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September 19, 2007

TO: Members of the MAG Specifications and Details Committee
FROM: Robert Herz, Maricopa County DOT, Chairman
SUBJECT: MEETING NOTIFICATION AND TRANSMITTAL OF AGENDA

Wednesday, October 3, 2007 at 1:30 p.m.
MAG Office, Second Floor, Cholla Room
302 North First Avenue, Phoenix

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

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AGENDA

<u>ITEM</u>	<u>COMMITTEE ACTION REQUESTED</u>
1. <u>Call to Order</u>	1. No action required.
2. <u>Approval of September 5, 2007 Meeting Minutes</u>	2. Corrections and approval of September 5, 2007 minutes.
3. <u>2007 Cases</u>	3. Discussion and voting on cases 2007-13 and 2007-14.
4. <u>General Discussion</u>	4. For information and discussion.
5. <u>Adjournment</u>	5. No action required.

A Voluntary Association of Local Governments in Maricopa County

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

September 5, 2007

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

AGENCY MEMBERS

Jim Badowich, Avondale
Steven Borst, Buckeye
David Fern, Chandler
Mark Weiner, Gilbert
Tom Kaczmarowski, Glendale
Troy Tobiasson, Goodyear
Bob Herz, MCDOT
Gordon Haws, Mesa

Jesse Gonzalez, Peoria
Jeff Van Skike, Phoenix (St. Trans.)
Jami Erickson, Phoenix (Water)
* Gerald Wright, Queen Creek
Rodney Ramos, Scottsdale
Don Moseley, Surprise
James Bond, Tempe

ADVISORY MEMBERS

John Ashley, ACA
Jeff Benedict, AGC
Brian Gallimore, AGC
Peter Kandaris, SRP, Vice Chairman
Don Cornelison, ARPA

Adrian Green & Amanda McGinnis for
Don Green, ARPA
Paul R. Nebeker, Independent
William Ast, NUCA
Dale Phelan, NUCA

MAG ADMINISTRATIVE STAFF

Gordon Tyus

* Members not attending or represented by proxy.

GUESTS/VISITORS

Jim Sterne, City of Phoenix (Water Services)
Stew Waller, Arizona Cement Association

1. Call to Order

Chairman, Bob Herz, called the meeting to order at 1:30 p.m.

2. Approval of Minutes

The members reviewed the August 1, 2007 meeting minutes. Jami Erickson noted that a change was needed for Case 07-13 discussion. The fourth paragraph should read as follows:

“The committee recognized that there is a need for both a wet barrel and a dry barrel specification, but that the revision presented would be only for the **dry** barrel application.”

Gordon Haws introduced a motion to accept the minutes as modified. Jesse Gonzalez seconded the motion. A voice vote of all ayes and no nays was recorded.

3. 2006 Cases (old cases)

- a. **Case 06-04 – Reduced cement content for Reinforced Concrete Pipe (RCP) mixes, Section 735.** Revisions to Section 735 to use ASTM C76 requirements for fly ash and cement, eliminate minimum fly ash percentage, and eliminate minimum cement content. David Fern introduced a motion for a vote on the case as presented. Rodney Ramos seconded the motion. A vote of 9 yes, 2 no, 0 abstentions and 3 not present was recorded.

4. 2007 Cases (new cases)

- a. **Case 07-02 – Revisions to Asphalt Concrete, Sections 321 and 710:** Major re-writes of Asphalt Concrete placement and materials Sections 321 and 710 as proposed by the Asphalt Paving Technical Committee (APTC). The committee and sponsors agreed to carry over this case to next year so that all comments received to date could be incorporated.
- b. **Case 07-03 – PVC Catch Basins, Proposed New Details 535-2, 535-3, 537-2, 539-2, 542-1 through 4, and 543-1 through 5:** Details to allow the use of PVC catch basins. No new revisions were available for review. Dale Phelan hopes to have updated details by the next meeting so that a vote could be taken on the case. If not, this case will be carried over to next year. Members were requested to be prepared to vote on this case at the next meeting.
- c. **Case 07-04 – Revision to Water Service Taps, Section 631.3.5:** Removing requirements for insulation of copper service pipe at corporation stops with dielectric insulators. Gordon Haws introduced a motion to vote on the case as originally presented. He proposed that a new detail showing water meter box construction could be introduced next year, but that this case should be considered as a separate issue. Troy Tobiasson seconded the motion. A vote of 8 yes, 1 no, 2 abstentions and 3 not present was recorded.
- d. **Case 07-05 – Revision to Fire Hydrant Installation, Detail 360:** Gordon Haws proposed that the case be limited to the original proposal to add a new note allowing the use of joint restraint systems along with thrust blocks. After discussion, the committee agreed to minor word changes to better clarify the case (from “can” to “may” on new Note 7 and changing pipe type references from CIP to DIP). Jesse Gonzalez stated that he would propose a new wet barrel detail next year. Gordon Haws introduced a motion to

vote on the case as modified. Rodney Ramos seconded the motion. A vote of 12 yes, 0 no, 0 abstentions and 2 not present was recorded.

e. **Case 07-06 – Revision to Section 104, Scope of Work:** Add order of precedence for contract documents and eliminate gender-specific wording. Bob Herz handed out a revision based on comments from the last meeting. Gordon Haws pointed out that the list did not include agency supplemental details. Troy Tobiasson also noted that Section 102.2, paragraph 3 uses a similar order of precedence for bid documents. The committee agreed that the proposed revision to Section 104 and the existing Section 102 are both needed since each is used for different work phases, but that they should have similar wording and order. Bob proposed to add “addenda” to the list in Section 102.2, include agency supplemental details in the new order of precedence in Section 104, and modify the item noting standard details to insure that the reference is to the MAG standards. He then moved to vote on the case as revised. Rodney Ramos seconded the motion. A vote of 13 yes, 0 no, 0 abstentions and 1 not present was recorded.

f. **Case 07-08 – Revision to Section 615.2, Sewer Line Construction:** Provide water ponding tolerances inside sewer pipe. The committee agreed that there is a need for this case since there is no standard for present field practices using video inspection of pipes. Paul Nebeker and Brian Gallimore explained the necessity for more work on the proposed changes since they do not address equipment calibration or technician qualifications, nor is there uniform agreement on the proposed tolerance limits. There was general agreement that video-based tolerances were also needed for manholes and pipe inverts. The committee agreed to carry over this case to next year.

g. **Case 07-09 – Revision to Detail 145, Safety Rail:** Require steel reinforcing around anchors placed in concrete walls that support safety rails. The committee was concerned that the proposed changes could result in confusion in the field about who would provide reinforcement detailing and where this detailing would be presented. Rodney Ramos suggested the revision state that Type 1 through 3 anchor plate details require special design for standard MAG headwalls. It was agreed that another note be added to Detail 145 explaining that the project plans would show anchor details for single reinforced and non-reinforced walls. Bob Herz moved to vote on the case as revised. Jesse Gonzalez seconded the motion. A vote of 13 yes, 0 no, 0 abstentions and 1 not present was recorded.

h. **Case 07-10 – Deletion of Obsolete Details:** Deletion of Type C redwood pavement terminations in Detail 201 and deletion of curb warning beacons in Detail 221. Bob Herz moved to vote on the case as presented. Jesse Gonzalez seconded the motion. A vote of 13 yes, 0 no, 0 abstentions and 1 not present was recorded.

i. **Case 07-11 – Revision to Detail 370, Vertical Realignment of Water Mains:** Include an option for realignment of ductile iron mechanical joint. The committee discussed lengths required for retrofit projects, use of both joint restraints and thrust blocks, and minimum clearances for sewer crossings. Jesse Gonzalez requested and the

committee agreed to carry over this case to next year. Members are to provide Jesse feedback for any needed modifications into the proposed changes.

j. Case 07-12 – Revision to Detail 404-2, Water & Sanitary Sewer Separation/Protection: Adding language to clarify the location of pipe and joint restraints to insure that fittings/couplings do not fail and create cross-contamination. The committee noted both new and retrofit work still need to be addressed. Jesse Gonzalez requested and the committee agreed to carry over this case to next year. Members are to provide Jesse feedback for any needed modifications into the proposed changes.

k. Case 07-13 – Revisions to Section 756, Fire Hydrants: Modify Section 756 by providing performance criteria that will reduce maintenance and operation issues with fire hydrants. Jami Erickson handed out revisions with changes requested from the last meeting and Jim Sterne discussed these latest modifications. The committee discussed case items including options for agencies to have their own approved product list, maintenance requirements allowing work done without removing the entire upper barrel section, burial depth requirements, and 304 stainless steel nut and bolt requirements. It was agreed that the wording would be changed so that (a) hydrants would be suitable for installation in a 42 to 66 inch depth of bury, and (b) all nuts and bolts of the factory hydrant to be buried below ground would be of a minimum 304 stainless steel. A number of agencies wanted to have their water departments review these final modifications prior to a vote. Any questions or comments need to be provided to Jami or Jim Sterne (602-262-6509) before the next meeting. Members were requested to be prepared to vote on this case at the next meeting.

l. Case 07-14 – Revisions to Section 505, Concrete Structures: Modify Section 505 as requested by the supplements subcommittee to reduce the number of agency supplements to this section. Bob Herz handed out changes to proposed revisions as discussed during the last meeting. These changes included compaction requirements for structural backfill and replacing the word “pour” with “place” for concrete. The committee discussed a number of items in Section 206 including (a) over-excavation requirements (modified wording to clarify that the cost of backfill replacement would not be at the contractor’s expense if requested by the agency), (b) changing “structure” to “structural” backfill, (c) allowing backfill material options, (d) allowing backfill lifts thicker than 8 inches, and (e) allowing exceptions to the 72 hour limit for backfill against fresh poured concrete catch basins. Bob proposed to make changes in these areas and have the section ready for final review at the next meeting. Members were requested to be prepared to vote on this case at the next meeting. If necessary, this case may be carried over to next year for a vote.

5. General Discussion:

There were no discussion items.

6. Adjournment:

The meeting was adjourned at 4:08 p.m.

2007 PROPOSED REVISIONS TO MAG SPECIFICATIONS AND DETAILS

CASE	DESCRIPTION	PROPOSED BY	MEMBER	SUBMITTAL DATE Last Revision	VOTE DATE	VOTE		
						Yes	No	Abstain
06-04	Reduce cement content requirement for RCP section 735.4 (C)	Chandler	David Fern	5/03/2006 8/04/2006	9/05/2007	9	2	0
07-01	Miscellaneous Bloopers Case A – Correct Catch Basin wall thickness in detail 535.	Mesa	Kelly Jensen	1/03/2007 4/11/2007	8/01/2007	8	0	0
07-01	Miscellaneous Bloopers Case B – Detail 222, Correct Type A formed height.	MCDOT	Bob Herz	2/07/2007 2/07/2007	8/01/2007	8	0	0
07-01	Miscellaneous Bloopers Case C – Section 105.5, Correct wording in first sentence.	Mesa	Kelly Jensen	2/07/2007 2/07/2007	8/01/2007	8	0	0
07-01	Miscellaneous Bloopers Case D – Detail 510, Correct dimension from metric to English Units	MCDOT	Bob Herz	8/01/2007 8/01/2007	8/01/2007	8	0	0
07-02	Revision/ Re-Write Section 710 & Section 321	ARPA	Don Green	2/07/2007 4/13/2007	Carry over to 2008	0	0	0
07-03	PVC Catch Basins - New Details 535-2, 535-3, 537-2, 539-2, 542-1 through 4, and 543-1 through 5.	NUCA	Dale Phelan	2/07/2007 8/01/2007	Carry over to 2008	0	0	0
07-04	Section 631.3.5 Service Taps – Revise dielectric insulator requirements.	Mesa	Kelly Jensen	2/07/2007 2/07/2007	9/05/2007	8	1	2
07-05	Detail 360 – Revise to allow restrained joints.	Mesa	Kelly Jensen	2/07/2007 2/07/2007	9/05/2007	12	0	0
07-06	Revision to Section 104 Scope of Work	MCDOT	Bob Herz	3/07/2007 8/02/2007	9/05/2007	13	0	0
07-07	Revision to Section 109 Measurements and Payments	MCDOT	Bob Herz	3/07/2007 3/07/2007	8/01/2007	8	0	0

2007 PROPOSED REVISIONS TO MAG SPECIFICATIONS AND DETAILS

CASE	DESCRIPTION	PROPOSED BY	MEMBER	SUBMITTAL DATE Last Revision	VOTE DATE	VOTE		
						Yes	No	Abstain
07-08	Revision to Section 615 Sewer Line Construction – Clarify tolerances for pipe versus trench bottom.	Queen Creek	Gerald Wright	5/02/2007 8/01/2007		0 0 0	Yes No Abstain	
07-09	Detail 145, Safety Rail – Adding reinforcement requirement for anchor types 1, 2 and 3.	MCDOT	Bob Herz	5/02/2007 8/02/2007	9/05/2007	13 0 0	Yes No Abstain	
07-10	Deletion of Obsolete or Unused Details 1. Delete Type 'C' from Detail 201 Pavement Section at Termination. 2. Delete the Curb Warning Beacon from Detail 221 Curb and Gutter	MCDOT	Bob Herz	5/02/2007 5/02/2007	9/05/2007	13 0 0	Yes No Abstain	
07-11	Revision to Detail 370, Vertical Realignment of Water Mains	Peoria	Jesse Gonzalez	6/06/2007		0 0 0	Yes No Abstain	
07-12	Revision to Detail 404-2, Water & Sanitary Sewer Separation/Protection	Peoria	Jesse Gonzalez	6/06/2007		0 0 0	Yes No Abstain	
07-13	Revisions to Section 756, Fire Hydrants	Phoenix	Jami Ericson	7/11/2007 8/22/2007		0 0 0	Yes No Abstain	
07-14	Revisions to Section 505, Concrete Structures	MCDOT	Bob Herz	7/11/2007		0 0 0	Yes No Abstain	

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

DRY BARREL FIRE HYDRANTS

756.1 GENERAL:

Fire Hydrants furnished by the Contractor shall be designed, manufactured, and tested in compliance with the latest edition of the American Water Works Association (AWWA) - C. 502 Standard for Dry-Barrel Fire Hydrants, supplemented as follows:

Deleted: shall comply with AWWA C-502, supplemented as follows.¶

756.2 DRAWINGS:

Detail drawings or blue prints showing all components, principal dimensions, construction details and materials used shall be submitted to the Contracting Agency for approval. The Contracting Agency reserves the right to consider the quality, appearance and past performance of fire hydrants when reviewing drawings for approval.

756.3 HYDRANTS:

Fire hydrant ~~makes and models (and approved alternates)~~ shall be specified by the owner and designated on an approved products list. Alternate hydrants by request only to Owner. The diameter of the main valve seat opening shall be not less than 5 inches in diameter. The entire valve assembly shall be effectively sealed against moisture.

Deleted: dry barrel similar or equal to the Corey or Mueller Improved Type.

Deleted: The inside diameter of the barrel shall be a minimum of 7 inches and t

All interior ferrous surfaces of the shoe exposed to fluid flow (including the valve plate and cap nut), shall be epoxy coated to a minimum dry thickness of 6 mils. Epoxy coatings shall be factory applied by an electrostatic or thermosetting process in accordance with the manufacturer's printed instructions. The epoxy materials used shall be 100% powder epoxy or liquid epoxy that conforms to the requirements of AWWA C-550-81, NSF 61 approved, and to the prevailing requirements of the Food and Drug Administration and of the Environmental Protection Agency.

Style of inlet Shoe connections shall be mechanical joint with accessories, gland, bolts, gaskets and having a 6 inch diameter inlet connection. Facing of the main valve against seats shall be rubber or synthetic rubber. The top of the stem or bonnet shall be equipped with the O-ring seal. Hydrants shall be constructed so that extension sections in multiples of 6 inches, with rod and coupling, can be added to increase barrel length. The hose and streamer nozzle connections shall match the standard size and threads per inch of the Contracting Agency. Operating and outlet nozzle cap nuts shall be of solid pentagonal shape. The pentagon shall measure fifteen-sixteenths to thirty-one thirty-seconds inch on side, 1 1/2 inch from point to flat. All barrels above ground shall have a prime coat and painted with two coats of fire hydrant yellow paint. Hydrants shall be constructed so that the standpipe can be rotated 360 degrees to at least 8 different positions.

Deleted: bell or

Deleted: or balata

Hydrants shall be designed for a 250 psi working pressure and factory bench tested to a 500 psi hydrostatic pressure. Hydrants shall be field tested consistent with the specified pressure ratings for the connecting pipes.

Hydrants shall be of the break flange traffic model type with a replaceable breakable unit immediately above the ground line to minimize repairs necessary due to traffic damage. The breakable stem coupling will be made of a corrosion resistant material such as stainless steel or bronze, or have a permanently applied non corrosive finish such as nickel plating or fusion bonded epoxy coating.

Hydrants shall be of the compression type; constructed such that the main valve closes with the water pressure to assure no loss of water in the event of damage to the upper portion of the fire hydrant.

Main valve opening shall have a minimum diameter of 5-inches to assure optimum flow. Facing of the main valve against the seats shall be of rubber or synthetic rubber minimum of 1 inch in thickness. Plastic or Neoprene type main valves will not be allowed.

Hydrants shall be of the dry top design with o-ring seals to ensure that the operating threads will be

protected from water entry. Dry top design to include factory- lubricated operating mechanism which allows supplemental lubricant to be added in the field without removal of the upper barrel. Standard lubricant shall be a NSF 61 approved oil or grease suitable for a temperature range of 40 degrees to 150 degrees F.

Hydrants shall have a cast iron weather shield at the operating nut to protect the clearance area between the top casting and the operating nut.

The operating nut shall be a one-piece bronze casting. Both the operating nut and the nozzle cap nuts shall be National Standard Pentagon in shape and measure 1-1/2 inches from point to flat at the base of the nut.

Hydrants shall have two hose nozzles, 2-1/2 inch diameter, and one pumper nozzle approved by the Owner. Rubber gasket nozzle caps shall be provided. Screw Threads shall be per owner requirements.

Hydrant nozzle section shall be capable of rotation through 360 degrees to at least 8 points of rotation with respect to the standpipe to allow the positioning of the hose or pumper nozzles

Minimum distance allowable between the centerline of the lowest nozzle and ground / bury line is 18-inches. Bury line shall be visibly marked on lower barrel of hydrant.

Hydrants shall have markings indicating direction of opening right to left (counter-clockwise).

Hydrants shall have permanent markings identifying the manufacturer name, model identification, size of the main valve opening and the year of manufacture

Hydrants shall have an automatic drain that is operated by the main valve rod. The drain valve is to open as the main valve is closed and close as the main valve is opened. The port and seat of the drain valve shall be bronze. Drain facings shall not be leather.

The outside of the hydrant top section shall be painted a minimum of one coat of non- lead base premium primer and two (2) finished coats of non-lead base premium durable paint. The surface will be properly prepared, smooth, clean, and dry before primer is applied. The primer coat will be applied to a DFT (Dry Film Thickness) of 3-4 mils. The final 2 coats will be applied to achieve a DFT of 6-8 mils on top of the primer coat. Paint will be a semi-gloss, bright chrome safety yellow in color. Paint will have high color retention. Paint will be fade and UV resistant, rust resistant, resistant to abrasions and chipping and have flexibility qualities.

Hydrants shall have a bronze valve seat and shall be threaded into a bronze drain ring or shoe bushing to prevent electrolysis between these components

Hydrants shall be designed to permit the use of extension sections.

Hydrants shall be designed to allow all working parts to be removed through the bonnet/dome or upper nozzle section of the hydrant without removal of the entire upper barrel section.

Hydrants shall be suitable for installation in 36-inch and 72-inch trench depth or as specified by owner.

All nuts and bolts of the factory hydrant to be buried below ground will be a minimum of 304 stainless steel and coated for gall protection.

The friction loss must be guaranteed by the manufacturer to match statistics in Table 756-1

756.4 MANUFACTURER:

The manufacturer shall guarantee that the hydrant is so constructed that the valve stem will not be bent when hydrant is damaged or broken at or near the grade level. A safety breaking flange or thimble, shall be provided. The friction loss must be guaranteed, by the manufacturer, to satisfy Table 756-1.

TABLE 756-1			
MAXIMUM PERMISSIBLE LOSS OF HEAD FOR HYDRANTS			
Number of Outlet Nozzles	Nominal Diameter of Outlet	Total Flow From Outlet Nozzles GPM	Maximum Permissible Head Loss PSI
2	2 1/2 inches	500	2.0
1	4 inches	600	2.5

756.5 WARRANTY:

All items shall be warranted by the manufacturer for a minimum period of five (5) years from date of acceptance by the Owner, against defects in material and workmanship. At any time during that period, if a defect should occur in any item, it shall be repaired or replaced by the manufacturer at no obligation to the Owner, except where it would be shown that the defect was caused by misuse and not by fault of manufacturer. The manufacturer expressly warrants all items to be new, free from defect in design, materials, and workmanship and to be fit and sufficient for their intended purpose. All warranties shall survive acceptance and payment by the city.

756.6: INSPECTION

All items shall be inspected before acceptance by an authorized representative of the Owner for workmanship, acceptance and proper functioning of components, and conformance to all requirements of this specification.

Should deficiencies be found, it shall be the responsibility of the supplier to pack the item(s) in question, make necessary corrections, and then return to the Owner for re-inspection and acceptance at no additional expense or obligation to the Owner.



MARICOPA COUNTY
Department of Transportation

MEMORANDUM

Date: September 17, 2007 (Initial Submittal: July 11, 2007)

To: MAG Specifications and Details Committee

From: Robert Herz, MCDOT Representative

Subject: Revisions to Section 505 CONCRETE STRUCTURES

Case 07- 14

PURPOSE: Incorporate specification modifications from MCDOT's Supplement into the MAG specifications as requested by the MAG Standards & Details Consolidation Subcommittee.

REVISIONS:

Section 505 (Revised 9/17/2007)

1. Define MINOR STRUCTURES as structures that may be cast-in-place or furnished as precast units.
2. Defines construction tolerances.
3. Bending of reinforcing steel is revised to reference the AASHTO LRFD Bridge Construction Specifications.
4. Adds new section to define placement and anchorage requirements for Dowels.
5. Requires certification of falsework by the Contractor's Professional Engineer.
6. Addresses Bridge Deck Joint Assemblies.
7. Adds a MEASUREMENT section and expands the payment section.

Revisions to the following sections are included in this case due to references from proposed revisions of section 505:

101.2 DEFINITIONS AND TERMS

- Added definition for Professional Engineer

105.2 PLANS AND SHOP DRAWINGS

- Adds the requirement that shop drawings for temporary support structures be sealed by a professional engineer.

206 STRUCTURE EXCAVATION AND BACKFILL (Revised 9/17/2007)

- Defines structural backfill requirements based on conditions of use.
- Allows structural excavation and structural backfill to be pay items and defines criteria for measurement and payment.

101.2 DEFINITIONS AND TERMS:

[Add the following:]

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.

105.2 PLANS AND SHOP DRAWINGS:

The Contractor shall submit, for review, a proposed schedule of shop drawings and product data submittals. This schedule will include concrete and asphalt concrete mix designs unless they are previously approved supplier's mix design. The schedule will show the needed response date for each submittal and will indicate the relationship of the submittal to the project construction schedule.

Shop drawings for major temporary support structures such as falsework, shoring, soldier piles, and other major temporary structures that facilitate construction shall be prepared by and bear the seal and signature of a Professional Engineer. Temporary support structures for Minor Structures as defined in Section 505.1.1 are exempt from this requirement.

The Contractor shall submit five (5) copies of each shop drawing, product data or mix design to the Engineer for review. Each submittal shall be numbered sequentially and shall be submitted in accordance with the schedule established in conjunction with the Contracting Agency so as to cause no delay in the work schedule. The Contractor shall certify, by stamp or letter, that he has reviewed and approved the submittal and that it conforms to the requirements of the contract documents. If this certification is not included, the submittal will be returned without action.

At the time of each submittal, the Contractor shall define and delineate in writing, separate from the certification, any deviations from the contract documents. If the Engineer accepts this deviation, he will authorize the deviation by issuing a change order or if the deviation is minor by endorsement to the letter.

The Engineer will review and return the submittals in accordance with the previously established response date. The review will be only for conformance with the design concept of the work and for compliance with the information contained in the contract documents. The review of a specified item, as such, will not indicate review of the assembly in which the item functions. Review by the Engineer will not relieve the Contractor from responsibility for any errors or omissions in the submittals nor from his responsibility for complying with the contract documents. The only exception is deviations accepted in accordance with the preceding paragraph.

If the submittal is acceptable, one (1) copy with each page stamped "Furnish as Submitted" will be returned to the Contractor. The Contractor shall submit additional copies (as required) to the Engineer.

If the Engineer determines that the submittal requires corrections or is to be rejected, one (1) copy stamped "Furnish as Noted" or "Revise and Resubmit" will be returned to the Contractor. The Contractor will submit five (5) corrected or new copies.

The copy stamped "Furnish as Submitted," returned to the Contractor, will become a part of the contract documents and will be kept at the job site. Any work done prior to the receipt of this review will be at the Contractor's risk and expense.

SECTION 206

STRUCTURE EXCAVATION AND BACKFILL

206.1 DESCRIPTION:

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

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

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

206.2 FOUNDATION MATERIAL TREATMENT:

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

When no piles are used and footing concrete or masonry is to rest on an excavated surface other than rock, care shall be taken not to disturb the bottom of the excavation and final removal of the foundation material to grade shall not be made until just before the concrete or masonry is placed. ~~Except when over-excavation is directed by the Engineer,~~ Excavation below grade shall be replaced with the same class of concrete specified for the structure or with 1 1/2 sack controlled low strength material as specified in Section 728. When the replacement material is structural concrete, the material shall be placed at the same time as the structure material. Placement of the controlled low strength material shall be per Section 604 which will require a time lag between placement of the material and the structural concrete. The placement of the additional material shall be at no cost to the Agency except when over-excavation is directed by the Engineer.

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

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

206.3 INSPECTION:

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

206.4 STRUCTURE BACKFILL:

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

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

- (A) Shall conform to the material requirements of Section 701.2.1 Crushed Rock, and the gradation requirements for Select Material, Type A or B in Table 702-1 unless otherwise approved by the Engineer.
- (B) Shall not be placed until the concrete has reached its full design strength.
- (C) Shall be placed in layers not more than 8 inches in depth before compaction, when compacted by pneumatic or mechanical tamping devices.
- (D) Shall be uniformly compacted to at least 95 percent of maximum density.

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

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

- (A) Shall not be placed until the concrete has attained a minimum compressive strength of 2500 psi in compression as specified in Section 725 and in no case less than 72 hours after casting.
- (B) Shall be uniformly compacted to at least 90 percent of maximum density.

206.4.4 Structure Backfill for Structures within Paved Areas: Where a structure is located within an ~~Backfilling operations~~ shall conform to the following requirements: Structure backfill shall not be placed until the structure footings or other portions of the structure or facility have been inspected by the Engineer and approved for backfilling. No backfill material shall be deposited against the back of concrete abutments, concrete retaining walls, or the outside walls of cast in place concrete box culverts until the concrete has developed a strength of not less than 2500 psi in compression as specified in Section 725.

All structural backfill in any existing street, or proposed street, or paved area: and

- (A) Where any portion of the Backfill is within 2 feet of the surface shall be compacted to the minimum density specified in Table 601-2, for Type I or shall be filled with 1/2 sack or 1 sack controlled low strength material as specified in Sections 604 and 728.
- (B) All other ~~structural~~ structure backfill shall be compacted to the minimum density specified in Table 601-2, for ~~Type II or~~ Type III or shall be filled with 1/2 sack or 1 sack controlled low strength material as specified in Sections 604 and 728.

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

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

206.5 PAYMENT:

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

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

206.5.1 Measurement

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

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

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

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

206.5.2 Payment

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

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

SECTION 505

CONCRETE STRUCTURES

505.1 DESCRIPTION:

Concrete bridges, culverts, catch basins, manholes, retaining walls, abutments, piers, footings, foundations and similar structures shall be constructed in conformity with the plans and specifications. Concrete for use in work constructed under this specification and testing thereof shall conform to the requirements of Section 725. Reinforcing shall conform to the requirements of Section 727.

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

505.1.1 MINOR STRUCTURES:

Concrete structures such as cattle guards, catch basins, median barriers, headwalls, and other small miscellaneous structures of sizes that can readily be precast as units, and furnished and installed in place, are hereby defined as Minor Structures. Such Minor Structures, at the option of the Contractor, may be either constructed of cast-in-place concrete, or furnished as precast units. Precast units shall be fabricated in accordance with shop drawings submitted by the Contractor and approved by the Engineer, in accordance with the requirements of Section 105.2.

505.2 SUBGRADE FOR CONCRETE STRUCTURES:

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

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

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

Precast Concrete Minor Structures shall be founded in accordance with the requirements of Section 206.4.5.

505.3 FORMS:

Forming plans for cast-in-place bridge decks and cast-in-place bridge superstructures shall be prepared in accordance with the requirements of Section 105.2.

Forms shall be of suitable material and of type, size, shape, quality, and strength to enable construction as designed. The forms shall be true to line and grade, mortar tight, and sufficiently rigid to resist any appreciable amount of springing out of shape during placing of the concrete. The responsibility for their adequacy shall rest with the Contractor. All dirt, chips, sawdust, nails, and other foreign matter shall be completely removed from forms before any concrete is deposited. The surfaces of forms shall be smooth and free from irregularities, dents, sags and holes that would appreciably deface the finished surface. Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being reused, and the reuse of forms shall be subject to the approval of the Engineer. Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly treated with an approved releasing agent that will leave no objectionable film on the surface of the forms that can be absorbed by the concrete. Care shall be exercised that no releasing agent is deposited on previously placed concrete.

Forms for all surfaces that will not be completely enclosed or hidden below the permanent surface of the ground shall be made of surfaced lumber, or material which will provide a surface at least equally satisfactory. Any lumber or material which becomes badly checked or warped prior to placing concrete may be rejected.

Forms for all exposed surfaces of bridges, viaducts, overcrossings and similar structures shall be constructed of plywood or an approved equal. Plywood for forms shall be exterior type, of the grade Concrete-Form Exterior, conforming to the specifications of the NBS, Commercial Standards latest edition. Plywood shall be furnished and placed in 48 inches widths and in uniform lengths of not less than 96 inches, except where the dimension of the member formed is less than the specified panel dimension. Plywood shall be placed with the grain of the outer plies in the direction of the span. Where plywood is attached directly to the studding or joints, the panels shall be not less than 5/8 inch thick, and the studdings or joints shall be spaced not more than 12 inches, center to center. Plywood less than 5/8 inch thick, otherwise conforming to the requirements specified, may be used with a continuous backing of 5/8 inch sheathing. All form panels shall be placed in a neat, symmetrical pattern with the horizontal joints level and continuous.

Wood forms for copings and curbs shall have a thickness of not less than 1 5/8 inches and a width of not less than the full depth of coping or curb.

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

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

Forms for girders and slabs shall be cambered as may be required by the Engineer.

Forms shall, as far as practicable, be so constructed that the form marks will conform to the general lines of the structure.

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

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

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

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

Regardless of the method used in ~~po~~uring ~~the~~placement of concrete without outside forms the following stipulations shall hold:

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

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

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

505.3.1 Removal of Forms: The falsework supporting any span of a continuous or rigid frame structure subject to bending stress shall not be released until after the last concrete placed in the span and in the adjoining spans, excluding concrete above the deck slab, has attained a compressive strength of not less than twice the design unit stress, or 21 days after the concrete is placed, whichever occurs first.

Stairway riser forms shall be removed and the finish of the steps completed on the day the concrete is placed. Metal stairway treads, if required by the plans, shall be installed immediately after the steps have been placed.

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

Side forms for arch rings, columns, and piers shall be removed before the members of the structure which they support are ~~poured~~ or placed so that the quality of the concrete may be inspected. Such forms shall be so constructed that they may be removed without disturbing other forms which resist direct load or bending stress.

Forms and shoring for box and arch sections of sewers and storm drains may be removed as follows:

- (A) Forms for open channel walls — 16 hours.
- (B) Outside forms of box sections and inside wall forms of box sections which do not support the slab forms — 16 hours.
- (C) Arch sections in open cut — 12 hours.
- (D) Slab forms for box sections:
 - (1) Type II Cement — 48 hours or 6 hours per foot of span between supports, whichever is greater.
 - (2) Type III Cement — 24 hours or 3 hours per foot of span between supports, whichever is greater.
 - (3) Type V Cement — 56 hours or 7 hours per foot of span between supports, whichever is greater.

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

505.4 FALSEWORK:

Falsework construction and erection shall not commence until the Contractor has received written approval of the sealed final falsework shop drawings.

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

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

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

Falsework and forms shall be so constructed as to produce in the finished structure the lines and grades indicated on the plans. Suitable jacks or wedges shall be used in connection with the falsework to set the forms to grade or camber shown on the plans, or

to take up any settlement in the form work either before or during the placement of concrete. Single wedges for this purpose will not be permitted; it being required that all such wedges be in pairs to insure uniform bearing. Dead load deflection in stringers and joints will be compensated for by varying depths of the joists or by using varying depth nailing strips.

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

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

505.4.1 Falsework Design: Falsework design shall be in accordance with the requirements of Section 105.2.

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

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

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

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

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

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

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

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

505.5 PLACING REINFORCEMENT:

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

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

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

The Contractor will be allowed the following tolerances when placing, tying and supporting reinforcing steel:

- (1) In slabs and beams, horizontal bars shall be within ¼ inch measured vertically, of the position indicated on the plans.
- (2) In vertical walls, columns, wings, and similar members, clearance from the forms shall be within ¼ inch of the clearance shown on the plans.

- (3) In slabs or walls, long runs of bars may vary up to 2 inches in spacing; however, the specified number of bars shall be placed.

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

Welding of reinforcing steel will not be permitted unless specifically authorized by the Engineer.

505.5.2 Bending Reinforcement: Bending of reinforcing steel shall conform to the requirements of the AASHTO LRFD Bridge Construction Specifications Section 9.4. Bends and hooks in bars shall be made in the manner prescribed in the ACI, Manual of Standard Practice.

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

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

505.5.4 Dowels

505.5.4.1 Dowel Placement: Dowel placement shall consist of drilling or coring dowel holes in concrete, furnishing and placing anchoring materials, and placing reinforcing steel dowels in accordance with the details shown on the Project Plans, and the requirements of the project Special provisions and these Specifications.

Dowel holes shall be cored where dowels are to be placed:

- (A) in bridge decks and other thin concrete sections, and the depth of the dowel hole shown on the project plans projects to 3 inches or less from the opposite face of the concrete section, or
- (B) within 4 inches from an existing concrete edge.

Cored holes shall be intentionally roughened after coring.

All holes shall be blown clean with compressed air, prior to applying the anchoring material.

The diameter of the holes for the dowels shall be 1/8" larger than the diameter of the dowels to be placed. The depth of the holes for the dowels shall be as shown on the Project Plans.

The anchoring materials for the dowels shall be an epoxy adhesive conforming to the requirements of Section 505.5.4.2, unless otherwise specified on the Project Plans and/or the project Special Provisions, or as approved by the Engineer.

505.5.4.2 Anchoring Materials: Epoxy materials shall be used for anchoring dowels. The Contractor shall submit Certificates of Compliance or Analysis, complete with supporting documentation, to the Engineer for all epoxy materials to be used for anchoring dowels on a specific project, in accordance with the requirements of Section 106.2. The epoxy materials shall be provided by the Contractor in general conformance with the requirements of Section 1015.1 – General Requirements of Section 1015 – EPOXY MATERIALS of the current Arizona Department of Transportation (ADOT) Standard Specifications for Road and Bridge Construction, amended to date.

Epoxy resin base anchoring adhesive shall be used for anchoring dowels in concrete. High viscosity, or non-sag epoxies in the form of a gel, shall be used for horizontal or near-horizontal applications, where flow out of the anchoring hole is a problem. Low and medium viscosity epoxies may be used in vertical anchoring holes that open upward. The anchoring product shall specifically be designed for the designated application, according to the manufacturer's product literature.

Epoxy resin base anchoring adhesive shall provide the specified minimum tensile pullout resistance, when tested in accordance with Arizona Test Method 725, as modified in accordance with Section 505.5.4.3 of these specifications. The pot life of the anchoring material shall be determined in accordance with AASHTO T 237, Part I. The determined pot life shall be within 25 percent or 10 minutes of the pot life specified by the manufacturer, whichever is greater.

505.5.4.3 Dowel Strength Requirements: The epoxy resin base anchoring adhesive shall provide the following minimum pullout resistances:

#4 dowels:	12.0 Kips
#5 dowels:	18.6 Kips
#6 dowels:	26.4 Kips
#7 dowels:	36.0 Kips

Arizona Test Method (ATM) 725 is a Tensile Proof Dowel Test, developed by ADOT to specifically test #6 reinforcing steel dowels anchored in Portland cement concrete with an epoxy adhesive. When testing reinforcing steel dowel sizes, the anchoring hole (ATM 725: PREPARATION – 4.(a)) shall be modified as follows; the rotary hammer drill bit size (ATM 725: APPARATUS – 2.(a)) shall be modified accordingly:

#4 dowels:	5/8" diameter x 8" long
#5 dowels:	3/4" diameter x 10" long
#6 dowels:	7/8" diameter x 12" long
#7 dowels:	1" diameter x 14" long

The Contractor may opt to conduct pullout tests with hole lengths other than those required above, based on the adhesive manufacturer's product literature and recommendations; however, test results shall demonstrate that the tested system provides the required pullout resistances.

505.6 PLACING CONCRETE:

No concrete shall be placed in any forms supported by falsework until the Contractor's Professional Engineer has inspected the completed falsework, and has issued a properly sealed and signed certificate that the falsework has been constructed according to the approved falsework drawings.

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

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

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

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

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

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

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

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

Concrete for columns shall be placed using poured—preferably through pipes of adjustable length and not less than 6 inches in diameter.

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

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

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

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

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

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

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

Asphalt paint or premolded asphalt filler used in joints shall be as specified in Section 729.

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

505.6.2 ADVERSE WEATHER CONCRETING:

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

As an absolute minimum, the Contractor shall insure that the following measures are taken:

(1) An ample supply of water, hoses, and fog nozzles are available at the site. (2) Spare vibrators are on hand in the ratio of one spare vibrator for each three in use. (3) Preplanning has been accomplished to insure prompt placement, consolidation, finishing, and curing of the concrete. (4) Concrete temperature on arrival should be approximately 60°F. and in any event shall not exceed 90°F. The use of cold water and ice is recommended. (5) The subgrade is moist, but free of standing water. (6) Fog spray is utilized to cool the forms and steel. Under extreme conditions of high ambient temperature, exposure to the direct rays of the sun, low relative humidity, and wind, even strict adherence to these measures may not produce the quality desired and it may be necessary to restrict concrete placement to early morning only. If this decision is made, then particular attention must be directed to the curing process since the concrete will be exposed to severe thermal stresses due to temperature variation; heat of hydration plus midday sun radiation versus nighttime cooling.

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

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

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

(E) Recommended Reference:

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

505.6.3 Bridge Deck Joint Assemblies

505.6.3.1 Description: This work shall consist of furnishing and installing expansion devices including the seals, anchorage system, and hardware in accordance with the project plans and these specifications.

505.6.3.2 Materials: Elastomer Seals shall be of the Compression Seal or Strip Seal type, and shall conform to the requirements of the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction Section 1011-5.

Steel shapes and plates shall conform to the requirements of ASTM A36, or ASTM A588.

505.6.3.3 Construction Requirements:

(1) General: Deck joint assemblies shall consist of elastomer and steel assemblies which are anchored to the concrete at the deck joint. The seal armor shall be cast in the concrete. The completed assembly shall be properly installed in the planned position, shall satisfactorily resist the intrusion of foreign material and water, and shall provide bump-free passage of traffic. For each size of seal on a project, one piece of the seal material supplied shall be at least 18 inches longer than required by the project Plans. The additional length will be removed by the Engineer and used for materials testing. Certificates of Compliance conforming to the requirements of Section 106.2 shall also be submitted by the Contractor.

(2) Shop Drawings: Prior to fabrication, the Contractor shall submit shop drawings to the Engineer for approval, in accordance with the requirements of Section 105.2. The shop drawings shall show complete details of the method of installation to be followed, including a temperature correction chart for adjusting the dimensions of the joint according to the ambient temperature, and any additions or rearrangements of the reinforcing steel from that shown on the project plans.

Deck joint assemblies for pretensioned and post-tensioned prestressed concrete superstructures shall be installed at the narrowest joint opening possible to allow for long-term superstructure shortening.

(3) Elastomer Seals: Seals shall conform to the requirements specified.

(4) Welding: All welding and inspection of welding for structural steel, except for tubular structures, shall be performed in accordance with the requirements of the ANSI/AASHTO/AWS D1.5-88 Bridge Welding Code. All other references to the American Welding Society (AWS) Structural Welding Code AWS D1.1-80 and the AASHTO Standard Specifications for the Welding of Structural Steel Highway Bridges are deleted.

The use of electro-slag welding process on structural steel will not be permitted.

(5) Armor: All steel for cast-in-place deck joint assemblies shall conform to the requirements specified.

(6) Galvanizing: All steel parts of strip seal assemblies shall be galvanized after fabrication, in accordance with the requirements of ASTM A123 and A153, unless ASTM A588 steel is used. Bolts shall be high strength, conforming to the requirements of ASTM A325M, with a protective coating of cadmium or zinc, followed by a chromate and baked organic coating conforming to the requirements of ASTM F1135, Grade 3, 5, 6, 7, or 8 and Color Code A.

Steel parts of compression seal assemblies do not require galvanizing, plating, or painting.

(7) Joint Preparation and Installation: At all joint locations, the Contractor shall cast the bridge decks and abutment backwalls with a formed blockout, sized to accommodate the pre-assembled joint assembly. The joint assembly will be anchored in the concrete to be placed with the secondary pour in the blockout. Prior to the secondary pour, the surface of the existing concrete in the blockout shall be coated with an approved adhesive specifically formulated for bonding new concrete to old concrete.

Installed armor assemblies shall be covered or otherwise protected at all times prior to installing the elastomer portion of the joint assembly. The elastomer shall be installed at such time and in such manner that it will not be damaged by construction operations.

The seal element shall be installed subject to these specifications and approval of the Engineer. Immediately prior to the installation of the seal element, the steel contact surfaces of the joint armor shall be clean, dry, and free of oil, rust, paint, or foreign material. Any perforation or tearing of the seal element due to installation procedures or construction activities will be cause for rejection of the installed seal element.

During the installation of all proprietary deck joint assemblies, the manufacturer's representative shall be present. As a minimum, the representative shall be present during the placement of the joint assembly in the deck blockout, prior to the secondary concrete pour, and shall also be present during the installation of the seal element.

505.6.4 Water Stops

Water stops of rubber or plastic, shall be placed in accordance with the details shown on the project plans. Where movement at the joint is provided for, the water stops shall be of the type permitting such movement without damage. Water stops shall be mechanically spliced, vulcanized, or heat-sealed to form continuous watertight joints, in accordance with the manufacturer's recommendations, and as approved by the Engineer.

505.6.5 Longitudinal Joints between Precast Bridge Deck Units

After erection of the units and at the time requested by the Engineer, the longitudinal shear key joints between units shall be thoroughly packed with a pre-packaged non-shrink grout or a sand-cement grout with an expansion agent approved by the Engineer. The Contractor shall then transversely connect the deck units with the connection rods, stressing and anchoring them as shown on the project plans.

505.7 CONCRETE DEPOSITED UNDER WATER:

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

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

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

Concrete deposited in water shall have 10 percent extra cement added.

505.8 CURING:

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

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

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

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

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

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

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

505.9 FINISHING CONCRETE:

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

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

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

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

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

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

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

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

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

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

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

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

The surface shall then be struck off and worked to grade and cross section with a wood float.

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

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

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

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

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

When the mortar used in patching and pointing has set sufficiently, the surface shall be uncovered and thoroughly rubbed with either a float or a carborundum stone until the surface is covered with a lather. Cork, wood or rubber floats shall be used only on surfaces sufficiently green to work up such lather, otherwise a carborundum stone shall be used. During the rubbing process, a thin grout composed of 1 part cement and 1 part of fine sand may be used to facilitate producing a satisfactory lather; however, this grout shall not be used in quantities sufficient to cause a plaster coating to be left on the finished surface. A portion of the required cement for grout shall be white as required to match the color of the surrounding concrete. Rubbing shall continue until irregularities are removed and there is no excess material. At the time a light dust appears, the surface shall be brushed or sacked. Brushing or sacking shall be carried in one direction so as to produce a uniform texture.

Class III Finish — The surface shall be treated as specified above under Class II Finish except that after brushing, the surface shall again be securely covered with polyethylene film, wet burlap or wet cotton mats. In not less than 1 day nor more than 4 days, the surface shall be uncovered and rubbed with a carborundum stone. This rubbing shall continue until the entire surface is of a smooth texture and uniform color. During the process, the use of a thin mixture of equal parts of sand and cement with water will be permitted. At the time a light dust appears, the surface shall be brushed or sacked, care being taken to carry this brushing in one direction so as to produce a uniform texture.

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

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

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

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

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

505.10 DIMENSIONAL TOLERANCES:

The maximum allowable tolerances or deviations from dimensions shown on the project plans or the approved shop drawings shall be as follows:

505.10.1 Cast-in-Place Concrete

(A) Variation from plumb in the lines and surfaces of columns, piers, abutment and girder walls:

In any 10 foot or less length: 0.4 inches
Maximum for the entire length: 1 inch

(B) Variation in cross-sectional dimensions of columns, piers, girders, and in the thickness of slabs and walls:

+ 1/4 inch
- 1/8 inch

(C) Girders alignment (deviation from straight line parallel to center line of girder measured between diaphragms):

1/8 inch per every 10 feet in length

(D) Variation in footing cross sectional dimensions in project plans:

+ 2 inches
- 1/2 inch

(E) Variation in footing thickness:

Greater than specified - No Limit
Less than specified - 5 percent of specified thickness up to a maximum of 1 inch

(F) Subgrade Tolerances:

Slab poured on subgrade excepting footing thickness:

+ 1/4 inch
- 3/4 inch

(G) Girder Bearing Seats:

Deviation from plane surface (flatness): $\pm 1/8$ inch in 10 feet.

Deviation from required elevation:

+ 1/4 inch
- 1/8 inch

(H) Cast-in-Place concrete box girder superstructures:

Deviation in overall depth:

+ 1/4 inch
- 1/8 inch

Deviation in slab and wall thickness:

+ 1/4 inch
- 1/8 inch

Deviation of post-tensioning ducts:

± ¼ inch

505.10.2 Minor Precast Concrete Structures:

Precast units that do not comply with the dimensional tolerances specified herein will be rejected. Precast units that show evidence of cracks, pop outs, voids or other evidence of structural inadequacy, or imperfections that will reduce the aesthetics of the unit after final placement, will be rejected. The maximum allowable tolerances or deviations from the dimensions shown on the drawings shall be as follows:

(A) Over-all dimensions of member: ± ¼ inch per 10 feet, maximum of ± ¾ inch.

(B) Cross-sectional dimensions: Sections 6 inches or less ± 1/8 inch

Sections 18 inches or less and over 6 inches ± ¼ inch

Sections 39 inches or less and over 18 inches ± ¼ inch

(C) Deviations from straight line:

Not more than ¼ inch per 10 feet

All exposed, sharp corners of the concrete shall be filleted ¾ inches with a maximum allowable deviation of ± 1/8 inch.

505.11 MEASUREMENT:

505.11.1 Reinforcing Steel:

When reinforcing steel is scheduled for payment as a specific item, it will be measured in pounds, based on the total computed weight for the size and length of bars, or for the area of welded wire fabric, as shown on the Project Plans or as approved by the Engineer.

Unit bar weights for deformed and plain billet-steel bars will be the nominal unit weights specified in AASHTO M 31 (ASTM A 615).

Area unit weights for steel welded wire fabric will be calculated based on specified wire spacings and unit weights for specified wire types and sizes. Unit weights for plain wire shall be based on the nominal areas specified for Wire Size Numbers in AASHTO M 32 (ASTM A 82). Unit weights for deformed wire shall be the nominal unit weights specified for Deformed Wire Size Numbers in AASHTO M 225 (ASTM A 496).

If the area unit weights for steel welded wire fabric are specified on the Project Plans or in the Special Provisions, both the Contractor and the Engineer shall independently calculate the area unit weight, using specified wire spacings, types and sizes, and the criteria in the preceding paragraph. Any apparent discrepancy between the specified and calculated area unit weights shall be resolved by the Engineer prior to the Contractor placing the order for the steel welded wire fabric.

Lap splices made for the convenience of the Contractor will not be included in the measurement for payment.

Reinforcing steel for Minor Structures, as defined in Section 505.1.1, will not be measured, but will be included in the items unit price or specified method of payment, unless otherwise called out on the Project Plans or in the Special Provisions.

Dowel Placement will be measured by the unit each.

505.11.2 Concrete:

When concrete is scheduled for payment on the basis of cubic yards, the calculation of the quantity of concrete for payment will be

made only to the neat lines of the structures as shown on the plans. The quantity will be based on the concrete having the specified plan lengths, widths/depths, and thicknesses. However, all concrete shall be placed to line and grade within the tolerances specified in Section 505.10, or as approved by the Engineer as being reasonable and acceptable for the type of work involved. No volumetric deductions will be made for rounded or beveled edges, space occupied by reinforcing steel, metal inserts, or openings 0.5 square yard or less in area.

The quantity of concrete will be calculated considering any mortar used to cover construction joints as being concrete. The cost of cement used in any mortar for covering construction joints, patching, or other uses in the structure being constructed, in excess of that required for the design mix of the adjacent concrete, shall be absorbed in the cost of the item of work of which said mortar is a part.

505.11.3 Deck Joint Assemblies:

Deck joint assemblies will be measured to the nearest tenth of a foot. Measurement will be made along the centerline of the joint, at the surface of the roadway, from face-to-face of curb or barrier. No measurement will be made for that portion of the deck joint assembly required by plan details to extend through the barrier face or curb; that portion of the joint assembly will be considered incidental to the sealing of the joint.

505.11.4 Bridge Railing, Curbs, Barriers, and Approach Slabs

Bridge Pedestrian Fence and Curb, Bridge Pedestrian Fence and Parapet, and Bridge Fence and Parapet will be measured to the nearest tenth of a foot, from end post to end post.

Bridge Traffic and Pedestrian Rail will be measured to the nearest foot, determined from the outside dimensions of the rail.

Bridge Concrete Barrier will be measured to the nearest tenth of a foot.

Barrier Concrete Barrier Transition will be measured as a unit for each constructed.

Reinforced Concrete Approach Slab will be measured to the nearest square yard.

505.10 505.12 PAYMENT:

Payment for portland cement concrete structures will be made in conformity with the terms of the contract and will be based on unit prices and/or lump sums as set forth in the proposal. Such payment shall include full compensation for furnishing all labor, materials, tools and equipment, preparation of subgrade for placing of concrete and doing all work required to construct the structures in conformity with the plans and specifications.

505.12.1 Reinforcing Steel: The accepted quantities of reinforcing steel, of the type indicated on the Project Plans or specified in the Special Provisions, and measured in conformance with Section 505.11.1 will be paid for at the contract unit price per pound, complete in place.

The accepted quantity of dowels placed will be paid for at the contract unit price for Dowel Placement, which shall be full compensation for the work, complete in place. Steel reinforcement furnished for the dowels will be measured and paid for under the pay item Reinforcing Steel.

No measurement or direct payment will be made for dowels which are required to replace existing reinforcing steel that is damaged as a result of the Contractor's operations; the Contractor shall furnish and place such dowels at his own expense.

505.12.2 Concrete: Payment for Portland cement concrete structures will be made in conformity with the terms of the contract and will be based on unit prices and/or lump sums as set forth in the proposal. Such payment shall include full compensation for furnishing all labor, materials, tools and equipment, preparation of subgrade for placing of concrete, and doing all work required to construct the structures in conformity with the plans and specifications.

Where concrete is scheduled for payment on the basis of cubic yards, the calculation of the quantity of concrete for payment will be made only to the neat lines of the structures as shown on the plans and on the basis of the concrete having the specified lengths, breadths, and thicknesses. ~~However, all concrete shall be placed to line and grade within such tolerances as, in the opinion of the Engineer, are reasonable and acceptable for the type of work involved.~~ The quantity of such concrete will be calculated considering the mortar used to cover construction joints as being concrete and no deductions will be made for rounded or beveled edges, space occupied by reinforcing steel, metal inserts, or openings 5 square feet or less in area. The cost of cement used in mortar for covering construction joints, patching, or other uses in the structure being constructed, in excess of that required for the design mix of the adjacent concrete, shall be absorbed in the item of work of which said mortar is a part.

An adjustment in the contract unit price, to the nearest cent, will be made for the quantity of concrete represented by the results of cylinder strength tests that are less than the specified 28-day compressive strength. Strength tests will be conducted in accordance with Section 725.10 of the Uniform Standard Specifications. The adjustment in contract unit price, if the concrete is accepted, will be based on the schedule in Section 725.11.

The contract unit price for structural concrete shall include full compensation for all items incidental to providing a concrete structure complete in place, including waterstops, roadway drains, scuppers, metal inserts, and bearing pads.

505.12.3 Minor Concrete Structures and Accessories:

The accepted quantities of:

<u>Minor Structures</u>	<u>Each</u>
<u>Deck Joint Assemblies</u>	<u>0.1 Foot</u>
<u>Bridge Pedestrian Fence and Curb</u>	<u>0.1 Foot</u>
<u>Bridge Pedestrian Fence and Parapet</u>	<u>0.1 Foot</u>
<u>Bridge Fence and Parapet</u>	<u>0.1 Foot</u>
<u>Bridge Traffic and Pedestrian Rail</u>	<u>Foot</u>
<u>Bridge Concrete Barrier</u>	<u>0.1 Foot</u>
<u>Bridge Concrete Barrier Transition</u>	<u>Each</u>
<u>Reinforced Concrete Approach Slab</u>	<u>Square Yard</u>

will be paid for at the unit price and/or lump sums as set forth in the proposal. The contract unit price shall include full compensation for all labor, materials, tools and equipment necessary to provide the concrete structure or accessory complete in place, including all concrete, reinforcing steel, and items embedded in the concrete, such as anchor bolts, grates and frames, metal inserts, etc.

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September 19, 2007

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**UNIFORM STANDARD
SPECIFICATIONS
for
PUBLIC WORKS
CONSTRUCTION**

**SPONSORED and DISTRIBUTED
by the**



**1998
ARIZONA
(Includes revisions through 2008)**

FOREWORD

Publication of these Uniform Standard Specifications and Details for Public Works Construction fulfills the goal of a group of agencies who joined forces in 1966 to produce such a set of documents. Subsequently, in the interest of promoting county-wide acceptance and use of these standards and details, the Maricopa Association of Governments accepted their sponsorship and the responsibility of keeping them current and viable.

These specifications and details, representing the best professional thinking of representatives of several Public Works Departments, reviewed and refined by members of the construction industry, were written to fulfill the need for uniform rules governing public works construction performed for Maricopa County and the various cities and public agencies in the county. It further fulfills the need for adequate standards by the smaller communities and agencies who could not afford to promulgate such standards for themselves.

A uniform set of specifications and details, updated and embracing the most modern materials and construction techniques will redound to the benefit of the public and the private contracting industry. Uniform specifications and details will eliminate conflicts and confusion, lower construction costs, and encourage more competitive bidding by private contractors.

The Uniform Standard Specifications and Details for Public Works Construction will be revised periodically and reprinted to reflect advanced thinking and the changing technology of the construction industry. To this end a Specifications and Details Committee has been established as a permanent organization to continually study and recommend changes to the Specifications and Details. Interested parties may address suggested changes and questions to:

Standard Specifications & Details Committee
c/o Maricopa Association of Governments
302 North First Avenue, Suite 300
Phoenix, Arizona, 85003

These suggestions will be reviewed by the committee and appropriate segments of the industry and cumulative annual revisions will be published the first of each year. A copy of this publication is available for review on the internet at the website listed below. Please follow the links to the publications page and look for *Uniform Standard Specifications for Public Works Construction* and/or *Uniform Standard Details for Public Works Construction*.

www.mag.maricopa.gov

While in the interest of uniformity, it is hoped that all using agencies will adopt these standards with as few changes as possible, it is recognized that because of charter requirements and for other reasons, some agencies will find it necessary to modify or supplement certain requirements.

SECTION 101

Superstructure: The entire structure or building except the substructure.

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

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

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

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

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

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 102

BIDDING REQUIREMENTS AND CONDITIONS

102.1 ELIGIBILITY AND PREFERENCE:

The employment of Contractors and Subcontractors on Public Works shall be governed by the provisions of Section 34-241 of the Arizona Revised Statutes.

102.2 CONTENTS OF PROPOSAL PAMPHLET:

The prospective bidder may examine and/or purchase plans, special provisions, and proposal pamphlets at the Engineering Office of the Contracting Agency advertising for bids.

The proposal pamphlet will state the location of the contemplated construction; give the description of the various quantities of work to be performed or materials to be furnished, and have a bid schedule of pay items for which unit bid prices are invited. In addition, it will state the form and amount of the proposal guarantee, the time in which the work shall be completed and include additional instructions not included in these specifications.

The plans, the standard specifications, the standard details, the special provisions, the contracting agency's supplements and all supplementary documents are essential parts of the contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In a case of a discrepancy or conflict, the order in which the various documents shall govern is as follows from highest to lowest: addenda, special provisions, plans, agency's supplements to the standard specifications, agency's supplements to the standard details, standard specifications and standard details.

Each and every provision of law and clause required by law to be inserted in the contract shall be deemed to be inserted herein, and the contract shall be read and enforced as though it were included herein.

102.3 INTERPRETATION OF QUANTITIES IN PROPOSAL:

The quantities appearing in the proposal are approximate only and are to be used for the comparison of bids. Payment to the Contractor will be made only for the actual quantities of work performed and accepted or materials furnished in accordance with the contract at the unit bid price in the proposal.

After the contract is awarded the quantities of work listed by any pay item, or all pay items, may be increased or decreased a reasonable amount at the discretion of the Contracting Agency, without in any way invalidating the unit bid price.

102.4 EXAMINATION OF PLANS, SPECIAL PROVISIONS AND SITE OF WORK:

The Contracting Agency will prepare plans and special provisions in accordance with acceptable engineering standards, giving such direction as will enable any competent Contractor to carry them out.

The bidder shall examine the site of the proposed work and all documents pertaining to the work. It is mutually agreed that the submission of a proposal shall be considered prima facie evidence that the bidder has made such examination and is familiar with the character, quality and quantity of the work to be performed and material to be furnished.

Logs of the test holes, ground water levels, and any accompanying soil reports as furnished by the Contracting Agency are furnished for general information only. The field condition so set forth shall not constitute a representation or warranty, expressed or implied, that such conditions are actually existent. Bidders shall make their own investigations and form their own estimates of the site conditions.

After the submission of the proposal, no complaint or claim that there was any misunderstanding as to the quantities, conditions or nature of the work will be entertained.

SECTION 103

(B) **Worker's Compensation and Employer's Liability:** A Letter of Certification, from the Industrial Commission of Arizona, that the Contractor is insured by the State Compensation Fund or is an authorized self-insurer or a Certificate of Insurance issued by an insurance company authorized by the Arizona Department of Insurance to provide Workmen's Compensation and Employer's Liability Insurance in the State of Arizona.

(C) **Builders Risk/Course of Construction:** When the project includes construction of a new building or addition to an existing building, the Contractor shall also obtain insurance coverage for at least, as a minimum, the perils of fire, extended coverage, vandalism and malicious mischief for the full amount of the contract. The Contractor shall be responsible for any deductibles, mutual waiver of subrogation and any co-insurance for the construction that is the subject of this contract.

(D) **Additional Insured:** The Contracting Agency, its officers, agents and employees shall be named as insureds on policies listed in (A) and (C) and this shall also be indicated on the Certificates of Insurance issued to the Contracting Agency. The Contractor's coverage shall be primary for any and all losses arising out of the performance of this contract.

(E) **Owner Protective Policy:** In addition to other insurance the Contractor is required herein to provide and maintain in its own name, the Contractor shall also provide and maintain a separate policy of insurance, at its sole cost and expense, naming the Contracting Agency as the insured and providing primary coverage for the Contracting Agency in an amount not less than One Million Dollars, or other minimum amount determined by the Agency, for personal injury or death, per person and per occurrence, and not less than \$500,000 for property damage for any damage or injury suffered as a result of any work performed by Contractor or its employees, representatives, contractors or subcontractors in connection with the Project or Permit. Such policy shall also provide the Contracting Agency coverage, in the amounts specified above, for any and all damages or injury suffered as a result of alleged acts or omissions of the Contracting Agency in connection with, directly or indirectly, the Project or Permit. Such policy shall be primary and not contributory to any insurance maintained by the Contracting Agency. The insurance company writing such policy must have a BEST rating of not less than "A-" and be licensed by the Arizona Department of Insurance to do business in the State of Arizona. The form of the policy must be approved by the Contracting Agency before the notice to proceed will be issued.

103.6.2 Indemnification of the Contracting Agency Against Liability: To the fullest extent permitted by law, the Contractor, its successors, assigns and guarantors, shall pay, defend, indemnify and hold harmless the Agency, its agents, representatives, officers, directors, officials and employees from and against all allegations, demands, proceedings, suits, actions, claims, damages, losses, expenses, including but not limited to, attorney fees, court costs, and the cost of appellate proceedings, all claim adjusting and handling expense, related to, arising from or out of or resulting from any actions, acts, errors, mistakes or omissions caused in whole or part by the Contractor relating to work or services in the performance of the Contract, including but not limited to, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable and any injury or damages claimed by any of the Contractor's and Subcontractor's employees.

103.7 EXECUTION AND APPROVAL OF CONTRACT:

The Contractor shall execute the contract with the Contracting Agency as follows:

(A) **Bond Issue or Budget Projects** within 10 calendar days after the date of Notice of Award of contract from the Contracting Agency.

(B) **Improvement District Projects**, not less than 15 or more than 20 calendar days after the date of the first publication of Notice of Award, if no objections have been filed.

The Contracting Agency will approve and execute the contract within 10 calendar days following receipt of signed contract and acceptable bonds and certificates of insurance.

No contract shall be considered in effect until it has been fully executed by all parties concerned.

Information relative to the execution of contract documents may be obtained from the Engineering Office of the Contracting Agency advertising for bids.

103.8 FORFEITURE OF PROPOSAL GUARANTEES:

If the Contractor fails or refuses to enter into the contract, within the time stated, then the Contracting Agency may declare a forfeiture of his proposal guarantee as liquidated damages for failure to enter into the contract.

End of Section

SECTION 104

SCOPE OF WORK

104.1 WORK TO BE DONE:

104.1.1 General: The Contractor shall perform all work as may be necessary to complete the contract in a satisfactory and acceptable manner in full compliance with the plans, specifications and terms of the contract.

In the event a conflict exists between Contract Documents the order of precedence listed in descending order shall be as follows:

Change Orders
Addenda
Special Provisions
Project Plans
Contracting Agency's supplements to the MAG Uniform Standard Specifications and Details
MAG Uniform Standard Specifications
MAG Standard Details

Unless otherwise specified in the special provisions, The Contractor shall furnish all labor, materials, equipment, transportation, utilities, services and facilities required to perform all work for the construction of the project within the time specified.

All existing concrete or bituminous surfaced sidewalks, driveways and alleys which were disturbed by the Contractor at the direction of the Engineer, shall be replaced. Private concrete or bituminous surfaced sidewalks and driveways, which were disturbed by the new improvements must be replaced. The slope of the replaced sidewalk or driveway must comply with the agency's minimum standards. If the standard cannot be constructed within the disturbed area, the Contractor shall remove and replace to a distance required to obtain the slope. Payment for such work will be made under the respective pay items provided for in the contract, or by agreed prices in advance, if no pay items are provided for in the contract.

104.1.2 Maintenance of Traffic: The Contractor's operations shall be in accordance with the traffic manual and/or policies of the appropriate public agency having jurisdiction over the project and Section 401. These operations shall cause no unnecessary inconvenience to the public and public access rights shall be considered at all times. Unless otherwise authorized in the specifications or on a temporary basis by the Engineer, traffic shall be permitted to pass through the work area. The Contractor shall coordinate with the various agencies both commercial and public, involved in the collection and removal of trash and garbage, so that adequate services are maintained.

Safe and adequate pedestrian and vehicular access shall be provided and maintained to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, motel, hospitals, fire stations, police stations, and establishments of a similar nature. Access to residential properties shall be in accordance with Section 107.

Grading operations, roadway excavation and fill construction shall be conducted and maintained in such a manner as to provide a reasonably satisfactory and safe surface for vehicular and pedestrian traffic. When rough grading is completed, the roadbed shall be brought to and maintained in a reasonably smooth condition, satisfactory and safe for vehicular traffic at the posted speed limit. Pedestrian walkways shall be provided and maintained in a like manner. The Contractor shall accomplish any additional grading operations and/or repairs, including barricade replacement or repairs during working and nonworking periods which, in the opinion of the Engineer, are required.

In the event of abnormal weather conditions, such as windstorms, rainstorms, etc., the Contractor shall immediately inspect his work area and take all necessary actions to insure that public access and safety are maintained.

The Contractor shall provide the Engineer with the emergency address of his representatives as required by Section 105.

104.1.3 Cleanup and Dust Control: Throughout all phases of construction, including suspension of work, and until final acceptance of the project, the Contractor shall keep the work area clean and free from rubbish, excess materials and debris generated by Construction Activities.

At disposal sites and storage sites, other than agency landfills, the Contractor shall be responsible for all required dust control measures. This includes temporary yard or staging areas.

SECTION 104

The Contractor shall take whatever steps, procedures or means required to prevent any dust nuisance due to his construction operations. The dust control measures shall be maintained at all times to the satisfaction of the Engineer and in accordance with the requirements of the Maricopa County Bureau of Air Pollution Control Rules and Regulations.

Failure of the Contractor to comply with the Engineer's cleanup orders may result in an order to suspend work until the condition is corrected. No additional compensation or time will be allowed as a result of such suspension and the Engineer has the authority to take such other measures as may be necessary to remedy the situation. Subsection 104.2.5 applies.

104.1.4 Final Cleaning Up: Before final acceptance, all private or public property and grounds occupied by the Contractor in connection with the work shall be cleaned of all rubbish, excess materials, temporary structures and equipment, and all parts of the work area shall be left in an acceptable condition.

104.2 ALTERATION OF WORK:

***104.2.1 By the Contracting Agency:** The Contracting Agency reserves the right to make, at anytime during the progress of the work, such alterations in the details of construction and such increases or decreases in quantities as may be found necessary or desirable. Such alterations and changes shall not invalidate the contract nor release the surety and the Contractor agrees to perform the work as altered, the same as if it had been a part of the original contract. The Engineer will issue Change Orders to cover unforeseen circumstances which make it impossible to carry out the work in accordance with the original contract plans and specifications.

If the alterations or changes made by the Contracting Agency increases or decreases the total cost of the contract or the total cost of any major item by more than 20 percent, either party may request an adjustment in payment in accordance with Section 109.

104.2.2 Due to Physical Conditions:

***(A)** Should the Contractor encounter or discover during the process of the work, subsurface or latent physical conditions at the site differing materially from those indicated in the contract, or unknown physical conditions at the site of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract, the Engineer shall be promptly notified in writing of such conditions before they are disturbed. The Engineer will thereupon promptly investigate the conditions and, if he finds they do so materially differ and cause an increase or decrease in the cost of or the time required for performance of the contract, an equitable adjustment will be made and the contract modified in writing accordingly.

***(B)** If at the time of opening up any portion of the work, material from which the subgrade, backfill or bedding is to be constructed contains an excess of moisture so that the required compaction cannot be obtained without additional manipulation, the Engineer will determine the cause of such condition. If the cause of such condition is determined to have been unforeseeable and beyond the control of and without fault or negligence of the Contractor, the Engineer will determine whether the material shall be aerated or removed and replaced. Such work shall be done as directed and will be paid for as provided in Section 109.

***(C)** Failure to notify the Engineer of the conditions described in A and B above prior to doing any work may be just cause to reject any claims for additional monies and/or time.

***(D)** Material in ditches and ditch banks that contains moisture in an amount considered excessive by the Engineer shall be removed and shall be aerated to the extent required by the Engineer before compaction is effected. No measurement or direct payment for the removal and aeration of such material will be made.

***(E)** After any portion of the work has been opened up, saturation of material caused by irrigation water, storm drainage, weather or such similar causes will be considered as within the responsibility of the Contractor.

***104.2.3 Due to Extra Work:** The Contractor shall perform unforeseen work, for which there is no unit bid price in the proposal, whenever it is deemed necessary or desirable by the Engineer in order to fully complete the work as contemplated. Such work shall be governed by all applicable provisions of the contract documents and payment will be made in accordance with the provisions set forth in Section 109.

SECTION 104

Should the Contractor claim that any instructions received involve extra work under the contract, he shall give the Engineer written notice within two work days after receipt of such instructions, and in any event before proceeding to execute the work, except in emergencies endangering life or property. No claim shall be valid unless written notice is given.

If this extra work is performed by others, the Contractor agrees to cooperate fully with the other source accomplishing this work and agrees that this action shall not invalidate the Contract or release the surety.

104.2.4 At the Contractor's Request: Changes in the plans or specifications, which do not materially affect and are not detrimental to the work or to the interests of the Contracting Agency, may be granted to facilitate the work. Requests shall be in writing and submitted to the Engineer for approval. These changes, if approved and when resulting in a saving to the Contractor, will be made at an equitable reduction in cost or in no case at any additional cost to the Contracting Agency.

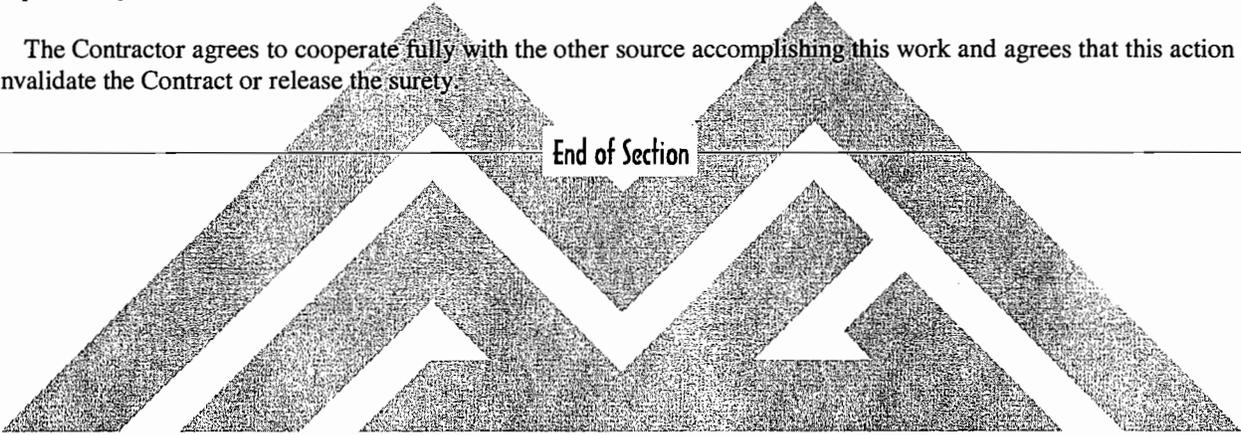
104.2.5 Due to the Failure of the Contractor to Properly Maintain the Project:

(A) If the Contractor fails to provide adequate Maintenance of Traffic or Cleanup and Dust Control or to correct deficiencies resulting from abnormal weather conditions, the Engineer has the authority to suspend the work wholly or in part until this condition has been corrected.

(B) If the Contractor fails to comply with the Engineer's written order to provide adequate maintenance of traffic, cleanup, dust control, or to correct deficiencies resulting from abnormal weather conditions, the Engineer has the authority to have this work accomplished by other sources.

(C) The Contractor agrees to cooperate fully with the other source accomplishing this work and agrees that this action shall not invalidate the Contract or release the surety.

End of Section



SECTION 105

CONTROL OF WORK

105.1 AUTHORITY OF THE ENGINEER:

The Engineer will decide all questions which may arise as to the quality and acceptability of materials furnished and work performed and as to the rate of progress of the work; all questions which may arise as to the interpretation of the plans and specifications; all questions as to the acceptable fulfillment of the contract on the part of the Contractor. The Engineer's estimates and decisions shall be final and conclusive. In case any question should arise, relative to the Contract Documents, the determination or decision of the Engineer shall be a condition precedent to the right of the Contractor to receive final approval of the work being questioned under the contract.

In giving instructions, the Engineer may make minor changes in the work, not involving extra work and not inconsistent with the purpose of the work, except in emergencies endangering life or property.

The Engineer will suspend the work wholly or in part due to the failure of the Contractor; to correct conditions unsafe for the workmen or the general public; for failure to carry out provisions of the contract; for failure to carry out orders; for such periods as he may deem necessary due to unsuitable weather; for conditions considered unsuitable for the prosecution of the work or for any other condition or reason deemed to be in the public interest.

105.2 PLANS AND SHOP DRAWINGS:

The Contractor shall submit, for review, a proposed schedule of shop drawings and product data submittals. This schedule will include concrete and asphalt concrete mix designs unless they are previously approved supplier's mix design. The schedule will show the needed response date for each submittal and will indicate the relationship of the submittal to the project construction schedule.

The Contractor shall submit five (5) copies of each shop drawing, product data or mix design to the Engineer for review. Each submittal shall be numbered sequentially and shall be submitted in accordance with the schedule established in conjunction with the Contracting Agency so as to cause no delay in the work schedule. The Contractor shall certify by stamp or letter, that he has reviewed and approved the submittal and that it conforms to the requirements of the contract documents. If this certification is not included, the submittal will be returned without action.

At the time of each submittal, the Contractor shall define and delineate in writing, separate from the certification, any deviations from the contract documents. If the Engineer accepts this deviation, he will authorize the deviation by issuing a change order or if the deviation is minor by endorsement to the letter.

The Engineer will review and return the submittals in accordance with the previously established response date. The review will be only for conformance with the design concept of the work and for compliance with the information contained in the contract documents. The review of a specified item, as such, will not indicate review of the assembly in which the item functions. Review by the Engineer will not relieve the Contractor from responsibility for any errors or omissions in the submittals nor from his responsibility for complying with the contract documents. The only exception is deviations accepted in accordance with the preceding paragraph.

If the submittal is acceptable, one (1) copy with each page stamped "Furnish as Submitted" will be returned to the Contractor. The Contractor shall submit additional copies (as required) to the Engineer.

If the Engineer determines that the submittal requires corrections or is to be rejected, one (1) copy stamped "Furnish as Noted" or "Revise and Resubmit" will be returned to the Contractor. The Contractor will submit five (5) corrected or new copies.

The copy stamped "Furnish as Submitted," returned to the Contractor, will become a part of the contract documents and will be kept at the job site. Any work done prior to the receipt of this review will be at the Contractor's risk and expense.

105.3 CONFORMITY WITH PLANS AND SPECIFICATIONS:

All work performed and all materials furnished shall be in conformity with the lines, elevations, grades, cross sections, dimensions and material requirements, including tolerances, shown on the plans or indicated in the specifications.

SECTION 105

In the event the Engineer finds the materials or the finished product in which the materials are used not in conformity with the plans and specifications, but that reasonably acceptable work has been produced, he shall then make a determination if the work shall be accepted and remain in place. In this event, the Engineer will document the basis of acceptance by contract modification which will provide for an appropriate adjustment in the contract price for such work or materials as he deems necessary to conform to his determination based on engineering judgement.

In the event the Engineer finds the materials or the finished product in which the materials are used or the work performed are not in conformity with the plans and specifications and have resulted in an inferior or unsatisfactory product, the work or materials shall be removed and replaced or otherwise corrected by the Contractor at no additional cost to the Contracting Agency.

In all instances wherein the items and/or specifications require installation or construction in accordance with either manufacturers' or suppliers' recommendations and/or instructions, said recommendations and/or instructions shall be submitted with the applicable portion clearly marked for approval prior to the commencement of work on that item or portions of the contract.

105.4 COORDINATION OF PLANS AND SPECIFICATIONS:

The Contractor shall take no advantage of any apparent error or omission in the plans or specifications. In the event the Contractor discovers such an error or omission, he shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations as may be deemed necessary for fulfilling the intent of the plans and specifications.

105.5 COOPERATION OF CONTRACTOR:

The Contractor will be supplied with a minimum of seven sets of approved plans and special provisions, one set of which the Contractor shall keep available on the work site at all times.

The Contractor shall give the work the constant attention necessary to facilitate the progress thereof, and shall cooperate with the Engineer, his inspectors, and other Contractors in every way possible.

The Contractor shall at all times be present at the work in person or represented by a competent superintendent. The superintendent shall be authorized to receive and fulfill instructions from the Engineer and who shall supervise and direct the work. No less than fourteen days prior to the scheduled/planned Notice to Proceed, the Contractor shall submit to the Engineer for review and approval, the name and qualifications of the proposed superintendent. When the superintendent is approved, he shall not be changed by the Contractor without written approval of the Engineer. Instructions and information given by the Engineer to the Contractor's superintendent shall be considered as having been given to the Contractor.

(A) All phases of the project such as concrete work, pipe work, etc., shall be under the direct supervision of a foreman or his designated representative on the site who shall have authority to accept instructions, with respect to that particular phase of the project, and take action required to properly carry out the work.

(B) In the event of noncompliance with the above, the Engineer may require the Contractor to stop work on that part of the project until the required supervision is present.

The Contractor shall file with the Engineer, the names, addresses, and telephone numbers of representatives who can be contacted, at any time, in case of emergency. These representatives must be fully authorized and equipped to correct unsafe or excessively inconvenient conditions on short notice.

Emergencies may arise during the progress of the work which may require special effort or require extra shifts of men to continue the work beyond normal working hours. The Contractor shall be prepared in case of such emergencies from whatever cause, to do all necessary work promptly.

105.6 COOPERATION WITH UTILITIES:

The Contracting Agency will notify all utility companies, all pipe line owners, or other parties affected, and endeavor to have all necessary adjustments of the public or private utility fixtures, pipe lines, and other appurtenances within or adjacent to the limit of construction, made as soon as practicable.

The Contractor shall comply with the requirements of Arizona Revised Statutes-40-360.21 through 40-360.29 (one call system, Blue Stake) in notification to the interested utility owners prior to start of construction. The Contractor shall resolve all problems with the utility owners concerned.

SECTION 108

- (B) Fails to perform the work with sufficient workmen and equipment or with sufficient materials to assure the prompt completion of said work, or
- (C) Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or
- (D) Discontinues the prosecution of the work, or
- (E) Fails to resume work which has been discontinued within a reasonable time after notice to do so, or
- (F) At any time colluded with any party or parties, or
- (G) Allows any final judgment to stand against him unsatisfied for a period of 14 calendar days, or
- (H) For any cause whatsoever, fails to carry on the work in an acceptable manner, the Engineer will give notice in writing to the Contractor and his surety of such delay, neglect, or default, and advise them that the work must be resumed immediately.

If the Contractor or surety, within a period of 14 calendar days after such notice, has not proceeded in accordance therewith, then the Contracting Agency will, upon written notification from the Engineer of the fact of such delay, neglect or default and the Contractor's failure to comply with such notice, have full power and authority without violating the contract, to take the prosecution of the work out of the hands of the Contractor. The Contracting Agency may appropriate or use any or all materials and equipment on the ground as may be suitable and acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the Engineer will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Contracting Agency, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due said Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the Contracting Agency the amount of such excess.

***108.11 TERMINATION OF CONTRACT**

The Contracting Agency may terminate the contract or a portion thereof if conditions encountered during the progress of the work make it impossible or impracticable to proceed with the work or a local or national emergency exists.

When contracts, or any portion thereof, are terminated before completion of all work in the contract, adjustments in the amount bid for the pay items will be made on the actual quantity of work performed and accepted, or as mutually agreed for pay items of work partially completed or not started. No claim for loss of anticipated profits will be considered.

Termination of the contract or any portion thereof shall not relieve the Contractor of his responsibilities for the completed work nor the surety of its obligation for and concerning any just claims arising out of the work performed.

End of Section

*Not applicable to Improvement District Projects.

SECTION 109

MEASUREMENTS AND PAYMENTS

109.1 MEASUREMENT OF QUANTITIES:

All work completed under the contract will be measured by the Engineer according to United States standard measures. The methods of measurement and computation to be used in determination of quantities of materials furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice. A station, when used as a definition or term of measurement, will be 100 linear feet.

Unless otherwise specified, longitudinal measurements will be made along the grade line.

Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the Engineer.

The term ton will mean the short ton consisting of 2,000 pounds avoirdupois.

Unless otherwise specified, structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.

In computing volumes of excavations or fill, the average end area method or other acceptable methods as determined by the Engineer will be used.

Volumes will be computed at 60°F, using ASTM D-1250 for Asphalt or ASTM D-633 for Tars.

Lumber will be measured by the thousand board foot measure actually used in the work. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.

The term lump sum, when used as a pay item, will mean complete payment for the work described.

Sundry items which have a basis for measurement and payment herein and which are incidental to or required in the construction of the work but are not included as items in the bid schedule shall be considered an integral part of the contract, and all labor, materials, etc. required for such items shall be furnished by the Contractor and the cost of same included in the unit price bid.

109.2 SCOPE OF PAYMENT:

Measurement and payment for pay items in the proposal will be as indicated in the applicable standard specification or in the special provisions.

When payment is specified to be made on the basis of weight, the weighing shall be done on certified platform scales sealed by the State Inspector or the City Sealer of Weights and Measures as defined by Arizona Revised Statutes Sections 44-2112 and 44-2116. The Contractor shall furnish the Engineer with duplicate Weighmaster's Certificates showing the actual net weights together with the information required by Arizona Revised Statutes Section 44-2142. The Contractor shall furnish the Engineer with duplicate Weighmaster's Certificates at the time of delivery unless the Engineer designates a different submittal time. The Contracting Agency will accept the certificates as evidence of the weight delivered

Payment for the various items in the proposal will be made at the unit price bid in the proposal, and shall be compensation in full for furnishing all labor, materials, equipment and appurtenances necessary to complete the work in a satisfactory manner as shown on the plans and as required in the specifications, with all connections, testing, and related work completed. Each item, fixture, piece of equipment, etc., shall be complete with all necessary connections and appurtenances, for the satisfactory use and operation of said item. No additional payment will be made for work related to any item unless specifically called for in the proposal. This compensation shall also cover all risk, loss, damage or expense of whatever character arising out of the nature of the work or the prosecution thereof, subject to the provisions of Section 107.

109.3 ASSIGNMENT OF PAYMENTS:

The Contractor shall not assign payments of a contract or any portion thereof without approval of surety and written consent of the Contracting Agency.

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Claims for monies due or to become due the Contractor may be assigned to a bank, trust company, or other financing institution, and may thereafter be further assigned and reassigned to any such institution. Any such assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in such financing. Any assignment of money shall be subject to all proper setoffs and withholdings in favor of the Contracting Agency and to all deductions provided for in these specifications.

109.4 COMPENSATION FOR ALTERATION OF WORK:

*109.4.1 By The Contracting Agency:

(A) For a decrease greater than 20 percent in either the total cost of the contract or the total cost of a major item and when a reasonable cost analysis supports an increase in the pro rata share of fixed cost chargeable to this item in total, an increase adjustment in the monies due the Contractor may be made. This adjusted compensation will not exceed 80 percent of the original lump sum contract amount or, if for a unit price item, the adjustment will not exceed 80 percent of the original extended unit bid price. This does not apply to items labeled as contingent bid item in the bid proposal.

(B) For an increase greater than 20 percent, any adjustment made will only apply to that cost in excess of 120 percent of the original bidding schedule. If either party presents a reasonable cost analysis that shows a change in the pro rata share of fixed costs chargeable to this item in total, an increase or decrease adjustment will be made. This increase or decrease adjustment will be made on such basis as is necessary to cover a reasonable estimate of cost, plus an allowance, not to exceed 15 percent, for overhead and profit. If the parties are unable to reach an agreement, the Engineer has the authority to order the excess work done on an actual cost basis as specified in Subsection 109.5.

(C) For either an increase or decrease in cost, no claim shall be made by the Contractor for any loss of anticipated profits.

*109.4.2 Due to Physical Conditions:

(A) If the Engineer, after his investigation of the site conditions, agrees that they materially differ from those indicated in the contract and would cause an increase in the Contractor's bid cost of accomplishing the work, new unit bid prices or a lump sum cost (for the additional work only) may be negotiated. If the parties are unable to reach an agreement on price, the Engineer has the authority to order this additional work accomplished on an actual cost basis as specified in Subsection 109.5.

(B) If the Engineer, after his investigation of the site conditions, finds that these conditions do not materially differ from those indicated in the contract, he has the authority to order the work to be accomplished at the original bid price(s).

~~*109.4.3 Due to Extra Work: If the Contractor can present valid, factual evidence, satisfactory to the Engineer, that the work in question is an item not provided for in the contract as awarded then a unit bid price or lump sum cost, for this item only, may be negotiated. If the parties are unable to reach an agreement on price or cost, the Engineer has the authority to order the extra work accomplished on an actual cost basis as specified in Subsection 109.5.~~

109.4.4 Made at the Contractor's Request: Any alterations, if approved, will be a reduction in cost or at no additional cost to the Contracting Agency.

109.4.5 Due to Failure of Contractor to Properly Maintain the Project:

(A) For any suspension of work during normal working hours due to failure of the Contractor to properly maintain the project, there will be no additional compensation or time allowed.

(B) If the Engineer provides the Contractor with a written order to provide adequate maintenance of traffic, adequate cleanup, adequate dust control or to correct deficiencies resulting from abnormal weather conditions and the Contractor fails to comply in the time frame specified, the Contracting Agency may have the work accomplished by other sources.

*Not applicable to Improvement District Projects.

SECTION 109

The Contracting Agency will deduct the cost of accomplishing the work from monies due or to become due to the Contractor. Computation of the cost will be in accordance with Subsection 109.5.4.2.

109.4.6 Allowable Mark-Ups:

Only the allowable mark-ups as defined in Subsection 109.5 shall be allowed. Additional compensation for other items shall not be considered or allowed.

*109.5 ACTUAL COST WORK:

The compensation for actual cost work performed by the Contractor (Subcontractor) shall be determined by the Engineer in the following manner.

109.5.1 Equipment: For all equipment, the use of which has been authorized by the Engineer, except for small tools and manual equipment, the Contractor will be paid in accordance with the latest Schedule of Equipment Rates used by the Arizona Department of Transportation. Payment of equipment will be made following the calculations in Section 109 of the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction. The value of 0.933 shall be used for the adjustment factor F used in the rental rate formulas ($F = 0.933$).

109.5.2 Material: For all material, accepted by the Engineer and used in the work, the Contractor will be paid the actual cost of such material including transportation cost, to which total cost will be added a sum equal to 15 percent thereof.

109.5.3 Labor: For all labor and for the foreman, when he is in direct charge of the operation, the Contractor will be paid:

(A) The actual wages paid plus the current percentage thereof as determined by the Arizona Department of Transportation which is deemed to cover the Contractor's cost incurred as a result of payment imposed by State or Federal Law and payments that are made to, or on behalf of, the workman other than the actual wage. Actual wage is defined as the required current hourly rate paid to the labor classification concerned and does not include any fringe benefits or dislocation allowances. If the Contractor is not required to pay fringe benefits equivalent to the Current rates published in the Federal Register, an equitable deduction will be made from the current percentage established by the Arizona Department of Transportation.

(B) For the first \$50,000 of labor cost computed under paragraph (A) above, the Contractor will be paid an amount equal to (15) fifteen percent for overhead and profit.

(C) For all labor cost computed under paragraph (A) above, in excess of \$50,000 but not exceeding \$100,000, the Contractor will be paid an amount equal to (12) twelve percent for overhead and profit.

(D) For any labor cost computed under paragraph (A) above in excess of \$100,000 the Contractor will be paid an amount equal to (10) ten percent for overhead and profit.

109.5.4 Work Performed by Subcontractors or Other Sources:

109.5.4.1 Work Performed by Subcontractors: If it is determined by the Engineer that portions of the Actual Cost Work to be performed requires specialized labor or equipment not normally used by the Contractor and such work is then authorized to be performed by a subcontractor(s), the subcontractor(s) will be paid by the Contractor in accordance with the actual cost work procedures outlined herein. The Contractor will be paid by the Contracting Agency the full amount of the subcontract plus the following percentages for administration and supervision.

(A) For the first \$10,000 accumulated total of all change order work performed by subcontractors (less mark-up for overhead and profit), the Contractor will be paid an amount equal to 10 percent of the accumulated total for administration and supervision. If the accumulated total is \$3,000 or less, the Contractor will be paid \$300 for administration and supervision.

(B) For all change order work in excess of \$10,000 accumulated total performed by subcontractors (less mark-up for overhead and profit), the Contractor will be paid an amount equal to five percent of the accumulated total for administration and supervision.

*Not applicable to Improvement District Projects.

SECTION 109

109.5.4.2 Work Performed by Other Sources: If the Contracting Agency has work performed by other sources, in accordance with Subsection 109.4.5 (B), the Contracting Agency will deduct, from monies due or to become due to the Contractor, the full amount of the cost of accomplishing the work by other sources plus the following percentages for administration and supervision:

(A) For the first \$10,000 accumulated total of work performed by other sources, the Contracting Agency will deduct an amount equal to 10 percent of the accumulated total for administration and supervision. If the accumulated total is \$3,000 or less, the Contracting Agency will deduct \$300 for administration and supervision.

(B) For all work in excess of \$10,000 accumulated total performed by other sources, the Contracting Agency will deduct an amount equal to 5 percent of the accumulated total for administration and supervision.

109.5.5 Documentation:

(A) Except in emergency situations, the Contracting Agency will not be liable for any Actual Cost Work performed by the Contractor prior to written authorization by the Engineer or prior to full execution of a written agreement by all parties concerned.

(B) Payment for work performed on an actual cost basis will not be made until the Contractor has furnished the Engineer, on forms agreed to by the Contracting Agency, duplicate itemized statements of such work, including subcontractor(s) costs, detailed as follows:

- (1) Name, classification, date, daily hours, total hours, rate and extension for each laborer and foreman.
- (2) Designation, dates, daily hours, total hours, rental rates and extension for each unit of equipment, and machinery.
- (3) Quantities of material, prices, extension and transportation cost on a daily basis. These charges shall be substantiated by vendor invoices.

(C) The Engineer will compare his records with the statement furnished by the Contractor, resolving any differences and making the required adjustments. This statement when agreed upon and signed by both parties, shall be the basis of payment for the work performed.

109.5.6 Bonds and Insurance: The Contractor shall be paid for the actual cost plus (10%) ten percent for Administrative cost when the Contractor can provide evidence of payment for premiums on required payment and performance bonds, premiums on railroad and/or airport extended liability insurance, and premiums for property damage and/or public liability insurance. No duplication of payment for Contractor's costs included under Subsection 109.5.3(A) will be allowed.

109.5.7 Authority of Engineer: The Engineer is in charge of Actual Cost Work and has the authority to direct which labor and equipment will be used, to suspend operations, and to refuse to pay for any labor or equipment which he feels is not doing productive work.

109.6 PAYMENT FOR IMPROVEMENT DISTRICT PROJECTS:

Payment to the Contractor shall be made in accordance with ARS Sections 48-523 to 48-613, both inclusive.

As soon as the Contractor has fulfilled his contract, the Superintendent of Streets shall estimate the benefits arising from the work and make assessments to cover the work performed and specified in the contract, including incidental expenses in accordance with ARS Section 48-589.

The Contractor agrees to accept payment in the form of Assessments with attached Warrants and/or Improvement Bonds at the rate of interest declared in the resolution of intention prepared by the Contracting Agency.

SECTION 109

***109.7 PAYMENT FOR BOND ISSUE AND BUDGET PROJECTS:**

(A) Partial Payments: The Contracting Agency will make a partial payment to the Contractor on the basis of an estimate prepared by the Contractor or Engineer for work completed through the last day of the preceding calendar month. Payment will be within 14 calendar days after the estimate has been certified and approved by the Engineer and received by the owner.

The Contracting Agency will retain 10 percent of all estimates as a guarantee for complete performance of the contract in accordance with Arizona Revised Statutes Section 34-221 or 34-607, unless the Contractor elects to deposit securities in accordance with Arizona Revised Statutes Section 34-221, Paragraph C.5. or 34-607, Paragraph B.5.

When the Contractor is fifty percent completed, one-half of the amount retained shall be paid to the Contractor provided he is making satisfactory progress on the contract and there is no specific cause or claim requiring a greater amount to be retained. After the contract is fifty percent completed, no more than five percent of the amount of any subsequent progress payments made under the contract will be retained providing the Contractor is making satisfactory progress on the project. Except that, if at any time the owner determines satisfactory progress is not being made, ten percent retention shall be reinstated for all progress payments made under the contract subsequent to the determination.

Any material or equipment which will become an integral part of the completed project will be considered for partial payment in the Contractor's monthly progress payments. The intent of making partial payments is to provide the Contractor payment for direct material or equipment purchased. The purpose is to minimize the effect of escalating costs by procuring key materials. It is not the intent to pay for all materials but only those meeting the following conditions.

- (1) A total value of all items requested for payment must be greater than \$20,000. No payment will be processed until the material or equipment has been observed, reviewed or verified by the Contracting Agent representative. Only the material or equipment meeting the requirements of the plans and specifications will be paid. Payment for material or equipment does not constitute final acceptance.
- (2) Materials or equipment must be stored or stockpiled either on site, in a warehouse, or secured storage area. The Contractor assumes all responsibility for protection of these materials or equipment and shall insure them to cover loss or damage to same without additional liability or added costs to the Agency for providing this security, insurance, and storage.
- (3) The Contractor will provide access to the storage area or warehouse upon request of the Contracting Agent's representative for the purpose of verifying the inventory of items paid for under this section. None of the materials or equipment paid for under this section will be removed from the storage site until incorporated into the work of the project. The storage site shall be within the general geographical area of the project.
- (4) The Contractor shall provide a paid invoice and/or lien waiver for items paid for under this section. The Agency will not pay more than the invoice price for the item or items, less retention.
- (5) The Engineer may exclude individual payment requests which in the Engineer's judgement do not warrant storage and prepayment under the intent of this section.

(B) Final Payment: When the project has been accepted as provided in Section 105, and within 30 calendar days after final inspection of the work completed under the contract, the Engineer will render to the Contracting Agency and the Contractor, a final estimate which will show the amount of work performed and accepted under the contract. All prior estimates and partial payments will be subject to correction in the final estimate for payment.

Within sixty (60) calendar days after final acceptance, the Contracting Agency will pay the Contractor all amounts due him under the contract, except that before final payment will be made, the Contractor shall satisfy the Contracting Agency by affidavit that all bills for labor and materials incorporated in the work have been paid. The Contractor's Affidavit may be obtained from the Engineering Office of the Contracting Agency.

*Not applicable to Improvement District Projects.

SECTION 631

WATER TAPS AND METER SERVICE CONNECTIONS

631.1 DESCRIPTION:

This specification covers work by Contractors installing water services in new subdivisions by Permit and in projects under Contract. All the materials used shall comply with applicable standard specifications and the work performed in accordance with these specifications and standard details. The service connections shall be complete and all material shall be furnished by the Contractor except for the water meter.

All water service connections shall be constructed of Type K copper tubing or ultra high molecular weight polyethylene pipe of nominal iron pipe outside diameter.

All new subdivision water lines shall be staked for line and grade at 100 foot intervals by the Developer's Engineer prior to construction. All meter locations shall be staked by setting two stakes for line and marking one of the stakes for grade.

631.2 MATERIALS:

Copper pipe, tubing and fittings shall conform with Section 754. Polyethylene pipe shall conform with Section 755.

All fittings, pipe and tubing for polyethylene and copper pipe shall be as noted on standard details.

631.3 INSTALLATIONS:

631.3.1 General: Installation of copper tubing for meter service connections shall be in accordance with Section 754.

Meter service connection with copper tubing shall be in accordance with standard details.

The water service connection shall include the tap on the main, the corporation stop, the saddle if applicable, service pipe, appurtenant fittings, the curb stop, meter box and meter box cover, in accordance with standard details. Water meter boxes shall be installed in accordance with standard details to line and grade set by the Developer's Engineer. Upon acceptance, the Developer shall be responsible for damage to water meter boxes and covers until such time as the meters are installed by the Contracting Agency.

After the installation and acceptance of the water main and meter service pipe connections the water meter will be installed by the Contracting Agency upon proper application and payment of prevailing fees.

631.3.2 Standards: Except as otherwise specified all work shall be done in accordance with Sections 601 and 610.

631.3.3 Excavation and Backfill: The backfilling and compaction may be done as soon as the service line is installed, except backfilling and compaction shall not be completed around the corporation stop at the main water line until after inspection and recording of all tap locations. Trench bottom must be smooth and free of sharp objects. The minimum width of trench for water service pipe shall be 3 inches. The minimum depth of service pipe shall be 30 inches below the finished paving grade.

631.3.4 Polyethylene Pipe: Polyethylene pipe shall not be kinked, gouged or damaged during installation and backfilling operations. The pipe shall be placed in the trench allowing at least 12 inches per 100 feet for thermal contraction and expansion. Polyethylene pipe has a high thermal expansion and should never be confined under tension. The pipe should not be stored in the sun or left in the trench under abnormal high temperature. The pipe shall be carefully snaked in the trench bottom and covered up with uniform slack throughout its length. In trenches less than 8 inches in width, the expansion shall be obtained by making the tap on the opposite side of the main from the water meter and providing a loop of slack service pipe back over the top of the water main. Before installing, inspect pipe to detect any damage that may be caused by shipping, storage or handling. Damage spots can be cut out and pipe recoupled with Ford C-66-33, C-66-44, or approved equal brass compression fitting to form a continuous length. Damaged pipe shall not be used. Polyethylene pipe shall be cut only with a tubing cutter with rollers properly designated for the size of pipe being cut. When polyethylene pipe is used, the meter box setting must be placed parallel to the back of the sidewalk in accordance with standard details. Polyethylene pipe shall be installed with large sweeping bends with radius of not less than 18 inches. Polyethylene pipe has a cold flow characteristic and must not be installed under a stressed condition. Compression fittings only may be used with the plastic being held securely between metal to metal. Stainless steel or brass inserts shall be placed in the proper position in each compression fitting with care taken to assure that the insert remains in place when the fitting is tightened. All meter service lines shall extend at right angles from the main to the curb lines.

SECTION 631

631.3.5 Service Taps: One inch and 3/4 inch service taps to new meter mains may be made with a saddle, tapped coupling or direct tap in accordance with the following provisions:

The Developer may use heavy tapped couplings for meter service connections on all sizes of pipe including the 3 inch pipe in cul-de-sac streets. Bronze corporation stops must be installed in the tapped couplings prior to pressure testing or disinfection of the water main. Normally in subdivisions no saddles are required for 6 inch pipe and larger. At the Contractor's option, saddles may be used on all 6 inch pipe and larger. All service connections on major and collector streets shall be made with saddles or heavy duty tapped couplings regardless of the water main size or service pipe size. All taps on pipe smaller than 6 inches must be made by either a saddle or heavy tapped coupling with bronze insert. Direct taps must be made by the use of a corporation stop with tapered AWWA machine thread. All wet taps must be made by the Mueller Type B-100 tapping machine or approved equal. A sharp tapping bit must be used in order to obtain clean sharp threads. In general, each tapping tool should be resharpened or discarded after making 6 taps. The minimum distance between taps, saddles, and tapped couplings shall be 3 feet.

631.4 TESTING:

All services, service taps and fittings shall be tested along with the water main in accordance with Subsection 610.14.

631.5 CLEANUP AND COMPLETION:

Upon completion and acceptance of all phases of the water main and meter service lines the Developer shall release the new subdivision water system to the Contracting Agency for final operation and maintenance with all interior valves and corporation stops in open position and with all meter curb stops and valves at the connections to existing mains closed.

631.6 INSPECTION:

The Developer's Engineer shall make an as-built plan and make a record of the locations of all water service connections prior to the connections being covered up. This as-built plan shall give the stationing of each service tap. The stationing to be continuous for each street, and shall begin at the street intersection or property line at the end of the block.

631.7 SERVICE OVER 2 INCHES:

All service taps larger than 2 inches shall be made by the Agency after an application and payment of prevailing fees, unless otherwise required by the Agency.

631.8 SERVICE ON EXISTING MAINS:

Where all or part of a new subdivision is served by existing water mains, only authorized personnel of the Contracting Agency shall install the service connections upon proper application and payment of prevailing fees.

End of Section

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(A) **Portland Cement:** Portland cement shall comply with ASTM C-150, Type II, 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 3 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. The number of steel wraps shall not be less than 5 percent below that shown on the shop drawing for any one pipe.

(D) **Rubber Gaskets** shall comply with Section 765.

735.5 MANUFACTURER'S QUALIFICATIONS AND EQUIPMENT REQUIREMENTS:

The manufacturer shall be competent to manufacture the type, size and quality of pipe; in addition, he 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 140 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 nor 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 he shall seal the surfaces of the concrete, except joint surfaces that are to be grouted, 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 C-76 by 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.

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(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 repairability 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 ASTM C-76 is elected, acceptance on the basis of material tests and inspection of manufactured pipe for defects and imperfections shall be as stated in ASTM C-76, 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 C-497, 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 ASTM C-76 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 Tables III, IV, or V, 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 any one 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 three. A minimum of one set shall be made for each day's production.

SECTION 735

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 C-31 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.

735.8 DOWNGRADING OF PIPE:

For the purpose of these specifications, downgrade pipe shall be defined as pipe which is to be used under loads less than that for which they have been designed.

735.9 SANITARY SEWER PIPE:

In addition to the above, sewer pipe shall meet the requirements of ASTM C-76, 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



**UNIFORM STANDARD
DETAILS**

for

**PUBLIC WORKS
CONSTRUCTION**

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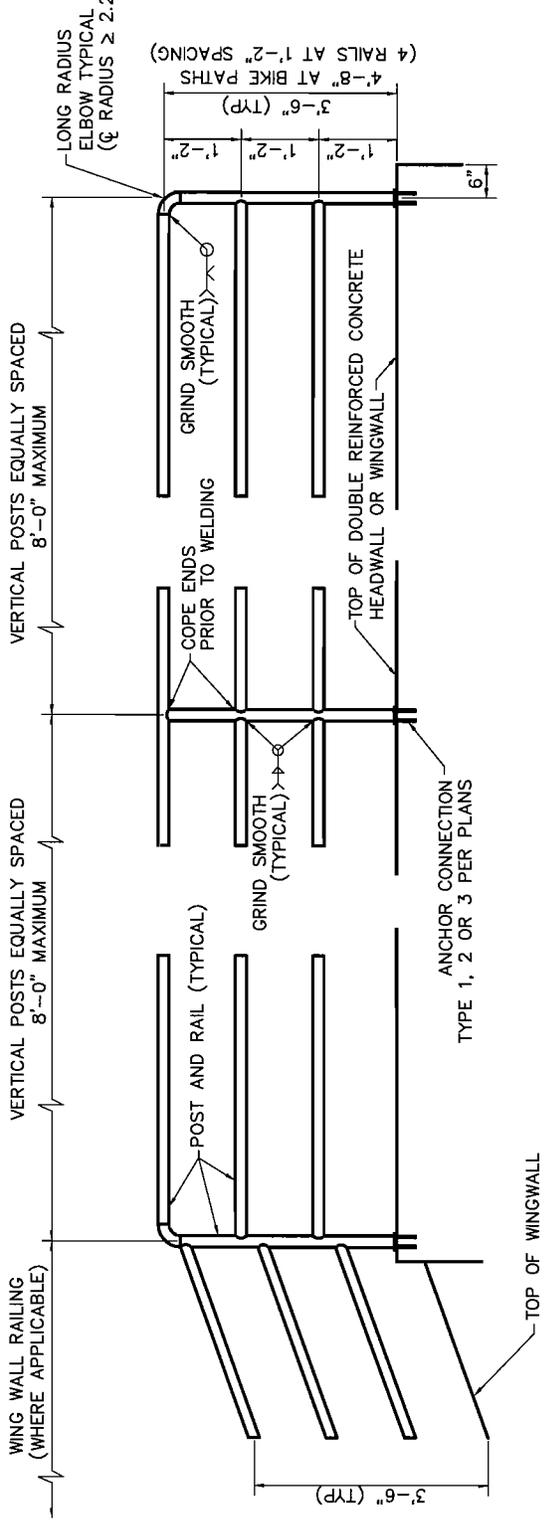
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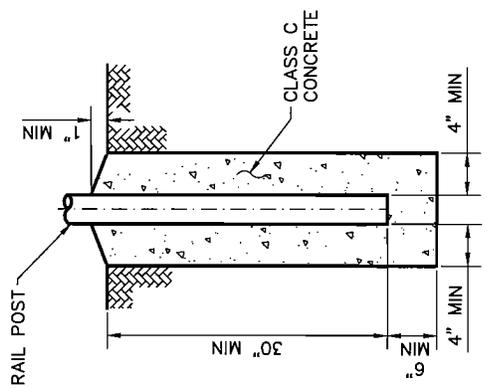
(Includes Revisions Through 2008)

NOTES:

1. POSTS AND RAILS SHALL BE 1.5" SCHEDULE 40 HOT-DIPPED GALVANIZED STEEL PIPE ASTM A 53, GRADE A (2.72 #/LF, 1.9" O.D.). GALVANIZING SHALL BE IN ACCORDANCE WITH SECTION 771.
2. PAINT RAIL PER MAG SPECIFICATIONS SECTION 530 WHEN REQUIRED BY PLANS. SHOP PRIME WITH RUST INHIBITING PRIMER (FIELD REPAIR PRIMER AS NEEDED). COLOR PER PLANS.
3. VERTICAL POSTS TO BE EVENLY SPACED.
4. REMOVE ALL SHARP EDGES.
5. INSTALL SAFETY RAIL AS REQUIRED BY PLANS OR SPECIFICATIONS.
6. THE EMBEDMENT FOR ANCHOR TYPES 1, 2 AND 3 SHALL BE LOCATED INSIDE THE WALL REINFORCEMENT CAGE.

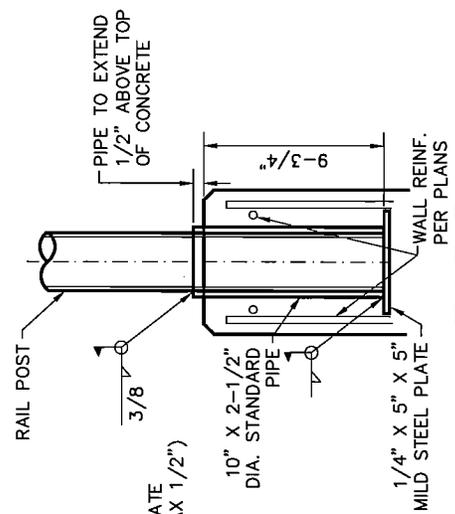


ELEVATION



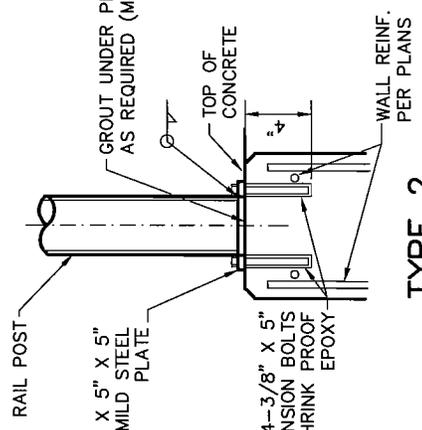
TYPE 4

GROUND INSTALLATION DETAIL



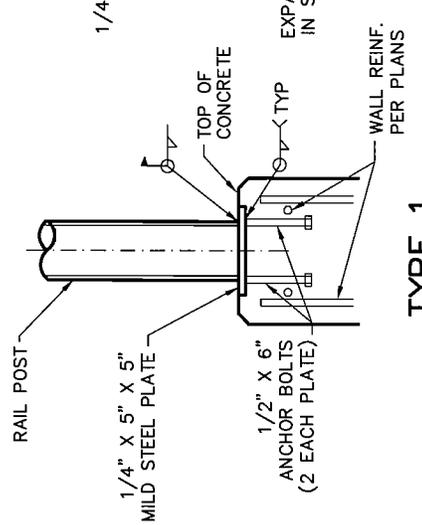
TYPE 3

PIPE SLEEVE DETAIL



TYPE 2

EXPANSION BOLT DETAIL



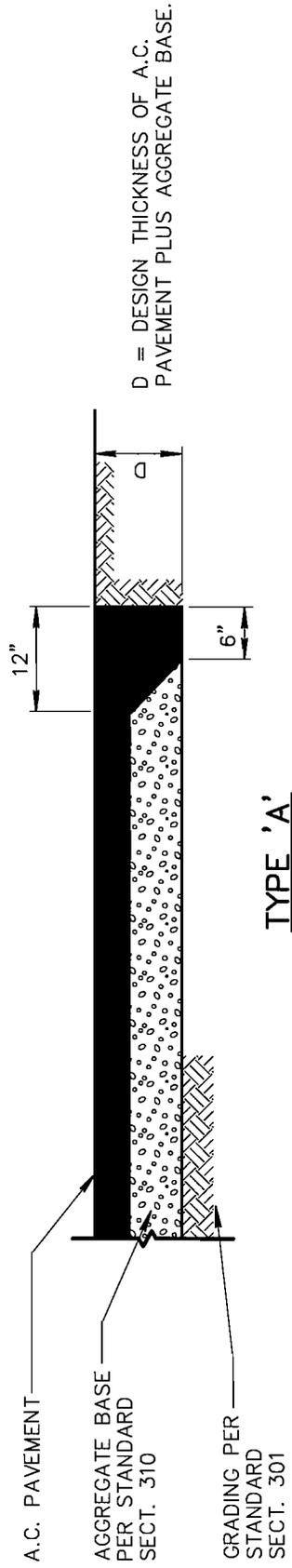
TYPE 1

ANCHOR PLATE DETAIL

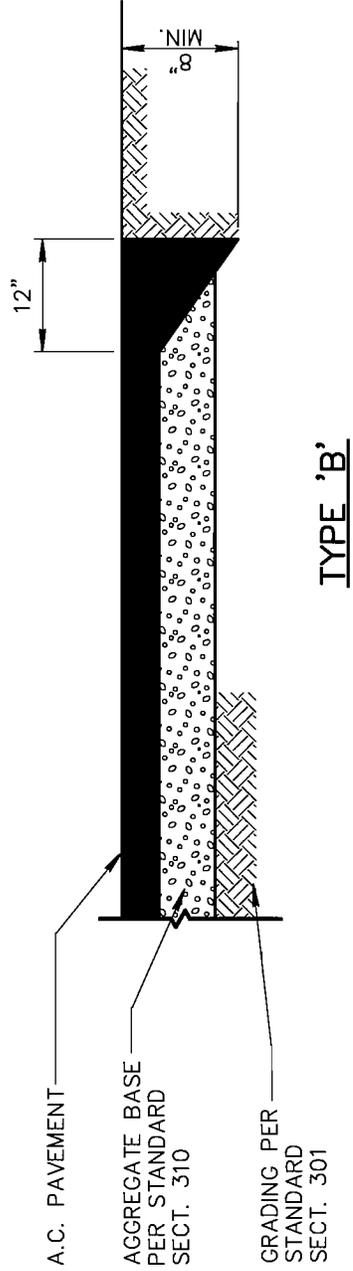
NOTE: SEE PLANS FOR ANCHORAGE DETAILS FOR ATTACHMENT TO SINGULARLY REINFORCED AND NON-REINFORCED WALLS.

DETAIL NO.	145	REVISION	01-01-2008	DETAIL NO.	145
STANDARD DETAIL			SAFETY RAIL		
ENGLISH					





D = DESIGN THICKNESS OF A.C. PAVEMENT PLUS AGGREGATE BASE.



DETAIL NO.
201

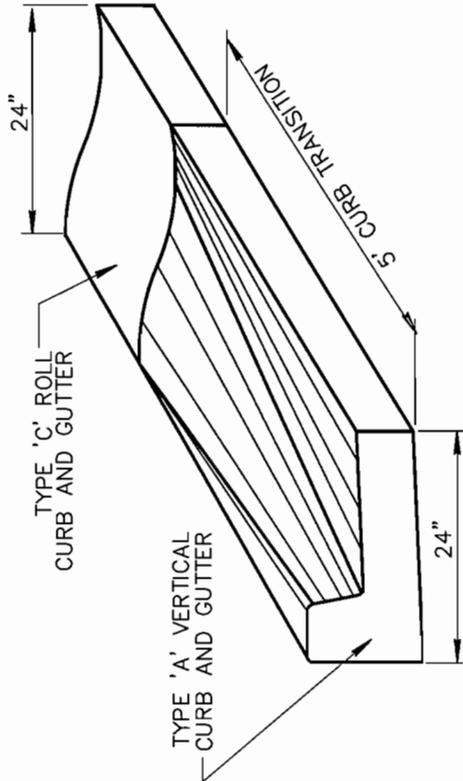
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01-01-2008

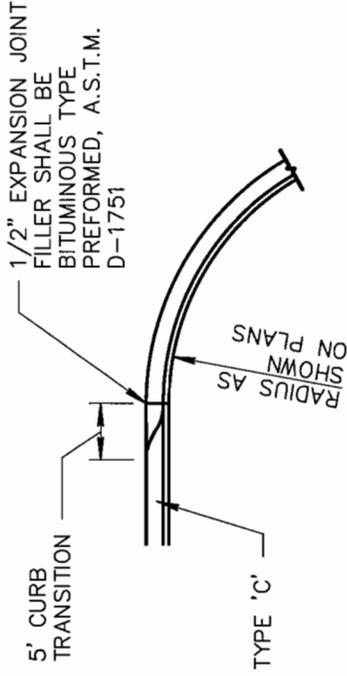
PAVEMENT SECTION AT TERMINATION

DETAIL NO.
201

CURB TRANSITION TYPE 'A' TO TYPE 'C'



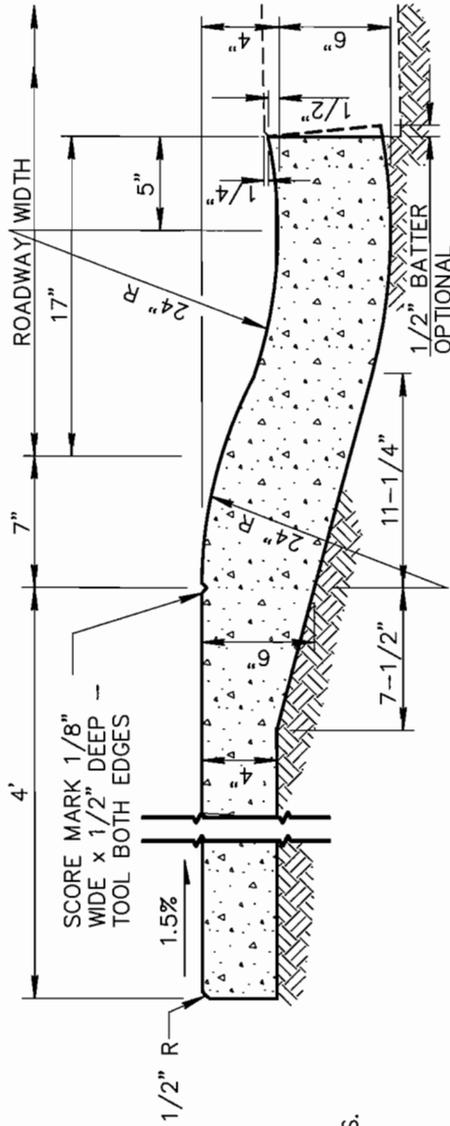
CURB AND GUTTER TRANSITION



NOTES: (CURB AND GUTTER TRANSITIONS)

1. THE CURB TRANSITION WILL BE PAID FOR AS TYPE 'C'. WHEN A PROJECT RETURN AND GUTTER THROUGHOUT, THE ENTIRE RETURN AND GUTTER THROUGHOUT, THE ENTIRE RETURN SHALL BE MEASURED AND PAID FOR AS TYPE 'A'.
2. WHERE PROPOSED CONSTRUCTION IS TO BE CONNECTED TO EXISTING CURB AND GUTTER, THE TRANSITION SHALL BE INDICATED ON PLANS.
3. CLASS 'B' CONCRETE PER SECT. 725.
4. TRANSITION BETWEEN TYPICAL SECTIONS SHALL BE ACCOMPLISHED BY THE USE OF DIRECT STRAIGHT LINE TRANSITIONS OF THE FLOW LINE AND OTHER SURFACE FEATURES.

INTEGRAL ROLL CURB, GUTTER AND SIDEWALK

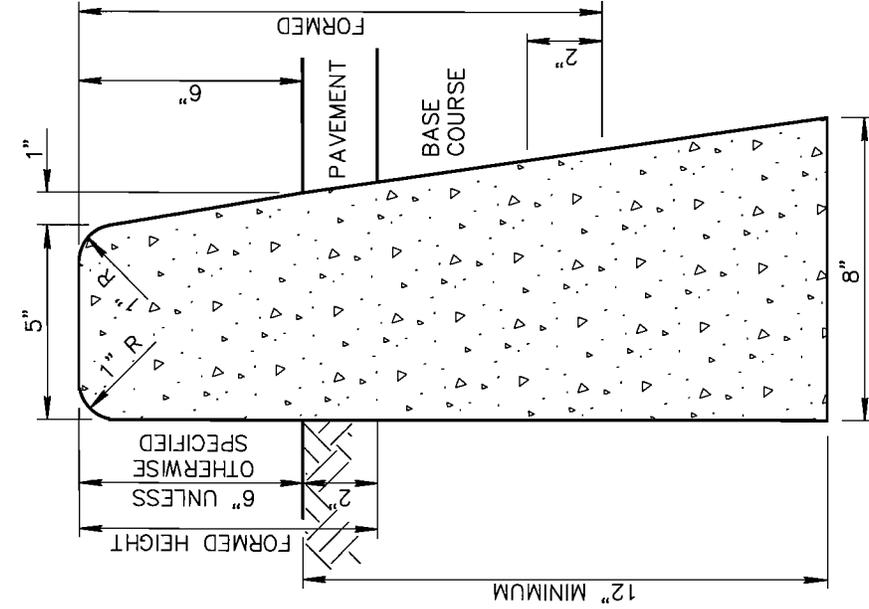


NOTES: (INTEGRAL ROLL CURB, GUTTER AND SIDEWALK)

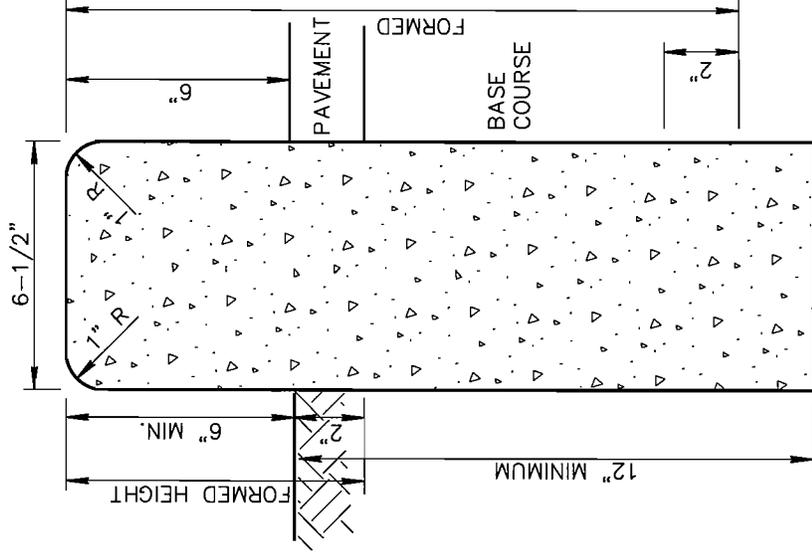
1. CONCRETE TO BE MONOLITHIC POUR. EXPOSED SURFACE FINISH AS PER SIDEWALK AND GUTTER DETAIL.
2. CONTRACTION JOINT SPACING 5' MAXIMUM.
3. EXPANSION JOINTS PER SECT. 340.
4. CLASS 'B' CONCRETE PER SECT. 725.

NOTES:

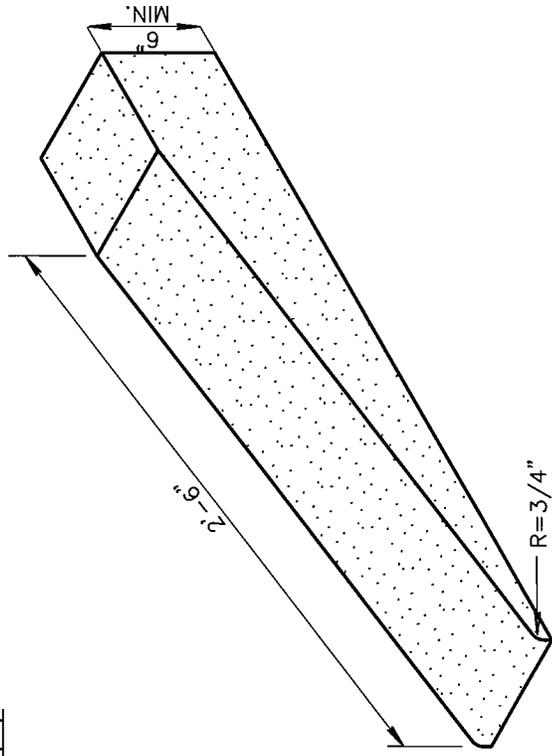
1. ALL VERTICAL SURFACES TO BE FORMED.
2. VERTICAL SURFACES DOWN FROM 2" BELOW UNDISTURBED SOIL MAY BE PLACED AGAINST NEAT CUT IF APPROVED BY THE ENGINEER AND CONCRETE WILL NOT EXTEND MORE THAN 1" BEYOND THEORETICAL FACE.
3. ALL EXPOSED SURFACES TO BE STRIPPED GREEN AND TROWEL FINISHED.
4. CONCRETE CURBS CONFORM TO SECT. 340.
5. MAXIMUM SPACING OF CONTRACTION JOINTS IS 10'.
6. CONCRETE TO BE CLASS 'B' PER SECT. 725.
7. WHEN PAVEMENT AND BASE COURSE EQUALS OR EXCEEDS 10" IN DEPTH, THE ENTIRE ROADWAY SIDE OF THE CURB SHALL BE FORMED. THE TOTAL CURB HEIGHT REMAINS 18" UNLESS NOTED OTHERWISE.



TYPE 'A'



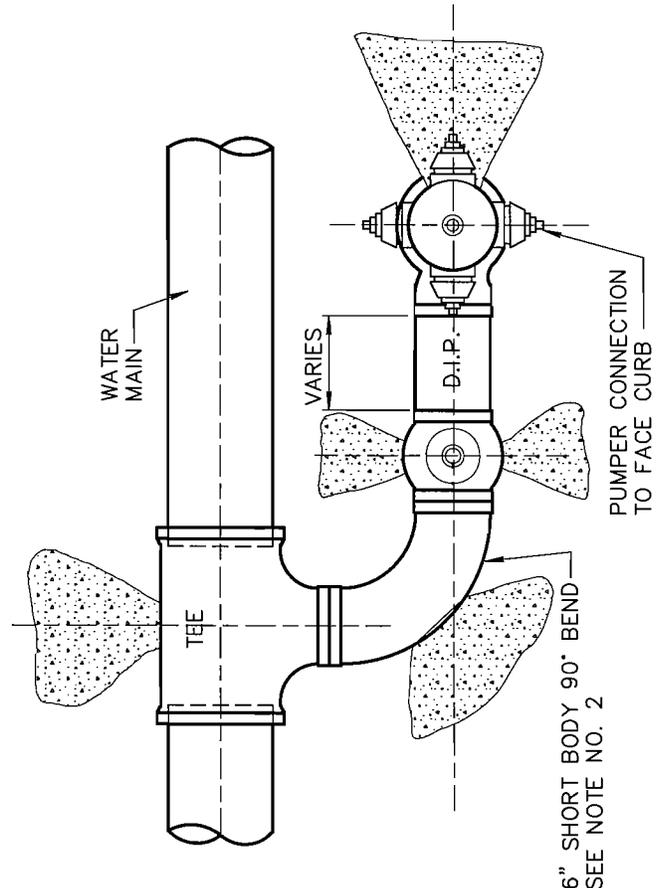
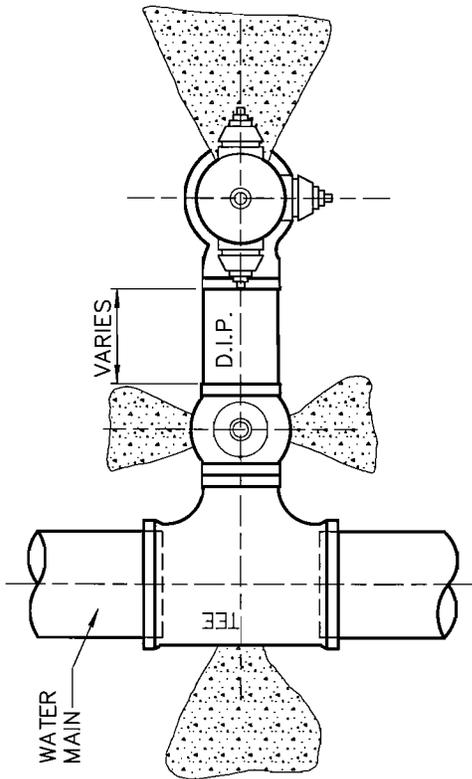
TYPE 'B'



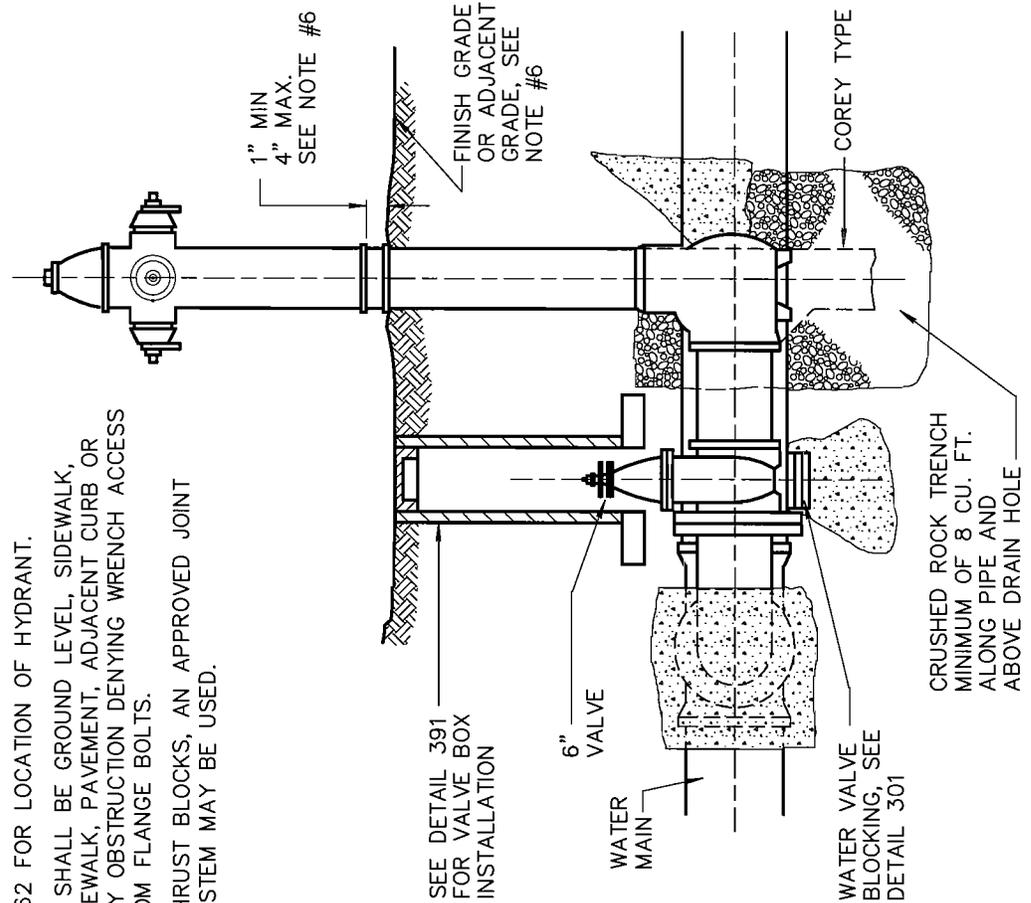
TYPICAL CURB TERMINATION

NOTES:

1. JOINTS BETWEEN THE VALVE AND THE MAIN SHALL BE FLANGED TYPE. JOINTS BETWEEN THE VALVE AND HYDRANT SHALL BE RESTRAINT OR MECHANICAL TYPE.
2. 90° BEND NOT REQUIRED IF SUFFICIENT ROOM FOR PERPENDICULAR INSTALLATION.
3. FOR CONCRETE THRUST BLOCKS, SEE DETAIL 380.
4. A FLANGE JOINT BY MECHANICAL JOINT VALVE MAY BE USED AS THE TRANSITION BETWEEN THE JOINT TYPES.
5. SEE DETAIL 362 FOR LOCATION OF HYDRANT.
6. FINISH GRADE SHALL BE GROUND LEVEL, SIDEWALK, ADJACENT SIDEWALK, PAVEMENT, ADJACENT CURB OR OTHER NEARBY OBSTRUCTION DENYING WRENCH ACCESS TO THE BOTTOM FLANGE BOLTS.
7. IN LIEU OF THRUST BLOCKS, AN APPROVED JOINT RESTRAINT SYSTEM MAY BE USED.



6" SHORT BODY 90° BEND
SEE NOTE NO. 2



CRUSHED ROCK TRENCH
MINIMUM OF 8 CU. FT.
ALONG PIPE AND
ABOVE DRAIN HOLE

DETAIL NO.

360

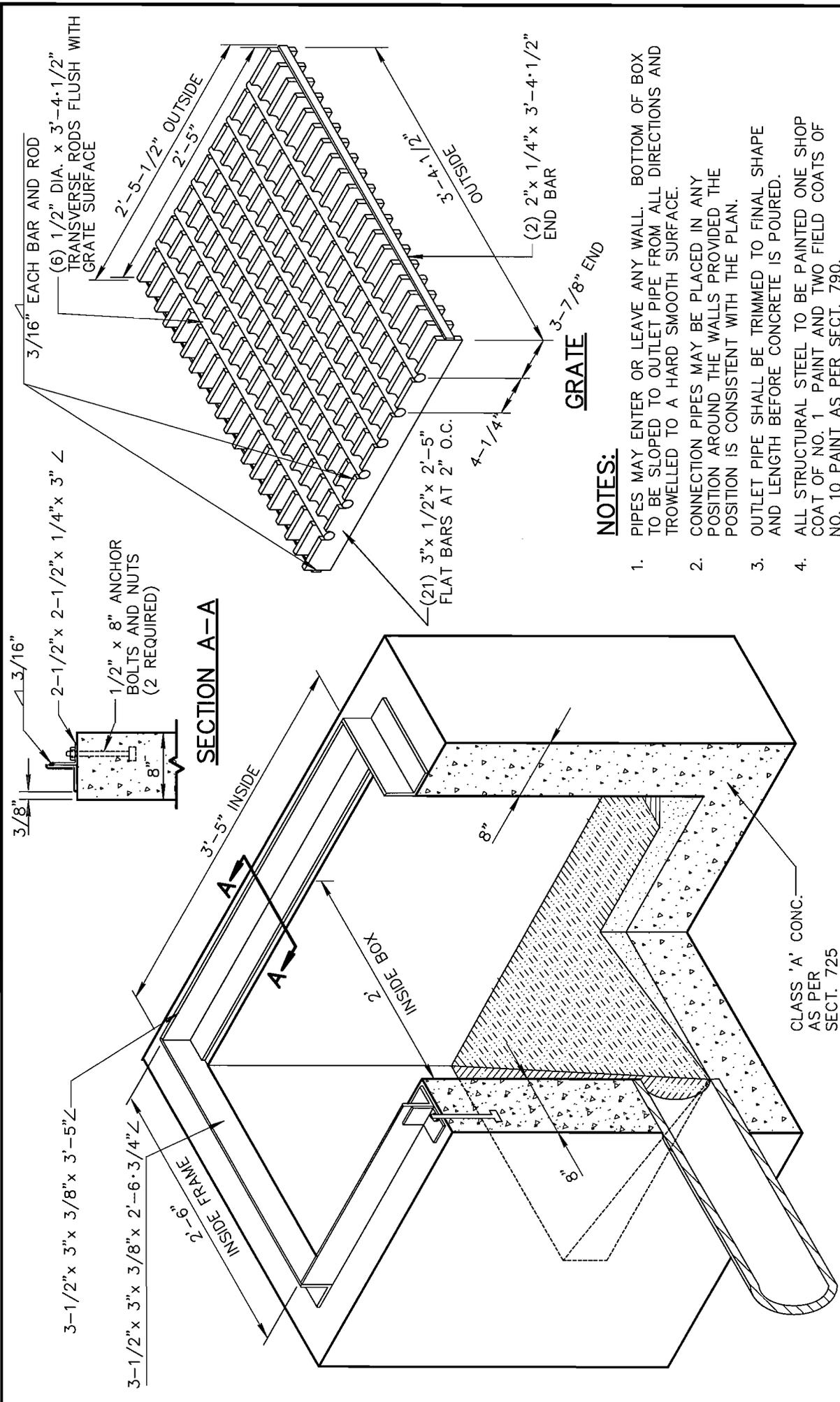
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FIRE HYDRANT INSTALLATION

DETAIL NO.

360



NOTES:

1. PIPES MAY ENTER OR LEAVE ANY WALL. BOTTOM OF BOX TO BE SLOPED TO OUTLET PIPE FROM ALL DIRECTIONS AND TROWELLED TO A HARD SMOOTH SURFACE.
2. CONNECTION PIPES MAY BE PLACED IN ANY POSITION AROUND THE WALLS PROVIDED THE POSITION IS CONSISTENT WITH THE PLAN.
3. OUTLET PIPE SHALL BE TRIMMED TO FINAL SHAPE AND LENGTH BEFORE CONCRETE IS POURED.
4. ALL STRUCTURAL STEEL TO BE PAINTED ONE SHOP COAT OF NO. 1 PAINT AND TWO FIELD COATS OF NO. 10 PAINT AS PER SECT. 790.
5. ALL WELDS ON FRAME AND SIDE BARS ON GRATE SHALL BE FULL LENGTH OF JOINT.
6. TOTAL COMBINED CLEARANCE BETWEEN FRAME AND GRATE IS 1/2".

NOTE:
SEE DETAIL 534-1 FOR THICKNESS AND
SLOPE DIMENSIONS OF BOTTOM.

DETAIL NO. 535	STANDARD DETAIL ENGLISH	REVISIONS 01-01-2008	DETAIL NO. 535
CATCH BASIN TYPE 'F' (FOR USE WITHOUT CURB)			

