material type shall be A.B.C. per Section 702. With agency approval, native or CLSM may be used as an option.

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

603.4.5 Final Backfill: The material placed above the initial backfill shall be placed in lifts the height of which shall not exceed that which can be effectively compacted depending on the type of material, type of equipment and methods used, and under no circumstances shall exceed 4 feet. Compaction requirements shall be per Section 601.4.6. All backfill 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.

603.4.6 Compaction Densities: Unless otherwise provided in the plans and/or special provisions, the trench backfill shall be thoroughly compacted to not less than the densities in Table 603-2 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 will be used for rock correction. All compaction discussed within this section shall be performed within 2 percentage points of optimum moisture content unless otherwise noted in the project plans or project specifications.

The density required will depend on the Type shown on the plans and/or called for in the special provisions. Density required for each type shall comply with Table 603-2.

| TABLE 603-2 | | | | |
|--|--|---|--|--|
| 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. | 95% | 95% | 95% |
| III | Around any structures (manholes, etc.) or exposed utilities. | 95% for A.B.C., 100% for native or CLSM | | |

Note: The type required will generally be shown on the plans and the plans will govern. Where no type is shown on the plans, the type shall comply with Table 603-2.

A consideration in determining the backfill Types as shown on the plans, is based on the trench widths as shown in the Contract Documents. If these trench widths increase beyond those widths referred to above and fall within the 2-foot limit of paved surfaces and other improvements due to construction exigencies, the backfill designation for that portion within the 2-foot limit of such improvements shall be Type I even though Type II backfill is shown on the plans.

603.4.7 Compaction Methods: Unless otherwise specified in the plans and/or special provisions, the backfill material shall be uniformly compacted using mechanical work methods. When allowed by the agency, consolidation by jetting is also an acceptable compaction method; however, testing requirements shall be increased (100% increase per lift). Care will be taken to prevent damage to or movement of the conduit by the compaction method or equipment used.

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Water consolidation by jetting shall be accomplished with a 1 ½ inches pipe of sufficient length to reach the bottom of the lift being settled with adequate hose attached and a water pressure of not less than 30 psi. All jetting shall be accomplished 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 entirely responsible for establishing each lift depth so as to avoid floating the conduit being placed and shall make any repair or replacement at no cost to the Contracting Agency. However, for conduit larger than 24 inches I.D. the first lift shall not exceed the springline of the conduit and subsequent lifts shall not exceed 3 feet.

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

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

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

If water consolidation is not successful, mechanical compaction methods shall be used to meet the compaction requirements. Backfill material may need to be removed and replaced. No exception shall be made for construction within new developments.

Where Type I backfill is required, water consolidation shall only be permitted when the material in which the trench is located and the backfill are both granular material.

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

603.4.9 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 and Maricopa County right-of-way outside the limits of the Contracting Agency shall be accomplished in accordance with their permit and/or specifications.

603.4.10 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.

603.4.11 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 for foundation, and bedding. The bedding depth shall be six inches and backfill depth shall be one foot above the top of the facility. Compaction will be in accordance with Section [603](#).

603.5 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 installation complies with those procedures and is consistent with MAG requirements.

Also, when required in the Special/Technical Provisions or requested by the Engineer, 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

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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.



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603.6 PAVEMENT REPLACEMENT AND SURFACE RESTORATION:

603.6.1 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.

603.6.2 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](#).

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

603.6.4 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.

603.7 PAYMENT:

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

- 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, see Section 745
- Ductile Iron (DI) Pipe, 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.

SECTION 615

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 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 pipe to concrete structures, manholes, etc. The water stop shall comply with Section [738](#) and will be installed per manufacturer recommendations.

615.8 SANITARY SEWER SERVICE TAPS:

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

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 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 JACKING PIPE:

Pipe jacking shall be in accordance with Section 602 or Section 607.

SECTION 615

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 Taps:

Measurement will be the number of taps installed.

Payment 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 serviceline shall be measured and payment made as indicated for Sanitary Sewer Pipe and Fittings. If no bid item is provided for the sanitary sewer taps, the connection cost 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**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, see Section 620
- Reinforced Concrete Pipe (RCP), see Section 735
- 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

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.

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 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.

Trenchless installations of piping shall 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 INSPECTION AND TESTING:

Testing and inspection shall be in accordance with Section 611.

SECTION 618

618.6 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.

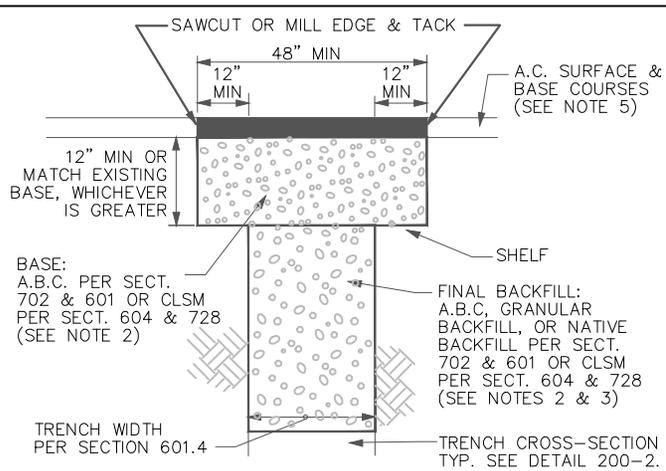
(B) Connecting Pipe: Shall be the number of linear feet of pipe installed, as measured along the pipe axis from a main line pipe, or a manhole, or a catch basin to a catch basin, or a plugged end, and shall include the portions of the connecting pipe embedded in the above structures.

618.7 PAYMENT:

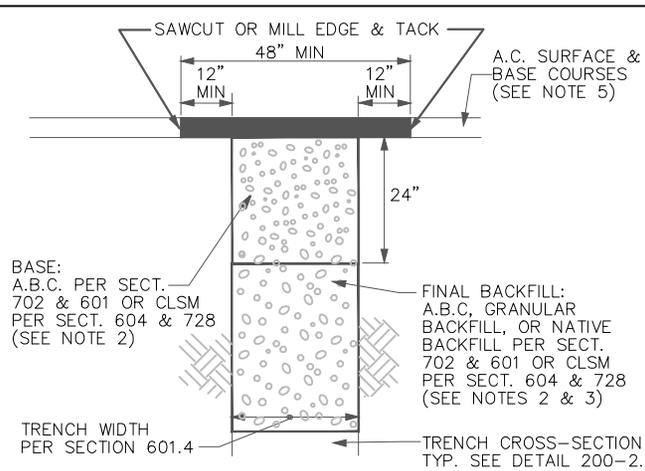
(A) Main Line Pipe: Will be paid at the unit price bid per linear foot, to the nearest foot, for each size and type of pipe and shall be compensation in full for furnishing and installing the type of pipe as specified and as shown on the plans including removal of obstructions, excavation, bedding, backfilling,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

(B) Connecting Pipe: Will be paid at the unit price bid per linear foot, to the nearest foot for each 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.

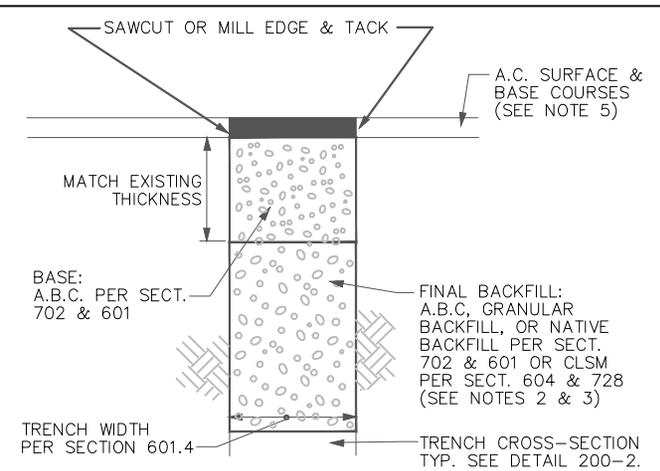
- End of Section -



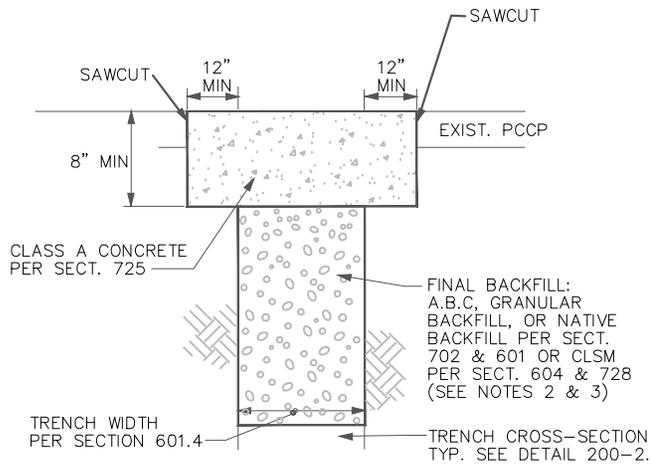
"T TOP" TRENCH REPAIR



TYPE "A" TRENCH REPAIR

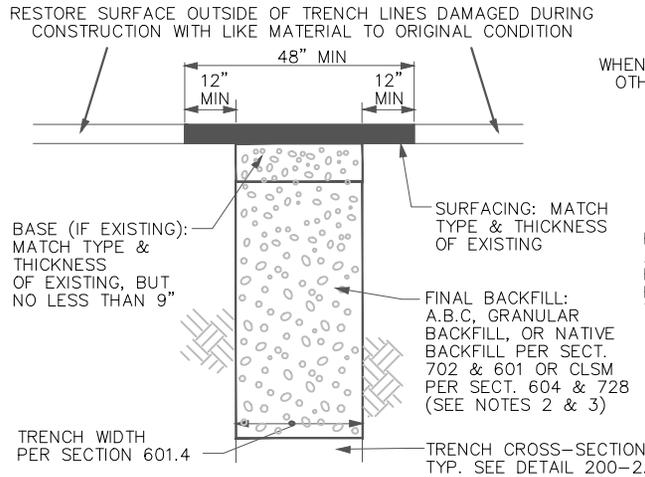


TYPE "B" TRENCH REPAIR



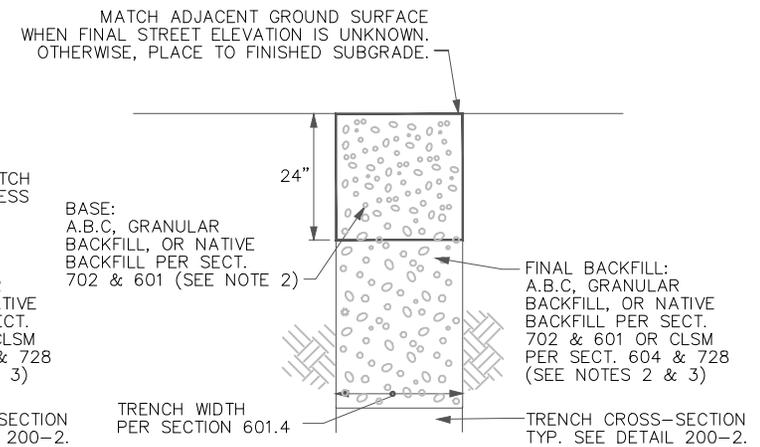
TYPE "C" TRENCH REPAIR

(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 BEDDING 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 OR SECTION 603.
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

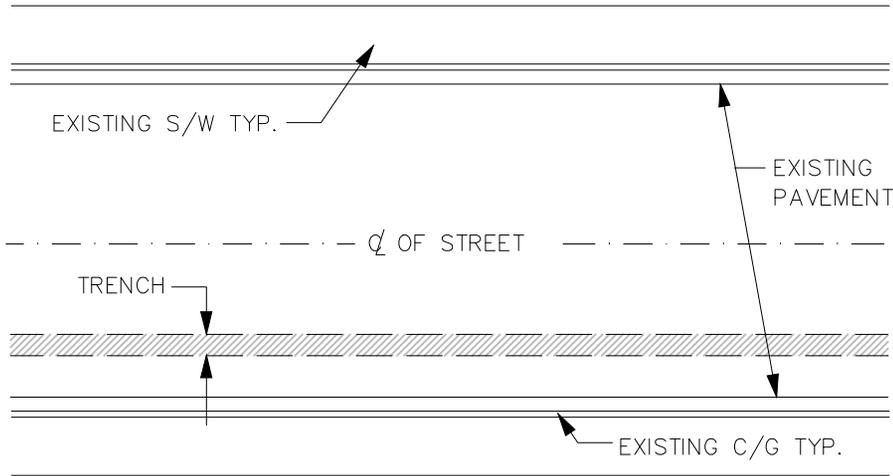
BACKFILL, PAVEMENT
AND SURFACE REPLACEMENT

PROPOSED
01-01-2015

DETAIL NO.
200-1

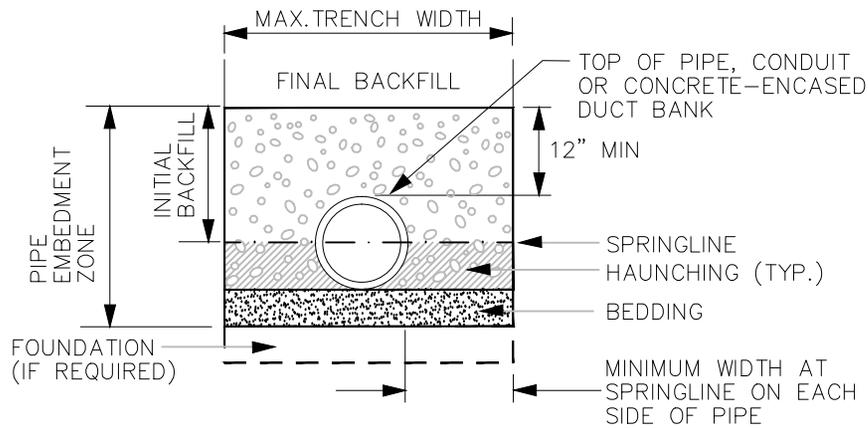
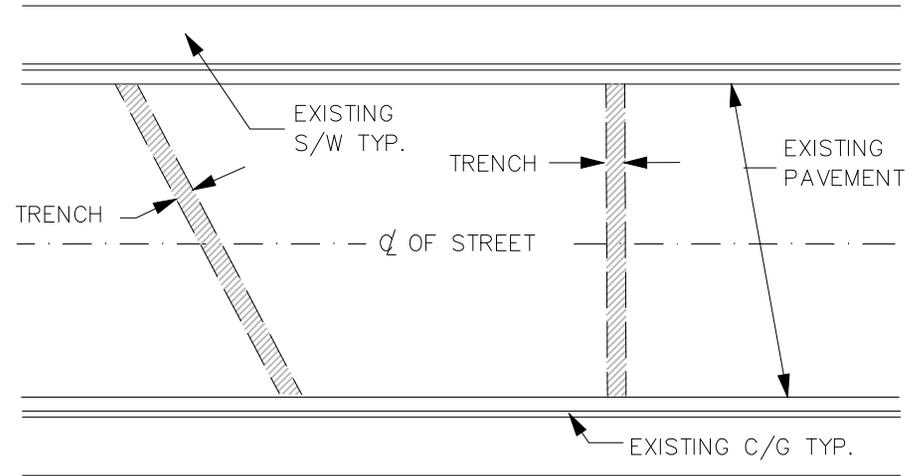
LONGITUDINAL TRENCH

(TRENCH IN PAVEMENT PARALLEL TO TRAFFIC)

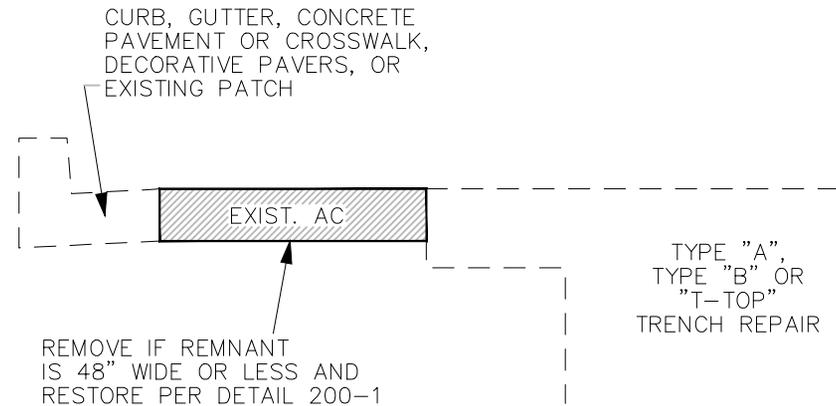


TRANSVERSE TRENCH

(TRENCH IN PAVEMENT NOT PARALLEL TO TRAFFIC)



TRENCH CROSS-SECTION DETAIL



REMNANT PAVEMENT REMOVAL

NOTES:

1. SEE SECTION 601 FOR RIGID PIPE INSTALLATION AND 603 FOR FLEXIBLE PIPE INSTALLATION.
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



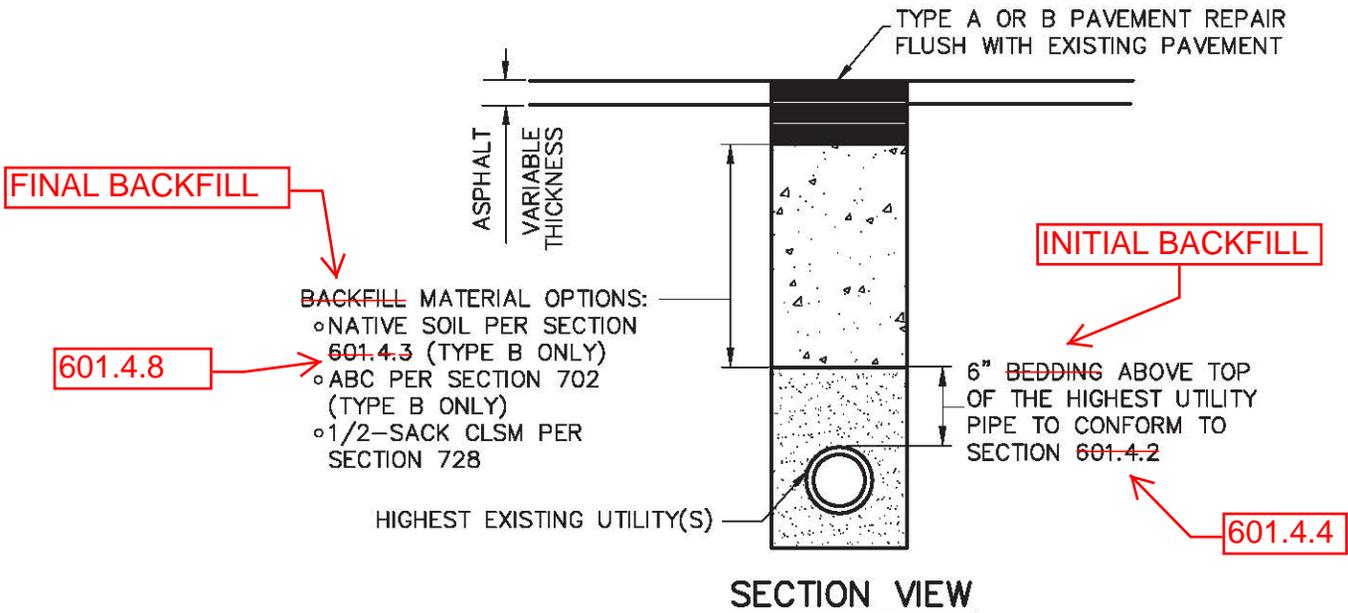
STANDARD DETAIL
ENGLISH

BACKFILL, PAVEMENT AND
SURFACE REPLACEMENT

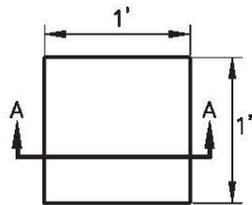
PROPOSED
01-01-2015

DETAIL NO.
200-2

DRAFT 3-12-2014

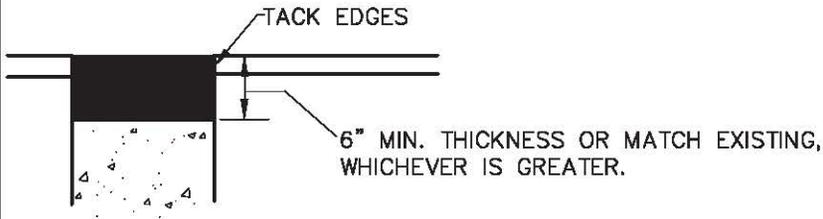


TYPE A PAVEMENT REPAIR



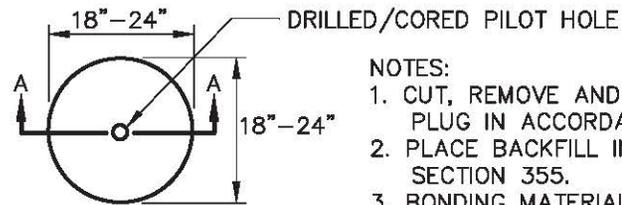
PLAN VIEW

- 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.



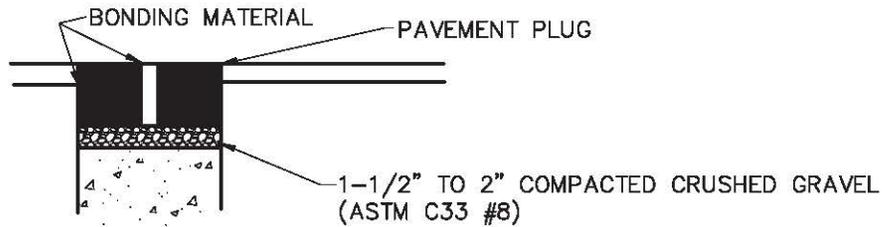
SECTION A-A

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

From: [Robert Herz - MCDOTX](#)
To: ["Warren.White@chandleraz.gov"](mailto:Warren.White@chandleraz.gov)
Cc: [Gordon Tyus](#)
Subject: RE: MAG Case 13-15 Comments regarding file: 101 8-19-14.docx
Date: Tuesday, August 26, 2014 1:34:29 PM
Attachments: [AASHTO Glossary - Springline.pdf](#)

Two comments regarding file: 101 8-19-14.docx, Section 101.2 DEFINITIONS AND TERMS:

1. Native Material – the definition provided is a material requirement when native material is used for backfill, it does not define Native Material. Native Material should be removed from section 101.2.
2. Springline – The present definition needs to be revised to be valid for pipe arches. A simplified definition could read: *The vertical location having the maximum horizontal dimension or in box sections, the mid-height of the vertical wall.* If a more technical definition is desired see the definition provided in the AASHTO glossary (attached file).

This completes my review of the many sections in your case. I did not review section 603 since I believe the flexible pipe requirements should be incorporated into section 601 as previously sent and then delete section 603 from the specifications.

From: Warren.White@chandleraz.gov [mailto:Warren.White@chandleraz.gov]
Sent: Tuesday, August 19, 2014 2:10 PM
To: Robert Herz - MCDOTX
Subject: Re: MAG Case 13-15 Comments

Hi Bob,

Here are updates to 101, 601, 615. I believe I incorporated most all of your comments. I thought more about those links to the other sections and I agree that we don't need them except for the ones kept. So, I will need to apply those same updates made in 601 to 603. Have you looked at 603 yet?

(See attached file: 601 8-19-14.docx)(See attached file: 615 8-19-14.docx)(See attached file: 101 8-19-14.docx)

Regards,

Warren

▼ Robert Herz - MCDOTX ---08/14/2014 05:13:42 PM---Attached are review comment files.

From: Robert Herz - MCDOTX <rherz@mail.maricopa.gov>
To: ["Warren.White@chandleraz.gov"](mailto:Warren.White@chandleraz.gov) <Warren.White@chandleraz.gov>
Date: 08/14/2014 05:13 PM
Subject: MAG Case 13-15 Comments

Attached are review comment files.[attachment "MAG Case 13-15 Section 101 Review Comments 2014-08-13.docx" deleted by Warren White/COC] [attachment "MAG Case 13-15 Section 615 Review Comments 2014-08-13.docx" deleted by Warren White/COC] [attachment "MAG Case 13-15 Section 601 Review Comments 2014-08-13.docx"

LSL, called a single specification limit; or to USL and LSL together, called double specification limits.

Specifications The compilation of provisions and requirements for the performance of prescribed work.

Specific Energy The energy contained in a stream of water, expressed in terms of head, referred to the bed of a stream. It is equal to the mean depth of water plus the velocity head of the mean velocity.

Specified Strength of Concrete The nominal compressive strength of concrete specified for the work and assumed for design and analysis of new structures.

Speed The rate of vehicular movement, generally expressed in kilometers per hour (miles per hour).

Speed-Change Lane An auxiliary lane, including tapered areas, primarily for the acceleration or deceleration of vehicles entering or leaving the through traveled way.

Speed Limit The maximum (or minimum) speed applicable to a section of highway as established by law.

Speed Zone A section of highway with a speed limit that is established by law but that might be different from a legislatively specified statutory speed limit.

Spike A 19-mm (3/4-in.) square, 178-mm (7-in.) long metal device used to secure rails to ties.

Spillthrough Abutment A bridge abutment having a fill slope on the channel side. The term originally referred to the "spillthrough" of fill at an open abutment, but is now applied to any abutment having such a slope.

Spillway A passage for spilling surplus water; a wasteway.

Spiral Reinforcement Continuously wound reinforcement in the form of a cylindrical helix.

Split Run Two operating assignments separated by a period of time during which the driver is unassigned by the transit operator. Also referred to as Swing Run.

Split Sample A sample that has been divided into two or more portions representing the same material. Split samples are sometimes taken to verify the acceptability of an operator's test equipment and procedure. This is possible because the variability calculated from differences in split test results is comprised solely of testing variability.

Splitter Island The raised island at each two-way leg between entering vehicles and exiting vehicles, designed primarily to deflect entering traffic.

Splitting Tensile Strength The tensile strength of concrete that is determined by a splitting test made in accordance with AASHTO T 198 (ASTM C 496).

Split Web A longitudinal or diagonal transverse crack in the web of a rail.

Spoil The material removed from an excavation or by dredging.

Spread 1) The accumulated flow in and next to the roadway gutter. 2) The transverse encroachment of stormwater onto a street.

Spread Beam A beam not in physical contact, carrying a cast-in-place concrete deck.

Spread Footing A generally rectangular or square prism of concrete that distributes the load of the vertical support to the subgrade.

Spread Time The time between two pieces of work in a run generally between the start of the morning and the end of the afternoon or evening periods.

Springline The points on the internal surface of the transverse cross section of a pipe intersected by the line of maximum horizontal dimension; or in box sections, the mid-height of the internal vertical wall.

Spur Dike A projecting dike usually located on the upstream side of a bridge, projecting out from the approach roadway embankment, reducing erosion caused by water flowing along the upstream side of the embankment. Also referred to as Groin or Guide Bank.

Stabilization Modification of soils or aggregates by incorporating materials that increase load bearing capacity, firmness, and resistance to weathering or displacement.

Stable Channel A condition that exists when a channel has a bed slope and cross section that allow it to transport the water and sediment delivered from the upstream watershed without significant aggradation, deposition, or bank erosion.

Staff Gauge 1) A vertical board or structure with a graduated scale for measuring the depth of a river in millimeters. 2) A graduated scale, on such things as a staff, plank, metal-plate pier, or wall, by which the elevation of the water surface may be read.

Stage 1) Height of water surface above a specified datum. 2) Water surface elevation of a channel with respect to a reference elevation. 3) The elevation of a water surface above its minimum; also above or below an established low-water plane; hence, above or below any datum of reference; gauge height. The height of a water surface above an established datum plane.

Stall Torque The motor torque available at the stall condition immediately following cessation of motor shaft rotation.

Standard Instrument Departure (SID) A preplanned IFR air traffic control departure

procedure providing transition from the terminal to the enroute airway structure.

Standard Plans Drawings approved for repetitive use, showing details to be used where appropriate.

Standard Project Flood A totally theoretical or deterministic flood. The magnitude of the flood is computed by taking the precipitation from the greatest storm in the hydrologic region and transposing it to the stream basin and hydraulically routing it through the point of interest.

Standard Project Storm (SPS) The relationship of precipitation versus time that is intended to be reasonably characteristic of large storms that have occurred or could occur in the locality of concern.

Standard Rail 1) A rail track gauge that is 1.44 m 94 ft 8.5 in.) wide. 2) A 12-m (39-ft) section of rail.

Standard Sieve Screens used in aggregate gradation analysis in which the size of the opening is successively halved as the sizes decrease.

Standard Specifications A book of specifications approved for general application and repetitive use. The items in the standard specifications relate to or illustrate the method and manner of performing the work or describe the qualities and quantities of materials and labor to be furnished under the contract.

Standard Terminal Arrival Route (STAR) A preplanned IFR air traffic control procedure providing transition from en route to terminal airway structure. Also referred to as Profile Descent.

Standard Urban Bus A motor bus designed to accommodate the maximum number of passengers both seated and standing for short-ride, frequent-stop service and to have quick-opening entrance and exit service doors.

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

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 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 INSTILLATION INSPECTION AND TESTING:

~~Post instillation 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 -

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, Pozzolan 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.

Calibration of Cement and Aggregate Scales: The pipe manufacturer shall make whatever alterations are necessary to his equipment to enable the Contracting Agency's Sealer or State Inspector of Weights and Measures to check, calibrate, and seal the aggregate and cement scales used in the pipe production.

735.6 CURING OF PIPE:

(A) Steam Curing: The manufacturer shall provide adequate steam plant, piping, enclosures, and other facilities for curing the pipe. The enclosures shall be such that the temperature is maintained continuously between 110 and 150°F.

(B) Curing of the pipe shall not commence until the concrete has attained its initial set, but in any event not sooner than 1 hour and no later than 8 hours after placing of the concrete. Rate of rise of temperature shall not exceed 30°F per hour.

(C) Water Curing: The pipe shall be kept moist during daylight hours. The pipe, including the ends, shall be covered with burlap for the first 3 days, except that, if the pipe is kept constantly and completely wet with fog sprays during the daylight hours, the burlap covering may be omitted. If the manufacturer fails to proceed immediately with the required water curing, the surfaces of the concrete except joint surfaces that are to be grouted shall be sealed with an approved white pigmented sealing compound in accordance with Section [726](#).

735.7 TESTS AND ACCEPTANCE:

(A) Basis of Acceptance: The basis of acceptance for the reinforced concrete pipe shall be in accordance with ASTM C76, ASTM C506, or ASTM C507, as applicable, including the method stated in the special provision and as amended herein. However, the purchaser may, at his option, make concrete cylinder tests for the purpose of determining release dates for shipment of the pipe and for his information in regard to general quality of the concrete.

(B) Segregation of Material: The slump of the concrete mix shall not exceed 4 inches so as to preclude excessive segregation of the materials used and shall be proportioned so that the result shall be a homogeneous concrete mixture of such quality that the pipe will conform to the tests and design requirements of these specifications.

(C) A pipe has failed the D-load test when the opening crack exceeds .01 inch for a distance of 1 foot when measured at close intervals. These measurements are taken within the 1 foot measured span only when the crack line is more or less parallel to the axis of the pipe, as it is obvious that where the crack deviates substantially from parallel, and approaches a direction normal to the axis, that the edges of the crack tend to slip past each other, instead of opening up under load. The intent of the test is to measure the crack opening under stress.

(D) Porous or honeycomb concrete areas 6 inches or less in diameter may be removed and repaired. Pipe having defects or repairs greater than 6 inches in diameter will not be accepted.

(E) Any crack exceeding 1 foot in length that goes completely through the pipe, is not considered acceptable whether repaired or not, except that a single end crack that does not exceed the depth of the joint as measured from the end to the inside shoulder is acceptable.

(F) Any crack that is .01 inch in width for one-sixteenth inch in depth or deeper, for a length of 1 foot or more and continues as a hairline crack down to the reinforcing steel for over 1/2 the length of the pipe is not considered acceptable whether repaired or not.

(G) A single continuous hairline crack which does not extend to the reinforcing steel and not in excess of .01 inch in width for a distance of 1 foot is acceptable without repair. This type of crack, longer than 1 foot shall be repaired.

(H) Repairs shall be made by filling the defect with epoxy under pressure or by chipping out a V-Section to the full depth of the defect and repairing with an approved patching compound. The composition of the patching compound shall be furnished to the Engineer for approval.

(I) The words regarding acceptability and repair ability in the above paragraphs shall also apply when the crack occurs after loading of the pipe in the trench with backfill. Cracks wider than .01 inch shall be assumed to indicate

overstress of the steel. In such case, the defective portion of the installation shall be replaced or repaired in a manner acceptable to the Engineer. After structural repairs are completed, the remaining cracks shall be filled as required above. All corrective measures shall be at the expense of the Contractor.

(J) Blisters: All pipe joints having blisters involving less than 1/4 the interior surface area shall be repaired by removing all loose material and exposing all hollow area and replacing with fresh concrete properly bonded, with an acceptable bonding agent, and curing the repair with membrane coating. Blisters with larger areas are not considered to be repairable or acceptable.

(K) Painting of pipe, or portion of pipe, with grout to cover defects, minor or major, will not be permitted until approved by the Engineer.

(L) Where the modified or special design method, under the ASTM Standard is elected, acceptance on the basis of material tests and inspection of manufactured pipe for defects and imperfections shall be as stated in the ASTM Standard, and as amended herein. However, one joint of each size and D-load shall be selected by the Engineer for test purposes, and shall be tested for strength by the 3 edge bearing method, ASTM C497, with the results being used for confirmation of the submitted design for this D-load. If the pipe section tested fails in compression or shear before reaching the D-load specified, the test shall be considered a failure. Additional sections of the same diameter size and class shall be tested as specified above until the load requirements are met for the D-load strength. This test procedure shall be accomplished only once per manufacture regardless of the number of contractors he supplies. Placing of reinforcing steel in the test section of pipe to control shear cracks will not be permitted.

Requirements regarding defects shall be the same as stated above for standard pipe.

Concrete test requirements specified under compression tests of the ASTM Standard shall be amended in part to read as follows: "The average of any 5 consecutive strength tests of the laboratory-cured specimens shall be equal to or greater than the specified strength set forth in the design strength requirements table for the type and class of pipe being produced, and not more than 20 percent of the strength tests shall have values less than the specified strength. If more than 20 percent have values less than the specified strength, the lot represented shall be considered to be defective and not acceptable. In no case shall any cylinder tested fall below 80 percent of the specified design strength. If anyone cylinder falls below 80 percent of the specified design strength, then the entire production represented by that cylinder will not be accepted for purchase by the Contracting Agency unless the Contractor can demonstrate by coring to the satisfaction of the Engineer, that the cylinder in question is not representative of the entire production, or is representative of only a portion of the entire production."

During the fabrication of the pipe, concrete cylinders shall be made from a representative sample of the concrete. Concrete cylinders and slump tests shall be made by the Engineer or under his direct supervision. A set of cylinders shall consist of five. A minimum of one set shall be made for each day's production.

In vibrated and spun pipe, where the slump of the concrete approaches 0, the cylinders shall be made as follows:

Fill the cylinder can in 3 equal layers. Each layer shall be vibrated and assisted by rodding or other mechanical contrivance simultaneously until the moisture comes to the surface. Care shall be taken that the material is not over-vibrated which will cause segregation. When the moisture rises to the surface of the third layer, it is struck off and leveled. The cap is put on the cylinder and it is marked for identification. It shall then be steam cured in the same manner as the pipe, at the conclusion of which, the cylinders shall be brought into the laboratory for standard moist curing until the prescribed time for the compressive test.

The cylinders shall be made according to ASTM C31 where the pipe is manufactured with concrete that has enough slump for the material to be hand rodded. For reinforced concrete pipe made by the centrifugal method, the manufacturer may substitute centrifugally cast test cylinders for standard test cylinders. Centrifugally cast cylinders shall be made in accordance with AWWA C302 and cured in the same manner as normal test cylinders, except that the net area of the hollow cylinder will be used to determine the compressive strength.

735.9 SANITARY SEWER PIPE:

In addition to the above, sewer pipe shall meet the requirements of ASTM C76, reinforced concrete pipe having O-ring Rubber Gasket Joints with an interior lining of plastic liner plate in accordance with Section [741](#).

(A) Pipe Design: The wall thickness and the amount of circumferential reinforcement shall not be less than that required for the D-load indicated on the plans and required by the specifications. The calculations for wall thickness and amount of steel area per foot of pipe, having concrete lining, shall be for a pipe 2 inches larger in internal diameter than that specified on the plans. The additional concrete lining shall not be considered in the calculation for the area of steel required, nor in any of the load calculations.

D-load class of pipe and the date poured shall be plainly marked inside each pipe section. Specific approval must be obtained, prior to submitting a bid; to decrease the cover over the reinforcing steel at the joint should the steel interfere with the rubber gasket in the groove at the spigot end.

(B) Pipe Construction: Tamped or packer head pipe will not be allowed. Pipe having concrete lining shall have the internal diameters indicated on the plans, measured to the inside of the additional 1 inch of covering. The various sizes of pipe shall be centrifugally spun. Pipe having plastic liner plate shall be vibrocast to 1/2 inch tolerance to match the unlined pipe of the D-load indicated on the plans.

(C) Test and Acceptance: In addition to the statements above, any crack that goes completely through the pipe, regardless of length of crack is not considered acceptable whether repaired or not, except that a single end crack that does not exceed the depth of the joint as measured from the end to the inside shoulder is acceptable.

735.10 ACCEPTANCE MARK:

The Engineer may, at the place of manufacturer, indicate his acceptance of the pipe for delivery to the job by marking the pipe with the Contracting Agency's mark. Such acceptance, however, shall not be considered a final acceptance.

If the pipe is subsequently rejected, the mark placed thereon by the Engineer shall be defaced.

- End of Section -



CITY OF BUCKEYE
Engineering Department

Case Number: 13-21

Date: 07-25-13

To: MAG Specifications and Details Committee

From: Craig Sharp

RE: Section 742 Precast Manhole Bases

Purpose: Creating a new section and details for precast manhole bases and modifying the existing cast in place manhole detail No. 420-1, 420-2, 421 and 422.

Revisions:

Creating a new section and details for precast manhole bases and modifying existing details.

Updated 08-25-14

SECTION 742

PRECAST MANHOLE

742.1 GENERAL:

This specification covers requirements for precast manhole sections. All precast manhole manufacturers shall be NPCA (National Precast Association) certified and shall provide all NPCA certifications upon request. Loading criteria for the precast manholes shall meet or exceed the AASHTO H20 loading requirements. All precast manhole risers shall be monolithically cast to ensure water tightness and have a certified structural design and the manhole shall be cast in a fashion to achieve water tightness. This shall include a monolithic cast manhole or a multi section cast manhole which also shall have a certified structural design.

742.2 MATERIALS:

742.2.1 Concrete Materials: Concrete materials shall conform to the requirements of Section 725 and Table 725-1 for Class AA.

742.2.2 Precast Sections: Precast sections shall conform to ASTM C478, AASHTO M199. The design shall be in accordance with ACI 318 and ASTM C890 using traffic load A-16 (HS20-44).

742.2.3 Joints and Connections: Details of proposed joints and connections shall be submitted to the engineer for approval and shall conform to ASTM C990, C993, or C425 as applicable.

742.3 MANHOLE PENETRATIONS:

The location of penetrations shall be determined by the plans and specifications. Manhole penetrations may be formed or cut out. Cut outs of the precast base shall be done using a mechanical hole saw. After the core is removed from the casting the precaster shall coat all exposed reinforcing with a corrosion inhibiting epoxy suitable for end use application. The thickness of the epoxy shall be per the epoxy manufacturer's recommendation. Knock outs shall be formed in the location noted on the plans or specifications.

742.4 REINFORCING

Reinforcing steel shall meet the following specifications:

- Bars ASTM A615 or A706
- Wire and wire fabric A1064

Design of the reinforcing shall be in accordance with ACI 318 and ASTM C890

742.5 GASKETS

A flexible pipe to manhole connector shall be used whenever a pipe penetrates into a precast concrete manhole or structure. The design of the connector shall provide a flexible, watertight seal between the pipe and the concrete. The connector shall assure that a seal is made between the structure wall and the pipe by:

- Casting the connector integrally with the structure wall during the manufacturing process in a manner that will not pull out during pipe coupling.
- compressing the connector against the inside circumference of the structure by means of wedge or toggle style connection, expansion ring or other means approved by the engineer.

The connector shall be made from materials that conform to the physical and chemical requirements in ASTM C923 or C425 as applicable.

The connector shall be sized specifically for the type of pipe being used and shall be installed in accordance with the recommendations of the manufacturer.

The connection hardware shall be constructed of type 316 stainless steel meeting ASTM A480. The hardware shall ensure a water tight connection between the concrete and the pipe material and shall provide an adequate seal enough to withstand the negative air pressure test per ASTM C-1244.

742.6 LIFTING POINTS

Lifting points shall be designed and evaluated by a registered professional engineer and have a minimum safety factor of 4. There shall be a minimum of 2 lifting points on every precast manhole base. After base installation, the lifting holes shall be thoroughly packed with a pre-packaged non-shrink grout. Bent reinforcing steel bars shall not be used as lifting devices. Through lifting holes will not be allowed.

742.7 IMPERFECTIONS

742.7.1 Imperfections: Any imperfections which in the opinion of the engineer may adversely affect the performance of the precast section shall be cause for rejection.

TYPE 'A' TOP
(PRECAST ECCENTRIC CONICAL TOP MANHOLE)

24" OR 30" FRAME
& COVER PER DET.
423, 424, 425 (TYP)

24" TO 26-3/4" ON
48" MANHOLE
30" ON 60" MANHOLE
(TYP)

OVERALL
ADJUSTMENT RING
HEIGHT SHALL BE
12" MIN TO 18"
MAX (TYP)

24" MAX
ADJUSTING RINGS
PER DETAIL 422
(TYP)

30" MIN.
36" MAX.

USE BUTYL RUBBER
MASTIC JOINT SEALANT ON
ALL JOINTS; EXCEPT TOP
ADJUSTMENT RINGS

PRECAST RISER SECTIONS
AS REQUIRED

CONCRETE SHELF SHALL BE
PER DETAIL 420-3 SECTION
A-A

DIAMETER
PER PLAN

CEMENT MORTAR

KEYWAY PRESSED INTO BASE
TO MATCH PRECAST RISER

4" TYP.

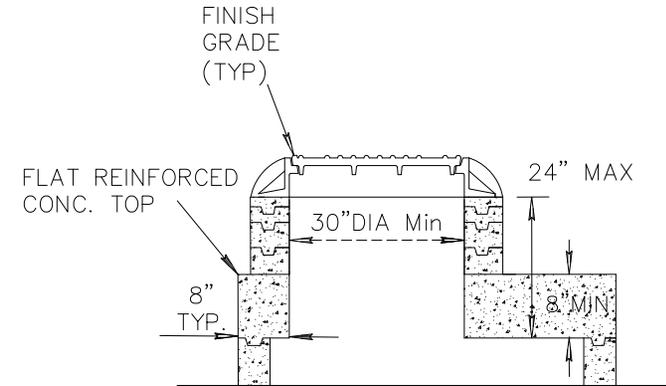
3" MIN.
5" MAX.

FLOW

8" IF MANHOLE IS 13' OR LESS
12" IF MANHOLE IS OVER 13'

CLASS "A" CONCRETE
BASE PER SECTION
725, 505

(PRECAST FLAT TOP M.H.)



NOTES:

1. PRECAST STEEL REINFORCED MANHOLE SECTIONS SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C 478 EXCEPT AS MODIFIED HEREIN.
2. CAST-IN-PLACE MANHOLE BASE TO BE CONSTRUCTED IN ONE PLACEMENT.
3. CAST-IN-PLACE MANHOLE BASE SHELF AND CHANNEL TO RECEIVE SMOOTH TROWEL FINISH.
4. MANHOLE COATINGS PER AGENCY.
5. SEE MAG DETAIL 422 FOR FINAL ADJUSTMENT TO GRADE.
6. ANY MANHOLE OVER 20' SHALL REQUIRE ENGINEER (STRUCTURAL) CALCS.
7. THE MANHOLE ACCESS POINT SHALL BE ORIENTED IN SUCH A WAY THAT THE OPENING IS DIRECTLY ABOVE THE LOWEST INVERT, OR AS OTHERWISE DIRECTED BY THE PLANS OR ENG.
8. FOR PRECAST BASE SEE DETAIL 420-2.
9. FLAT TOPS SHALL ONLY BE USED WITH APPROVAL FROM THE ENGINEER..

DETAIL NO.
420-1

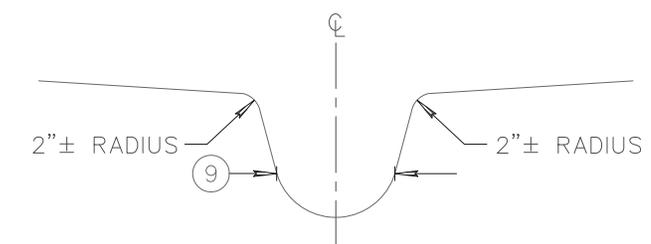
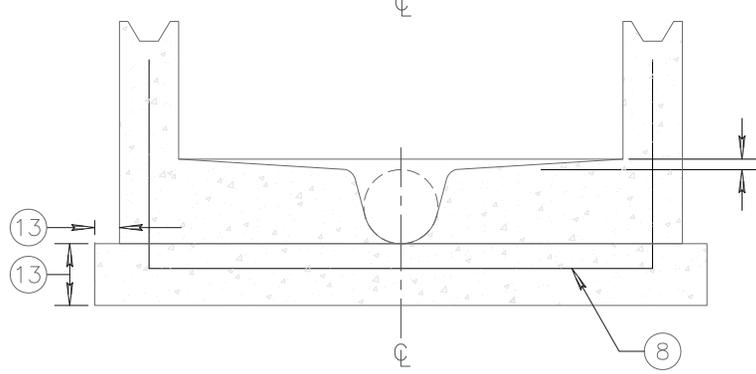
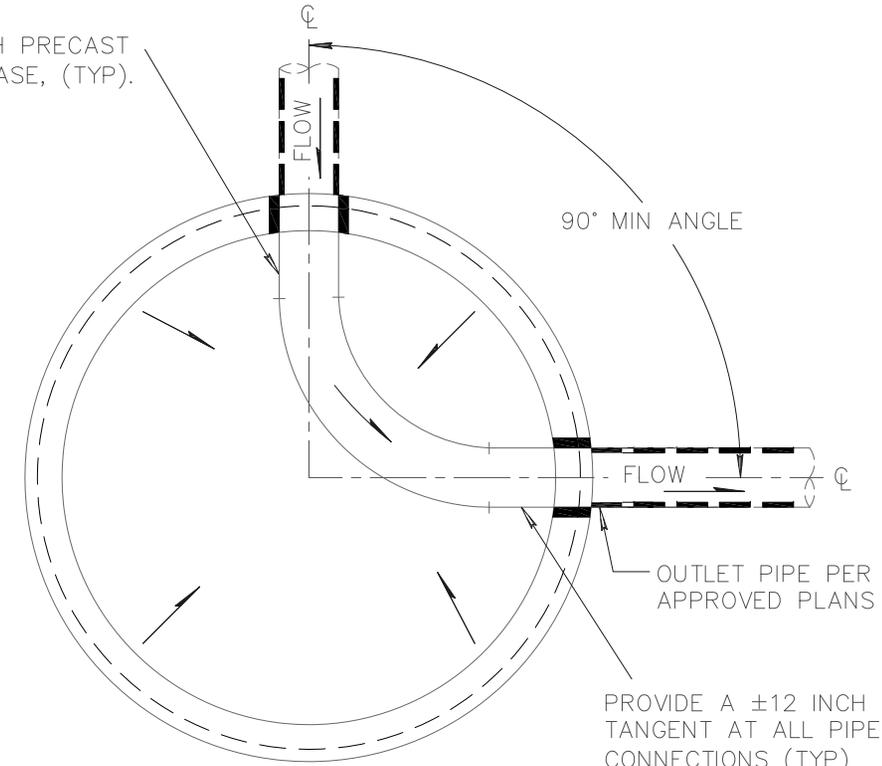
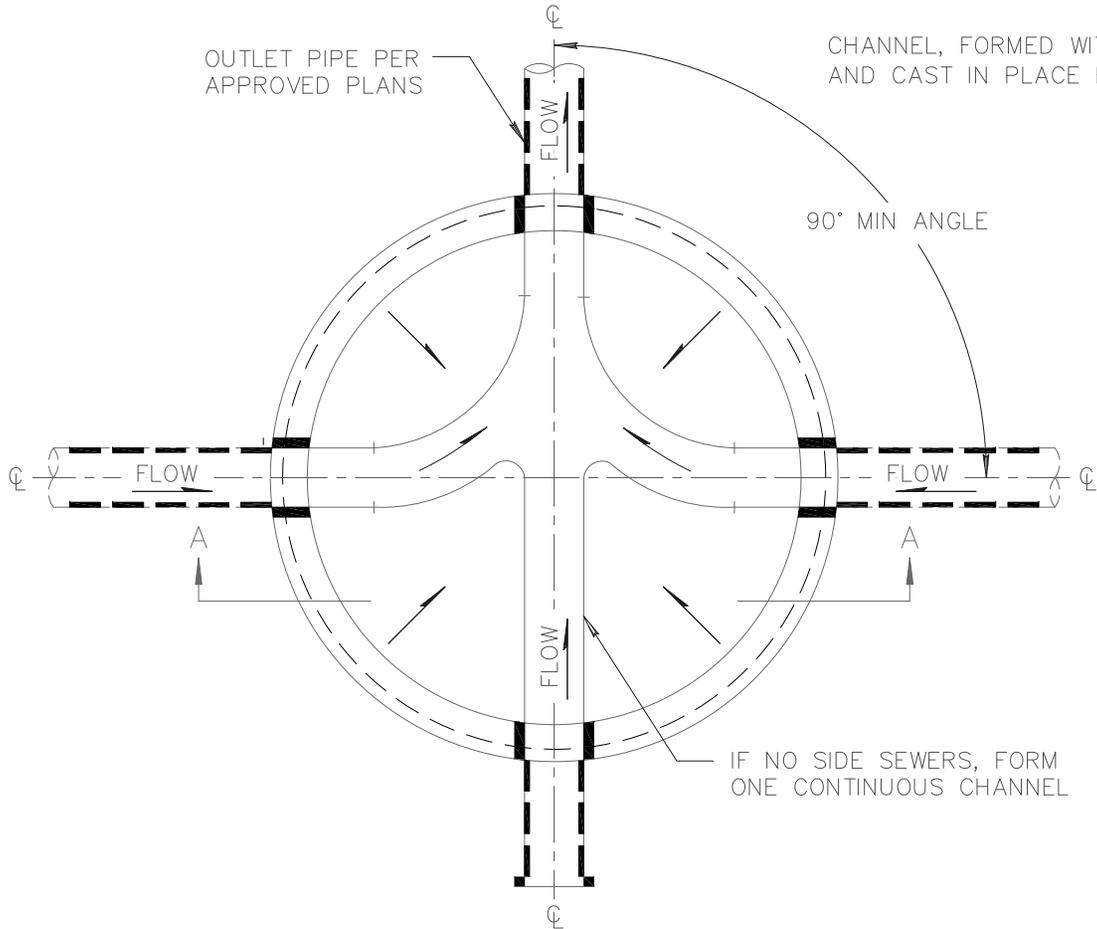


STANDARD DETAIL
ENGLISH

CONCRETE SANITARY SEWER MANHOLE

REVISED
01-01-2015

DETAIL NO.
420-1

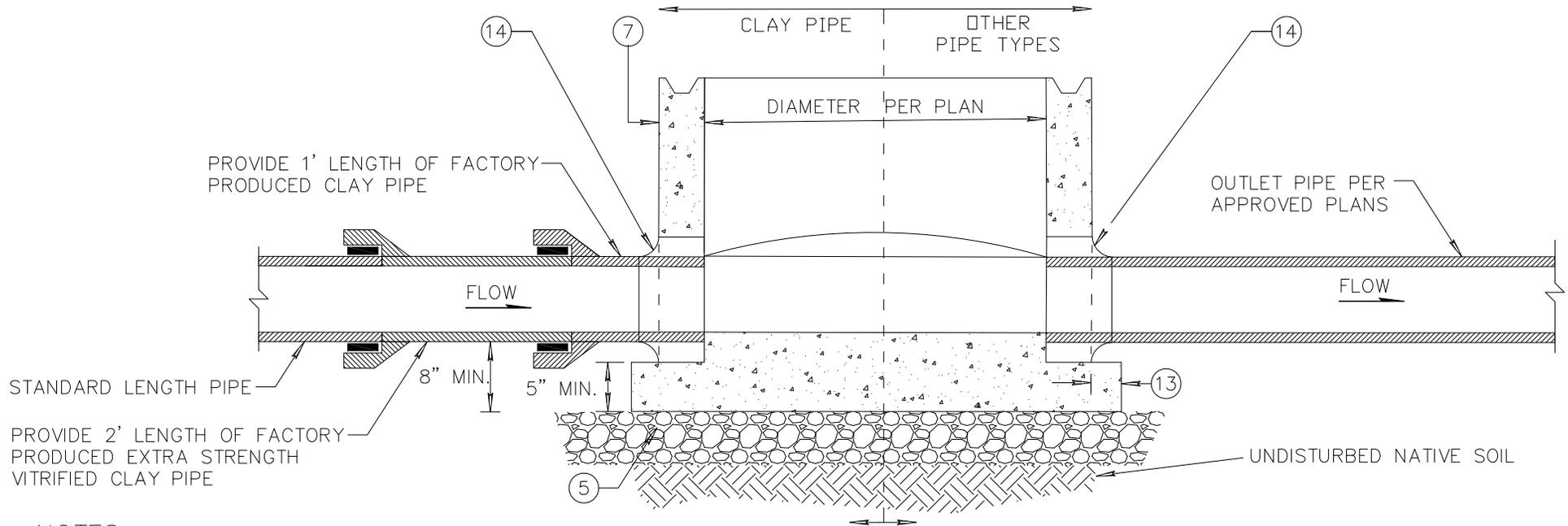


CHANNEL TRANSITION SHALL BE CONSISTENT FROM INLET TO OUTLET OF MANHOLE TO FACILITATE SMOOTH TRANSITIONS AND ACCOMMODATE CORRESPONDING MANDREL.

TYPICAL CHANNEL

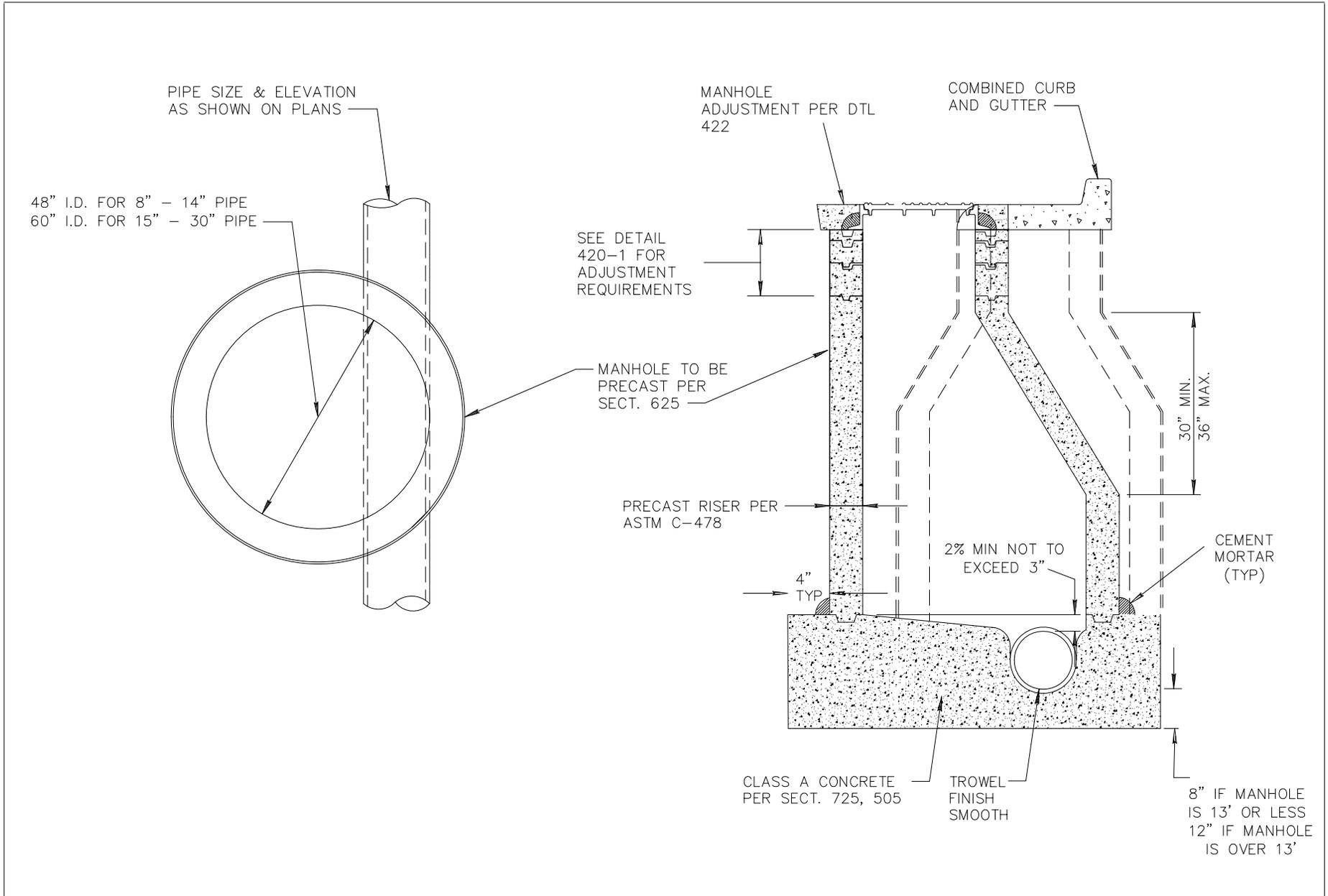
SEE DETAIL 420-2 FOR NOTES

| | | | | |
|----------------------------|---|------------------------------|-----------------------|----------------------------|
| DETAIL NO. 420-3 |  STANDARD DETAIL ENGLISH | CONCRETE MANHOLE BASE | REVISED 01-01-2015 | DETAIL NO. 420-3 |
|----------------------------|---|------------------------------|-----------------------|----------------------------|



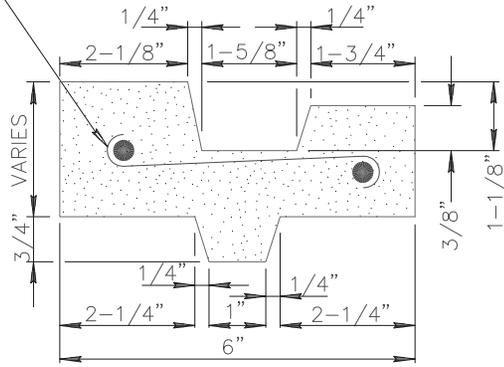
NOTES:

- ① PRECAST, MANUFACTURER SHALL BE AN NATIONAL PRECAST CONCRETE ASSOCIATION (NPCA) CERTIFIED PLANT. ENTIRE PRECAST BASE SHALL BE MANUFACTURED AT THE PLANT PER ASTM C478.
- ② MAG "AA" 4000 PSI CONCRETE SHALL BE USED FOR PRECAST MANHOLE BASES.
- ③ SPRING LINE OF CAST-IN-PLACE BELL SHALL STOP AT INSIDE FACE OF MANHOLE.
- ④ JOINTS FOR BARREL SECTION SHALL BE TONGUE AND GROOVE TYPE. ALL LIFTING HOLES SHALL BE SEALED WITH GROUT.
- ⑤ ALL PRECAST MANHOLE BASES SHALL BE PLACED ON 10" MINIMUM #57 ROCK PER ASTM D448 WITH AT LEAST 50% ONE FRACTURED FACE WHEN TESTED IN ACCORDANCE WITH ARIZ 212 OR 8" ABC PER SECTION 702 COMPACTED TO 100% RELATIVE DENSITY.
- ⑥ ALL MODIFICATIONS SHALL BE APPROVED BY THE ENGINEER.
- ⑦ MINIMUM WALL THICKNESS SHALL BE PER ASTM C478 (MIN 5").
- ⑧ REINFORCEMENT SHALL BE DESIGNED BY AN ARIZONA REGISTERED PROFESSIONAL ENGINEER.
- ⑨ CHANNEL TRANSITION SHALL BE CONSTANT FROM INLET TO OUTLET OF MANHOLE TO FACILITATE SMOOTH TRANSITIONS AND ACCOMMODATE CORRESPONDING MANDREL.
- ⑩ THERE SHALL BE NO HARD CONNECTIONS (GROUTED) INTO THE MANHOLE BASE UNLESS APPROVED BY THE ENGINEER.
- ⑪ ALL SEWER SERVICE CONNECTIONS SHALL HAVE THE SAME CONNECTION TYPES IN THE PRECAST MANHOLE BASE.
- ⑫ ALL CORE HOLES INTO THIS STRUCTURAL PRECAST BASE SHALL BE COATED WITH AN APPROVED COATING MATERIAL.
- ⑬ THE MANHOLE BOTTOM SHALL EXTEND OUTSIDE THE MANHOLE WALL A MINIMUM 6" WIDE ON 48" BASES, 7" WIDE ON 60" BASES, AND 8" WIDE ON 72" BASES. EXTENDED BOTTOM SHALL BE A MINIMUM OF 5" THICK.
- ⑭ ALL PIPE CONNECTIONS SHALL BE IN COMPLIANCE WITH ASTM F477 OR ASTM C425. AN EXTRA STRENGTH VCP BELL WITH A POLYURETHANE JOINT THAT MEETS ASTM C425 MAY BE USED WITH VCP.

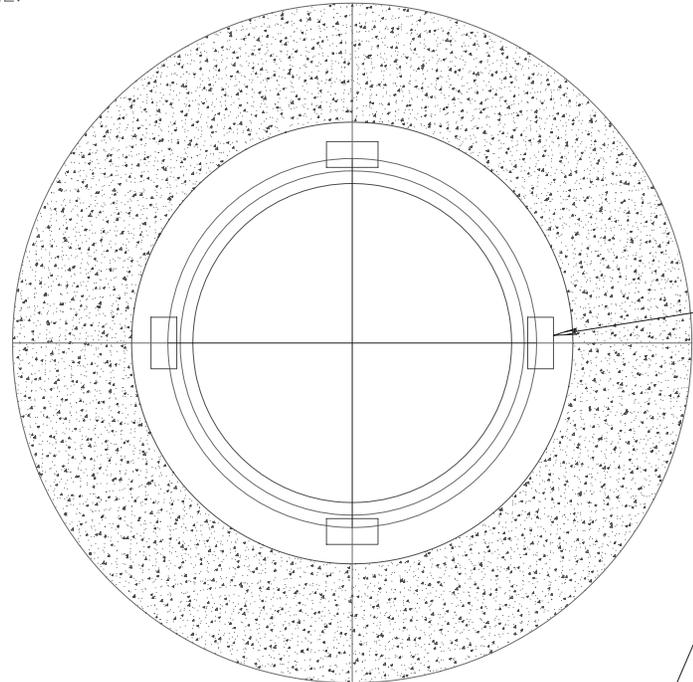


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|-------------------|--|-------------------------------|-----------------------|-------------------|
| DETAIL NO. 421 |  STANDARD DETAIL ENGLISH | OFFSET MANHOLE 8" TO 30" PIPE | REVISED 01-01-2015 | DETAIL NO. 421 |
|-------------------|--|-------------------------------|-----------------------|-------------------|

(2) NO.2 HOOPS FOR 4" RING TIED WITH NO. 4 A.S.& W. GAUGE WIRE. 6" & 8" RING REQUIRE (4) NO. 2 HOOPS.



ADJUSTING RING DETAIL



NOTES:

1. CONTRACTORS SHALL ADJUST ALL MANHOLE RINGS AND COVERS, INCLUDING MANHOLES OUTSIDE OF THE PAVEMENT.
2. ADJUSTMENT SHALL BE CONSTRUCTED PER MAG SECTION 345.
3. MANHOLE COATINGS PER AGENCY.
4. GROUT SHALL BE USED BETWEEN FRAME AND ADJUSTING RING TO ACHIEVE WATER TIGHTNESS.

ADJUSTMENT SUPPORTS PER SECTION 345

OUT OF PAVEMENT—FINISH GRADE

12" MIN. BOTH SIDES

MEDIUM BROOM FINISH WITH RADIALLY SCORED MARKS (4 MIN.)

EXISTING OR RECENTLY INSTALLED PAVEMENT

8" MIN

10" MIN

GROUT INTERIOR SURFACE OF ADJUSTMENT RINGS CONTINUOUS

#4 REINFORCING STEEL HOOP EQUALLY CENTERED HORIZONTALLY & VERTICALLY (IF REQUIRED BY AGENCY)

CONCRETE COLLAR, CLASS 'AA' CONCRETE PER SECT. 725 & 505

ADJUSTING RINGS

SUBGRADE PREPARATION TO CONFORM TO SECT. 301 OR 601



CITY OF BUCKEYE
Engineering Department

Case Number: 13-22

Date : 06-05-13

Revised: 08-13-14

To: MAG Specifications and Details Committee

From: Craig Sharp

RE:

- Section 625 - Manhole construction and drop sewer connections
- Section 775 – Bricks and masonry units
- Delete MAG Standard Detail 428 – Manhole Steps

Purpose: Deleting references to bricks and steps in manholes

Revisions:

This revision is to delete references for the use of bricks and steps in sanitary sewer manholes, this is to include the deletion of the manhole step detail 428.

SECTION 625

MANHOLE CONSTRUCTION AND DROP SEWER CONNECTIONS

625.1 DESCRIPTION:

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

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

625.2 MATERIALS:

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

~~If allowed by the contracting agency, brick may be used for maintenance and adjustment of the existing sanitary sewer manhole or ring and cover. Bricks for manholes see Section 775.~~

Cement mortar for manholes Class D, ~~per~~ Section 776.

Concrete for ~~cast in place manholes~~ ~~bases shall be~~ Class A, for drop sewer connection ~~shall be~~ Class C, ~~per~~ Section 725.

Pipe used in manholes or drop sewer connections shall comply with pipe requirements of Section 615.

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

~~Plastic manhole steps, which conform to O.S.H.A. and A.S.T.M. C 487 requirements, and steel manhole steps, which are completely encapsulated in corrosion resistant rubber and conform to O.S.H.A. and A.S.T.M. C 478 requirements, may be substituted for cast iron manhole steps. The manufacturer shall furnish the Engineer a certification indicating conformance. Manhole steps shall not be used.~~

625.3 CONSTRUCTION METHODS:

625.3.1 Manholes: Manholes shall be constructed ~~of brick~~, of precast concrete sections, or ~~of~~ cast in place concrete, ~~with cast iron manhole steps, frames and covers, in accordance with the standard details.~~ The invert channels shall be smooth and semi-circular in shape, conforming to the inside of the adjacent sewer sections. Changes in direction of flow shall be made with a smooth curve, having a consistent radius as large as the manhole will permit with no angle points. Changes in size and grade of the channels shall be made gradually, ~~and evenly~~, and uniformly throughout the manhole base.

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

The excavation shall be in such a manor, access is maintained around the manhole base before, during, and after placement of the manhole, made cylindrical to a diameter sufficient in size to permit sheeting if necessary and leave room that the bricks may be laid in a workmanlike manner and the outside mortar coat properly applied or the precast concrete sections or forms may be properly assembled.

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

~~Brickwork shall not be laid upon a concrete foundation less than 24 hours after such foundation has been poured.~~ No brickwork shall be laid in water, nor, except as prescribed for curing, shall water be allowed to stand or run on any brickwork until the mortar has thoroughly set. Where new work is joined to existing unfinished work, the contact surfaces of the latter shall be thoroughly cleaned and moistened.

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SECTION 625

Bricks shall be thoroughly moistened prior to placing, and shall be laid in full cement mortar beds. Every course may be a header course, but at least every fourth course shall be a header course. The horizontal cross-section of the manhole shall be circular unless otherwise called for on the plans or standard details. An oval or egg-shaped section will not be permitted. ~~A double row lock course of brick in the manhole wall shall be arched over the top half of the circumference of all inlet and outlet pipes.~~ The brick manholes shall be mortared outside with ½ inch of cement mortar as shown ~~on the standard details.~~ Inside of the brick wall shall be neatly pointed. The mortar coat shall be cured with a liquid membrane-forming compound conforming with Section [726](#) immediately after mortar has been placed and finished.

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

Backfilling shall be done in accordance with the requirements for trench backfilling as stated in Section [601](#).

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

Backfilling shall be done in accordance with the requirements for trench backfilling as stated in Section [601](#).

625.4 MEASUREMENT:

~~Each type of manhole installed, shall be measured as a complete unit, no distinction shall be made based on manhole depth. Measurement will be per manhole installed, complete in place, regardless of depth.~~

625.5 PAYMENT:

Payment will be made at the contract unit price ~~bid~~ for each accepted manhole, and shall be compensation in full for furnishing and installing the manhole, complete in place, with formed or pre-cast invert, concrete foundation, ~~sanitary sewer drop connections ladder rungs, sheeting and bracing, removal of obstructions~~ cast iron frame and cover, excavation and backfill, paving cut replacement in excess of the applicable pay widths authorized in Section [336](#), and any incidentals thereto, in conformance with the plans and specifications.

~~Payment will be made at the unit price bid each, and shall be compensation in full for furnishing and installing vitrified clay pipe sanitary sewer drop connections, concrete encasement, excavation, backfilling, water settling, compaction, sheeting and bracing, removal of obstructions, paving cut replacement, in excess of the applicable pay widths authorized in Section [336](#), testing, and all work incidental thereto in conformance with the plans and specifications.~~

- End of Section -

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SECTION 625

MANHOLE CONSTRUCTION AND DROP SEWER CONNECTIONS

625.1 DESCRIPTION:

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

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

625.2 MATERIALS:

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

If allowed by the contracting agency, brick may be used for maintenance and adjustment of the existing sanitary sewer manhole or ring and cover. Bricks for manholes see Section [775](#).

Cement mortar for manholes Class D, per Section [776](#).

Concrete for cast in place manhole bases shall be Class A, for drop sewer connection shall be Class C, Section per [725](#).

Pipe used in manholes or drop sewer connections shall comply with pipe requirements of Section [615](#).

Manhole frame, cover Section [787](#) and cast in accordance with standard details.

Manhole steps shall not be used.

625.3 CONSTRUCTION METHODS:

625.3.1 Manholes: Manholes shall be constructed of precast concrete sections, or cast in place concrete. The invert channels shall be smooth and semi-circular in shape, conforming to the inside of the adjacent sewer sections. Changes in direction of flow shall be made with a smooth curve, having a consistent radius as large as the manhole will permit with no angle points. Changes in size and grade of the channels shall be made gradually, evenly, and uniformly throughout the manhole base.

Invert channels may be formed of concrete or be half tile laid in concrete or may be constructed by laying full section of sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. The bench of the manhole outside the channels shall be smoothed and shall slope towards the channels.

The excavation shall be in such a manner, access is maintained around the manhole base before, during, and after placement of the manhole.

A concrete foundation of Class A concrete shall be poured in accordance with the Standard Details and Section [505](#).

No brickwork shall be laid in water, nor, except as prescribed for curing, shall water be allowed to stand or run on any brickwork until the mortar has thoroughly set. Where new work is joined to existing unfinished work, the contact surfaces of the latter shall be thoroughly cleaned and moistened.

SECTION 625

Bricks shall be thoroughly moistened prior to placing, and shall be laid in full cement mortar beds. Every course may be a header course, but at least every fourth course shall be a header course. The horizontal cross-section of the manhole shall be circular unless otherwise called for on the plans or standard details. An oval or egg-shaped section will not be permitted. The brick manholes shall be mortared outside with ½ inch of cement mortar as shown. Inside of the brick wall shall be neatly pointed. The mortar coat shall be cured with a liquid membrane-forming compound conforming with Section [726](#) immediately after mortar has been placed and finished.

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

Backfilling shall be done in accordance with the requirements for trench backfilling as stated in Section [601](#).

625.3.2 Sanitary Sewer Drop Connections: Drop sewer connections shall be constructed in conformance with standard details.

Backfilling shall be done in accordance with the requirements for trench backfilling as stated in Section [601](#).

625.4 MEASUREMENT:

Each type of manhole installed, shall be measured as a complete unit, no distinction shall be made based on manhole depth .

625.5 PAYMENT:

Payment will be made at the contract unit price for each accepted manhole, and shall be compensation in full for furnishing and installing the manhole, complete in place, with formed or pre-cast inverts, concrete foundation, sanitary sewer drop connections sheeting and bracing, removal of obstructions cast iron frame and cover, excavation and backfill, paving cut replacement in excess of the applicable pay widths authorized in Section [336](#), and any incidentals thereto, in conformance with the plans and specifications.

- End of Section -

SECTION 775

BRICK AND CONCRETE MASONRY UNITS (BLOCKS)

775.1 BRICK:

Brick shall be whole, sound, and hard burned and shall give a clear ringing sound when struck together. They shall be uniform in quality and shall be culled or sorted before delivery to the work.

775.1.1 Manhole Brick: Agency approval is required prior to using brick within manholes. When Approved brick may be used for maintenance and adjustment of the existing manholes or rings and covers. Sewer and water manhole brick shall conform, except for dimensional tolerances, to the requirements of ASTM C32, Grade MM.

Manhole brick shall conform to Table [775-1](#).

| TABLE 775-1 | | | |
|---------------------------------|---------------------|---------------------|----------------------|
| MANHOLE BRICK DIMENSIONS | | | |
| Brick | Inches Depth | Inches Width | Inches Length |
| Standard Size | 2 1/4 | 3 1/2 | 7 1/2 |
| Allowable Variations | ±1/8 | ±1/8 | ±1/4 |

The following paragraphs shall be added to the section on visual inspection:

No individual brick shall be rejected unless it shows visual evidence of major cracking. A major crack is defined as one that has at least one complete separation, for a distance of 1 3/4 inches, through the brick in any direction, including any cored area. Such a crack shall be regarded as affecting the serviceability of the brick and shall be rejected and not used in the structure.

Fifty bricks may be sampled at random intervals from any cube for visual inspection. Of the 50 samples, 45 must pass visual inspection for major cracks. Should less than 45 pass, the cube of brick shall be rejected and the brick must not be used in the structure.

775.1.2 Building Brick: Building brick shall conform to the requirements of ASTM C62, grade MW.

775.1.3 Facing Brick: Facing brick shall conform to the requirements of ASTM C216, Grade MW, Type FBS. The size, color, and texture shall be as specified on the plans or as approved by the Engineer.

775.2 CONCRETE MASONRY UNITS:

Unless otherwise noted on the plans or special provisions, concrete masonry units shall conform to ASTM C90, Normal Weight, Type I with a minimum compressive strength of 1900 psi.

The units shall be fully cured and shall have been made not less than 28 days prior to delivery.

The moisture content at the time of delivery shall not exceed 30 percent of the minimum absorption value of the units. The Contractor shall provide any protection he deems necessary to maintain the units in this condition until time of use.

The linear change from saturated to cool oven dry shall not exceed 0.0054 inches per linear foot or 0.045 of 1 percent conducted in accordance with test method in ASTM C426.

The units shall be made with normal weight aggregate conforming to ASTM C33.

The nominal size of the units shall be as indicated on the plans. The overall dimensions for width, height and length shall differ by not more than ±1/8 inch from the specified standard dimensions. Standard dimensions of units are the

SECTION 775

manufacturer's designated dimensions. Nominal dimensions of units are equal to the standard dimensions plus the thickness of one mortar joint.

No less than 5 samples of the units shall be submitted to the Engineer for approval and to show the full variance of texture and full range of color. Units used in the work shall match the approved samples. These samples may be tested for strength.

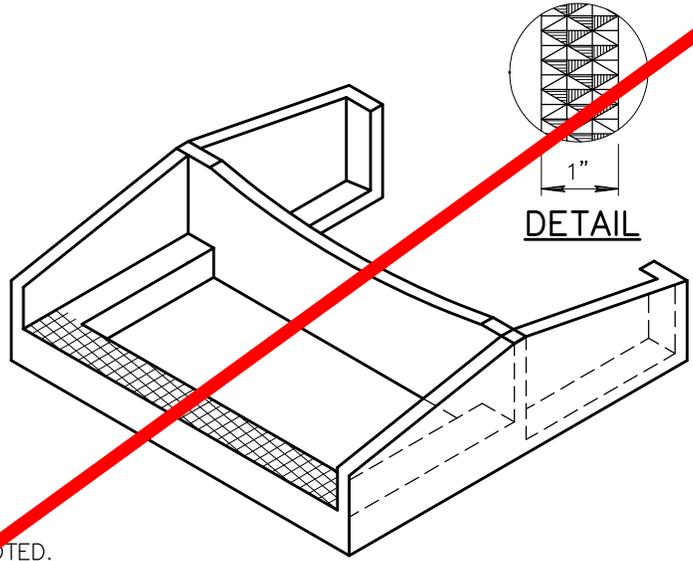
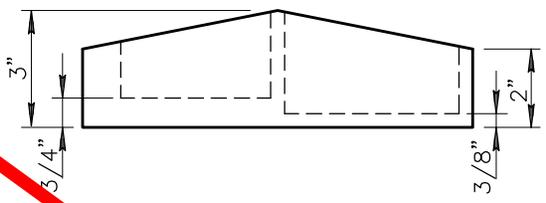
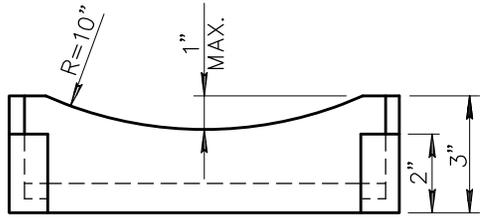
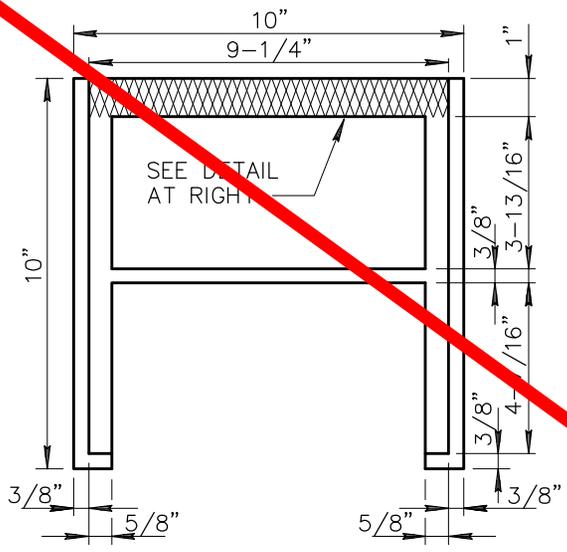
All units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or would significantly impair the strength or permanence of the construction. When units are to be used in an exposed setting, the face or faces that are to be exposed shall not show chips or cracks, not otherwise permitted, or other imperfections when viewed from a distance of not less than 6 feet under diffused lighting.

Units that are intended to serve as a base for plaster or stucco shall have a sufficiently rough surface to afford a good bond.

End of Section -

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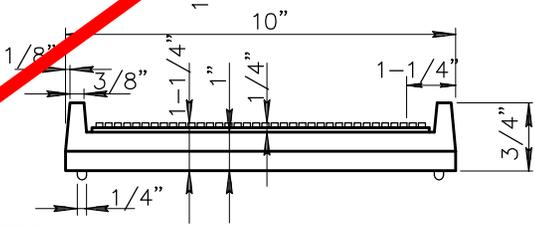
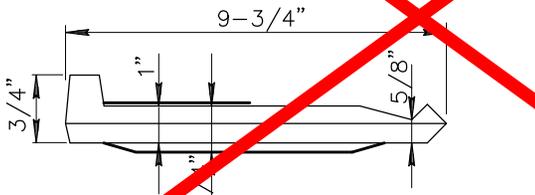
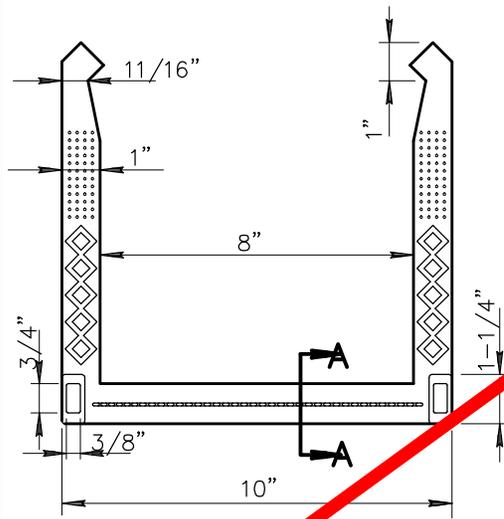




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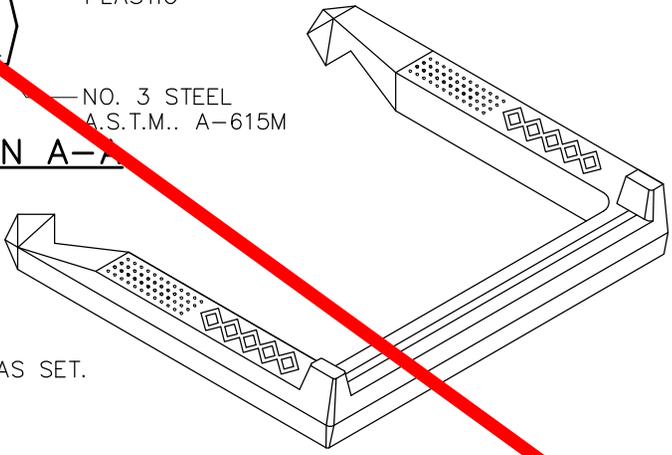
1. ALL DIMENSIONS ARE MINIMUM EXCEPT WHERE NOTED.
2. CASTING AS PER SECT. 787.

CAST IRON MANHOLE STEP



POLYPROPYLENE PLASTIC
NO. 3 STEEL
A.S.T.M. A-615M

SECTION A-A



NOTES

1. STEPS SHALL BE PLACED INTO WET CONCRETE WALL DURING MANUFACTURE OR MORTARED INTO HOLES AFTER CONCRETE HAS SET.
2. POLYPROPYLENE MUST MEET REQUIREMENTS OF A.S.T.M. 2146, TYPE II, GRADE 16906.

POLYPROPYLENE MANHOLE STEP

SECTION 775

BRICK AND CONCRETE MASONRY UNITS (BLOCKS)

775.1 BRICK:

Brick shall be whole, sound, and hard burned and shall give a clear ringing sound when struck together. They shall be uniform in quality and shall be culled or sorted before delivery to the work.

775.1.1 Manhole Brick: Agency approval is required prior to using brick within manholes. When Approved brick may be used for maintenance and adjustment of the existing manholes or rings and covers.

Manhole brick shall conform to Table 775-1.

| TABLE 775-1 | | | |
|--------------------------|--------------|--------------|---------------|
| MANHOLE BRICK DIMENSIONS | | | |
| Brick | Inches Depth | Inches Width | Inches Length |
| Standard Size | 2 1/4 | 3 1/2 | 7 1/2 |
| Allowable Variations | ±1/8 | ±1/8 | ±1/4 |

The following paragraphs shall be added to the section on visual inspection:

No individual brick shall be rejected unless it shows visual evidence of major cracking. A major crack is defined as one that has at least one complete separation, for a distance of 1 3/4 inches, through the brick in any direction, including any cored area. Such a crack shall be regarded as affecting the serviceability of the brick and shall be rejected and not used in the structure.

Fifty bricks may be sampled at random intervals from any cube for visual inspection. Of the 50 samples, 45 must pass visual inspection for major cracks. Should less than 45 pass, the cube of brick shall be rejected and the brick must not be used in the structure.

775.1.2 Building Brick: Building brick shall conform to the requirements of ASTM C62, grade MW.

775.1.3 Facing Brick: Facing brick shall conform to the requirements of ASTM C216, Grade MW, Type FBS. The size, color, and texture shall be as specified on the plans or as approved by the Engineer.

775.2 CONCRETE MASONRY UNITS:

Unless otherwise noted on the plans or special provisions, concrete masonry units shall conform to ASTM C90, Normal Weight, Type I with a minimum compressive strength of 1900 psi.

The units shall be fully cured and shall have been made not less than 28 days prior to delivery.

The moisture content at the time of delivery shall not exceed 30 percent of the minimum absorption value of the units. The Contractor shall provide any protection he deems necessary to maintain the units in this condition until time of use.

The linear change from saturated to cool oven dry shall not exceed 0.0054 inches per linear foot or 0.045 of 1 percent conducted in accordance with test method in ASTM C426.

The units shall be made with normal weight aggregate conforming to ASTM C33.

The nominal size of the units shall be as indicated on the plans. The overall dimensions for width, height and length shall differ by not more than ±1/8 inch from the specified standard dimensions. Standard dimensions of units are the manufacturer’s designated dimensions. Nominal dimensions of units are equal to the standard dimensions plus the thickness of one mortar joint.

SECTION 775

No less than 5 samples of the units shall be submitted to the Engineer for approval and to show the full variance of texture and full range of color. Units used in the work shall match the approved samples. These samples may be tested for strength.

All units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or would significantly impair the strength or permanence of the construction. When units are to be used in an exposed setting, the face or faces that are to be exposed shall not show chips or cracks, not otherwise permitted, or other imperfections when viewed from a distance of not less than 6 feet under diffused lighting.

Units that are intended to serve as a base for plaster or stucco shall have a sufficiently rough surface to afford a good bond.

End of Section -



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.

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.

TABLE 321-2

MINIMUM ASPHALT CONCRETE PLACEMENT TEMPERATURE

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

(1) Base on which mix is to be placed

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.



MARICOPA COUNTY
Department of Transportation

MEMORANDUM

Date: May 21, 2014 Revised 2014-08-14
To: MAG Specifications and Details Committee
From: Robert Herz, MCDOT Representative
Subject: Delete the use of Asbestos-Cement Pipe in Valve Box Installations **Case 14-11**

PURPOSE: Delete the use of Asbestos-Cement Pipe (ACP) in new Valve Box Installations.

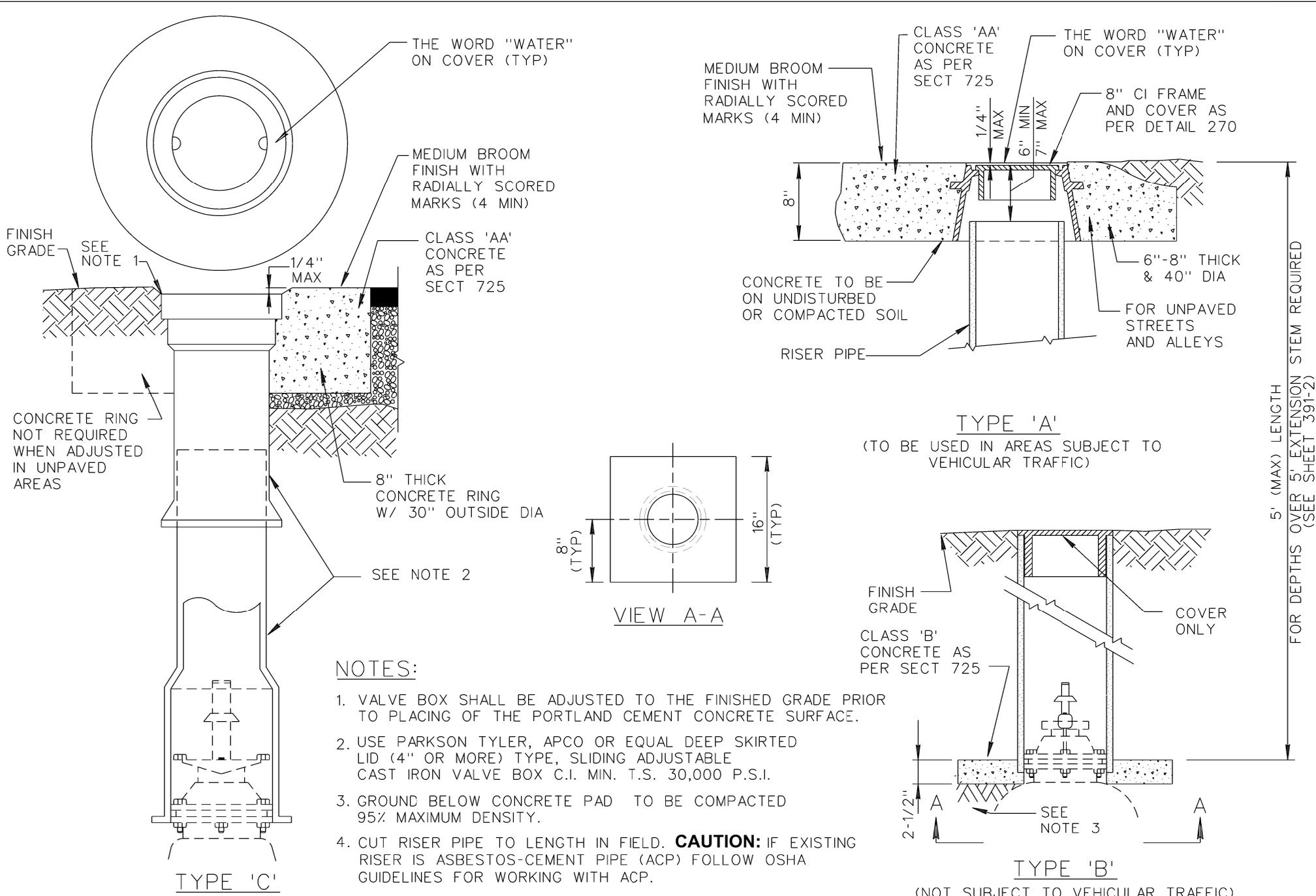
REVISIONS:

1. Replaced ACP with PVC C900 pipe or approved equal.
2. Pictorial adjustments made to Details 391-1, 391-2, and 392.
3. Deleted the brick alternative for supporting the valve box riser pipe as requested by the committee.
4. Deleted requirement for a 12" riser pipe for lengths greater than 10' as requested by the committee.

Detail 391-1 Added Note 4: Cut riser pipe to length in field. Caution: If existing riser is asbestos-cement pipe (ACP) follow OSHA guidelines for working with ACP.

Detail 391-2, Revised the first sentence of Note 2 to read: If two or more sections of pipe are used to make the valve box riser, they shall be coupled or bonded to form debris-tight joints.

Detail 392: Deleted from the end of note 1 the following: "Once installed the cap must withstand, without slippage, a minimum vertical force of 50 pounds at a loading rate of 1 inch/minute."



DETAIL NO.

391-1



STANDARD DETAIL
ENGLISH

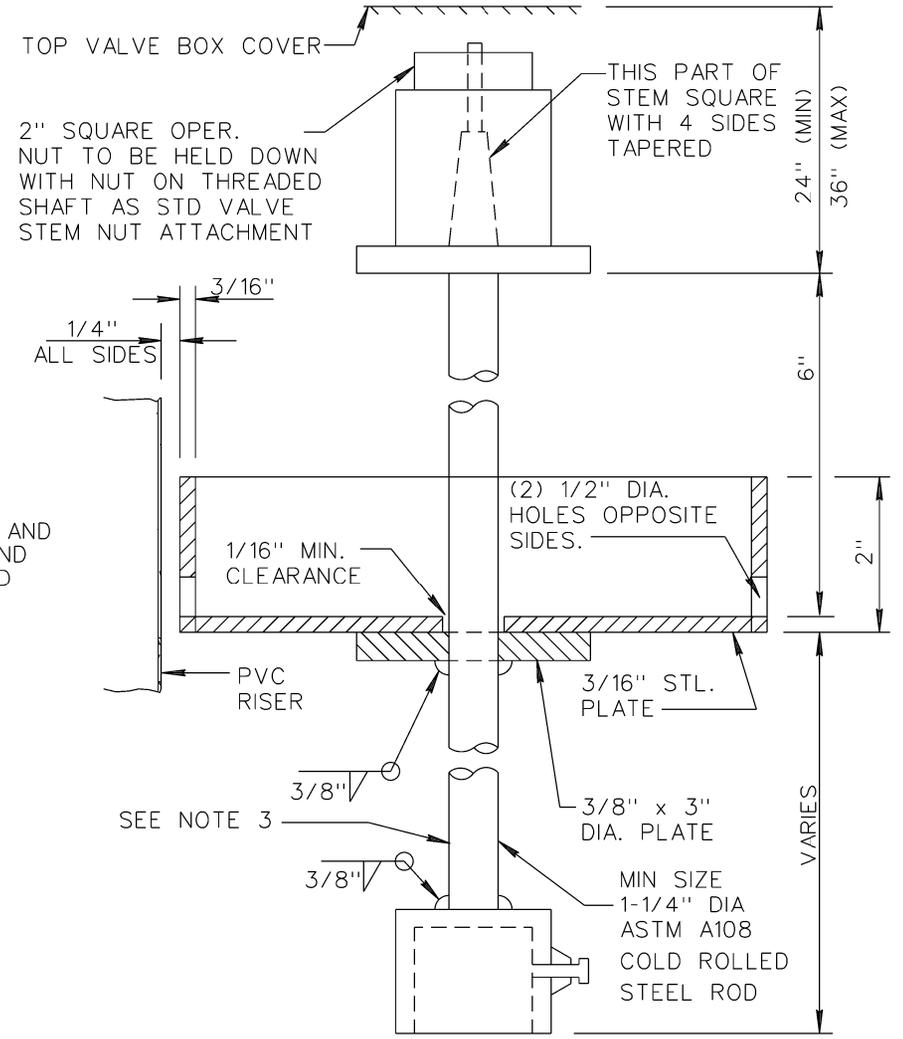
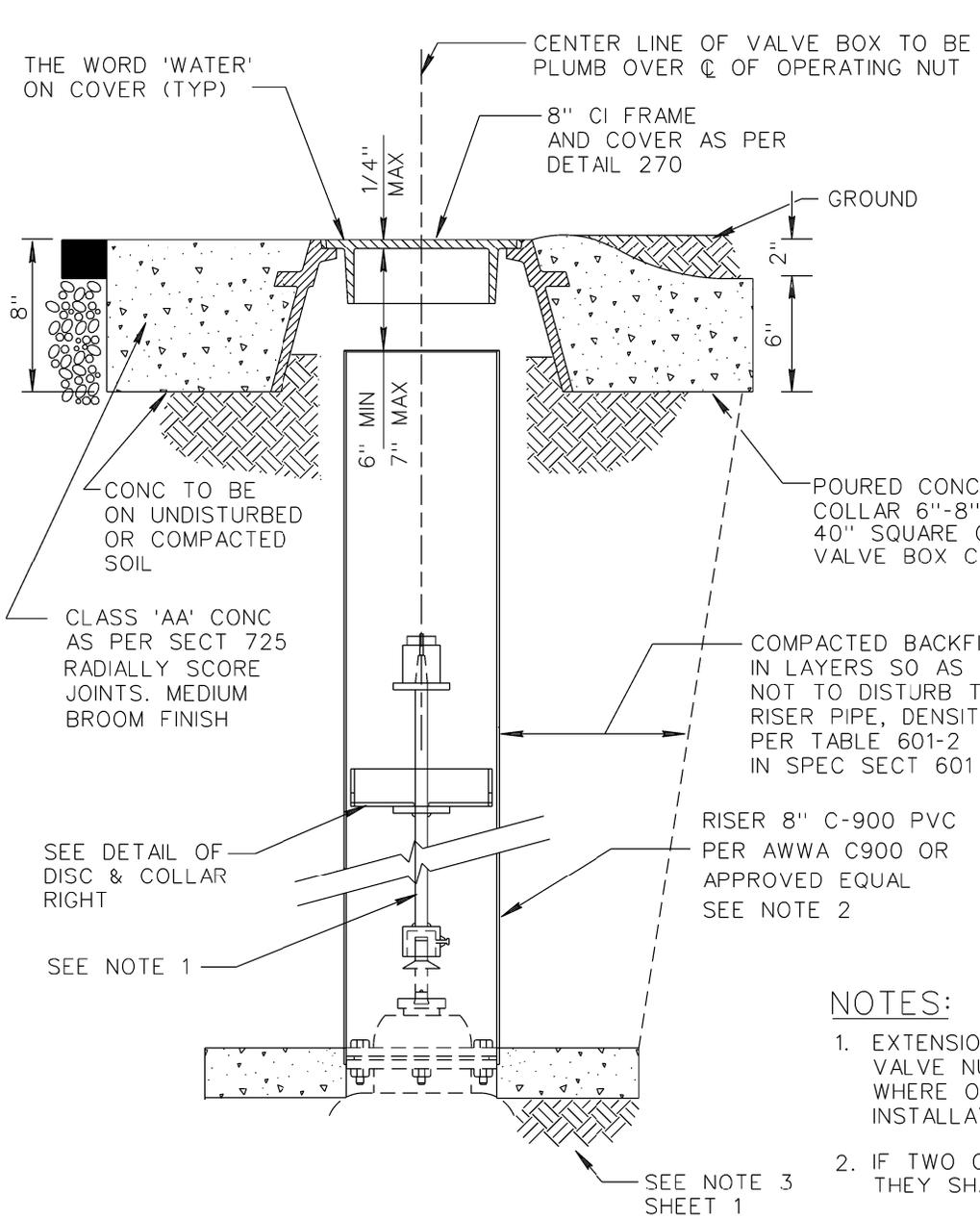
VALVE BOX INSTALLATION
AND GRADE ADJUSTMENT

REVISED

01-01-2015

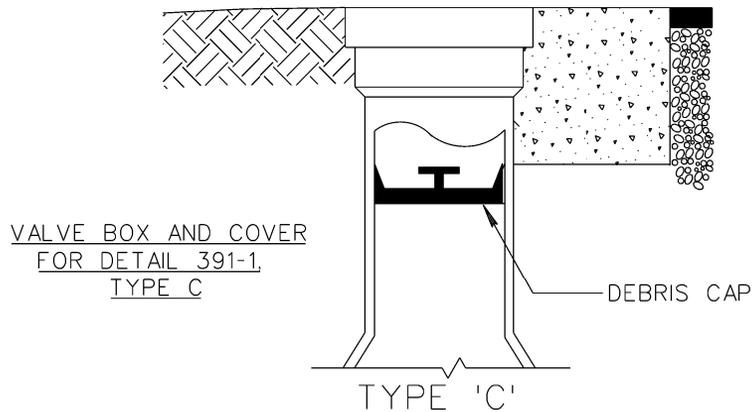
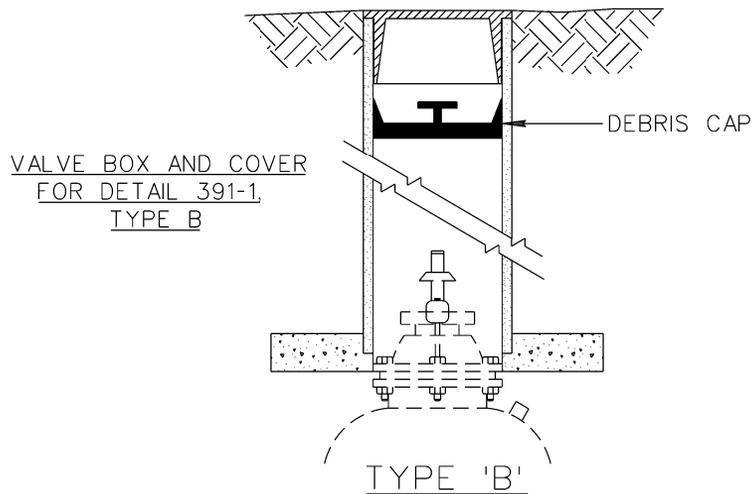
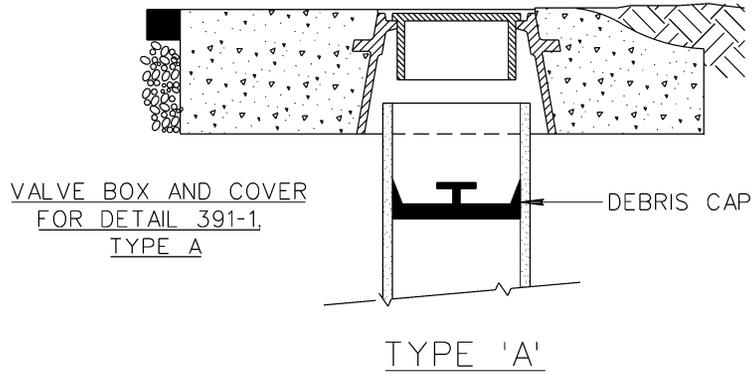
DETAIL NO.

391-1



NOTES:

1. EXTENSION STEM: WITH SQUARE SOCKET ON BOTTOM TO FIT 2" SQUARE VALVE NUT. EXTENSION TO VALVE STEMS REQUIRED ON ALL VALVES INSTALLED WHERE OPERATING NUT IS OVER 5' BELOW SURFACE. LENGTH TO FIT EACH INSTALLATION. OPERATING NUT TO BE HELD ON TOP OF EXTENSION WITH STOP NUT.
2. IF TWO OR MORE SECTIONS OF PIPE ARE USED TO MAKE THE VALVE BOX RISER, THEY SHALL BE COUPLED OR BONDED TO FORM DEBRIS-TIGHT JOINTS.
3. STEM PAINTING: ALL STEEL TO HAVE PRIME COAT OF PAINT NO. 1-D AND ONE HEAVY APPLICATION (FINISH COAT) OF PAINT NO. 9 AS PER SECT. 790.



NOTES:

1. THE DEBRIS CAP SHALL BE DESIGNED AND INSTALLED TO PREVENT DEBRIS SUCH AS DIRT, DUST SAND, ETC., FROM PASSING AROUND THE CAP AND DOWN INTO THE VALVE HOUSING. THE CAP SHALL BE HELD IN PLACE BY A MECHANISM WHICH WILL NOT DAMAGE THE VALVE HOUSING.
2. THE CAP SHALL BE MANUFACTURED OF CORROSIVE RESISTANT MATERIALS.
3. DEBRIS CAP SHALL BE INSTALLED AS CLOSE UNDER THE CAST IRON COVER WITHOUT INTERFERING WITH COVER OPERATION.
4. THE CAP SHALL BE CAPABLE OF SECURELY HOLDING A STANDARD LOCATING COIL, "SCOTCH MARK" 4 DISK MARKER BY 3M OR EQUAL.
5. THE CAP SHALL BE CONSTRUCTED TO ALLOW THE DEVICE TO BE SECURED BY A LOCK. THE LOCK (PAD, BARREL, ETC.) SHALL BE SUPPLIED BY THE AGENCY.
6. THE CAP SHALL BE INSTALLED IN ALL VALVE HOUSINGS AS REQUIRED BY THE CONTRACT DOCUMENTS OR BY THE AGENCY'S POLICIES.

DETAIL NO.

392



STANDARD DETAIL
ENGLISH

DEBRIS CAP INSTALLATION

REVISED

01-01-2015

DETAIL NO.

392



MARICOPA COUNTY
Department of Transportation

MEMORANDUM

Date: June 4, 2014

Revised 2014-08-21

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.
 - Require longitudinal construction joint 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 – Adjusted acceptance testing procedure.
- 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 – Expanded corrective measures to be taken when total pavement thickness deficiency is 0.50 inches or greater for agency contracted work.
- 321.10.6 – Adjusted Table 321-9 to correspond with the 2013 revisions to Table 321-5 and Table 321-8.
- 321.11 – Revised requirements for referee testing.

Changes in section 321 made after the August 6, 2014 committee meeting have been highlighted in yellow in the attached document.

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.

| 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 (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. 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 e Each 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 | | |
| 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 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 | |
| Total Specified Asphalt Pavement Thickness exclusive of ARAC (if any) | Reduction in Payment or Corrective Action 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 ~~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 7.50 |
| Limits of In-place Air Voids | Less than 3% or Greater than 10.0% 10.1% to 11.0% | \$ 15 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. 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 or 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.** 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 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 $\pm 0.40\%$ 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 every asphalt concrete layer 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 D5361-05).

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.

*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* -

WATER, SEWER AND STORM DRAIN TESTING DISINFECTING WATER MAINS**611.1 HYDROSTATIC TESTING: (610.15)**

Water lines, including all fittings and connections to the water mains shall be tested for watertightness by subjecting each section to hydrostatic testing in accordance with applicable provisions of AWWA C-600, except as modified below, and shall consist of pressure testing and allowance testing.

The test section shall be slowly filled with potable water and all air shall be vented from the line. The rate of filling shall be as determined by the Superintendent of Water Distribution, with at least 24 hour notice required before tests are scheduled.

The Contractor shall provide all vents, piping, plugs, bulkheads, valves, bracing, blocking, pumps, and measuring devices and all other equipment necessary for making the tests, including pressure gages, and shall pay the Contracting Agency for water used in the tests.

Hydrostatic Testing: Pressure testing may be made before or after backfilling, but backfilling must be completed before allowance testing. If the pipe is center-loaded, a visual inspection for leaks may be made along the pipe line while the test section is under test pressure, and all visible leaks repaired. However, if mechanical compaction is to be used in the backfilling operations as spelled out in AWWA C-600, the tests shall not be made until the backfilling is completed and compacted. Backfill and compaction for the full distance encompassed by restrained/welded joints shall be completed prior to testing. All connections, blowoffs, hydrants and valves shall be tested with the main as far as is practicable. Hydrostatic testing shall not begin until the pipe has been filled with water for at least 24 hours to allow for air venting.

(A) Pressure Testing: Unless otherwise noted in the contract documents, the minimum prescribed test pressure shall be at least 200 psi for lines smaller than 16 inches and 150 psi for lines 16 inches or larger, not to exceed 5 psi over the minimum prescribed test pressure, as measured at the lowest end of the section under test. The duration of each pressure test shall be at least 2 hours, during which time the test section shall not drop below the minimum prescribed test pressure. If the pressure in the pipe test section has not stabilized by the end of the testing period, a hydrostatic retest will be required.

Each section of a new line between sectionalizing valves or between the last sectionalizing valve and the end of the project shall be tested separately as required in AWWA C-600, and/or as modified in these specifications, except that any such section less than 500 feet in length may be tested with the adjacent section, if both sections of line have the same pipe class rating. No section greater than 1/2 mile in total pipe length shall be tested without special written permission of the Engineer.

(B) Testing Allowance/Makeup Water: Makeup water volume shall be determined after the pressure test has been satisfactorily completed and all backfilling and compaction has been completed to top of trench. Testing allowance shall be defined as the maximum quantity of makeup water necessary to be supplied into the pipe line section under test to restore the ending test pressure to the beginning test pressure, after the pipe line has been filled with water and all air expelled. The Contractor shall furnish the necessary apparatus and assistance to conduct the test.

The duration of each makeup water test shall be at least 2 hours. To pass the allowance testing, the quantity of makeup water from the pipe line shall not exceed the makeup water quantity allowed by the following formula, from AWWA C-600:

$$M = \frac{SD \sqrt{P}}{148,000}$$

in which

M = testing Allowance (makeup water), in gallons per hour.

S = length of pipe tested, in feet

D = nominal diameter of pipe, in inches.

P = test pressure of the pipe being tested, per 610.15 (A)

Should the test on any section of the pipe line require more makeup water than allowed by the above formula, the Contractor shall locate and repair the defective pipe, fittings, or joint until the makeup water volume is within the specified allowance. All repairs and retests, if required, shall be made at the Contractor's expense.

Connections to the existing pipelines or existing valves shall not be made until after that section of new construction has satisfactorily passed the hydrostatic tests.

Ductile iron pipe used in conjunction with ACP will be tested to the ACP standards, unless otherwise directed by the Engineer. High pressure systems of all ductile iron pipe will be tested in accordance with AWWA C-600, Section 4.1.

611.2~~1~~ DISINFECTING WATER MAINS

~~CLEANING AND TREATING PIPE:~~

~~The interior of all pipe and fittings shall be kept as free as possible of all dirt and foreign material at all times, until the pipe is placed in the new line.~~

~~If in the opinion of the Engineer, the pipe contains dirt that will not be removed during the flushing operation, the interior of the pipe shall be cleaned and swabbed, as necessary, with a .005 to .010 percent chlorine solution.~~

611.2 LAYING PIPE:

~~If the Contractor or pipe laying crew cannot install the pipe in the trench without getting earth into it, the Engineer may require that, before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size be placed over each end of the pipe and left there until the connection is to be made to the adjacent pipe.~~

~~At the close of each day's work, the end of the last laid section of pipe shall be plugged, capped, or otherwise tightly closed to prevent the entry of foreign material of any nature.~~

611.3 PREVENTING TRENCH WATER FROM ENTERING PIPE:

~~At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Engineer. Joints of all pipe in the trench shall be completed before the work is stopped. If water is in the trench, the seal shall remain in place until the trench is pumped dry.~~

611.4 PACKING MATERIAL:

~~Only such packing materials as are included in the list of acceptable materials in AWWA C-600 for installation of cast iron water main, shall be used. The packing materials shall be handled in such a manner as to avoid contamination, and shall be dry when placed in the joints. All such materials shall be free of oil, tar, or greasy substances, except that treated paper packing material, jute, cement, or sulphur compound caulking will not be permitted.~~

611.2.15 FLUSHING COMPLETED PIPE LINES:

(A) Preliminary Flushing: All mains 12 inches and smaller shall be flushed, prior to chlorination, as thoroughly as possible with the water pressure and outlets available. Flushing shall be done after the pressure test has been made. It must be understood that flushing removes only the lighter solids and cannot be relied upon to remove heavy material allowed to get into the main during laying. It is difficult to flush mains over 12 inches in diameter, so in such instances the requirements above, must be rigidly adhered to.

Heavy duty, factory bushed, tapped couplings, with corporation stops shall be located at all high points in the lines to allow the air to be removed prior to testing the water lines and at disinfection points as may be required. Field taps will not be permitted.

The couplings, at high points and disinfection points, shall be left exposed during backfilling until the testing is complete. Couplings and corporation stops shall be left on the mains upon completion of water mains.

(B) Valve Damage by Foreign Material: Unless proper care and thorough inspection are practiced during the laying of water mains, small stones, pieces of concrete, particles of metal, or other foreign material may gain access to mains newly laid or repaired. If it is believed that such foreign material(s) may be in the main, all hydrants on the line shall be thoroughly flushed and carefully inspected after flushing to see that the entire valve operating mechanism of each hydrant is in good condition.

611.2.26 CHLORINE RESIDUAL:

Before being placed in service, all new mains and repaired portions of, or extensions to existing mains shall be chlorinated so that a chlorine residual of not less than 10 ppm remains in the water after 24 hours standing in the pipe.

611.2.37 METHODS OF APPLYING CHLORINE:

Any of the following methods of application of chlorine (arranged in order of preference) may be used, subject to the approval of the Engineer.

- Liquid chlorine gas-water mixture.
- Direct chlorine feed.
- Calcium or sodium hypochlorite and water mixture.

611.2.48 APPLICATION OF LIQUID CHLORINE:

A chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device or, if approved by the Engineer, the dry gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine gas or of the gas itself must provide means for preventing the backflow of water into the cylinder.

611.2.59 CHLORINE-BEARING COMPOUNDS IN WATER:

On approval of the Engineer, a mixture of water and a chlorine-bearing compound of known chlorine content may be substituted for liquid chlorine.

(A) Compounds to be Used: The chlorine-bearing compounds that may be used are: Calcium hypochlorite*, and sodium hypochlorite**.

(B) Preparation of Mixture: High-test calcium hypochlorite must be prepared as a water mixture for introduction into the water mains. The powder should first be made into a paste and then thinned to approximately a 1 percent chlorine solution (10,000 ppm). The preparation of a 1 percent chlorine solution requires the following proportions of powder to water:

| Product | Amount of Compound | Quantity of Water (Gallons) |
|--|---------------------------|------------------------------------|
| High-test calcium hypochlorite (65—70% Cl) | 1 lb. | 7.50 |
| Liquid laundry bleach (5.25% Cl) | 1—2 pts. | 12.6 |

611.2.610 POINT OF APPLICATION:

The preferred point of application of the chlorinating agent is at the beginning of the pipe line extension or any valved section of it and through a corporation stop inserted in the top of the newly laid pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipe line extension.

611.2.711 RATE OF APPLICATION:

Water from the existing distribution system or other source of supply shall be controlled so the rate of flow shall not exceed 500 gpm, unless approved by the Superintendent of Water Distribution, through a suitable measuring device into the newly laid pipe line during the application of chlorine. The rate of chlorine solution flow shall be in such proportion to the rate of water entering the pipe that the chlorine dose applied to the water entering the newly laid pipe shall produce at least 10 ppm

of residual chlorine after 24 hours standing in the pipe. This may be expected with an application of 50 ppm, although some conditions may require more

On lines 12 inches in diameter or less, determination of the rate of flow of water into the line to be treated may be made by starting with the line full of water and measuring the rate of discharge at a hydrant located at the end of the pipe farthest away from the point of chlorine application.

For lines larger than 12 inches in diameter, the disinfection operation is generally started with the line empty.

Measurement of the flow of water into and out of all lines shall be made by means of a pitot gage, current type meter, or other approved device.

611.2.812 PREVENTING REVERSE FLOW:

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Check valves shall be used to accomplish this.

611.2.913 RETENTION PERIOD:

Treated water shall be retained in the pipe long enough to destroy all nonspore-forming bacteria. This period should be at least 24 hours and should produce no less than 10 ppm residual chlorine at the extreme end of the line at the end of the retention period.

NOTE: If the circumstances are such that less than a 24 hour retention period must be used, the chlorine concentration shall be increased to 100 ppm. Under these conditions, special care should be taken to avoid attack on pipes, valves, hydrants and other appurtenances.

611.2.104 CHLORINATING VALVES AND HYDRANTS:

In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent. All valves in lines being disinfected shall be opened and closed several times during the 24 hour period of disinfection.

611.2.115 FINAL FLUSHING, SAMPLING AND TESTING:

Following chlorination, all treated water in the newly laid pipeline shall be thoroughly flushed until the replacement water throughout the new pipeline can be proved, by laboratory testing, comparable in quality to the water served to the public from the existing water system. Prior to sampling for laboratory testing, the residual chlorine throughout the length of the pipeline shall be reduced to 1.0 ppm or less. Once the required residual chlorine level in the pipeline is achieved, samples shall be taken as outlined below.

The Contracting Agency or its authorized representative will collect all samples for testing of the new water mains. To initiate the sampling and testing, the Contractor will present to the Contracting Agency a written request for such work no later than 24 hours prior to the time when samples are to be taken.

Samples shall be taken from a tap and riser located and installed in such a way as to prevent outside contamination. Samples shall never be taken from an unsterilized hose or fire hydrant, because such samples will seldom meet bacteriological standards. The number of sampling locations shall be as follows: Waterlines up to but less than 150 feet in length require one sampling riser installed as near the end as possible; lines 150 feet to 300 feet in length, two sampling risers, one near each end of the line; lines 300 to 3,000 feet in length, a minimum of three sampling risers. In addition, dead ends on main lines should be represented with a sampling riser.

The number of samples taken at each sampling location shall be determined by the Contracting Agency based on one of the following methods.

(A) One sample from each sampling location which is examined and analyzed in the laboratory over a three day (72 hour) period.

(B) Two samples taken on separate days from each sampling location. Satisfactory water quality of the new main shall continue for a period of at least two days (48 hours) as demonstrated by laboratory examination of these samples.

Upon completion of laboratory testing, results of all tests shall be sent by the laboratory to the Contracting Agency. Results of laboratory analysis will be interpreted by the Contracting Agency, and reported to the Contractor. Under no circumstance shall the Contractor contact the laboratory. If there is need for test results before written reports are submitted, such information shall be obtained only from the Contracting Agency or its authorized representative.

611.2.126 REPETITION OF CHLORINATION PROCEDURE:

Should the initial treatment fail to result in the conditions specified above, the original chlorination procedure shall be repeated until satisfactory results are obtained.

611.17 PAYMENT:

~~No separate pay item shall be contained in the proposal for disinfecting water mains. This operation shall be included in the price bid for the water mains, installed complete in place, as specified in the proposal.~~

611.3 SEWER LINE TESTING: (615.11)

~~Pressure testing of force mains shall be done in accordance with Section 611.1 (610.15).~~

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

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

~~(A) Low Pressure Air Test:~~

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

~~Test Procedure:~~

- ~~(1) Before testing, the pipe shall be thoroughly cleaned.~~
- ~~(2) The Contractor shall seal off the section of pipe to be tested at each manhole connection. Test plugs must be securely braced within the manholes.~~
- ~~(3) A minimum of two connecting hoses to link the air inlet test plug with an above ground test monitoring panel must be provided.
 - ~~(a) One hose is to induce air through the test plug and into the test chamber.~~
 - ~~(b) The second hose is for the purpose of monitoring the test pressure from within the enclosed pipe.~~~~
- ~~(4) UNDER NO CIRCUMSTANCES ARE WORKERS TO BE ALLOWED IN THE CONNECTING MANHOLES WHILE A PRESSURE TEST IS BEING CONDUCTED.~~
- ~~(5) Add air slowly into the test section. After an internal pressure of 4.0 psi is obtained, allow internal air temperature to stabilize.~~
- ~~(6) After stabilization period, adjust the internal air pressure to 3.5 psi, disconnect the air supply and begin timing the test.~~
- ~~(7) Refer to Table 615-1 to determine the length of time (minutes) the section under test must sustain while not losing in excess of 1 psi as monitored by the test gauge. If the section of line to be tested includes more than one pipe size, calculate the test time for each size and add the test times to arrive at the total test time for the section.~~
- ~~(8) Sections so determined to have lost 1 psi or less during the test period will have passed the leakage test. Those sections losing in excess of 1 psi during the test period will have failed the leakage test.~~
- ~~(9) Appropriate repairs must then be completed and the line retested for acceptance.~~

TABLE 611-1

SANITARY SEWER AIR TEST

Minimum Test Time for Various Pipe Sizes*

| <u>Nominal Pipe Size, in.</u> | <u>T (time), min/100 ft</u> | <u>Nominal Pipe Size, in.</u> | <u>T (time), min/100 ft.</u> |
|-------------------------------|-----------------------------|-------------------------------|------------------------------|
| <u>3</u> | <u>0.2</u> | <u>21</u> | <u>3.0</u> |
| <u>4</u> | <u>0.3</u> | <u>24</u> | <u>3.6</u> |
| <u>6</u> | <u>0.7</u> | <u>27</u> | <u>4.2</u> |
| <u>8</u> | <u>1.2</u> | <u>30</u> | <u>4.8</u> |
| <u>10</u> | <u>1.5</u> | <u>33</u> | <u>5.4</u> |
| <u>12</u> | <u>1.8</u> | <u>36</u> | <u>6.0</u> |
| <u>15</u> | <u>2.1</u> | <u>39</u> | <u>6.6</u> |
| <u>18</u> | <u>2.4</u> | <u>42</u> | <u>7.3</u> |

* The time has been established using the formulas contained in ASTM C828, Appendix.

(B) Hydrostatic Test:

Exfiltration Testing (water):

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

Testing Procedure:

- (1) The Contractor shall furnish all equipment for testing.
- (2) Seal off the downstream end of the line and fill with water to a minimum head of 4 feet in a stand pipe at the high end.
- (3) A period of at least one hour will be allowed for absorption time before making the test.
- (4) A suitable meter or method of measuring the quantity of water used is necessary.
- (5) The allowable water loss for sanitary sewers shall not exceed 0.158 gallons per hour per 100 feet of pipe per inch of diameter of pipe under a minimum test head of 4 feet above the top of the pipe at the upper end.

(C) Deflection Test for HDPE and PVC Pipe:

In addition to the tests prescribed above, the Contractor shall perform a deflection test on the system as directed by the Engineer. Any part of the installation which shows deflection in excess of 5% of the nominal inside diameter per Section 738 for HDPE pipe or in excess of 5% of the average inside diameter per ASTM D3034 for PVC pipe, shall be corrected evaluated and appropriate remedy, if any, shall be performed.

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

(D) Closed Circuit T.V. Inspection:

The Contracting Agency reserves the right to visually inspect the interior of the sewer line using a television camera. Any defects in the pipe or construction methods revealed shall be corrected by the Contractor at no additional cost to the Contracting Agency.

611.4 POST INSTALLATION INSPECTION OF NEW MAINLINE STORM DRAINS:

(A) Video Inspection: (618.5)

The Contractor shall provide the Engineer with an annotated video inspection record (either VHS or DVD format) of the new mainline storm drain pipeline. The video shall clearly show all joints, seals, connecting pipes, and manholes. This video shall be provided to the Engineer, and reviewed and approved by the Engineer prior to the Contractor being allowed to place the final pavement over the storm drain line.

(B) Deflection Test for HDPE and PVC Pipe:

In addition to the tests prescribed above, the Contractor shall perform a deflection test on the system as directed by the Engineer. Any part of the installation which shows deflection in excess of 5% of the nominal inside diameter per Section 738 for HDPE pipe or in excess of 5% of the average inside diameter per ASTM D3034 for PVC pipe, shall be ~~corrected~~ evaluated and appropriate remedy, if any, shall be performed.

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

611.5 PAYMENT : (611.17)

No separate pay item shall be contained in the proposal for disinfecting water mains. This operation shall be included in the price bid for the water mains, installed complete in place, as specified in the proposal

The Contracting Agency will pay for the initial Sewer C.C.T.V. inspection. Any additional inspection(s) required, due to the failure of the initial inspection, shall be paid for by the Contractor.

No separate payment will be made for this Storm Drain Video or Deflection Testing; the cost of the video and deflection testing shall be included in the cost of the pipe.

- End of Section



WATER, SEWER AND STORM DRAIN TESTING

611.1 HYDROSTATIC TESTING:

Water lines, including all fittings and connections to the water mains shall be tested for watertightness by subjecting each section to hydrostatic testing in accordance with applicable provisions of AWWA C-600, except as modified below, and shall consist of pressure testing and allowance testing.

The test section shall be slowly filled with potable water and all air shall be vented from the line. The rate of filling shall be as determined by the Superintendent of Water Distribution, with at least 24 hour notice required before tests are scheduled.

The Contractor shall provide all vents, piping, plugs, bulkheads, valves, bracing, blocking, pumps, and measuring devices and all other equipment necessary for making the tests, including pressure gages, and shall pay the Contracting Agency for water used in the tests.

Hydrostatic Testing: Pressure testing may be made before or after backfilling, but backfilling must be completed before allowance testing. If the pipe is center-loaded, a visual inspection for leaks may be made along the pipe line while the test section is under test pressure, and all visible leaks repaired. However, if mechanical compaction is to be used in the backfilling operations as spelled out in AWWA C-600, the tests shall not be made until the backfilling is completed and compacted. Backfill and compaction for the full distance encompassed by restrained/welded joints shall be completed prior to testing. All connections, blowoffs, hydrants and valves shall be tested with the main as far as is practicable. Hydrostatic testing shall not begin until the pipe has been filled with water for at least 24 hours to allow for air venting.

(A) Pressure Testing: Unless otherwise noted in the contract documents, the minimum prescribed test pressure shall be at least 200 psi for lines smaller than 16 inches and 150 psi for lines 16 inches or larger, not to exceed 5 psi over the minimum prescribed test pressure, as measured at the lowest end of the section under test. The duration of each pressure test shall be at least 2 hours, during which time the test section shall not drop below the minimum prescribed test pressure. If the pressure in the pipe test section has not stabilized by the end of the testing period, a hydrostatic retest will be required.

Each section of a new line between sectionalizing valves or between the last sectionalizing valve and the end of the project shall be tested separately as required in AWWA C-600, and/or as modified in these specifications, except that any such section less than 500 feet in length may be tested with the adjacent section, if both sections of line have the same pipe class rating. No section greater than 1/2 mile in total pipe length shall be tested without special written permission of the Engineer.

(B) Testing Allowance/Makeup Water: Makeup water volume shall be determined after the pressure test has been satisfactorily completed and all backfilling and compaction has been completed to top of trench. Testing allowance shall be defined as the maximum quantity of makeup water necessary to be supplied into the pipe line section under test to restore the ending test pressure to the beginning test pressure, after the pipe line has been filled with water and all air expelled. The Contractor shall furnish the necessary apparatus and assistance to conduct the test.

The duration of each makeup water test shall be at least 2 hours. To pass the allowance testing, the quantity of makeup water from the pipe line shall not exceed the makeup water quantity allowed by the following formula, from AWWA C-600:

$$M = \frac{SD \sqrt{P}}{148,000}$$

in which

M = testing Allowance (makeup water), in gallons per hour.

S = length of pipe tested, in feet

D = nominal diameter of pipe, in inches.

P = test pressure of the pipe being tested, per 610.15 (A)

Should the test on any section of the pipe line require more makeup water than allowed by the above formula, the Contractor shall locate and repair the defective pipe, fittings, or joint until the makeup water volume is within the specified allowance. All repairs and retests, if required, shall be made at the Contractor's expense.

Connections to the existing pipelines or existing valves shall not be made until after that section of new construction has satisfactorily passed the hydrostatic tests.

Ductile iron pipe used in conjunction with ACP will be tested to the ACP standards, unless otherwise directed by the Engineer. High pressure systems of all ductile iron pipe will be tested in accordance with AWWA C-600, Section 4.1.

611.2 DISINFECTING WATER MAINS

611.2.1 FLUSHING COMPLETED PIPE LINES:

(A) Preliminary Flushing: All mains 12 inches and smaller shall be flushed, prior to chlorination, as thoroughly as possible with the water pressure and outlets available. Flushing shall be done after the pressure test has been made. It must be understood that flushing removes only the lighter solids and cannot be relied upon to remove heavy material allowed to get into the main during laying. It is difficult to flush mains over 12 inches in diameter, so in such instances the requirements above, must be rigidly adhered to.

Heavy duty, factory bushed, tapped couplings, with corporation stops shall be located at all high points in the lines to allow the air to be removed prior to testing the water lines and at disinfection points as may be required. Field taps will not be permitted.

The couplings, at high points and disinfection points, shall be left exposed during backfilling until the testing is complete. Couplings and corporation stops shall be left on the mains upon completion of water mains.

(B) Valve Damage by Foreign Material: Unless proper care and thorough inspection are practiced during the laying of water mains, small stones, pieces of concrete, particles of metal, or other foreign material may gain access to mains newly laid or repaired. If it is believed that such foreign material(s) may be in the main, all hydrants on the line shall be thoroughly flushed and carefully inspected after flushing to see that the entire valve operating mechanism of each hydrant is in good condition.

611.2.2 CHLORINE RESIDUAL:

Before being placed in service, all new mains and repaired portions of, or extensions to existing mains shall be chlorinated so that a chlorine residual of not less than 10 ppm remains in the water after 24 hours standing in the pipe.

611.2.3 METHODS OF APPLYING CHLORINE:

Any of the following methods of application of chlorine (arranged in order of preference) may be used, subject to the approval of the Engineer.

Liquid chlorine gas-water mixture.
Direct chlorine feed.
Calcium or sodium hypochlorite and water mixture.

611.2.4 APPLICATION OF LIQUID CHLORINE:

A chlorine gas-water mixture shall be applied by means of a solution-feed chlorinating device or, if approved by the Engineer, the dry gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine gas or of the gas itself must provide means for preventing the backflow of water into the cylinder.

611.2.5 CHLORINE-BEARING COMPOUNDS IN WATER:

On approval of the Engineer, a mixture of water and a chlorine-bearing compound of known chlorine content may be substituted for liquid chlorine.

(A) Compounds to be Used: The chlorine-bearing compounds that may be used are: Calcium hypochlorite*, and sodium hypochlorite**.

(B) Preparation of Mixture: High-test calcium hypochlorite must be prepared as a water mixture for introduction into the water mains. The powder should first be made into a paste and then thinned to approximately a 1 percent chlorine solution (10,000 ppm). The preparation of a 1 percent chlorine solution requires the following proportions of powder to water:

| Product | Amount of Compound | Quantity of Water (Gallons) |
|--|-----------------------------------|--|
| High-test calcium hypochlorite (65—70% Cl) | 1 lb. | 7.50 |
| Liquid laundry bleach (5.25% Cl) | 1—2 pts. | 12.6 |

611.2.6 POINT OF APPLICATION:

The preferred point of application of the chlorinating agent is at the beginning of the pipe line extension or any valved section of it and through a corporation stop inserted in the top of the newly laid pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipe line extension.

611.2.7 RATE OF APPLICATION:

Water from the existing distribution system or other source of supply shall be controlled so the rate of flow shall not exceed 500 gpm, unless approved by the Superintendent of Water Distribution, through a suitable measuring device into the newly laid pipe line during the application of chlorine. The rate of chlorine solution flow shall be in such proportion to the rate of water entering the pipe that the chlorine dose applied to the water entering the newly laid pipe shall produce at least 10 ppm of residual chlorine after 24 hours standing in the pipe. This may be expected with an application of 50 ppm, although some conditions may require more

On lines 12 inches in diameter or less, determination of the rate of flow of water into the line to be treated may be made by starting with the line full of water and measuring the rate of discharge at a hydrant located at the end of the pipe farthest away from the point of chlorine application.

For lines larger than 12 inches in diameter, the disinfection operation is generally started with the line empty.

Measurement of the flow of water into and out of all lines shall be made by means of a pitot gage, current type meter, or other approved device.

611.2.8 PREVENTING REVERSE FLOW:

Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Check valves shall be used to accomplish this.

611.2.9 RETENTION PERIOD:

Treated water shall be retained in the pipe long enough to destroy all nonspore-forming bacteria. This period should be at least 24 hours and should produce no less than 10 ppm residual chlorine at the extreme end of the line at the end of the retention period.

NOTE: If the circumstances are such that less than a 24 hour retention period must be used, the chlorine concentration shall be increased to 100 ppm. Under these conditions, special care should be taken to avoid attack on pipes, valves, hydrants and other appurtenances.

611.2.10 CHLORINATING VALVES AND HYDRANTS:

In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent. All valves in lines being disinfected shall be opened and closed several times during the 24 hour

period of disinfection.

611.2.11 FINAL FLUSHING, SAMPLING AND TESTING:

Following chlorination, all treated water in the newly laid pipeline shall be thoroughly flushed until the replacement water throughout the new pipeline can be proved, by laboratory testing, comparable in quality to the water served to the public from the existing water system. Prior to sampling for laboratory testing, the residual chlorine throughout the length of the pipeline shall be reduced to 1.0 ppm or less. Once the required residual chlorine level in the pipeline is achieved, samples shall be taken as outlined below.

The Contracting Agency or its authorized representative will collect all samples for testing of the new water mains. To initiate the sampling and testing, the Contractor will present to the Contracting Agency a written request for such work no later than 24 hours prior to the time when samples are to be taken.

Samples shall be taken from a tap and riser located and installed in such a way as to prevent outside contamination. Samples shall never be taken from an unsterilized hose or fire hydrant, because such samples will seldom meet bacteriological standards. The number of sampling locations shall be as follows: Waterlines up to but less than 150 feet in length require one sampling riser installed as near the end as possible; lines 150 feet to 300 feet in length, two sampling risers, one near each end of the line; lines 300 to 3,000 feet in length, a minimum of three sampling risers. In addition, dead ends on main lines should be represented with a sampling riser.

The number of samples taken at each sampling location shall be determined by the Contracting Agency based on one of the following methods.

(A) One sample from each sampling location which is examined and analyzed in the laboratory over a three day (72 hour) period.

(B) Two samples taken on separate days from each sampling location. Satisfactory water quality of the new main shall continue for a period of at least two days (48 hours) as demonstrated by laboratory examination of these samples.

Upon completion of laboratory testing, results of all tests shall be sent by the laboratory to the Contracting Agency. Results of laboratory analysis will be interpreted by the Contracting Agency, and reported to the Contractor. Under no circumstance shall the Contractor contact the laboratory. If there is need for test results before written reports are submitted, such information shall be obtained only from the Contracting Agency or its authorized representative.

611.2.12 REPETITION OF CHLORINATION PROCEDURE:

Should the initial treatment fail to result in the conditions specified above, the original chlorination procedure shall be repeated until satisfactory results are obtained.

611.3 SEWER LINE TESTING:

Pressure testing of force mains shall be done in accordance with Section 611.1

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

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

(A) Low Pressure Air Test:

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

Test Procedure:

- (1) Before testing, the pipe shall be thoroughly cleaned.
- (2) The Contractor shall seal off the section of pipe to be tested at each manhole connection. Test plugs must be securely braced within the manholes.
- (3) A minimum of two connecting hoses to link the air inlet test plug with an above ground test monitoring panel must be provided.
 - (a) One hose is to induce air through the test plug and into the test chamber.
 - (b) The second hose is for the purpose of monitoring the test pressure from within the enclosed pipe.
- (4) UNDER NO CIRCUMSTANCES ARE WORKERS TO BE ALLOWED IN THE CONNECTING MANHOLES WHILE A PRESSURE TEST IS BEING CONDUCTED.
- (5) Add air slowly into the test section. After an internal pressure of 4.0 psi is obtained, allow internal air temperature to stabilize.
- (6) After stabilization period, adjust the internal air pressure to 3.5 psi, disconnect the air supply and begin timing the test.
- (7) Refer to Table [615-1](#) to determine the length of time (minutes) the section under test must sustain while not losing in excess of 1 psi as monitored by the test gauge. If the section of line to be tested includes more than one pipe size, calculate the test time for each size and add the test times to arrive at the total test time for the section.
- (8) Sections so determined to have lost 1 psi or less during the test period will have passed the leakage test. Those sections losing in excess of 1 psi during the test period will have failed the leakage test.
- (9) Appropriate repairs must then be completed and the line retested for acceptance.

| TABLE 611-1 | | | |
|---|----------------------|------------------------|-----------------------|
| SANITARY SEWER AIR TEST | | | |
| Minimum Test Time for Various Pipe Sizes* | | | |
| Nominal Pipe Size, in. | T (time), min/100 ft | Nominal Pipe Size, in. | T (time), min/100 ft. |
| 3 | 0.2 | 21 | 3.0 |
| 4 | 0.3 | 24 | 3.6 |
| 6 | 0.7 | 27 | 4.2 |
| 8 | 1.2 | 30 | 4.8 |
| 10 | 1.5 | 33 | 5.4 |
| 12 | 1.8 | 36 | 6.0 |
| 15 | 2.1 | 39 | 6.6 |
| 18 | 2.4 | 42 | 7.3 |

* The time has been established using the formulas contained in ASTM C828, Appendix.

(B) Hydrostatic Test:

Exfiltration Testing (water):

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

Testing Procedure:

- (1) The Contractor shall furnish all equipment for testing.
- (2) Seal off the downstream end of the line and fill with water to a minimum head of 4 feet in a stand pipe at the high end.
- (3) A period of at least one hour will be allowed for absorption time before making the test.
- (4) A suitable meter or method of measuring the quantity of water used is necessary.
- (5) The allowable water loss for sanitary sewers shall not exceed 0.158 gallons per hour per 100 feet of pipe per inch of diameter of pipe under a minimum test head of 4 feet above the top of the pipe at the upper end.

(C) Deflection Test for HDPE and PVC Pipe:

In addition to the tests prescribed above, the Contractor shall perform a deflection test on the system as directed by the Engineer. Any part of the installation which shows deflection in excess of 5% of the nominal inside diameter per Section

[738](#) for HDPE pipe or in excess of 5% of the average inside diameter per ASTM D3034 for PVC pipe, shall be evaluated and appropriate remedy, if any, shall be performed.

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

(D) Closed Circuit T.V. Inspection:

The Contracting Agency reserves the right to visually inspect the interior of the sewer line using a television camera. Any defects in the pipe or construction methods revealed shall be corrected by the Contractor at no additional cost to the Contracting Agency.

611.4 POST INSTALLATION INSPECTION OF NEW MAINLINE STORM DRAINS:

(A) Video Inspection:

The Contractor shall provide the Engineer with an annotated video inspection record (either VHS or DVD format) of the new mainline storm drain pipeline. The video shall clearly show all joints, seals, connecting pipes, and manholes. This video shall be provided to the Engineer, and reviewed and approved by the Engineer prior to the Contractor being allowed to place the final pavement over the storm drain line.

(B) Deflection Test for HDPE and PVC Pipe:

In addition to the tests prescribed above, the Contractor shall perform a deflection test on the system as directed by the Engineer. Any part of the installation which shows deflection in excess of 5% of the nominal inside diameter per Section 738 for HDPE pipe or in excess of 5% of the average inside diameter per ASTM D3034 for PVC pipe, shall be evaluated and appropriate remedy, if any, shall be performed.

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

611.5 PAYMENT :

No separate pay item shall be contained in the proposal for disinfecting water mains. This operation shall be included in the price bid for the water mains, installed complete in place, as specified in the proposal

The Contracting Agency will pay for the initial Sewer C.C.T.V. inspection. Any additional inspection(s) required, due to the failure of the initial inspection, shall be paid for by the Contractor.

No separate payment will be made for this Storm Drain Video or Deflection Testing; the cost of the video and deflection testing shall be included in the cost of the pipe.

- End of Section

WATER LINE CONSTRUCTION**610.1 DESCRIPTION:**

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

610.2 GENERAL:

All pipes shall be delivered, handled and installed in accordance with the manufacturer's recommendations and/or applicable provisions of AWWA standards for installation of the various types of water mains specified, insofar as such recommendations and provisions are not in variance with the standard specifications and details.

Where water lines are to be constructed in new subdivisions or in conjunction with street repaving projects, the streets shall be pre-graded to within 6 inches of the new street subgrade prior to trenching or cut stakes shall be set for trenching.

610.3 MATERIALS:

All pipes for water lines shall be of the classes shown on the plans or as specified below.

(A) The 4-inch through 16-inch diameter pipe sizes may be PVC C900 or ductile iron, except where a particular material is specified by the agency or the contract documents. All pipes shall be minimum 150 psi design unless otherwise specified.

(B) Pipe 16 inches and larger may be either ductile iron, or concrete pressure pipe-steel cylinder type.

Ductile iron **and cast iron** water pipe and fittings per: Section [750](#). Concrete pressure pipe-steel cylinder type per: Section [758](#). C900 PVC per: AWWA C900-07.

Service material containing brass or bronze must comply with the current NSF 61-8 standards at the time the project begins.

All brass or bronze service material must meet the current AWWA C-800 standards.

Any product used in water line construction containing brass or bronze that comes in contact with potable water shall meet the current NSF standards and federal law.

Only such packing materials as are included in the list of acceptable materials in AWWA C-600 for installation of cast iron water main, shall be used. The packing materials shall be handled in such a manner as to avoid contamination, and shall be dry when placed in the joints. All such materials shall be free of oil, tar, or greasy substances, except that treated paper packing material, jute, cement, or **sulfur** compound caulking will not be permitted.

610.4 CONSTRUCTION METHODS:

610.4.1 Trenching/Cover: All water mains in major streets shall have a minimum cover of 48 inches over the top of the pipe. Water mains in other locations shall have a minimum cover over the top of the pipe as follows:

(A) 36 inches for mains smaller than 12 inches.

(B) 48 inches for mains 12 inches and larger.

Cover for water mains will be measured from existing or proposed finished grade of pavement or from natural ground, whichever is deeper.

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Except as otherwise required in this specification, the special provisions, or by the Engineer, trench excavation, backfilling and compaction shall be in accordance with the requirements of Section 601. Backfilling may be accomplished as soon as the pipe line has been installed to the satisfaction of the Engineer, subject to the requirements for testing per Section 611, ~~as contained below~~.

610.4.2 Laying Pipe: No water main shall be deflected, either vertically or horizontally, in excess of that recommended by the manufacturer of the pipe or coupling, ~~without the appropriate use of bends or offsets~~.

If adjustment of the position of a length of pipe is required after it has been laid, it shall be removed and rejoined as for a new pipe.

Curb stops with flushing pipes or fire hydrants shall be installed at the ends of dead-end mains according to standard details.

Thrust blocks shall be installed in accordance with this specification.

Valve boxes and covers shall be according to standard details.

Ductile iron pipe shall be installed in accordance with this specification and pipe and fittings shall be in accordance with Section 750.

PVC C-900 pipe shall be installed in accordance with AWWA C900 and Section 601.

610.4.3 Blocking and Restraints: All pipe lines, valves and fittings 16 inches and smaller in diameter shall be blocked with concrete thrust blocks in accordance with standard details. Thrust block areas for pipe, valves and fittings larger than 16 inches in diameter shall be ~~calculated for each size pipe, valve and fitting to be~~ installed per details and shown on the plans. The areas stipulated in the standard details are minimums and shall not be decreased.

~~Thrust block areas shall be calculated on the basis of 200 psi test pressure bearing against undisturbed 3,000 psf soil.~~

~~If irregular soil or pressure conditions other than those stated above are encountered, the thrust block areas shall be calculated and submitted for approval. a thrust block design revision or an alternate joint restraint system may be required by the Engineer.~~

When restrained/welded joints are specified to resist thrust forces, blocking is not required.

With the Engineers approval, restrained/welded joints may be used in lieu of thrust blocks. ~~to resist thrust forces~~.

Where restrained joints are specified on mains sixteen (16) inches in diameter and smaller, ductile iron pipe shall be used with an approved joint restraint method.

On mains sixteen (16) inches in diameter and larger where plans specify welding joints and where ductile iron pipe is furnished, joints shall be restrained by an approved joint restraint method for the distance specified.

610.4.4 Maintain Pipe Cleanliness / Pipe Cleaning: The interior of all pipe and fittings shall be kept as free as possible of all dirt and foreign material at all times, until the pipe is placed in the new line.

Every precaution shall be taken to prevent foreign material from entering the pipe. When on the project site, the ends of the pipe section shall be plugged, wrapped or tarped at all times when pipe laying is not in progress, which includes storage and staging at the site. The pipe shall be stored on a pallet, blocking or other means to prevent foreign materials from entering the pipe. The pipe line shall be protected by a water-tight plug or other means approved by the Engineer when the pipe is in the trench if pipe laying is not in progress.

If in the opinion of the Engineer, the pipe contains dirt that will not be removed during the flushing operation; the interior of the pipe shall be cleaned and swabbed, as necessary, with a .005 to .010 percent chlorine solution.

If the Contractor or pipe-laying crew cannot install the pipe in the trench without getting earth into it, the Engineer may require that, before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size be placed over each end of the pipe and left there until the connection is to be made to the adjacent pipe.

At the close of each day's work, and at times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Engineer. Joints of all pipe in the trench shall be completed before the work is stopped. If water is in the trench, the seal shall remain in place until the trench is pumped dry.

610.4.5 Testing:

Hydrostatic testing shall be in accordance ~~with this specification~~ Section 611.

After pressure testing and before placing in service, all water lines shall be disinfected. Disinfection shall be accomplished in accordance with Section 611.

All corporation stops used for testing and chlorination shall be left in the pipe line with the stop closed and all connecting pipe removed.

610.5 SEPARATION:

610.5.1 General: Water lines and sewer lines shall be separated to protect water lines from contamination by sewer lines.

The angle of a water line and sewer line crossing shall be limited to between (45) forty-five degrees and (90) ninety degrees. Intersection angles of less than (45) forty-five degrees shall not be allowed.

Separation distances are measured from the outside diameter of the water or sewer line, or the centerline of a manhole.

When water and sewer lines cannot meet separation requirements, extra protection is required as described in Subsection 610.5.5 and shown in Standard Details 404-1, 404-2 and 404-3.

Extra protection requirements for line crossings are measured from the closest outside surfaces of the sewer and water line.

Water line service connections to individual building supply and distribution plumbing shall not be placed below sewer lines, and shall otherwise comply with the separation requirements of the applicable plumbing code as applied by the Agency (Administrative Authority). Methods described for extra protection do not apply to these service lines.

Water and sewer lines shall not be constructed parallel within a common trench.

610.5.2 Water Line Separation from Gravity Sewer Lines: Water lines shall not be placed within two (2) feet horizontal and one (1) foot vertical above and two (2) feet vertical below gravity sewer lines.

Extra protection is required where a water line is placed within six (6) feet horizontal and two (2) feet vertical above a gravity sewer line.

Extra protection is required where a water line is placed within six (6) feet horizontal and any distance below a gravity sewer line.

610.5.3 Water Line Separation from Pressurized Sewer Lines: Water lines shall not be placed within six (6) feet horizontal and within two (2) feet vertical below or within two (2) feet vertical above a pressurized sewer line.

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Extra protection is required where a water line is placed within six (6) feet horizontal and within six (6) feet vertical above a pressurized sewer line.

Extra protection is required where a water line is placed within (6) feet horizontal and any distance below a pressurized sewer line.

610.5.4 Water Line Separation from Manholes: Water lines shall not pass through or come into contact with any part of a sewer manhole and shall be separated six (6) feet horizontal from the center of a sewer manhole.

610.5.5 Extra Protection: New water lines that require extra protection from new sewer lines, shall have extra protection provided by using ductile iron pipe for both lines. Lines of standard pipe length shall be centered at the point of crossing so that no joints exist within six (feet) horizontal and only restrained or mechanical joints exist within ten (10) feet horizontal.

New water lines that require extra protection from sewer lines, shall have identification wrap and/or tape installed on the water and sewer lines for the length that requires extra protection for each line.

New water lines that require extra protection from existing sewer lines shall be constructed using the extra protection specified for new water lines, and the existing sewer line:

- (1) shall be reconstructed using a standard length of ductile iron pipe centered at the point of crossing so that no joints exist within six (6) feet horizontal and only restrained or mechanical joints exist within ten (10) feet horizontal, or
- (1) shall be encased in 6 inches of concrete for the horizontal distance of the line that requires extra protection but for a distance no less than ten (10) feet horizontal.

Existing water lines that require extra protection from new sewer lines shall provide for extra protection by:

- (1) constructing the new sewer line and reconstructing the existing water line using ductile iron pipe for both lines with standard pipe lengths centered at the point of crossing so that no joints exist within six (feet) horizontal and restrained or mechanical joints exist within ten (10) feet horizontal, or
- (2) encasement of both the existing water line and the new sewer line in six (6) inches of concrete for the horizontal distance of the lines that require extra protection but for a distance no less than ten (10) feet horizontal.
- (3) Extra protection for existing ductile iron water lines can be met by the installation of restrained or mechanical joints on the existing water line within ten (10) feet horizontal of the crossing and either
 - (a) construction of new sewer line using a standard pipe length of ductile iron pipe centered at the point of crossing so that no joints exist within six (6) feet horizontal and restrained or mechanical joints exist within ten (10) feet horizontal, or
 - (b) encasement of the new sewer line in 6 inches of concrete for the horizontal distance of the line that requires extra protection but for a distance no less than ten (10) feet horizontal.

610.6 POLYETHYLENE CORROSION PROTECTION

610.6.1 General: Where called for in the plans and specifications or directed by the Engineer, pipe, valves and fittings shall be protected from corrosion by encasement in a polyethylene protective wrapping referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.

610.6.2 Materials: The polywrap shall be of virgin polyethylene, not less than 8 *mils* in thickness, formed into

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tubes or sheets as may be required. Naturally pigmented material may be used where exposure to ultraviolet light will be less than 48 hours.

Otherwise the material shall be pigmented with 2 to 2 1/2 percent of well dispersed carbon black with stabilizers.

The polywrap shall be secured as specified below with 2-inch wide pressure sensitive tape not less than 10 mils thick. This flexible tape shall consist of a polyethylene or polyvinyl chloride backing with a synthetic elastomeric adhesive film comprised of butyl rubber. Tape shall remain flexible over a wide range of temperatures, with tensile strength and elongation properties in conformance with ASTM D1000.

The minimum tube size for each pipe diameter shall be per Table [610-1](#).

| TABLE 610-1 (from AWWA C105-05) | | |
|--|---|--|
| POLYWRAP FLAT TUBE WIDTHS | | |
| Nominal Pipe Diameter (Inches) | Cast Iron Or Ductile Iron With Push-On Joints (inches) | Cast Iron or Ductile Iron With Mechanical Joints (inches) |
| 4 | 14 | 16 |
| 6 | 17 16 | 20 |
| 8 | 21 20 | 24 |
| 10 | 25 24 | 27 |
| 12 | 29 27 | 30 |
| 14 | 33 30 | 34 |
| 16 | 37 34 | 37 |
| 18 | 41 37 | 41 |
| 20 | 45 41 | 45 |
| 24 | 53 54 | 53 |
| 30 | 67 | . |
| 36 | 81 | . |
| 42 | 81 | . |
| 48 | 95 | . |
| 54 | 108 | . |
| 60 | 108 | . |
| 64 | 121 | . |

610.6.3 Installation: The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. With the pipe suspended from the center the tube shall be slipped over the spigot end and bunched up between the point of support and the spigot end. After the pipe is installed into the bell of the adjacent pipe the pipe shall be lowered to the trench bottom and the supporting sling removed from the center of the pipe. The pipe shall then be raised at the bell end enough to allow the tube to be slipped along the full length of the barrel with enough left at each end to overlap the adjoining pipe about 1 foot. A shallow bell hole must be made at each joint to facilitate installation of the polywrap.

Pull the bunched-up polywrap from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. Then slip the end of the polywrap from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Tape it in place.

The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe, and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.

Repair any rips, punctures or other damage to the tube with the adhesive tape or pieces of tube material secured with tape.

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Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.

Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body to the stem. Edges shall be brought together, folded twice and secured with the adhesive tape.

610.6.4 Payment for Polywrap: Payment for this item shall be per the provisions of Subsections [109.4](#) and [109.5](#) of the specifications unless this item is specifically called for on the plans or in the supplemental specifications or special provisions as a specific component and pay item for a given project.

610.7 VALVES:

Valves shall be installed in accordance with AWWA C-600 or AWWA C-603 modified as follows:

All tapping sleeves, gate valves, butterfly valves, air release and vacuum valves and corporation stops shall be in accordance with Section [630](#).

Just before installation in the trench, valves shall be fully opened and closed to check the action, and a record made of the number of turns required to fully open or close the valve. For valves 16 inches and larger, a member of the water utility shall be present to check the action and record the number of turns. The inside of all valves shall then be thoroughly cleaned and the valve installed.

Valves 12 inches and smaller in size shall be supported by concrete blocks, in accordance with the standard details.

Valves 16 inches and larger in size along with their bypass valves, shall be supported on concrete slabs, and/or concrete piers, as indicated on the plans.

Concrete supports shall be provided under valves in vaults and manholes, and shall be constructed an inch low, then grouted with non-shrink grout. Adjustable pipe supports shall be as indicated on the plans. Buried valves shall be supported on concrete blocks as detailed on the plans.

Valve boxes shall be installed over all buried valves in accordance with standard details.

Standard couplings or matching joints shall be used when more than one length of pipe is required, or when two or more pieces are joined, to form the valve box riser. Install extension stems on all valves where the operating nut is 5 feet or more below grade.

610.8 MANHOLES AND VAULTS:

Construction shall consist of furnishing all materials and constructing manholes or vaults complete in place, as detailed, including foundation walls, cast iron steps, frames, covers, and any incidentals thereto, at location shown on the plans.

Manholes shall be constructed to conform with the requirements of Section [625](#) and standard details, except the inside diameter shall be 60 inches.

Vaults shall be constructed of reinforced concrete conforming to Section [725](#) and of concrete pipe conforming to ASTM C76 Wall A or B. Vaults shall be kept moist for 7 days before backfilling.

610.9 FIRE HYDRANTS:

The Contractor shall furnish all labor, materials, and equipment necessary to install fire hydrants complete in place at locations shown on the plans in accordance with the standard details and special provisions. Fire hydrants furnished by the Contractor shall conform to the requirements of Section [756](#).

If paint is chipped, scuffed, or otherwise damaged during handling and installation, the Contractor shall touch up

such spots as may be designated by the Engineer.

All hydrants must be flushed and left in good working condition with the control valve open.

610.10 COUPLINGS, JOINTS, GASKETS AND FLANGES:

(A) Couplings: The couplings used to join the pipe to flanged valve adapters shall have a minimum working pressure of 150 psi, and shall have a fusion-bonded epoxy finish. The coupling sleeves shall be carbon steel with a minimum yield of 30,000 psi. The flanges shall have a minimum yield of 30,000 psi and be ductile iron or carbon steel for sizes up to 12", or high-strength, low-alloy steel for sizes 14" and larger.

(B) Joints: The joints and fitting shall conform to Sections 750 and 752.

(C) Bolts and Nuts:

- (1) Bolts, studs, and nuts used in underground field flanged connections or for connecting fittings shall be carbon steel compliant with ASTM A307, Grade A unless Grade B is specified. Bolts, studs, and nuts shall be in accordance with AWWA C111. Bolts and studs shall have Class 2A thread tolerance with the corresponding nuts having Class 2B tolerance. Bolts, studs and nuts shall have a hot-dipped zinc coating in accordance with ASTM F2329. All bolt diameters shall normally be 1/8 inch smaller than the bolt hole diameter. If specified, allowable exceptions to zinc coating shall be bolts, studs, and nuts made from 316 stainless steel per ASTM F593 or cadmium plated per ASTM B766. All bolts shall be hexagonal heads.
- (2) The minimum requirement for underground mechanical joint connections using T-head bolts shall meet the requirements of AWWA C111 using a high strength low alloy steel manufactured for atmospheric corrosion resistance per ASTM A242.

These bolted joints shall be protected as follows: Following installation and before backfilling, all couplings, steel flanges, bolts, nuts, anchor bolts and rods, bolting of all flanged valves, and all exposed steel shall be protected from corrosion by either of the two methods outlined below at the Contractor's option.

(A) Below ground installations shall be coated with NO-OX-ID "A" with a film of not less than 1/32 inch thick and then coated with cement mortar not less than 1 inch thickness before backfilling. Cement mortar shall be composed of 1 part cement, ASTM C150, Type II, low alkali, to 3 parts sand. Before application of the cement mortar coating the area to be protected shall be covered with a layer of 2 x 2 inch No. 14 gage welded wire fabric, firmly wired in place.

(B) Below ground installations shall be protected by the application of hot coal-tar enamel. The coal-tar enamel shall be in accordance with AWWA C-203 and shall be applied to the top part of the pipe or fittings by daubers for at least 2 coats for a total minimum thickness of 1/16 inch. The coal-tar for under side of the pipe flanges or fittings shall be applied by the pan or cocoon method as described below and in AWWA Manual M-11, Steel Pipe.

Pan Method: The coating pan is securely anchored in place on the underside of the pipe and straddling the connection to be coated. The pan shall be wide enough so that the entire connection will be coated.

Hot coal-tar enamel is poured into the pan, from one side only, until the pan is completely filled. The drain plug or valve, is then opened and the excess coal-tar drained out. The pan can then be removed. Details of the coating pan and corresponding dimensions are given in AWWA Manual M-11.

The upper portion of the connection, and all remaining exposed steel pipe, will then be coated by the use of a dauber. The coal-tar coating shall be applied in at least 2 coats for a minimum thickness of 1/16 inch. The daubers and method of application shall conform to AWWA C-203. No thinning will be allowed.

(C) Cocoon Method: The cocoon is formed by placing glass fiber cloth or roofing paper, of the proper width, around the underside of the connection and adjacent exposed steel pipe. The edges of the cocoon shall be securely fastened to the pipe. Backfill is lightly placed to the spring line, and the top of the cocoon is opened and layed back

on the filled area and hot coal-tar enamel poured, from one side only, until the cocoon is completely filled. The loose backfill prevents rupture of the cocoon. The upper portion of the connection and remaining exposed steel pipe shall be coated as above.

(D) Gaskets: Except as otherwise provided, all gaskets for pipe lines shall be one piece full faced gaskets from one-ply cloth inserted SBR rubber material. Gaskets for flanges 20 inches and smaller shall be from 1/16 inch thick material. Gaskets for flanges 24 inches and larger shall be from 1/8 inch thick material. Gasket material shall be J-M 109 as manufactured by Johns-Manville Corporation or an approved equal. Physical characteristics of the rubber compound shall meet ASTM D2000, Class 4AA805A13.

(E) Flanges: Cast iron flanges shall conform to AWWA C-110 as to material, diameter, thickness, drilling, etc. Steel flanges shall be ring or hub type, and shall conform to AWWA C-207, Class D. All flanges shall be drilled and have flange diameters and bolt circles conforming to AWWA C-110, except bolt holes will be 1/8 inch larger than the bolts given for the various sizes. All bolts shall be as specified above and all flanges shall have a flat facing.

~~610.11 DISINFECTING WATER LINES:~~

~~After pressure testing and before placing in service, all water lines shall be disinfected. Disinfection shall be accomplished in accordance with Section 611. All valves in the lines being disinfected shall be opened and closed several times during the 24-hour period of disinfection.~~

610.11 CONNECTION TO EXISTING MAINS:

Existing pipe to which connections are to be made shall be exposed by the Contractor as directed by the Engineer, to permit field changes in line, grade or fittings, if necessary.

All connections to existing mains shall be constructed according to the plans.

Valves connecting new work to the existing system shall be kept closed at all times.

Only Agency personnel shall operate existing valves. The Contractor shall not operate valves in the existing system.

After disinfected samples have been taken and the new work passes the bacteriological tests, the new line shall then be turned over to the Contracting Agency with all branch lines and tie-in valves closed.

When shutdown of an existing water main is necessary in order to connect to the new lines, the Contractor shall make application and pay the required charges to the Contracting Agency. A conference between the Contractor's representative, Engineering Inspection, and Water Distribution personnel shall establish the time and procedures to insure that the shutdown will be for the shortest possible time. If necessary to minimize inconvenience to customers, shutdowns may be scheduled during other than normal working hours. The water supply to some customers, such as hospitals, cannot be shut off at any time. Provisions to furnish a continuous supply of water to such establishments will be required. After the procedures and time for a shutdown are agreed upon, it shall be the Contractor's responsibility to notify all customers in advance that the water will be turned off. When possible, customers shall be notified 24 hours in advance and in no case, except in emergency, shall notification be less than 30 minutes. Notification shall be in writing, giving the reason for the shutdown and the time and duration the water service will be shut off.

The Contracting Agency will close existing valves, but will not guarantee a 100% complete ~~bone dry~~ shutdown.

610.12 FIRE LINE SERVICE CONNECTIONS:

Fire line service connections shall be installed in accordance with standard details.

The fire line from the control valves at the main to the detector check valve shall be constructed of ductile iron pipe

per Section 750.

610.13 METER SERVICE CONNECTIONS:

All new meters must be installed by the Contracting Agency after the proper application as required by Code with fees paid at prevailing rates.

When plans call for connections from a new water main to an existing water meter, the work shall include new copper pipe and fittings except as follows:

(A) Wrapped galvanized pipe shall be used to connect or extend existing galvanized service pipe. Type K soft copper pipe or tubing shall be used to connect or extend existing copper service pipe except when otherwise called for in the plans.

(B) When the existing main is not abandoned, and the existing meter is to be connected to the new line, the corporation stop at the old main shall be closed and the abandoned service line cut 6 inches from the old main.

(C) Taps and service connections to the new main shall be made prior to testing and disinfection of the new line.

(D) Meter service piping may be installed by drilling in place of open cut construction when approved by the Engineer.

When called for on the plans, the meter and box shall be relocated by the Contractor as directed by the Engineer. Existing meters which are shown on the plans to be relocated shall be located and installed in accordance with standard details.

Water meter boxes which are broken during construction shall be replaced by the Contractor at no additional cost to the Contracting Agency. Existing meter boxes which are already broken prior to start of construction shall be replaced by the Contractor with boxes furnished by the Contracting Agency. Boxes may be picked up by the Contractor after written authorization is received from the Engineer. The written authorization shall include the street address of each broken meter box and the size of meter box required. All water meter boxes shall conform to the standard details.

~~610.15 (Move to Section 611) HYDROSTATIC TESTING: (Referenced in new section "610.4.5 Testing:") herein)~~

~~610.16 (Move to Section 611) DISINFECTING WATER LINES: (Referenced in new section "610.4.5 Testing:") herein)~~

610.14 CLEANUP:

When testing, chlorination, compaction, and cleanup do not follow pipe laying in an orderly manner, the Engineer reserves the right to close down trenching and pipe laying until these operations are adequately advanced.

610.15 PAVEMENT AND SURFACING REPLACEMENT:

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

610.16 MEASUREMENT AND PAYMENT:

(A) Pipe:

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- (1) Measurement of all pipe shall be of the linear feet of pipe installed, measured along the centerline of the pipe, through all valves and fittings, from the centerline of the fittings or centerline of valves on ends of pipe to the centerline of fittings, centerline of valves on ends of pipe or to the end of pipe, as the case may be, for all through runs of pipe. Measurement of ~~branch lateral~~ line pipes shall start at the centerline of valve at connection to the main. Measurement of ~~meter service lines~~ pipe shall be from the centerline of the new main to the connection at the meter, ~~along the centerline of service pipe~~. Measurement shall be to the nearest ~~0.1~~ foot.

~~Branches of tees that are valued, valved and capped will not be measured.~~

- (2) Payment will be made at the contract unit price ~~bid~~ per linear foot of each type and size of pipe. ~~called for in the proposal~~. Such payment shall be compensation in full for furnishing and installing the pipe and fittings, specials, adapters, etc., complete in place, as called for on the plans and/or on the standard details, and shall include all costs of excavation, removal of obstructions, shoring and bracing, bedding, backfilling, compaction, maintenance of traffic, testing, disinfecting, connections to existing lines or works, and all work not specifically covered in other pay items.

~~A contingent item for fittings not shown on the plans shall be included in the proposal. Payment will be made at the unit price bid per pound on the theoretical weight of the fittings installed, which shall be compensation in full for furnishing and installing the fittings.~~

(B) ~~(1)~~ Service Line Connections ~~: To Existing Water Meters~~: Measurement shall be of the number of unit connections made for water ~~meter~~ services, as ~~if~~ called for in the ~~bid proposal~~. Each ~~bid proposal~~ item unit shall consist of the connection to the water main and to the meter, as may be required in standard the plan details. Payment will be made at the contract unit price ~~bid~~ for each ~~unit~~ water ~~meter~~ service connection and shall be compensation in full for labor materials (other than pipe) equipment, tapping, and all necessary incidentals. ~~(2)~~ Payment for new service pipe required to make the connection will be made separately, as stipulated above. If no contract bid item exists for connections, then the cost for connections to meters and main lines shall be included in the corresponding pipe bid item unit price.

(C) ~~(B)~~ Relocation of Existing Meters and Boxes: Measurement shall be of the number of meters and boxes moved and reinstalled. Payment will be made at the contract unit price ~~bid in the proposal~~ for each meter and box relocated and installed.

(D) ~~(C)~~ Permanent Pipe Supports and Encasement of Existing Pipes: Measurement shall be of each unit included in the ~~bid proposal~~, and payment shall be compensation in full for supporting or encasing existing pipe, as required on the plans, including excavation, form work, reinforcing, concrete, handling and controlling flows in the existing pipe, removing and replacing existing pipe where necessary, supporting, backfilling and compaction, and pavement and/or surfacing replacement required in excess of pay width(s) allowed in Section 336.

(E) ~~(D)~~ Concrete Thrust Blocks: Concrete thrust blocks and anchors for all pipe 16 inches and larger shall be measured by the cubic yard(s) of concrete placed, as required on the plans and/or as directed by the Engineer. Payment will be made at the contract unit price ~~bid~~ per cubic yard, and shall be compensation in full for excavation, formwork, placing and finishing concrete, reinforcing, backfilling and compaction, and pavement and/or surfacing replacement required in excess of pay width(s) allowed in Section 336. All thrust blocks and anchors for 12 inches and smaller pipe shall be included in the linear foot cost of the pipe.

(F) ~~(E)~~ Valves: Measurement of and payment for valves, tapping sleeves and valves, and valve boxes shall be for each item furnished and installed, as designated in Section 630.

(G) ~~(F)~~ Fire Hydrants: Measurement shall be the number of fire hydrants installed. Payment will be at the contract unit price ~~bid~~ for the installation of each fire hydrant complete in place and in operating condition. The 6 inch ~~es east~~

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ductile iron pipe and fittings, required for making the connection from the main to the hydrant, shall be a separate pay item in the proposal as described above.

(H) Pavement and/or Surfacing Replacement: Payment for pavement and/or surfacing replacement will be made as stipulated in Section 336, except as otherwise established in this specification. The cost of pavement and/or surface replacement required for ~~meter~~-service line installations shall be included in the contract unit price ~~bid~~ for ~~meter~~ service line pipe.

- End of Section -



WATER LINE CONSTRUCTION**610.1 DESCRIPTION:**

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

610.2 GENERAL:

All pipes shall be delivered, handled and installed in accordance with the manufacturer's recommendations and/or applicable provisions of AWWA standards for installation of the various types of water mains specified, insofar as such recommendations and provisions are not in variance with the standard specifications and details.

Where water lines are to be constructed in new subdivisions or in conjunction with street repaving projects, the streets shall be pre-graded to within 6 inches of the new street subgrade prior to trenching or cut stakes shall be set for trenching.

610.3 MATERIALS:

All pipes for water lines shall be of the classes shown on the plans or as specified below.

(A) The 4-inch through 16-inch diameter pipe sizes may be PVC C900 or ductile iron, except where a particular material is specified by the agency or the contract documents. All pipes shall be minimum 150 psi design unless otherwise specified.

(B) Pipe 16 inches and larger may be either ductile iron, or concrete pressure pipe-steel cylinder type.

Ductile iron and cast iron water pipe and fittings per: Section [750](#). Concrete pressure pipe-steel cylinder type per: Section [758](#). C900 PVC per: AWWA C900-07.

Service material containing brass or bronze must comply with the current NSF 61-8 standards at the time the project begins.

All brass or bronze service material must meet the current AWWA C-800 standards.

Any product used in water line construction containing brass or bronze that comes in contact with potable water shall meet the current NSF standards and federal law.

Only such packing materials as are included in the list of acceptable materials in AWWA C-600 for installation of cast iron water main shall be used. The packing materials shall be handled in such a manner as to avoid contamination, and shall be dry when placed in the joints. All such materials shall be free of oil, tar, or greasy substances, except that treated paper packing material, jute, cement, or sulfur compound caulking will not be permitted.

610.4 CONSTRUCTION METHODS:

610.4.1 Trenching/Cover: All water mains in major streets shall have a minimum cover of 48 inches over the top of the pipe. Water mains in other locations shall have a minimum cover over the top of the pipe as follows:

(A) 36 inches for mains smaller than 12 inches.

(B) 48 inches for mains 12 inches and larger.

Cover for water mains will be measured from existing or proposed finished grade of pavement or from natural ground, whichever is deeper.

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Except as otherwise required in this specification, the special provisions, or by the Engineer, trench excavation, backfilling and compaction shall be in accordance with the requirements of Section 601. Backfilling may be accomplished as soon as the pipe line has been installed to the satisfaction of the Engineer, subject to the requirements for testing per Section 611.

610.4.2 Laying Pipe: No water main shall be deflected, either vertically or horizontally, in excess of that recommended by the manufacturer of the pipe or coupling.

If adjustment of the position of a length of pipe is required after it has been laid, it shall be removed and rejoined as for a new pipe.

Curb stops with flushing pipes or fire hydrants shall be installed at the ends of dead-end mains according to standard details.

Thrust blocks shall be installed in accordance with this specification.

Valve boxes and covers shall be according to standard details.

Ductile iron pipe shall be installed in accordance with this specification and pipe and fittings shall be in accordance with Section 750.

PVC C-900 pipe shall be installed in accordance with AWWA C900 and Section 601.

610.4.3 Blocking and Restraints: All pipe lines, valves and fittings 16 inches and smaller in diameter shall be blocked with concrete thrust blocks in accordance with standard details. Thrust block areas for pipe, valves and fittings larger than 16 inches in diameter shall be installed per details shown on the plans. The areas stipulated in the standard details are minimums and shall not be decreased.

If irregular soil or pressure conditions are encountered, a thrust block design revision or an alternate joint restraint system may be required by the Engineer.

When restrained/welded joints are specified to resist thrust forces, blocking is not required.

With the Engineers approval, restrained/welded joints may be used in lieu of thrust blocks.

Where restrained joints are specified on mains sixteen (16) inches in diameter and smaller, ductile iron pipe shall be used with an approved joint restraint method.

On mains sixteen (16) inches in diameter and larger where plans specify welding joints and where ductile iron pipe is furnished, joints shall be restrained by an approved joint restraint method for the distance specified.

610.4.4 Maintain Pipe Cleanliness / Pipe Cleaning: The interior of all pipe and fittings shall be kept as free as possible of all dirt and foreign material at all times, until the pipe is placed in the new line.

Every precaution shall be taken to prevent foreign material from entering the pipe. When on the project site, the ends of the pipe section shall be plugged, wrapped or tarped at all times when pipe laying is not in progress, which includes storage and staging at the site. The pipe shall be stored on a pallet, blocking or other means to prevent foreign materials from entering the pipe. The pipe line shall be protected by a water-tight plug or other means approved by the Engineer when the pipe is in the trench if pipe laying is not in progress.

If in the opinion of the Engineer, the pipe contains dirt that will not be removed during the flushing operation; the interior of the pipe shall be cleaned and swabbed, as necessary, with a .005 to .010 percent chlorine solution.

If the Contractor or pipe-laying crew cannot install the pipe in the trench without getting earth into it, the Engineer may require that, before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size be placed over each end of the pipe and left there until the connection is to be made to the adjacent pipe.

At the close of each day's work, and at times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Engineer. Joints of all pipe in the trench shall be completed before the work is stopped. If water is in the trench, the seal shall remain in place until the trench is pumped dry.

610.4.5 Testing:

Hydrostatic testing shall be in accordance with Section 611.

After pressure testing and before placing in service, all water lines shall be disinfected. Disinfection shall be accomplished in accordance with Section 611.

All corporation stops used for testing and chlorination shall be left in the pipe line with the stop closed and all connecting pipe removed.

610.5 SEPARATION:

610.5.1 General: Water lines and sewer lines shall be separated to protect water lines from contamination by sewer lines.

The angle of a water line and sewer line crossing shall be limited to between (45) forty-five degrees and (90) ninety degrees. Intersection angles of less than (45) forty-five degrees shall not be allowed.

Separation distances are measured from the outside diameter of the water or sewer line, or the centerline of a manhole.

When water and sewer lines cannot meet separation requirements, extra protection is required as described in Subsection [610.5.5](#) and shown in Standard Details 404-1, 404-2 and 404-3.

Extra protection requirements for line crossings are measured from the closest outside surfaces of the sewer and water line.

Water line service connections to individual building supply and distribution plumbing shall not be placed below sewer lines, and shall otherwise comply with the separation requirements of the applicable plumbing code as applied by the Agency (Administrative Authority). Methods described for extra protection do not apply to these service lines.

Water and sewer lines shall not be constructed parallel within a common trench.

610.5.2 Water Line Separation from Gravity Sewer Lines: Water lines shall not be placed within two (2) feet horizontal and one (1) foot vertical above and two (2) feet vertical below gravity sewer lines.

Extra protection is required where a water line is placed within six (6) feet horizontal and two (2) feet vertical above a gravity sewer line.

Extra protection is required where a water line is placed within six (6) feet horizontal and any distance below a gravity sewer line.

610.5.3 Water Line Separation from Pressurized Sewer Lines: Water lines shall not be placed within six (6) feet horizontal and within two (2) feet vertical below or within two (2) feet vertical above a pressurized sewer line.

Extra protection is required where a water line is placed within six (6) feet horizontal and within six (6) feet vertical above a pressurized sewer line.

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Extra protection is required where a water line is placed within (6) feet horizontal and any distance below a pressurized sewer line.

610.5.4 Water Line Separation from Manholes: Water lines shall not pass through or come into contact with any part of a sewer manhole and shall be separated six (6) feet horizontal from the center of a sewer manhole.

610.5.5 Extra Protection: New water lines that require extra protection from new sewer lines, shall have extra protection provided by using ductile iron pipe for both lines. Lines of standard pipe length shall be centered at the point of crossing so that no joints exist within six (feet) horizontal and only restrained or mechanical joints exist within ten (10) feet horizontal.

New water lines that require extra protection from sewer lines, shall have identification wrap and/or tape installed on the water and sewer lines for the length that requires extra protection for each line.

New water lines that require extra protection from existing sewer lines shall be constructed using the extra protection specified for new water lines, and the existing sewer line:

- (1) shall be reconstructed using a standard length of ductile iron pipe centered at the point of crossing so that no joints exist within six (6) feet horizontal and only restrained or mechanical joints exist within ten (10) feet horizontal, or
- (1) shall be encased in 6 inches of concrete for the horizontal distance of the line that requires extra protection but for a distance no less than ten (10) feet horizontal.

Existing water lines that require extra protection from new sewer lines shall provide for extra protection by:

- (1) constructing the new sewer line and reconstructing the existing water line using ductile iron pipe for both lines with standard pipe lengths centered at the point of crossing so that no joints exist within six (feet) horizontal and restrained or mechanical joints exist within ten (10) feet horizontal, or
- (2) encasement of both the existing water line and the new sewer line in six (6) inches of concrete for the horizontal distance of the lines that require extra protection but for a distance no less than ten (10) feet horizontal.
- (3) Extra protection for existing ductile iron water lines can be met by the installation of restrained or mechanical joints on the existing water line within ten (10) feet horizontal of the crossing and either
 - (a) construction of new sewer line using a standard pipe length of ductile iron pipe centered at the point of crossing so that no joints exist within six (6) feet horizontal and restrained or mechanical joints exist within ten (10) feet horizontal, or
 - (b) encasement of the new sewer line in 6 inches of concrete for the horizontal distance of the line that requires extra protection but for a distance no less than ten (10) feet horizontal.

610.6 POLYETHYLENE CORROSION PROTECTION

610.6.1 General: Where called for in the plans and specifications or directed by the Engineer, pipe, valves and fittings shall be protected from corrosion by encasement in a polyethylene protective wrapping referred to hereafter as polywrap. Although not intended to be a completely air and water tight enclosure the polywrap shall provide a continuous barrier between the pipe and surrounding bedding and backfill.

610.6.2 Materials: The polywrap shall be of virgin polyethylene, not less than 8 *mils* in thickness, formed into tubes or sheets as may be required. Naturally pigmented material may be used where exposure to ultraviolet light will be less than 48 hours.

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Otherwise the material shall be pigmented with 2 to 2 1/2 percent of well dispersed carbon black with stabilizers.

The polywrap shall be secured as specified below with 2-inch wide pressure sensitive tape not less than 10 mils thick. This flexible tape shall consist of a polyethylene or polyvinyl chloride backing with a synthetic elastomeric adhesive film comprised of butyl rubber. Tape shall remain flexible over a wide range of temperatures, with tensile strength and elongation properties in conformance with ASTM D1000.

The minimum tube size for each pipe diameter shall be per Table [610-1](#).

| TABLE 610-1 (from AWWA C105-05) | | |
|--|---|--|
| POLYWRAP FLAT TUBE WIDTHS | | |
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| 12 | 27 | 30 |
| 14 | 30 | 34 |
| 16 | 34 | 37 |
| 18 | 37 | 41 |
| 20 | 41 | 45 |
| 24 | 54 | 53 |
| 30 | 67 | . |
| 36 | 81 | . |
| 42 | 81 | . |
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| 60 | 108 | . |
| 64 | 121 | . |

610.6.3 Installation: The polyethylene tubing shall be cut into lengths approximately 2 feet longer than the pipe sections. With the pipe suspended from the center the tube shall be slipped over the spigot end and bunched up between the point of support and the spigot end. After the pipe is installed into the bell of the adjacent pipe the pipe shall be lowered to the trench bottom and the supporting sling removed from the center of the pipe. The pipe shall then be raised at the bell end enough to allow the tube to be slipped along the full length of the barrel with enough left at each end to overlap the adjoining pipe about 1 foot. A shallow bell hole must be made at each joint to facilitate installation of the polywrap.

Pull the bunched-up polywrap from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place with one circumferential turn of tape plus enough overlap to assure firm adhesion. Then slip the end of the polywrap from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Tape it in place.

The loose wrapping on the barrel of the pipe shall be pulled snugly around the barrel of the pipe, and excess material folded over the top of the pipe and the folds held in place by means of short strips of adhesive tape, at about 3 foot intervals along the pipe.

Repair any rips, punctures or other damage to the tube with the adhesive tape or pieces of tube material secured with tape.

Bends and reducers in the line shall be covered with polyethylene in the same manner as pipe.

Valves, tees, crosses and outlets shall be wrapped with flat sheets of the same material. The sheets shall be passed under valves and brought up around the body to the stem. Edges shall be brought together, folded twice and secured

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with the adhesive tape.

610.6.4 Payment for Polywrap: Payment for this item shall be per the provisions of Subsections [109.4](#) and [109.5](#) of the specifications unless this item is specifically called for on the plans or in the supplemental specifications or special provisions as a specific component and pay item for a given project.

610.7 VALVES:

Valves shall be installed in accordance with AWWA C-600 or AWWA C-603 modified as follows:

All tapping sleeves, gate valves, butterfly valves, air release and vacuum valves and corporation stops shall be in accordance with Section [630](#).

Just before installation in the trench, valves shall be fully opened and closed to check the action, and a record made of the number of turns required to fully open or close the valve. For valves 16 inches and larger, a member of the water utility shall be present to check the action and record the number of turns. The inside of all valves shall then be thoroughly cleaned and the valve installed.

Valves 12 inches and smaller in size shall be supported by concrete blocks, in accordance with the standard details.

Valves 16 inches and larger in size along with their bypass valves, shall be supported on concrete slabs, and/or concrete piers, as indicated on the plans.

Concrete supports shall be provided under valves in vaults and manholes, and shall be constructed an inch low, then grouted with non-shrink grout. Adjustable pipe supports shall be as indicated on the plans. Buried valves shall be supported on concrete blocks as detailed on the plans.

Valve boxes shall be installed over all buried valves in accordance with standard details.

Standard couplings or matching joints shall be used when more than one length of pipe is required, or when two or more pieces are joined, to form the valve box riser. Install extension stems on all valves where the operating nut is 5 feet or more below grade.

610.8 MANHOLES AND VAULTS:

Construction shall consist of furnishing all materials and constructing manholes or vaults complete in place, as detailed, including foundation walls, cast iron steps, frames, covers, and any incidentals thereto, at location shown on the plans.

Manholes shall be constructed to conform with the requirements of Section [625](#) and standard details, except the inside diameter shall be 60 inches.

Vaults shall be constructed of reinforced concrete conforming to Section [725](#) and of concrete pipe conforming to ASTM C76 Wall A or B. Vaults shall be kept moist for 7 days before backfilling.

610.9 FIRE HYDRANTS:

The Contractor shall furnish all labor, materials, and equipment necessary to install fire hydrants complete in place at locations shown on the plans in accordance with the standard details and special provisions. Fire hydrants furnished by the Contractor shall conform to the requirements of Section [756](#).

If paint is chipped, scuffed, or otherwise damaged during handling and installation, the Contractor shall touch up such spots as may be designated by the Engineer.

All hydrants must be flushed and left in good working condition with the control valve open.

610.10 COUPLINGS, JOINTS, GASKETS AND FLANGES:

(A) Couplings: The couplings used to join the pipe to flanged valve adapters shall have a minimum working pressure of 150 psi, and shall have a fusion-bonded epoxy finish. The coupling sleeves shall be carbon steel with a minimum yield of 30,000 psi. The flanges shall have a minimum yield of 30,000 psi and be ductile iron or carbon steel for sizes up to 12", or high-strength, low-alloy steel for sizes 14" and larger.

(B) Joints: The joints and fitting shall conform to Sections 750 and 752.

(C) Bolts and Nuts:

- (1) Bolts, studs, and nuts used in underground field flanged connections or for connecting fittings shall be carbon steel compliant with ASTM A307, Grade A unless Grade B is specified. Bolts, studs, and nuts shall be in accordance with AWWA C111. Bolts and studs shall have Class 2A thread tolerance with the corresponding nuts having Class 2B tolerance. Bolts, studs and nuts shall have a hot-dipped zinc coating in accordance with ASTM F2329. All bolt diameters shall normally be 1/8 inch smaller than the bolt hole diameter. If specified, allowable exceptions to zinc coating shall be bolts, studs, and nuts made from 316 stainless steel per ASTM F593 or cadmium plated per ASTM B766. All bolts shall be hexagonal heads.
- (2) The minimum requirement for underground mechanical joint connections using T-head bolts shall meet the requirements of AWWA C111 using a high strength low alloy steel manufactured for atmospheric corrosion resistance per ASTM A242.

These bolted joints shall be protected as follows: Following installation and before backfilling, all couplings, steel flanges, bolts, nuts, anchor bolts and rods, bolting of all flanged valves, and all exposed steel shall be protected from corrosion by either of the two methods outlined below at the Contractor's option.

(A) Below ground installations shall be coated with NO-OX-ID "A" with a film of not less than 1/32 inch thick and then coated with cement mortar not less than 1 inch thickness before backfilling. Cement mortar shall be composed of 1 part cement, ASTM C150, Type II, low alkali, to 3 parts sand. Before application of the cement mortar coating the area to be protected shall be covered with a layer of 2 x 2 inch No. 14 gage welded wire fabric, firmly wired in place.

(B) Below ground installations shall be protected by the application of hot coal-tar enamel. The coal-tar enamel shall be in accordance with AWWA C-203 and shall be applied to the top part of the pipe or fittings by daubers for at least 2 coats for a total minimum thickness of 1/16 inch. The coal-tar for under side of the pipe flanges or fittings shall be applied by the pan or cocoon method as described below and in AWWA Manual M-11, Steel Pipe.

Pan Method: The coating pan is securely anchored in place on the underside of the pipe and straddling the connection to be coated. The pan shall be wide enough so that the entire connection will be coated.

Hot coal-tar enamel is poured into the pan, from one side only, until the pan is completely filled. The drain plug or valve, is then opened and the excess coal-tar drained out. The pan can then be removed. Details of the coating pan and corresponding dimensions are given in AWWA Manual M-11.

The upper portion of the connection, and all remaining exposed steel pipe, will then be coated by the use of a dauber. The coal-tar coating shall be applied in at least 2 coats for a minimum thickness of 1/16 inch. The daubers and method of application shall conform to AWWA C-203. No thinning will be allowed.

(C) Cocoon Method: The cocoon is formed by placing glass fiber cloth or roofing paper, of the proper width, around the underside of the connection and adjacent exposed steel pipe. The edges of the cocoon shall be securely fastened to the pipe. Backfill is lightly placed to the spring line, and the top of the cocoon is opened and layed back on the filled area and hot coal-tar enamel poured, from one side only, until the cocoon is completely filled. The loose backfill prevents rupture of the cocoon. The upper portion of the connection and remaining exposed steel pipe shall be coated as above.

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(D) Gaskets: Except as otherwise provided, all gaskets for pipe lines shall be one piece full faced gaskets from one-ply cloth inserted SBR rubber material. Gaskets for flanges 20 inches and smaller shall be from 1/16 inch thick material. Gaskets for flanges 24 inches and larger shall be from 1/8 inch thick material. Gasket material shall be J-M 109 as manufactured by Johns-Manville Corporation or an approved equal. Physical characteristics of the rubber compound shall meet ASTM D2000, Class 4AA805A13.

(E) Flanges: Cast iron flanges shall conform to AWWA C-110 as to material, diameter, thickness, drilling, etc. Steel flanges shall be ring or hub type, and shall conform to AWWA C-207, Class D. All flanges shall be drilled and have flange diameters and bolt circles conforming to AWWA C-110, except bolt holes will be 1/8 inch larger than the bolts given for the various sizes. All bolts shall be as specified above and all flanges shall have a flat facing.

610.11 CONNECTION TO EXISTING MAINS:

Existing pipe to which connections are to be made shall be exposed by the Contractor as directed by the Engineer, to permit field changes in line, grade or fittings, if necessary.

All connections to existing mains shall be constructed according to the plans.

Valves connecting new work to the existing system shall be kept closed at all times.

Only Agency personnel shall operate existing valves. The Contractor shall not operate valves in the existing system.

After disinfected samples have been taken and the new work passes the bacteriological tests, the new line shall then be turned over to the Contracting Agency with all branch lines and tie-in valves closed.

When shutdown of an existing water main is necessary in order to connect to the new lines, the Contractor shall make application and pay the required charges to the Contracting Agency. A conference between the Contractor's representative, Engineering Inspection, and Water Distribution personnel shall establish the time and procedures to insure that the shutdown will be for the shortest possible time. If necessary to minimize inconvenience to customers, shutdowns may be scheduled during other than normal working hours. The water supply to some customers, such as hospitals, cannot be shut off at any time. Provisions to furnish a continuous supply of water to such establishments will be required. After the procedures and time for a shutdown are agreed upon, it shall be the Contractor's responsibility to notify all customers in advance that the water will be turned off. When possible, customers shall be notified 24 hours in advance and in no case, except in emergency, shall notification be less than 30 minutes. Notification shall be in writing, giving the reason for the shutdown and the time and duration the water service will be shut off.

The Contracting Agency will close existing valves, but will not guarantee a 100% complete shutdown.

610.12 FIRE LINE SERVICE CONNECTIONS:

Fire line service connections shall be installed in accordance with standard details.

The fire line from the control valves at the main to the detector check valve shall be constructed of ductile iron pipe per Section 750.

610.13 METER SERVICE CONNECTIONS:

All new meters must be installed by the Contracting Agency after the proper application as required by Code with fees paid at prevailing rates.

When plans call for connections from a new water main to an existing water meter, the work shall include new copper pipe and fittings except as follows:

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(A) Wrapped galvanized pipe shall be used to connect or extend existing galvanized service pipe. Type K soft copper pipe or tubing shall be used to connect or extend existing copper service pipe except when otherwise called for in the plans.

(B) When the existing main is not abandoned, and the existing meter is to be connected to the new line, the corporation stop at the old main shall be closed and the abandoned service line cut 6 inches from the old main.

(C) Taps and service connections to the new main shall be made prior to testing and disinfection of the new line.

(D) Meter service piping may be installed by drilling in place of open cut construction when approved by the Engineer.

When called for on the plans, the meter and box shall be relocated by the Contractor as directed by the Engineer. Existing meters which are shown on the plans to be relocated shall be located and installed in accordance with standard details.

Water meter boxes which are broken during construction shall be replaced by the Contractor at no additional cost to the Contracting Agency. Existing meter boxes which are already broken prior to start of construction shall be replaced by the Contractor with boxes furnished by the Contracting Agency. Boxes may be picked up by the Contractor after written authorization is received from the Engineer. The written authorization shall include the street address of each broken meter box and the size of meter box required. All water meter boxes shall conform to the standard details.

610.14 CLEANUP:

When testing, chlorination, compaction, and cleanup do not follow pipe laying in an orderly manner, the Engineer reserves the right to close down trenching and pipe laying until these operations are adequately advanced.

610.15 PAVEMENT AND SURFACING REPLACEMENT:

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

610.16 MEASUREMENT AND PAYMENT:

(A) Pipe:

(1) Measurement of all pipe shall be of the linear feet of pipe installed, measured along the centerline of the pipe, through all valves and fittings, from the centerline of the fittings or centerline of valves on ends of pipe to the centerline of fittings, centerline of valves on ends of pipe or to the end of pipe, as the case may be, for all through runs of pipe. Measurement of lateral line pipes shall start at the centerline of valve at connection to the main. Measurement of service lines shall be from the centerline of the new main to the connection at the meter. Measurement shall be to the nearest foot.

(2) Payment will be made at the contract unit price per linear foot of each type and size of pipe. Such payment shall be compensation in full for furnishing and installing the pipe and fittings, specials, adapters, etc., complete in place, as called for on the plans and/or on the standard details, and shall include all costs of excavation, removal of obstructions, shoring and bracing, bedding, backfilling, compaction, maintenance of traffic, testing, disinfecting, connections to existing lines or works, and all work not specifically covered in other pay items.

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(B) Service Line Connections: Measurement shall be of the number of unit connections made for water services, if called for in the bid. Each bid item unit shall consist of the connection to the water main and to the meter, as may be required in the plan details. Payment will be made at the contract unit price for each water service connection and shall be compensation in full for labor materials (other than pipe) equipment, tapping, and all necessary incidentals. Payment for new service pipe required to make the connection will be made separately, as stipulated above. If no contract bid item exists for connections, then the cost for connections to meters and main lines shall be included in the corresponding pipe bid item unit price.

(C) Relocation of Existing Meters and Boxes: Measurement shall be of the number of meters and boxes moved and reinstalled. Payment will be made at the contract unit price for each meter and box relocated and installed.

(D) Permanent Pipe Supports and Encasement of Existing Pipes: Measurement shall be of each unit included in the bid, and payment shall be compensation in full for supporting or encasing existing pipe, as required on the plans, including excavation, form work, reinforcing, concrete, handling and controlling flows in the existing pipe, removing and replacing existing pipe where necessary, supporting, backfilling and compaction, and pavement and/or surfacing replacement required in excess of pay width(s) allowed in Section [336](#).

(E) Concrete Thrust Blocks: Concrete thrust blocks and anchors for all pipe 16 inches and larger shall be measured by the cubic yard(s) of concrete placed, as required on the plans and/or as directed by the Engineer. Payment will be made at the contract unit price per cubic yard, and shall be compensation in full for excavation, formwork, placing and finishing concrete, reinforcing, backfilling and compaction, and pavement and/or surfacing replacement required in excess of pay width(s) allowed in Section [336](#). All thrust blocks and anchors for 12 inches and smaller pipe shall be included in the linear foot cost of the pipe.

(F) Valves: Measurement of and payment for valves, tapping sleeves and valves, and valve boxes shall be for each item furnished and installed, as designated in Section [630](#).

(G) Fire Hydrants: Measurement shall be the number of fire hydrants installed. Payment will be at the contract unit price for the installation of each fire hydrant complete in place and in operating condition. The 6 inch ductile iron pipe and fittings, required for making the connection from the main to the hydrant, shall be a separate pay item in the proposal as described above.

(H) Pavement and/or Surfacing Replacement: Payment for pavement and/or surfacing replacement will be made as stipulated in Section [336](#), except as otherwise established in this specification. The cost of pavement and/or surface replacement required for service line installations shall be included in the contract unit price for service line pipe.

- End of Section -

Date: 6/11/14
To: MAG Specifications and Details Committee
From: Brian Gallimore, Materials Working Group
Subject: Revision to Section 310 Placement of Construction of Aggregate Base Course

Case 14-16

Revised 2014-06-11

Purpose: Changed rock method correction to be consistent with Section 301.

Revisions: See the attached redlined strike-out version of the specification.

PLACEMENT AND CONSTRUCTION OF AGGREGATE BASE COURSE

310.1 DESCRIPTION:

Aggregate base course shall comply with Section [702](#) unless the use of a different type of material is specifically authorized in the special provisions.

310.2 PLACEMENT AND CONSTRUCTION:

The compacted lift thickness shall not exceed 6 inches, unless approved by the Engineer. Based on the type of material, type of equipment and compaction methods used, the Contractor may propose a greater lift thickness to the Engineer for approval.

After distributing, the aggregate base course material shall first be uniformly watered and then graded to a uniform layer that will net, after compacting, the required thickness. The grading operation shall be continued to such extent as may be necessary to minimize segregation. The quantity of water applied shall be that amount which will assure proper compaction resulting in the density required by Section [310.3](#).

After placement, the aggregate base course surface shall be true, even and uniform conforming to the grade and cross-section specified. In no case shall the aggregate base course vary by more than ½ inch above or below required grade.

310.3 COMPACTION

The contractor is responsible for providing appropriate equipment and techniques to achieve the compaction results required by this specification. The aggregate base course shall be compacted in lift thicknesses as allowed by Section [310.2](#).

The laboratory maximum dry density and optimum moisture content for the aggregate base course material shall be determined in accordance with AASHTO T-99. (Note: when testing base materials – use method “C” or “D” as required based upon the gradation of the material.) Field ‘one-point’ maximum dry density and optimum moisture procedures shall only be allowed upon approval of the Engineer.

The in-place density shall be determined in the field by nuclear density testing in accordance with AASHTO T-310 or sand cone density testing in accordance with AASHTO T-191. In the event nuclear density testing is selected, and density results are in question, a sand cone correlation will be performed by the accepting agency at the contractor’s request, not to exceed one sand cone for each ten nuclear density tests.

A rock correction, to compensate for rock content larger than the #4 or ¾ inch sieves (as required by the laboratory maximum dry density and optimum moisture procedure selected), shall be performed in accordance with AASHTO T-224. Care should be taken to account for the specific gravity of the oversize particles particularly if recycled materials are utilized for aggregate base course. The specific gravity shall be determined in accordance with ~~AASHTO T~~ ARIZ-227C, as applicable.

For roadway construction, a minimum of one field density test shall be performed per lift per 660 feet per lane. For other aggregate base course applications, a minimum of one field density test shall be performed for each 800 square yards.

Unless otherwise noted in the project plans or project specifications, the moisture content of the aggregate base course at the time of compaction shall be the optimum moisture content +/- 3%.

The following percent compaction is required:

| | |
|---|------|
| (A) Below asphalt concrete pavement | 100% |
| (B) Below Portland cement concrete pavement, driveways, curb & gutter, sidewalks, and roadway shoulders | 95% |
| (C) All other areas not subject to vehicular traffic | 85% |

SECTION 322
ASPHALT STAMPING

322.1 DESCRIPTION:

The work under this item will provide stamped asphalt which shall include surface patterning and/or asphalt surfacing (painting) as described herein in accordance with Owners Standard Details and/or as shown on the plans and called out in the special provisions.

322.2 GENERAL REQUIREMENTS:

A Contractor shall meet the following qualifications in order to perform asphalt stamping:

The Contractor shall have completed a minimum of three (3) asphalt stamping projects in the past year (from the date of bid) in the State of Arizona and totaling at least 50,000 S.F. The Contractor shall furnish evidence of meeting these experience requirements to the Engineer.

The Contractor shall submit for review and approval all manufacturer product and technical data for materials proposed to be installed in the right-of-way. The Contractor shall also submit for review and approval a sample of the stamped asphalt material prior to installation. These submittals shall be submitted to the Engineer.

Prior to acceptance of the project, the Contractor shall repair all damaged or unsuitable areas, as determined by the Engineer, at no expense to the Owner.

322.3 MATERIALS:

322.3.1 Asphalt Concrete: All roadway construction materials and asphalt thicknesses shall conform to the applicable requirements of MAG Section 321 and the project plans and specifications. Aggregate base course (ABC) shall be clean, well-graded sand and gravel compacted and placed per MAG Section 321.5.1 and the project plans and specifications.

For raised medians and other areas not subject to vehicular traffic, the surface course shall be at least 2-1/2" of MAG 1/2" or MAG 3/8" asphalt concrete mix in accordance with MAG 710.

322.3.2 Surface Patterning: The patterning equipment shall be metal templates that shall correspond to the patterns shown in Owner's standard details or as shown on the plans and called out in special provisions. Refer to the project plans and specifications for the pattern type to be used.

322.3.3 Surfacing System (Painted Asphalt): All products used in the surfacing system shall meet the minimum physical and performance properties in Tables 322-1 and 322-2. The Contractor shall submit a Certificate of Compliance to the Engineer indicating that the materials to be included in the work meet these specification requirements. The color used for painted asphalt shall be terracotta or as approved by the Engineer.

| TABLE 322-1 | | |
|--|--------------------|--------------|
| ASPHALT STAMPING SURFACING SYSTEM PHYSICAL PROPERTIES | | |
| Characteristic | Test Specification | Base |
| Solids by Volume (%) | ASTM D2697 | 55% |
| Solids by Weight (%) | ASTM D2369 | 68% |
| Density | ASTM D1475 | 13.0 lbs/gal |

| TABLE 322-2 | | |
|--|---|--|
| ASPHALT STAMPING SURFACING SYSTEM PHYSICAL PROPERTIES | | |
| Characteristic | Test Specification | Test Result |
| Dry-Time (To Recoat) | ASTM D5895 | 35 Min |
| Taber Wear Abrasion Dry H-10 Wheel | ASTM D4060 1 day cure | 0.98 g/1000 cycles |
| Taber Wear Abrasion Wet H-10 Wheel | ASTM D4060 7 days cure | 3.4 g/1000 cycles |
| QUV E Accel. | ASTM G154 Delta | 0.53 |
| HydrophobicityWater Absorption | ASTM D-570 | 8.3 %(9 Day Immersion) |
| Shore Hardness | ASTM D2240 | 63 Type D |
| Mandrel Blend | ASTM D522-93A | 1/4" @ 21 Degree C Pass |
| Permeance | ASTM D1653 | 3.77 g/m ² /hr (52 mils) |
| VOC | Per MSDS | 23 g/l |
| Adhesion to Asphalt | ASTM D4541 | Substrate Failure |
| Friction Wet | ASTM E303 British Pendulum Tester | WP * Coated- 62 WP* Uncoated - 57 AC ** Coated - 70 AC ** Uncoated - 60 |

322.4 INSTALLATION:

322.4.1 Asphalt Concrete:

The hot-mix asphaltic concrete shall be placed per the project plans and specifications. The Contractor shall contact the Engineer for roadway compaction approval prior to beginning asphalt stamping. Asphalt shall be fully compacted prior to positioning the patterning template.

322.4.2 Surface Patterning: After application and compaction of the asphaltic concrete, while it is still hot, templates shall be positioned on the surface in the required orientation. Templates shall be set in

place using a plate compactor and fully embedded using the same compaction equipment used in placing the asphalt (minimum static weight shall be 700 lbs).

The template print depth shall be 3/8" over 99% of the patterned area. All hand tooling shall be complete, full depth, straight in manner, and to the edge of the asphalt pavement, common edge, concrete curb, gutter, or other border. There shall be no overprint of patterns and no remnants of excess print on surrounding unintended areas.

322.4.3 Surfacing System (Painted Asphalt): The air temperature shall be at least 50° F and rising before the application of surface system products begins. There shall also be no precipitation expected within 24 hours of the anticipated surfacing completion in order for the application to be authorized by the Town.

The surfacing system products shall be spray-applied. Where required to cover small areas, the surfacing system may be painted on using brooms or brushes. When complete, the entire asphalt surface shall be covered with the surfacing product with no exposed asphalt present.

The Contractor shall use sufficient masking to ensure that the surface system products are applied only where specified. Masking shall be complete and no overspray onto surfaces not designated as coated surfaces shall be allowed.

The Contractor shall apply the surface system products with a minimum of four complete passes on a roadway surface. Three complete passes shall be allowed on medians, walkways, pathways, and bike paths where traffic is primarily pedestrian with minimal or no automobile traffic. Thickness of the surfacing product shall be 20 mils or greater.

After the surfacing system products have been applied, the treated asphalt shall not be exposed to vehicular traffic for eight (8) hours, overnight, or as approved by the Engineer.

322.5 MEASUREMENT:

Asphalt stamping shall be measured by the square foot, which shall include surface patterning and/or asphalt surfacing (painting).

322.6 PAYMENT:

Asphalt stamping shall be measured as provided above shall be paid for at the contract price per square foot which price shall be full compensation for the item complete as described and specified herein.



MARICOPA COUNTY
Department of Transportation

MEMORANDUM

Date: July 2, 2014

Revised August 6, 2014

To: MAG Specifications and Details Committee

From: Robert Herz, MCDOT Representative

Subject: Revision to Section 340

Case 14-18

PURPOSE: 1. Change the term “sidewalk ramp” in section 340 to “curb ramp” and to conform to ADA nomenclature and the various 235 Details.
2. ~~Modify the second paragraph of section 340.5 to prevent confusion regarding the curb and gutter pay item associated with valley gutters (Detail 240).~~

REVISION: 1. Change all occurrences of the term “sidewalk ramp” in section 340 to “curb ramp”
2. ~~Modifying the second paragraph of Section 340.5 as shown:~~

~~“Curb and gutter type shall be based on the configuration of the final exposed surfaces. The increased curb and gutter depth required at valley gutter aprons or driveways shall not be measured as a separate **type of curb and gutter pay item**; any additional Contractor cost **for increased depth or other modification** shall be included in the unit cost associated with the valley gutter, driveway, **curb ramp** or other associated item.”~~

Final form for the second paragraph of Section 340.5:

~~“Curb and gutter type shall be based on the configuration of the final exposed surfaces. The increased curb and gutter depth required at valley gutter aprons or driveways shall not be measured as a separate type of curb and gutter; any additional Contractor cost for increased depth or other modification shall be included in the unit cost associated with the valley gutter, driveway, curb ramp or other associated item.”~~

Date: July 8, 2014
To: MAG Specifications and Details Committee
From: Brian Gallimore, Chairman MAG Materials Working Group
Subject: Revisions to Sections 325 & 717

Case #14-19

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). Also identified ARB design location within Section 717.
- 325.2.2 - Corrected wording to improve clarity. Section needs additional work to better address terminal-blend operations.
- 325.5 - Added and revised wording to improve clarity.
- 325.7.2 - Minor wording revisions.
- 325.7.3 - Correction of referenced Section number.
- 325.8 - Removed redundant wording and revised wording for clarity.
- 325.9.2 - Added wording to address additional means of performing acceptance testing to provide flexibility to agencies. Current specification is not workable for most agencies or for smaller project; e.g. City of Scottsdale.
 - 325.9.2.1 - This entire section needs reworking to allow sampling from the grade and testing of ARAC via ignition method.
 - 325.9.2.2 - This entire section needs reworking to allow sampling from the grade and testing of ARAC via ignition method and adding language for ignition calibration protocol.
 - 325.9.3.2.1 - This entire section needs discussion as some agencies have expressed concerns.
 - 325.9.3.2.2 - Removed reference limiting nuclear gauges to thin lift models. Review correlation language.
- 717.2.2 - Table 717-3 needs review to ensure it is in line with current local practice.
- 717.3.2 - Table 717-5 needs review to ensure it is in line with current local practice. Wording revised and/or added to improve clarity

SECTION 325

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 & storage unit connected to the hot plant or at the asphalt binder supplier 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 (if applicable) 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 not be allowed to cool to a temperature of 250° F (121°C) or less 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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Comment [DL1]: I think the ARB language here is sufficient in that it mentions terminal blended ARB. It is also mentioned in 717.

Comment [DLC2]: May need additional language for terminal blended ARB.

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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.

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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

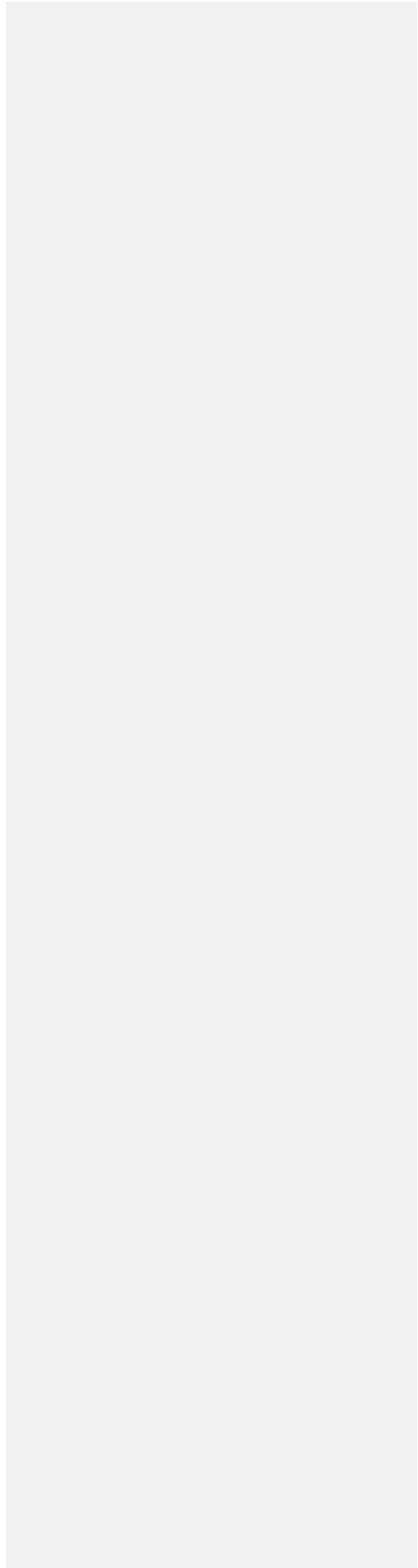
Failure of the control system to function properly shall be cause for the suspension of asphalt concrete production. In order to achieve a continuous operation, the speed of the paving machine shall be coordinated with the hot mix plant and transport units.

If the ARAC is 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 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

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| a distance greater than 150 feet in front of the paving machine.



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~~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 ~~325.10~~ 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 ~~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

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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: Unless otherwise specified, asphalt concrete will be divided into lots for the purpose of acceptance. A lot shall be considered to be one day's production. When the quantity of asphalt concrete placed in a day exceeds 500 tons but is less than 2000 tons, the lot shall be divided into 500 ton sublots or fraction thereof. Where the quantity of asphalt concrete placed in a day exceeds 2000 tons, the day's production will be divided into four (4) approximately equal sublots. A minimum of one sample will be obtained from each lot. Tests used to determine acceptance will be performed by the Engineer or a laboratory employed by the Engineer. In either case the laboratory shall be accredited by the AASHTO Accreditation Program (AAP), for the tests being performed. The acceptance laboratory will take representative samples of the asphalt concrete from each sublot to allow for gradation, binder content, air voids, pavement thickness and compaction of base and surface course. Each sublot will be accepted based upon the test data from the sample(s) from that sublot. All acceptance samples shall be taken using random locations or times designated by the Engineer in accordance with ASTM D3665. ~~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.~~

Comment [DL3]: Inserted same sampling criteria and language as MAG 321.

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.

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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 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.

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 | 100% | 100% |
| 3/4 inch | 100% | 92-100% |
| 1/2 inch | 92-100% | ±6% |
| 3/8 inch | ±6% | ±6% |
| No. 4 | ±6% | ±6% |
| No. 8 | ±6% | ±6% |

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| | | |
|---------|-----|-----|
| 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](#).

325.9.2.1.22 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.

Comment [DLC4]: Need to add language detailing performing gradation on the aggregate obtained from ignition testing.

Comment [DL5]: This language in the paragraph below the table is nearly identical to the same subsection in 321. Since Don referenced plant and grade sampling above, I think this subsection is ok as is. I added a subsection for gradation and binder content on End-Product samples.



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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.

Comment [DL6]: The gradation table is the same no matter which sampling method. Therefore, instead of adding the same table again, I just referenced the table above.

Comment [DL7]: Because grade samples will usually be tested after completion of the day's production, a payment table will probably need to be included for binder content. Because of the inherent issues with sampling and testing binder content on ARAC mixes, we would propose a allowable deviation of $\pm 0.60\%$ from the mix design target. The payment schedule would be similar to that found in section 321, with changes to the deviation column reflecting the $\pm 0.60\%$ value instead of the $\pm 0.40\%$ value shown in section 321.

TABLE 325-2

ASPHALT BINDER CONTENT ACCEPTANCE AND PENALTIES

| <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> |

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| | |
|--|--------------------------------|
| Over 0.1% to 0.2% above that permitted | \$6.00 |
| Over 0.0% to 0.1% above that permitted | \$2.00 |
| Within permitted range | Full Payment |
| Over 0.0% to 0.1% below that permitted | \$2.00 |
| Over 0.1% to 0.2% below that permitted | \$6.00 |
| Over 0.2% below that permitted | Removal* or EA |

Comment [DL8]: I inserted one table, same language as 321-4A where the contracting agency is the owner. Do we need a second table for Permits? It seems like 99% of the ARAC is for jobs for the agencies.

NOTES: *The Contractor shall remove and replace the entire subplot that is deficient.
 EA = Engineering Analysis per Section 325.9.4

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.

Comment [DL9]: Air voids are tested the same whether the sample was from the plant or the grade, so I modified the numbering system slightly so that gradation and binder content were broken out depending on the sample source but voids are now in their own little subsection.

| 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 325.9.5+10.6) |
| ± 3.0% to 4.0% | \$2.50 | EA (see 325.9.5+10.6) |
| ± Greater than 4.0% | Removal* or EA per 325.10.4 | Removal* or EA per 325.9.5+10.4 |

325.9.4.3 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.

325.9.4.3.1 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 rolling.

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325.9.43.2 Compaction Procedures

325.9.43.2.1 Pavement Lift Thickness 1 ½ Inches or Less: 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.

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.

325.9.43.2.2 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.

325.9.43.3 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.

325.9.54 Engineering Analysis (EA): Within 10 working days after receiving notice that a lot or sublot 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 sublot is submitted for referee testing by the contractor, the ten working days allowed to prepare an engineering analysis will begin upon notification of referee test results.

When an Engineering Analysis recommends that a specific lot or sublot 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.

Comment [DLC10]: This section needs discussion. May want to review COP approach.

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Comment [DL11]: Per DLC's comment above, this is the City's language.

Comment [DLC12]: Good correlation language for other sections.

TABLE 325-43

ENGINEERING ANALYSIS PENALTIES for REMOVAL* LOTS/SUBLOTS LEFT IN-PLACE

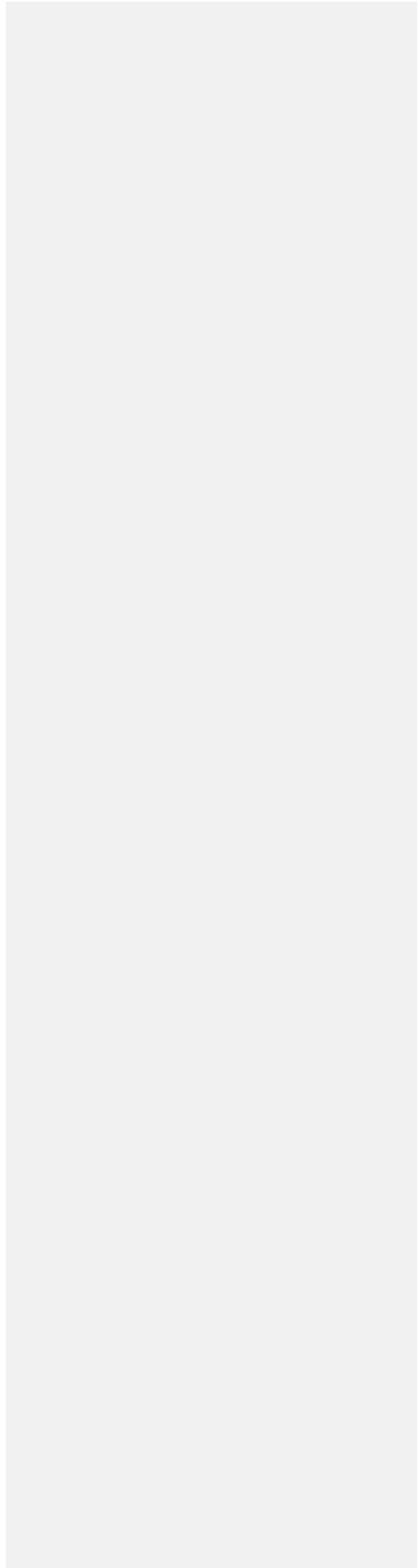
| Acceptance Criteria | Acceptance Limits | Penalty When Contracting Agency is the Owner (\$/Ton) |
|---------------------|-------------------|---|
|---------------------|-------------------|---|

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| | | |
|---|--|--------|
| Laboratory Air Voids (Measured at 75 blows) | Deviation from Target Greater Than $\pm 4.0\%$ | \$3.75 |
|---|--|--------|



Revised 2012



SECTION 325

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 -

SECTION 717

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):

Comment [DL1]: Insert language here regarding on-site ARB plant blending as well as off-site terminal blending?

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 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 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:

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| TABLE 717-2 | | | |
|--|-------------|----------|----------|
| PHYSICAL PROPERTIES OF ASPHALT RUBBER BINDER | | | |
| Property | Requirement | | |
| | Type 1 | 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 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 terminal blended.

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 µm) | 5-15 | 5-15 |
| No. 200 (75 µm) | 3.0-7.0 | 2.0-6.0 |

Comment [DLC2]: Need to review this table and compare to current practice.

The combined aggregate properties shall conform to the requirements of Table 717-4 below.

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| TABLE 717-4 COARSE/FINE AGGREGATE REQUIREMENTS | | |
|---|--------------------|---|
| 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.

| TABLE 717-5 MARSHALL MIX DESIGN CRITERIA | | |
|---|---------------------------|----------------------------|
| Criteria | Low Volume Traffic | High Volume Traffic |
| Asphalt Rubber Binder 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 |

Comment [DLC3]: Need to revisit this table as well.

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 asphalt binder, 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 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, 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
August 15, 2014

Opening:

A meeting of the Specifications and Details Water/Sewer Working Group was called to order by Jim Badowich on August 15, 2014, at 1:30 p.m. in the MAG Cholla Room.

1. Introductions/Attendance

Tony Ayala (Avondale), Jim Badowich (Avondale), Bob Herz (MCDOT), Mike Molina (Oldcastle), 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 the latest versions that included corrections from MCDOT Mr. Herz asked about the joint connection in Detail 420-2. Mr. Sharp said the group earlier decided to show it the same on both sides of the precast base. He also showed different options for the 90 degree transitions with 8", 12" and 16" tangents. The group suggested minor drafting corrections to the details. The latest version of Case 13-22 also removes the manhole steps Detail 428.

3. Revisions to Rigid and Flexible Pipe Installation (Case 13-15)

Bob Herz handed out comments for Case 13-15 including adding some abbreviations from the County supplement and revising some of the new definitions for bedding, initial and final backfill, haunching, foundation and springline. He also wanted to add a definition for Superpave Mix. Mr. Herz also provided review comments for Section 615 which the group discussed. He also provided comments for part of Section 601 and said he would provide Warren White additional comments to 601 and 603 soon. Mr. Herz suggested that the backfill compaction requirement of 2' max lifts be reduced since the county uses 8" and Phoenix requires 12" max lifts. Mr. Badowich said it has already been reduced from 4' to 2' and he doesn't want to reduce it further without comment from industry. Mr. Herz noted that new bedding terminology would need to be updated on Detail 212 as well. Mr. White said he would work with Mr. Herz to incorporate the changes for the final case submittal.

4. Consolidate Testing in Section 611 (Case 14-14)

Gordon Tyus provided a handout of the latest version of Section 611 sent by Jami Erickson. It incorporated comments from Maricopa County and should be the final version presented for a vote at the next committee meeting. Jim Badowich said he expected additional updates to Section 611 next year including adding bacteria testing. Stew Waller suggested adding laser testing as well.

5. Water Testing/Flushing: Section 610 (Case 14-15)

Jim Badowich handed out an update to Section 610 that incorporated comments from Mr. Herz. This included changes to the measurement and payment section 610.16. Mr. Herz suggested a few other minor corrections, but overall was happy with the revisions.

6. Horizontal Drilling Directional Drilling (New Section 608) and Revisions to Section 602 Trenchless Installation of Steel Casing

Arvid Veidmark was not present, and no comments were provided.

7. Valve Box Installation (Case 14-11)

Bob Herz handed out an updated Detail 391-2 that limits the riser size to 8" (removing 12" option) and also removing the note relating to the 12" riser. This updates the case based on feedback at the last committee meeting.

8. Future Case Items

Mr. Badowich asked the group for suggestions of additional cases for next year. In addition to the items previously discussed for 611 and 610, he suggested a section on manhole linings and details for square valve boxes for reclaimed water. Mr. Tyus said the whole reclaimed water section still needs to be revised.

9. Next Meeting Date

The next meeting of the Water/Sewer working group will be determined on the status of cases up for a vote at the next meeting.

The meeting was adjourned at 4:25 p.m.

Report to MAG Technical Committee
Meeting August 21, 2014
Asphalt and Materials Working Group meetings
By Chairmen, Jeff Benedict, Brian Galimore

The meeting was held on noon on August 21, 2014 at the ARPA offices.

Present at the meeting: Brian Gallimore (WSP), Greg Groneberg (S.W. Asphalt), Margie Torres (Peoria), Syd Anderson (City of Phoenix), Jeff Hearne (SRMG), Scott Thompson (Cardno ATC), Bob Kostelny (Cardno ATC), Doug Laquey (Fisher Industries), Trey Billingsley (Fisher Sand), Robert Herz & John Shi, (MCDOT), Phil Feliz (WTI), Adrian Green (Vulcan), John Vincent (Wright), Peter Kandarlis (DGA)

Cases for submittal:

Case 14-06 revision to section 718 table 718-1

Sam Huddleston was not present at the meeting to review this case.

Case 14-13 MCDOT supplement to MAG 321

The case was reviewed and a couple of questions were raised. One item of concern was in section 321.10.4 "Asphalt pavement thickness" This section needs a "total" in the first addition after the word Owner and (insert total) of added verbiage. This eliminates confusion on each lift or total lifts. Bob agreed to clear this point up and in addition add a comment about not including the ARACFC to the thickness. It was pointed out that table 321-9 needs to be adjusted to match the other tables in penalty severity.

The final comments were in section 321.11 "Referee" The working group had suggestions to make this more clear as well. This was going to be an additional repair by Bob. The working group applauds MCDOT for this effort. The case is pretty clear otherwise.

Case 14-12 MCDOT submitted this case for "Pavement removal" and to prevent joints along pavement wheel paths. The case was discussed and it was deemed very confusing. Bob decided that he would pull this case until he had more time to review it.

Case 14-17 Stamped (decorative) asphalt

This case was discussed and it was decided that more agency input was needed on specific language for paint warranty etc. to move forward. It was agreed to carry this case over.

Case 14-19 revisions to 325/717 asphalt rubber

This case had a long discussion that focused on sampling and testing of mix from the hot plant and the project. Due to the high binder content in rubber mixes, any transfer tends to affect the binder content. The specifications used are acceptable to both industry and to the agency. The issue discussed is the acceptable range of binder content when mix was sampled from the job as differentiated when sample were taken at the hot plant. It was decided to go with the .4 range rather than the .6 range that industry wanted. This will not be a problem to agencies that sample the hot plants. It will continue to show different binder content ranges for projects that sample from the field.

This meeting was adjourned at 1:45PM