

**SPECIAL PROVISIONS  
FOR  
PIMA COUNTY DEPARTMENT OF  
TRANSPORTATION**



**AUGUST 2009**

**LA CHOLLA BOULEVARD  
RUTHRAUFF ROAD TO RIVER ROAD  
PROJECT NO. 4LCITR**

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Expires 9/30/2010

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PCDOT DIRECTOR**

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#### APPENDICES TO THE SPECIAL PROVISIONS

- Appendix A – Nationwide Permit Number 14 and State of Arizona 401 Water Quality Conditions
- Appendix B – Pima County Noise Ordinance
- Appendix C – Conduit Installation Standard Drawings
- Appendix D – Stormwater Pollution Prevention Plan (BOUND SEPARATELY)

## GENERAL NOTES

### 1. Project Location

This project is located within Sections 15, 16, 21, and 22 of Township 13 South, Range 13 East, Gila and Salt River Meridian, Pima County, Arizona.

### 2. Scope of Work

The work consists of constructing a six lane arterial roadway with a raised median along the La Cholla Boulevard alignment from Ruthrauff Road to River Road. The total length of La Cholla Boulevard to be built under this project is 0.92 miles. Major intersections to be reconstructed include Ruthrauff Road and Curtis Road.

The work includes earthwork; constructing a storm drain system; building two similar three-span bridges; furnishing and placing aggregate base and asphaltic concrete; constructing concrete curb, concrete sidewalk, and grouted riprap channel lining; furnishing and installing guard rail, pavement markings, traffic signals, irrigation, and plants; and related incidental work.

### 3. Contract Time

The work specified shall be completed within 375 working days.

### 4. Specifications and Details

The work embraced herein shall be performed in accordance with the requirements of the following separate documents:

Pima County/City of Tucson, Standard Specifications for Public Improvements, 2003 Edition

Pima County/City of Tucson, Standard Details for Public Improvements, 2003 Edition

Pima County/City of Tucson Pavement Marking Design Manual, Second Edition, August 2008

Pima County/City of Tucson Signing Manual, May 2002

Pima County Street Lighting and ITS Conduit Design Manual, August 2006

Pima County Traffic Signal Design Manual, Second Edition, January 2008

U.S. Department of Transportation, Federal Highway Administration, Manual on Uniform Traffic Control Devices for Streets and Highways, 2003 Edition, including Revisions I & II

State of Arizona Department of Transportation, Standard Specifications for Road and Bridge Construction, 2008. Used only where specifically noted.

State of Arizona Department of Transportation Division of Highways, Part 1 – Construction Standard Drawings, May 2007

State of Arizona Department of Transportation Division of Highways, Part 2 – Structures Section  
Standard Drawings, June 1992, with current edition Structural Detail Drawings series

State of Arizona Department of Transportation Division of Highways, Part 3 – Traffic Signals and  
Lighting Standard Drawings, March 2004

State of Arizona Department of Transportation Division of Highways, Part 4 – Signing and Marking  
Standard Drawings, January 2002

## **5. Maintenance & Protection of Traffic**

Two way traffic on Ruthrauff Road, River Road, Curtis Road and La Cholla Boulevard shall be maintained by the Contractor on an asphaltic concrete paved surface at all times, except that the Contractor will be allowed to have intermittent closure of the bridge with advance notice and Engineer's approval for activities such as girder erection when such activities are seen as potential safety hazards to the public. The Contractor shall be responsible for all construction zone traffic control in accordance with Section 701 of the Standard Specifications and these Special Provisions. Access to the adjacent properties must be maintained during construction. Special attention shall be made to maintaining access to Fire Station 31 located on La Cholla Boulevard south of Ruthrauff Road. The contractor's compensation for maintaining traffic on an asphaltic concrete paved surface is included under Bid Item 7010001, Maintenance and Protection of Traffic.

## **6. Permits**

Before undertaking work at any location covered by this project, the contractor shall obtain all applicable permits, including but not limited to: air quality permits, water quality permits, street closure permits and permits for excavation/construction in the public rights-of-way from the City of Tucson, Town of Marana, Town of Oro Valley, or whichever agency has jurisdiction over the area where the work is located.

The contractor shall file a Notice of Intent to use the statewide Construction General Permit for Discharge to Waters of the United States with the Arizona Department of Environmental Quality. The contractor shall maintain and implement Pima County's Stormwater Pollution Prevention Plan under the Construction General Permit.

This project is operating under a non-notification Clean Water Act Section 404 Nationwide Permit Number 14 for Linear Transportation Projects. The contractor shall comply with all Clean Water Act Section 404 permit conditions as outlined in Nationwide Permit Number 14, Linear Transportation Projects, and the Nationwide Permit General Conditions. A copy of the permit and General Conditions may be found in Appendix A. For work below the ordinary high water mark of the Rillito wash during bridge demolition and construction, no stockpiling is allowed, all construction debris and excavated materials must be removed within 24 hours, the use of mechanized equipment shall be minimized as much as possible, work shall be conducted during no flow or low-flow conditions, and all disturbance shall be restored to original conditions when work is completed. No construction activity will occur outside the designated access roads and work areas. See the Storm Water Pollution Prevention Plans (SWPPP) for work area limits within the Rillito wash and for temporary access ramp locations. Any changes to approved access ramp locations or size or the work

area limits must be approved by the Engineer and Environmental Compliance. Any rework or damage due to flow in the Rillito River will be the responsibility of the contractor.

The contractor may be required to relocate certain water distribution facilities owned by Tucson Water and modify certain sanitary sewer system facilities owned by Pima County Regional Wastewater Reclamation Department as shown on the plans and hereinafter specified. The contractor shall obtain all construction permits required for this work. During construction operations, all contact between the contractor and Tucson Water or Pima County Regional Wastewater Reclamation Department personnel will be through the Engineer. The contractor shall give all notices to the Engineer two (2) working days in advance of the notice periods required by Tucson Water and Pima County Regional Wastewater Reclamation Department.

The contractor shall comply with all conditions of the Riparian Habitat Plan for the site in compliance with the Pima County Floodplain and Erosion Management Ordinance (Title 16.30). Construction work will only be allowed within designated limits of temporary disturbance. The boundary of the construction work zone shall be identified with stakes and maintained for the duration of construction. Contractor shall submit a Vegetation Removal Plan to the Engineer for review and approval prior to removing vegetation from all areas within the construction work zone and vegetation protection zones. Vegetation protection zones shall be identified using orange safety fence to prevent access during construction. A minimum of 0.44 acres of vegetation shall be protected within the work zone. Vegetation loss along the banks of the Rillito River where access to the wash is needed shall be minimized and identified in the Vegetation Removal Plan. This Vegetation shall be replaced by the Contractor upon completion of construction.

## **7. Stormwater/Groundwater Management**

It is the contractor's responsibility to allow for any subsurface groundwater and stormwater runoff at the time of project construction. The contractor shall not divert or impound water in such a manner as to flood adjacent homes, facilities, or roadways. No additional compensation shall be provided for dewatering or diversion structures required to construct or protect the work.

The contractor's attention is also directed to Section 810 of these Special Provisions regarding the requirements for erosion control. Also refer to the project plans and to the Stormwater Pollution Prevention Plan for the project.

Dewatering may be done by permit only. No measurement or direct payment will be made for dewatering groundwater or channelizing surface water required during the course of construction, including all permits. A licensed well driller is required for any dewatering operation, and all costs for dewatering shall be considered incidental to the contract unit cost of the bid items requiring dewatering. The contractor shall apply to the Arizona Department of Water Resources for the Dewatering Permit in a timely manner. The Contractor should note that up to approximately 90 days may be required for the approval of the Dewatering Permit.

## **8. Existing Vegetation**

The removal, salvage, or protection of vegetation shall be in accordance with the plans. Existing vegetation on this project shall not be disturbed beyond those limits actually needed for construction purposes. Those items unnecessarily damaged shall be repaired or replaced at the contractor's expense. Protect in place fencing shall be constructed in accordance with the project plans.

## 9. Project Limits

The contractor shall perform all work within the public right-of-way, legally obtained easements, and property legally acquired by the Agency. The contractor shall coordinate construction activities based on right-of-way and construction easements that have been and will be obtained for the project. The contractor shall assume all responsibility and liability for any encroachment upon private property. The use of private property for construction yards will be allowed only if zoning requirements allows its use for this purpose.

Section 106 in these Special Provisions includes additional requirements for temporary construction yards obtained by the Contractor.

## 10. Disposal of Materials

All construction debris, rubble, or other materials from site clearing and grubbing operations that are to be removed from the job site shall be disposed of by the contractor at a **County operated waste disposal facility only**. Fees associated with the disposal of these materials shall be paid by the contractor.

Lead testing of painted guard rail and bridge girders indicates that the lead concentration in the paint is below the Federal action levels. All metal painted guard rail and bridge components shall be recycled as scrap metal and thereby exempt from hazardous waste disposal regulations under EPA 40 CFR 261.4.a.13 and EPA 40 CFR 261.6.a.3.ii. Abatement of lead-based paint on-site shall not be allowed. The Contractor shall provide a tracking document which includes a description of the waste, quantity, name and location of recycling facility, and date of disposal to the Engineer. Fees associated with the disposal of these materials shall be paid by the Contractor and included under item 2020002 – REMOVAL OF BRIDGE.

Contractor shall follow the Occupational Safety and Health Regulations for Construction at all times. Title 29 Part 1926 Section 62, Lead, shall apply during the handling of painted bridge guard rail and girders.

Disposal of slurry material used during shaft drilling shall be in compliance with local landfill and Pima County Wastewater regulations.

## 11. Contract Administration

Prior to submittal of contract administration documents, examples of which are listed below, the contractor shall review all documentation for accuracy and compliance with the contract. Any variance from the plans and specifications shall be clearly noted and is subject to approval by the Engineer. A contractor's transmittal letter shall accompany all submittals and shall include certification as to accuracy and compliance with the plans and specifications.

Contract administration submittals shall include, but are not limited to, the following examples: escrow agreements, subcontracts, purchase orders, certified payrolls for the contractor and subcontractors, force account billings, equal employment opportunity reports for the contractor and subcontractors, trainee preconstruction information, proof of apprenticeship, weekly individual training reports, rental equipment invoices, material invoices showing all unit prices, pay estimates,

affidavit of certification of payments to disadvantaged business enterprise firms, requested lien releases, and consent from surety.

Monthly meetings may be scheduled with the contractor at the discretion of the Engineer to discuss and resolve any problems associated with contract administration submittals. The monthly meetings shall be held at the Field Engineering Building at 1313 South Mission Road. Meetings shall continue on an accelerated basis after project construction completion until all contract administration issues are resolved.

Submittals that are not certified, or are incomplete, will be returned to the contractor unprocessed for proper resubmittal and may result in payment delays, or partial payment, as deemed appropriate by the Engineer.

## **12. Work Hours/Noise Abatement Ordinance**

Construction noise abatement and start/stop times shall be in accordance with Pima County Ordinance No. 1999-61: Regulating the Excessive, Unnecessary and Annoying Noises in Pima County (see Appendix B).

## **13. Shoring and Bracing**

The contractor shall design, construct and then remove temporary excavation support systems (shoring) as required for construction of the new bridge, retaining walls, culverts, catch basins, and other miscellaneous structures to keep the existing facilities open during construction and to protect workers. Shoring shall remain in place until such time as the new construction is complete and the shoring is no longer required. The design of the shoring shall be prepared by and bear the seal and signature of a licensed professional civil or structural engineer registered in the State of Arizona and shall be approved by the Engineer prior to construction. No measurement or direct payment will be made for the design, construction or removal of temporary excavation support systems, the cost of this work considered as included in contract items.

The use of the existing bridge deck is not recommended for construction activities such as girder erection. However, if the Contractor's methods for girder erection require the use of the existing bridge deck for the placement of equipment such as cranes or girder haul trucks, then the Contractor shall notify PCDOT and provide a structural analysis showing that the equipment does not exceed the load capacity of the elements of the bridge supporting the equipment. The structural analysis shall be prepared by and bear the seal of a licensed Civil or Structural Engineer registered in the state of Arizona and shall be submitted to the Engineer for review and approval. The cost of the structural analysis and any required strengthening or shoring of the bridge shall be considered incidental to other contract items.

## **14. Construction Survey**

Construction survey and layout will be provided by Pima County.

## **15. Saw Cutting**

The work shall consist of saw cutting the existing pavement where new asphaltic concrete is to match existing bituminous surfaces with no provisions for overlaying the entire section. It shall also

include saw cutting of existing Portland cement concrete pavement, sidewalks, driveways, and parking lots where new construction shall match the grade of existing surfaces that are to remain where called for on the project plans or where designated by the Engineer.

Saw cuts shall be made to a minimum depth of 1½ inches and in all cases, deep enough to ensure a neat vertical joint. Portland cement concrete designated to remain that is damaged by the saw cutting shall be replaced in kind at the contractor's expense. No measurement or direct payment will be made for saw cutting. The cost will be considered as included in Removal of Structures and Obstructions.

## **16. Sewer System**

The contractor shall work on certain sanitary sewer system facilities owned by Pima County Regional Wastewater Reclamation Department (PCRWRD) as shown on the plans and hereinafter specified. The contractor shall obtain all construction permits required for this work except for approval by Pima County Department of Environmental Quality and the Aquifer Protection Permit that will be obtained by Pima County. During construction operations, all contact between the contractor and Pima County Regional Wastewater Reclamation Department personnel will be through the Engineer. The contractor shall give all notices to the Engineer two (2) working days in advance of the notice periods required by PCRWRD. Field Operations (326-4333) must be notified at least 48 hours prior to any scheduled diversion of flow and immediately if any sewage release occurs (295-4595 for emergencies after business hours).

Immediately report any release of sewage, and/or any damage to, or the dropping of debris into, the public sanitary sewage conveyance system, to either PCRWRD Field Engineering (740-2651) or PCRWRD Field Operations (326-4333). On weekends, holidays, or between 5:00 p.m. and 8:00 a.m., immediately call the Pima County Sheriff's Communication Center at 295-4595 or 791-4911 and request a PCRWRD Representative be dispatched to the site. Take immediate action to prevent or contain the sanitary sewage overflow (SSO) from the sewer system. The contractor shall be responsible for all costs to repair the sewer system, for all expenses to mitigate the release and to disinfect the release area, and for any regulatory penalties levied on PCRWRD because SSO entered a natural or constructed stormwater drainage system. The contractor shall repair all damage as directed and approved by PCRWRD Field Engineering Manager.

## **17. House Connection Sewers**

If encountered, and as directed by the Engineer, the contractor shall relocate house connection sewers. The work shall be performed in accordance with Pima County Standard Specifications and Standard Details for Public Improvements, Section 508. The contractor will be compensated for this work in accordance with Section 109-5.

## **18. Salvaged Items**

The contractor shall salvage existing reinforced concrete drainage pipe from approximate Station 72+00 of La Cholla Boulevard to the outlet located at the south bank of the Rillito River. Sections of pipe that are in good condition as determined by the Engineer shall be delivered to Pima County Houghton Maintenance Yard located at 4751 South Mesquite Ranch Road (Northwest corner of Houghton Road and Irvington Road). Sections of pipe that are damaged during removal and/or delivery shall become the responsibility of the contractor for disposal.

All other items designated to be salvaged shall be transported by the contractor to the Pima County Department of Transportation Operations yard at 1313 South Mission Road.

The contractor shall unload the salvaged items at both Pima County yards. The contractor shall coordinate delivery operations with David Cummings, Manager of the Operations Division, at (520) 740-2639.

## **19. Utility Relocation**

Utility relocation work not shown on the project plans or noted in the Special Provisions will be the responsibility of the appropriate utility. The contractor is hereby notified that the utility companies, in conjunction with the contract work, will do utility relocation work. Due to the accelerated design schedule, it is anticipated that utilities will not be fully relocated before the contractor receives a notice to proceed. The contractor shall make every effort to cooperate fully with each utility company and acknowledges and agrees that delays to his operations may necessarily occur. Due to these delays that are anticipated by the utility companies, the Engineer shall consider requests by the contractor for contract time extensions. The contractor will also acknowledge and agree that no monetary compensation will be given to the contractor by the Agency as a result of the impacts on his operations that are caused by the utility companies due to their anticipated work or delay. The contractor is also referred to Section 105-6 of the Standard Specifications, Cooperation With Utility Companies.

The contractor shall consider the extent of utility work in preparing the contract bid and project schedule. It will be the contractor's responsibility, prior to bidding, to contact the appropriate utilities to obtain additional information such as relocation sequencing, utility windows, construction time frames, and identification of areas requiring subgrade preparation by the contractor prior to the start of utility work.

## **20. Environmental Requirements**

The contractor shall conduct bridge demolition outside the swallow breeding season (after June and prior to March). If it is necessary to conduct bridge demolition during the breeding season, the contractor shall implement the following measure: Prior to the nesting season, remove nest remnants from the bridge to prevent the birds from rebuilding their nests. If needed, the contractor will apply measures to prevent the birds from rebuilding their nests. These measures could include coating the underside of the bridge with a slippery surface or installing netting. The cost of implementing these measures is included in the cost to remove the bridge.

If protected bird nests or owl burrows are identified during project construction, the contractor shall stop work immediately at that location and shall take all reasonable steps to prevent harassment of the birds and to secure the preservation of the nests or burrows and their contents. The Pima County engineer will be contacted at (520) 740-2814 to make arrangements for the proper treatment of the nest/burrow and inhabitants.

Any materials sources, storage areas and construction yards required for this project outside of the project area shall be examined for environmental effects by the contractor, prior to use, through a separate environmental analysis and cultural resource compliance in accordance with Pima County,

state, and federal requirements, unless the facility has already received prior clearance under local, state, and federal laws.

An Arizona State Museum permitted professional archaeological monitor must be present during disturbance activities within approximately 100 feet of the Hodges Ruin boundary (approximately station 89+00 to 91+80 along Ruthrauff Road). The contractor shall coordinate and cooperate with the permitted archaeologist retained by the County to conduct monitoring. The monitor will implement the approved monitoring and discovery plan as presented in *Cultural Resources Assessment of the La Cholla Boulevard – Ruthrauff Road to River Road Project, Pima County, Arizona*, Desert Archaeology, Inc. Project Report No. 07-133, dated 11 November, 2008. Disturbance activities pertain to all areas near the Hodges Ruin boundary where natural surfaces are exposed or disturbed, including native soil beneath sidewalks, curbs, and asphalt.

The contractor, in collaboration with Pima County, will: (1) notify the permitted archaeologist at least 2 weeks prior to any on-site work associated with the project to allow the archaeological monitor sufficient time to make arrangements for the archaeological work, and (2) keep the archaeological monitor informed of the work schedule and any changes to the schedule.

In the event that human remains, including human skeletal remains, cremations, and/or ceremonial objects and funerary objects are found during excavation or construction in any part of the project area, ground disturbing activities must cease in the immediate vicinity of the discovery. State laws ARS 41-865 and ARS 41-844 require that the Arizona State Museum (520-621-4795) be notified of the discovery by the contractor so that cultural groups who claim cultural or religious affinity to them can make appropriate arrangements for the repatriation and reburial of the remains. The human remains will be removed from the site by a professional archaeologist pending consultation and review by the Arizona State Museum and the concerned cultural groups.

If suspected hazardous materials are encountered during construction, work shall cease at the location and the Pima County engineer shall be contacted at (520) 740-2814 to arrange for proper assessment, treatment, or disposal of those materials.

Prior to any ground disturbing activity, the contractor shall obtain an Activity Permit from the Pima County Department of Environmental Quality. The contractor shall implement standard specifications for dust suppression.

The contractor shall coordinate with affected utilities so the utilities can notify affected customers of service interruptions.

The contractor shall maintain access to businesses and residences.

The contractor shall provide signs to identify business access during construction.

During construction, the contractor shall designate a pedestrian route around the work zone, when needed.

The contractor shall temporarily relocate existing irrigation lines and controllers at the Rillito River Park away from construction activities and reconnect those lines and controllers in order to provide uninterrupted irrigation to existing landscaping outside the limits of project construction.

The contractor shall maintain continuous water service for park irrigation, including reclaimed water main lines.

The contractor shall develop and implement an engineer approved park closure plan that includes appropriate fencing, barricades, and signing to alert the public to the park closure and the closest points to access the park. The Contractor shall designate an alternate route around the work zone for path users at Rillito River Park.

The contractor shall ensure that construction equipment is maintained in good working order; intake silencers are used where appropriate; new equipment is subject to new product noise emission standards; stationary equipment is located as far away from noise sensitive receivers as possible; and construction activities adjacent to residential areas are limited to daylight hours to the maximum extent practicable. Overnight construction activities in these areas will be minimized, will require prior approval from PCDOT, and will require notification of area residences and businesses.

The contractor shall complete the documentation for the National Emission Standard for Hazardous Air Pollutants (NESHAP) and submit it to Pima County Department of Environmental; Quality and/or any other regulatory agency as noted in the NESHAP regulations at least ten working days prior to bridge demolition.

## **21. Hazards Associated With Working in the Proximity of Utilities**

The contractor shall familiarize himself/herself with the project hazards associated while working in the proximity of existing underground and overhead utilities and should take extra precautions especially at the bridge construction site due to existence of high voltage electric lines.

## SECTION 101 - ABBREVIATIONS AND TERMS

**101-3 TERMS:** of the Standard Specifications, the following terms are modified as noted:

**Advertisement for Bids** – Change this to “Invitation to Bid” with the same definition.

**Change Order** - Change to read: “A supplemental agreement.”

**Contract Time** - Change to read “**Construction Time**”. This change is applicable when the term “Contract Time” is used in all sections throughout the Standard Specifications.

**Supplemental Agreement** - Add the following: “All supplemental agreements will be issued in compliance with Section 11.16.010 of the Pima County Procurement Code.”

**101-3 TERMS:** of the Standard Specifications is modified to add:

**National Pollutant Discharge Elimination System (NPDES)** - National Pollutant Discharge Elimination System (NPDES) shall also include the Arizona Pollution Discharge Elimination System (AZPDES).

## SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS

**102-4 CONTENTS OF BID DOCUMENT:** the 2nd paragraph of the Standard Specifications is revised to read:

All papers bound with or attached to the bid document are considered a part thereof. Bid forms may be detached and submitted as the bid. It is the contractor’s responsibility to include and execute all necessary bid forms.

**102-9 AFFIDAVIT AND CERTIFICATION FORMS:** of the Standard Specifications is hereby deleted.

**102-11 DELIVERY OF BIDS:** the last sentence of the Standard Specifications is hereby deleted.

## SECTION 103 - AWARD AND EXECUTION OF CONTRACT

**103-4 RETURN OF BID BOND:** of the Standard Specifications is revised to read:

All bid bonds will be held until the contract has been awarded and the contract forms are executed by the bidder.

**103-6 CONTRACTOR’S INSURANCE; INDEMNIFICATION:** of the Standard Specification is superseded by Article IV of the Construction Services Agreement.

**103-7 EXECUTION OF CONTRACT:** the 2<sup>nd</sup> paragraph of the Standard Specifications is revised to read:

The Agency shall execute the contract as soon as possible after receipt of the signed contracts, bonds and insurance certificates. No contract shall be considered as effective until it has been fully executed by all the parties thereto.

## **SECTION 104 - SCOPE OF WORK**

**104-1 INTENT OF CONTRACT:** of the Standard Specifications is modified to add:

**(A) Covenant of Good Faith and Fair Dealing:**

This contract imposes an obligation of good faith and fair dealing in its performance and enforcement. The contractor and the Agency, with a positive commitment to honesty and integrity, agree to the following mutual duties:

- (1) Each will function within the laws and statutes applicable to their duties and responsibilities.
- (2) Each will avoid hindering the other's performance.
- (3) Each will proceed to fulfill its obligations diligently.
- (4) Each will cooperate in the common endeavor of the contract.

**(B) Partnering:**

The Agency encourages the foundation of a cohesive partnering with the contractor and its principal subcontractors and suppliers. This partnering is not a legal partnership as defined by Arizona law. Partnering will be structured to draw on the strengths of each organization to identify and achieve reciprocal goals. The objectives are effective and efficient contract performance and completion within budget, on schedule, and in accordance with the contract.

The establishment of a partnering charter on a project will not change the legal relationship of the parties to the contract nor relieve either party from any of the terms of the contract.

Any cost associated with effectuating partnering will be agreed to by the Agency and the contractor and will be shared equally between them.

To implement this partnering initiative prior to starting of work in accordance with the requirements of Subsection 108.02 and prior to the preconstruction conference, the contractor's management personnel and the Field Engineering Division Manager will initiate a partnering development seminar/team building workshop. The Agency and the contractor will make arrangements to determine attendees at the workshop, the agenda of the workshop, its duration, and its location. Persons required to be in attendance will be the Field Engineering Manager, the Project Manager and key project personnel; the contractor's on-site project manager and key project supervision personnel of both the prime and principal subcontractors and suppliers. The project design engineers and key federal, state and local government personnel will also be invited to attend as necessary.

Follow-up workshops may be held periodically throughout the duration of the contract as agreed by the contractor and the Agency.

**104-5 MAINTENANCE OF TRAFFIC:** of the Standard Specifications is modified to add:

Miscellaneous work shall include all coordination and notification necessary to complete the project. Such coordination work shall include, but not be limited to: utility coordination, resident notification, and all other coordination work necessary whether mentioned on the plans or not.

Resident notification shall include the following procedures:

No later than seven (7) calendar days prior to the commencement of work, the contractor shall distribute notices of the intent of Pima County to begin construction in this project. The notices shall be distributed to the businesses and residences abutting the project right-of-way. Notices are not to be placed in mailboxes. Where there is no response, or there is no answer at the door, the notice is to be left in the door or screen door.

#### **SECTION 105 - CONTROL OF WORK**

**105-6 COOPERATION WITH UTILITY COMPANIES:** the 6<sup>th</sup> paragraph of the Standard Specification is modified to add:

The contractor will also acknowledge and agree that no monetary compensation will be given to the contractor by the Agency as a result of the impacts or delays to his operations that are caused by the utility companies.

#### **SECTION 106 - CONTROL OF MATERIAL**

**106-9 STORAGE OF MATERIALS:** of the Standard Specifications is modified to add:

A Temporary Use Permit (**Section 18.93.040 of the Pima County Zoning Code**) will be required for material storage and construction yards located outside road right-of-way on private property not zoned for such purposes. Said permits are issued by the Zoning Board of Adjustments.

Compliance with all federal, State and local laws and regulations, and associated costs shall be the contractor's responsibility for additional space obtained by the contractor for material storage or construction yards.

(107UTIL, 5/15/09)

#### **SECTION 107 - LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC**

**107-8 PUBLIC CONVENIENCE AND SAFETY** of the Standard Specifications is modified to add:

When requested by the Engineer, the contractor shall participate in any public or neighborhood meeting called by the Engineer or any other appropriate authority, for the purpose on informing the public concerning the nature, timing, status or scheduling of the work.

**107-15.01 National Pollution Discharge Elimination System** of the Standard Specifications is hereby deleted. See Section 810 of these Special Provisions.

**107-18 INSURANCE** of the Standard Specifications is superseded by Article IV of the Construction Services Agreement.

**107-21 Contractor's Responsibility for Utility Property and Services** of the Standard Specifications is modified to add:

The following utilities may have facilities in the project area:

<u>Owner</u>	<u>Contact</u>	<u>Phone Number</u>
Alltel Communications	Beverly Kinison	(602) 252-8828
AT&T Communications	Paul Diaz	(520) 629-8709
El Paso Natural Gas	Elwin O. Denmar	(520) 746-4225
Comcast Cable Communications	Mike Ginn	(520) 744-5477
Cox Communications	Ike Cruse	(520) 889-9062, Ext.104
Metropolitan Water	Timothy Dinkel	(520) 575-8100
MCI Communications (Fiber Optics)	Joe Ryan	(520) 882-0797
Pima County Regional Wastewater Reclamation Department	Souren Naradikian	(520) 740-6322
Qwest Corporation	Larry Lewis	(520) 292-8255
Southwest Gas Corporation	Melanie Rice	(520) 794-6043
Sprint/Nextel	Diane Adamson	(913) 829-0832
Trico Electric Cooperative	Paul Newton	(520)744-2944, Ext.1320
Tucson Electric Power	Cynthia Garcia	(520) 918-8246
Tucson Water	Tony Tineo	(520) 791-2648
Verizon	Kevin Dugan	(480) 777-4300

It shall be the responsibility of the contractor to contact the utility companies in order for them to determine if there is a need to brace, shore, support and protect their facilities during the construction of the project.

The contractor shall take full responsibility of costs incurred due to damage to utilities as a result of grading or excavation operations. Utility locations shown on the Plans are approximate, and all utilities are not necessarily shown. The possibility of conflicts with existing utilities-in-service exists. If conflicting utilities interfere with the contractor's normal progress towards completion of this project, the Pima County Department of Transportation may, at its option, authorize the contractor to relocate said conflicting utilities by force account in accordance with the provisions of subsection 109-5(B).

**The following companies have facilities in the area but are not anticipated to be in conflict; however, the contractor shall determine the location of any utilities prior to the start of construction activities.**

<u>COMPANY</u>	<u>CONTACT</u>	<u>TELEPHONE NO.</u>
<b>Time Warner</b> 33 N. Stone Ave, Suite 1200 Tucson, AZ 85701	Mr. Tom Seeley	(520) 547-2274 Ext. 207

Time Warner will be relocating a telephone line from TEP Power Poles to conduit supported from the underside of the bridge deck. They will also raise their lines on existing poles in other locations on the project. Contractor to coordinate with Time Warner.

<b>AT&amp;T</b> 22311 Brookhurst Street, Suite 203 Huntington Beach, CA 92646	Mr. Walter Werstiuk	(714) 963-7964
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**The following utility companies have facilities in conflict with the proposed construction, and anticipate certain adjustments and relocations before construction commences. Not all utilities will be relocated before the contractor commences, therefore, the contractor needs to coordinate and allow time in the work schedule to accommodate utility work:**

<b>Southwest Gas Corporation</b> 3401 East Gas Road Tucson, AZ 85714-1994	Ms. Melanie O. Rice	(520) 794-6043
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Southwest Gas (SWG) will relocate both high pressure and distribution lines by mid November, 2009. SWG requires a stand-by when the contractor is working within 10 feet of high pressure gas facilities. The contractor must call (520) 794-6021 to schedule the stand-by a minimum of 24 hours in advance. The contractor must use caution when working in the area of the SWG rectifier located at Sta 54+50±, 75'± Lt. (at the alley entrance on the west side of La Cholla Boulevard). The contractor must contact SWG for adjusting valves at least two weeks prior to the start of the construction by calling (520) 794-6018. These valves are located at:

- Sta 50+54, 68' Rt (Ruthrauff Sta 100+66, 56' Lt)
- Sta 76+05, 60' Rt
- Sta 88+25, 68' Rt

The Contractor shall coordinate with SWG so that SWG can install a conduit and gas line across La Cholla Boulevard south of Curtis Road at Sta 75 + 20.

<b>Tucson Electric Power</b> 4350 East Irvington Road Tucson, AZ 85702	Ms. Cynthia Garcia	(520) 918-8246
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Tucson Electric Power (TEP) will relocate both 46,000 volt and 14,000 volt overhead power lines, as well as various poles and guy wires.

**Cox Cable TV** Mr. Jeff Krause (520) 867-7526  
1440 E. 15<sup>th</sup> Street  
Tucson, AZ 85719

Cox Cable has overhead lines on some of TEP's poles.

**Qwest Communications** Mr. Larry J. Lewis (520) 292-8255  
333 E. Wetmore Road, 3<sup>rd</sup> Floor  
Tucson, AZ 85705

Qwest may be installing new ducts under the Rillito River using a directional bore or they will support new ducts from the underside of the southbound bridge deck as show on the plans as "Future Qwest Fiber Optics". Once that work is complete, their facilities north of Curtis Road can be removed. Bridge demolition can not commence until Qwest and other utilities are relocated from the existing bridge. If a directional bore is not used, the Contractor will need to coordinate and allow Qwest to move from the existing bridge to the southbound bridge before the existing bridge is demolished. Qwest will also have various relocations throughout the corridor.

**The following utility companies have adjustments that are part of the PCDOT construction project. The contractor shall adjust them in accordance with the specifications on the plans and the special provisions.**

**The contractor shall coordinate and allow time in the work schedule to accommodate utility work.**

**Tucson Electric Power** Ms. Cynthia Garcia (520) 918-8246  
4350 East Irvington Road  
Tucson, AZ 85702

The contractor shall place conduit for future Tucson Electric Power (TEP) facilities under the approach slabs and through the abutment walls of the southbound bridge in accordance with requirements to be provided by TEP.

**Comcast Cable Communications** Mike Ginn (520) 744-5477  
8251 N. Cortaro Farms Road  
Tucson, AZ 85743

Comcast Cable will be placing conduit onto the new southbound bridge supported by the underside of the bridge deck and underneath the approach slabs and through the abutment walls of the southbound bridge. Contractor to coordinate with Comcast.

**Cox Cable TV** Mr. Jeff Krause (520) 867-7526  
1440 E. 15<sup>th</sup> Street  
Tucson, AZ 85719

Cox Cable will be placing conduit onto the new southbound bridge supported by the underside of the bridge deck and underneath the approach slabs and through the abutment walls of the southbound bridge. Contractor to coordinate with Cox.

**Time Warner**  
33 N. Stone Ave, Suite 1200  
Tucson, AZ 85701

Mr. Tom Seeley

(520) 547-2274  
Ext. 207

Time Warner will be relocating a communication line from TEP Power Poles to conduit supported from the underside of the bridge deck and underneath the approach slabs and through the abutment walls of the southbound bridge. They will also raise their lines on existing poles in other locations on the project. Contractor to coordinate with Time Warner.

**Tucson Water**  
310 W. Alameda Street  
Tucson, AZ 85726

Mr. Tony Tineo

(520) 837-2129

The contractor shall relocate the conflicting water facilities as shown on the project plans. He shall also adjust the water valve frames and covers and water meter boxes to finished grade at the locations shown on the plans. Tucson Water is also building a new booster station adjacent to La Cholla Boulevard south of Ruthrauff Road. They anticipate being finished with this station in August, 2010. When it is complete, Tucson Water will connect the new booster station to the new water lines as shown in the plans. The contractor shall then remove the existing booster station as described in the special provision for ITEM 9300113.

**Qwest Communications**  
333 E. Wetmore Road, 3<sup>rd</sup> Floor  
Tucson, AZ 85705

Mr. Larry J. Lewis

(520) 292-8255

Qwest will be installing new conduits from the ends of the new bridge to a location outside of the new pavement. After the bridge abutments are complete, the contractor shall contact Qwest and allow them two weeks to install their conduits before backfilling the abutments and constructing the anchor slabs.

**Pima County Regional Water  
Reclamation Department**  
210 N. Stone Avenue, 3<sup>rd</sup> Floor  
Tucson, AZ 85701

Mr. Souren Naradikian

(520) 740-6322

The Pima County Regional Water Reclamation Department (PCRWRD) will be replacing sections of their sewer lines with ductile iron pipe at seven locations during construction of the project. These locations include La Cholla approximate sta. 46+44, 48+26, 50+53, 60+80, 63+25, 67+85, and Ruthrauff sta. 103+12. PCRWRD is also considering replacing some other sections of existing sewer lines with their own contractor. PCDOT's contractor shall coordinate with PCRWRD's contractor on all sewer relocation.

PCDOT will help facilitate coordination of the change outs at La Cholla sta. 60+89 and 63+25. PCDOT's contractor shall install storm drain up to the sanitary sewer crossing and provide a minimum of 3 days notice to PCRWRD's sewer contractor. PCRWRD's sewer contractor will perform the flow management and removal of existing sanitary sewer. PCDOT's contractor shall install the new storm drain under the flow line of the existing sanitary sewer cut out and provide backfill to the top of the storm drain. PCRWRD's contractor will install new ductile iron pipe at the cut out location and backfill to 1' above the sanitary sewer.

The contractor shall adjust and reconstruct the sewer manholes to finished grade as shown on the project plans. At least three working days prior to beginning any construction activities involving sanitary sewage facilities, the contractor shall obtain a Project Construction permit from Pima County Regional Wastewater Reclamation Department. There will be no charge for this permit. Three sets of approved plans must be submitted to PCRWRD prior to issuance of said permit.

## **SECTION 108 - PROSECUTION AND PROGRESS**

**108-3 Preconstruction Conference:** the seventh paragraph of the Standard Specifications is revised to read:

The Contractor shall also submit an implementation plan for stormwater pollution prevention, as set forth in Section 810 of these Special Provisions, on all projects requiring submittal of an Arizona Pollutant Discharge Elimination System or equivalent National Pollutant Discharge Elimination System (AZPDES/NPDES), Notice of Intent (NOI), or when such work is likely to create erosion or pollution problems. This implementation plan shall cover the project construction site and the Contractor's staging area.

**108-3 Preconstruction Conference:** of the Standard Specifications is modified to add:

The Contractor shall be responsible for planning, scheduling and reporting the progress of the work to ensure timely completion of the contract.

The Contractor shall submit a schedule in two parts, in accordance with the following:

**(A)** Part I shall be a preliminary schedule and shall be submitted at the Preconstruction Conference for the Engineer's review and concurrence. It shall be a schematic (arrow) diagram or precedence diagram, showing the work stages and operations for all activities required by the contract. The diagram shall be in sufficient detail to allow day-to-day monitoring of the Contractor's operations. Along with the preliminary schedule, the Contractor shall include its calendar for the contract period which shall show work days, calendar days and dates. The diagram shall include four to 10 milestone events as identified by the Contractor and accepted by the Engineer.

**(B)** Part II shall be submitted for the Engineer's review and concurrence within 15 calendar days after Part I has been accepted by the Engineer. This second schedule shall include a complete critical path schedule to cover the Contractor's anticipated time schedule. The schedule shall include a detailed network diagram acceptable to the Engineer with the following features:

- (1) It shall be time-scaled in calendar days. All activities shall be plotted on their early start and finish dates. Unless approved by the Engineer, activities shall not exceed 15 working days in length. The plot shall have a size and scale acceptable to the Engineer.
- (2) It shall show the order and interdependence of activities and the sequence of work as reflected in the Schedule Report specified in Subsection 108.03(B)(7) below. The critical activities shall be prominently distinguished on all reports by the use of color or other means acceptable to the Engineer.

- (3) It shall include, in addition to all construction activities, such tasks as mobilization, demobilization, submittal and approval of samples of materials and shop drawings, procurement of significant materials and equipment, fabrication of special items, installation and testing and interfacing with other projects.
  - (4) The activities shall be sufficiently detailed so that a reviewer can follow the sequence. For example, the activities shall show forming, reinforcing, and placement of concrete on the calendar days they are scheduled to be performed.
  - (5) The diagram shall show for each activity the preceding and following event numbers or activity numbers, the activity description, the total float, and the duration of the activity in working days.
  - (6) The activities shall be organized and described so as to conform to the contract bid items. Activity descriptions shall be unique and specific with respect to the type of work and location.
  - (7) The diagram shall be accompanied by a Schedule Report of the network with a tabulation of the following data for each activity:
    - (a) Preceding and following event numbers or activity number
    - (b) Activity description
    - (c) Activity duration
    - (d) Earliest start date
    - (e) Earliest finish date
    - (f) Latest start date
    - (g) Latest finish date
    - (h) Total float times
    - (i) Responsibility for activity - e.g., Contractor, subcontractor, supplier, etc.
    - (j) Resource loading for each activity listing personnel, equipment and anticipated revenue.
- (C) The Contractor shall make updated schedules and reports under the following circumstances or as requested:
- (1) The Contractor shall submit a monthly report of actual construction progress by the 10th working day of each calendar month by updating its schedule report to reflect all complete and in progress activities on the project. All negative float shall be explained in detail. If, in the opinion of the Engineer, the detailed network diagram requires revision,

either wholly or in part, the Engineer shall so direct the Contractor and the Contractor shall submit such revision within 10 calendar days.

- (2) The monthly report also shall show the activities or portion of activities completed during the one-month reporting period and the portion completed on the project to date, showing actual start and finish dates plus all future activities.
- (3) The monthly report shall state the percentage of revenue actually earned as of the report date. The Contractor shall also provide projected monthly invoice amounts for the length of the project, updated monthly.
- (4) The monthly report shall be accompanied by a narrative description of job progress, problem areas, current and anticipated delaying factors and their expected effect, and any corrective actions proposed or taken. The narrative description shall also clearly identify any departures from earlier schedules, including, but not limited to, changes in logical sequence or logical ties, constraints, changes in activity durations and changes, additions or deletions in event numbers, activity numbers and activity descriptions. The reasons for each departure shall be included in the narrative description. Any additions or deletions of milestone events must be approved by the Engineer.
- (5) The monthly report shall include a summary of all activities sequenced by the total float from least to greatest float and ordered by early start.
- (6) The required schedules and report shall be submitted to the Engineer as follows:
  - (a) Part I (Preliminary Schedule): seven originals
  - (b) Part II (Detail Network Diagram): seven originals
  - (c) Revisions to Part II: seven originals
  - (d) Monthly Report: three originals plus three copies of the narrative.
- (7) The monthly report shall include a detailed predecessor/successor analysis showing the predecessors, successors, logic ties, and constraints for each activity scheduled. These activities shall be ordered by event number or activity number from least to greatest.
- (8) All Extra Work shall be shown on an updated Schedule.

The automated system software shall be Primavera or approved equal.

No measurement or direct payment will be made for Contractor costs relating to preparation and submission of schedules and reports and revisions thereto, the cost being considered as included in the prices paid for contract items.

Float time is not for the exclusive use or benefit of either the Department or the Contractor. Extension of time for performance may be granted to the extent that equitable time adjustment for the activity affected exceeds the total float or where otherwise justified, impact on the contract completion can be shown.

Concurrence of the Contractor's schedules by the Engineer is not to be construed as relieving the Contractor of its obligation to complete the work within the contract time; or as granting, rejecting, or in any other way acting on the Contractor's requests for adjustments to the date for completing contract work, or claims for additional compensation. Such requests shall be processed in strict compliance with other relevant provisions of the contract.

The Contractor shall participate in a review and evaluation of the proposed Part I, Preliminary Schedule, and Part II, Schedule, and monthly updated schedule by the Engineer. Any revisions necessary as a result of their review shall be submitted for concurrence to the Engineer within 10 calendar days after the review. The accepted Part II, Schedule, shall then be used by the Contractor for planning, organizing, executing, and directing the work and for reporting progress of work accomplished. The Contractor shall furnish to the Engineer for project use a copy of the Part II, Schedule, and a monthly updated schedule on a compatible computer disk of a size and configuration designated by the Engineer.

The Engineer shall complete review of Part I, Preliminary Schedule, and Part II, Schedule, within 15 calendar days of the receipt of each. No monthly progress payment will be made until Part I has been accepted. Within the next 60 calendar days after concurrence with Part I, Part II will be submitted and reviewed. If Part II has not been accepted within these 60 calendar days, progress payment will be withheld until Part II has been concurred with by the Engineer.

Failure of the Contractor to comply with the monthly updated Schedule requirements specified herein will be grounds for the Engineer to withhold an additional 10 percent of the monthly progress payments, in addition to the normal retention, until the Contractor is in compliance. Additional money withheld will be paid upon compliance to the Contractor in the next scheduled monthly estimate. If the monthly updated schedule is not received by the 10th working day of each month, but received prior to the 25th of the month, five percent will be withheld until the following estimate.

## **SECTION 109 - MEASUREMENT AND PAYMENT**

**109-1 MEASUREMENT OF QUANTITIES:** the first sentence of the seventh paragraph of the Standard Specifications is revised to read:

In computing volumes of earthwork, the differential digital terrain model (DTM) method shall be used.

**109-1 MEASUREMENT OF QUANTITIES:** the eighth paragraph of the Standard Specifications is revised to read:

When computing volumes of earthwork for payment, measurement for both roadway excavation and roadway embankment shall be made from the bottom of existing asphaltic concrete to the top of new roadway subgrade. The quantities of existing asphaltic concrete are removed from the existing ground DTM prior to calculating roadway excavation, roadway embankment, and borrow, as required. The Contractor is responsible for replacing the quantity of aggregate base removed from the existing pavement section, at his own expense, if the material is utilized for purposes other than construction of embankments, as described in Section 203-9 of the Standard Specifications. This

also includes the replacement of excavated materials removed in trench excavation or structural excavation but not incorporated into the construction of roadway embankment.

**109-2 SCOPE OF PAYMENT:** the last two paragraphs of the Standard Specifications are hereby deleted.

**109-5 EXTRA AND FORCE ACCOUNT WORK:**

(A) **Extra Work.** the second paragraph of the Standard Specifications is revised to read:

Upon receipt of an approved supplemental agreement, the contractor shall proceed with the ordered work.

(B) **Force Account Work.**

(3) **Equipment.**

(a) **Rental Rates (Without Operators)** is modified to add:

$$F \text{ (Adjustment Factor)} = 0.933$$

(C) **Force Account Work by Subcontractor.** of the Standard Specifications is revised to read:

When force account work is determined by the Engineer to require specialized labor or equipment not normally utilized by the contractor, and such force account work is performed by subcontractors, the contractor will be allowed an additional markup based on the following:

For Force Account work performed by subcontractors or any combination of subcontractors, the prime contractor will be allowed a ten percent supplemental markup on the first \$10,000 of the work performed (less markups for overhead and profit).

For all subsequent Force Account work performed by subcontractors, the prime contractor will be allowed a five percent supplemental markup (less markups for overhead and profit).

The ten-percent supplemental markup shall apply to the first accumulated total of all force account work performed by all subcontractors.

The contractor shall submit payrolls or other cost data documents for all force account work performed by subcontractors. There shall be no payments made for force account work until receipt of proper and correct documentation.

**109-12 LUMP SUM PAYMENT FOR STRUCTURES:**

(A) **General.** of the Standard Specifications is modified to add:

The Department will compensate the contractor for construction of each of the following structures or groups of structures on the basis of a lump sum amount:

9999901 Lump Sum Structure No.1 (Southbound La Cholla Boulevard Bridge over the Rillito River)

9999902 Lump Sum Structure No.2 (Northbound La Cholla Boulevard Bridge over the Rillito River)

The lump sum amount includes concrete, reinforcing and prestressing steel, concrete barriers, parapets, metal railings, precast concrete members, architectural treatments, and all other work shown on the plans including utility and electrical conduits, pedestrian walkways, roadway and median curbs, bridge expansion joints, structural excavation and structure backfill, engineered fill, bearing pads, vertical restrainers, miscellaneous grout, mastic material, deck and abutment drains, signs, and all other work related to construction of the bridges, etc. Drilled caissons, concrete and reinforcement, shall be paid for under the contract item for caisson and shall not be paid for under lump sum payment for structures.

Work under this section shall also include all work to construct the approach slabs with the bridges, as shown on the Project Plans and as contained in these Special Provisions.

**109-13 COMPENSATION FOR FUEL ADJUSTMENT:** is hereby added to the Standard Specifications:

**109-13.01 Fuel Adjustment.**

**(A) General.** The Agency will adjust monthly progress payments up or down as appropriate for cost fluctuations in diesel fuel as determined in accordance with these Special Provisions.

A fuel cost adjustment will be made when fluctuations in the price of diesel fuel, in excess of 15 percent, occur throughout this contract. The Agency will not provide such adjustments for fluctuations in the price of diesel fuel of 15 percent or less.

No adjustments will be made for fluctuations in the price of fuels other than diesel.

**(B) Determination of Compensation.** The base index price of fuel will be determined by the Agency from the selling prices of diesel fuel published by OPIS (Oil Price Information Service). The base index price to be used will be the price for Diesel fuel No. 2, Low Sulfur, PAD 5, City of Tucson. The reported average value for the Tucson area will be used.

The base index price for each month will be the arithmetic average of the selling price for diesel fuel, as specified above, shown in the last four reports received prior to the last Wednesday of the month.

This price will be made known by means of a memorandum issued on the last Wednesday of each month and mailed to those currently receiving copies of the Advertisements for Bids. This price may also be obtained from Anthony Schiavone, Field Engineering, 1313 S. Mission Road at (520) 740-2827.

This price will be deemed to be the "initial cost" for diesel fuel on projects for which bids are opened during the following month.

The current index price for diesel fuel in subsequent months will be the base index price, determined as specified above, for the current month. The amount of adjustment per gallon will be the net difference between the "initial cost," adjusted by 15 percent, and the current index price. The monthly adjustment will be determined by the Engineer and included in the payment estimate as a fuel adjustment. For fluctuations in excess of 15 percent, fuel cost adjustments will only be made for current price index increases greater than 1.15 times the "initial cost" or for decreases less than 0.85 times the "initial cost." No calculation will be made for fluctuations in the current index price of 15 percent or less when compared to the "initial cost."

The cost of diesel fuel will be considered to be equal to one percent of the total construction costs for the project. The dollar amount of diesel fuel used each month will be considered to equal one percent of the dollar amount of work reported by the contractor for that month. The quantity of diesel fuel in gallons will be determined using the dollar value calculated above and the price per gallon specified as the "initial cost." A monthly adjustment, if applicable, will be made on this quantity, as shown below:

$$S = \frac{0.01(Q)}{IC} \times (CP - AC)$$

Where;  $S$  = Monetary amount of the adjustment (plus or minus) in dollars  
 $CP$  = Current index price in dollars per gallon  
 $IC$  = "Initial cost" as determined above, dollars per gallon  
 $AC$  = Adjusted "initial cost" (1.15 or 0.85 times  $IC$ ) in dollars per gallon  
 $Q$  = Dollar amount of work completed for the month

If adjustments are made in the contract quantities, the contractor shall accept any fuel adjustment as full compensation for increases or decreases in the price of fuel regardless of the amounts of overrun or under run.

No additional compensation will be made for any additional charges, costs, expenses, etc., which the contractor may have incurred since the time of bidding and which may be the result of any fluctuation in the base index price of diesel fuel.

No adjustments will be made for work performed beyond the contract time.

The need for application of the adjustments herein to extra work will be determined by the Engineer on an individual basis and, if appropriate, will be specified on the work order.

**(C) Payment.** Price adjustment will be shown on the monthly progress estimate, but will not be included in the total cost of work for determination of progress or for extension of contract time.

Fuel adjustment compensation ( $S$ ) will be paid for at the contract unit price each for each dollar of compensation determined above rounded to the nearest dollar and will be paid for under bid item 1090002 – Fuel Adjustment.

(202PVMT\_REM, 5/1/09)

## SECTION 202 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

### 202-3 CONSTRUCTION DETAILS

#### 202-3.03 Removal of Pavement

**202-3.03 (B) Bituminous Pavement** of the Standard Specifications is modified to add:

All excavated bituminous pavement, including millings, shall be processed and reused as embankment. Should the Contractor elect to use the excavated bituminous pavement material for a different use, the Contractor shall replace the material at his own expense. Standard Specification 104-7 applies.

## SECTION 202 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

### 202-3 CONSTRUCTION DETAILS

**202-3.05 Removal of Bridge:** the fifth paragraph of the Standard Specifications is revised to read:

Existing pier walls shall be removed to the top of the existing pile cap. The pile cap and piles may remain in place at the piers only. The existing pile cap and piles supporting the abutments shall be removed to 5'-0" minimum below the pile cap or to 5'-0" minimum below finish grade, whichever is deeper, unless specified otherwise in the project plans. The Existing piles that conflict with new construction, such as drilled shafts, shall be removed to a depth necessary to eliminate the conflict with the new construction. The Contractor should be aware that steel piles often stray from the plan locations during the driving process and that conflicts between the new drilled shafts and the existing piles may occur. If conflicts occur between the existing piles and drilled shafts, the steel piles shall be removed and the void left by the pile shall be filled with cement slurry. The removal of piles due to any anticipated or unanticipated conflict shall be paid for under the Force Account Item 2020005 Removal of Existing Piles.

**202-3.05 Removal of Bridge:** the last paragraph of the Standard Specifications is modified to add:

All construction debris shall be removed from the riverbed within 24 hours. No debris will be allowed to be buried in the River Channel.

**202-3.05 Removal of Bridge:** of the Standard Specifications is modified to add:

The existing La Cholla Boulevard Bridge over the Rillito River is a four-span precast prestressed Type IV AASHTO I Girder bridge with an approximate length of 353'-6" and a width of 52 feet out-to-out of bridge deck. The bridge has three concrete pier walls and two stub type abutments supported on driven steel pile foundations. The existing bridge, Structure No. 8636, was built in 1981 under Pima County Work Order No. 4-BLARI. Plans of the existing bridge are available upon request from PCDOT Engineering Records. The structure shall be removed as indicated on the

project plans and in accordance with Section 202 of the Standard Specifications and these Special Provisions. The existing La Cholla Boulevard Bridge over the Rillito River, as described above, is to be removed and paid for as a lump sum item under item 2020002 – REMOVAL OF BRIDGE.

The Contractor shall follow Occupational Safety & Health Administration (OSHA) 1926 Safety and Health Regulations for Construction for potential lead exposure during the demolition of the metal rails and concrete girders and walls since testing indicated the presence of lead in the paint. All scrap metal from the bridge that has been painted should be treated as if the paint contains lead. Therefore, in lieu of disposing the metal in a landfill, the Contractor shall transport it to a recycling facility approved by the County. The cost of recycling is considered incidental to the lump sum item 2020002 – REMOVAL OF BRIDGE.

(202SIGN\_REM, 5/29/09)

## **SECTION 202 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

### **202-3 CONSTRUCTION DETAILS**

**202-3.06 Removal of Signs and Delineators** the second sentence of this subsection of the Standard Specifications is revised to read:

The contractor shall dismantle the sign panels and delineators and remove the sign posts and concrete foundations from the ground in such a manner as to prevent damage to the posts.

## **SECTION 202 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

**202-3.08 Removal of Fence:** of the Standard Specifications is modified to add:

The fences that are to be removed as part of this project must be offered to the adjacent property owner and will become the property of the contractor only if the property owner does not want them.

### **ITEM 2020005 – REMOVAL OF EXISTING PILES**

#### **1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to safely remove existing steel piles that are in conflict with the new drilled shaft foundations or abutments. The new drilled shaft foundations at the abutments of the new northbound (& possibly southbound) bridge will be placed in close proximity to driven steel piles that support the existing bridge abutments. The Contractor should be aware that steel piles often stray from the plan location during the driving process and that conflicts between the new drilled shafts and the existing piles may occur.

#### **2. Materials:**

All materials used for pile removal shall conform to the Standard Specifications.

#### **3. Construction Requirements:**

Where existing piles conflict with the location of new drilled shafts, the existing piles shall be removed by the contractor. The piles shall be removed in such a way as to prevent damage to nearby existing underground and above ground facilities. Due to the soil conditions at the existing structures, it is anticipated that the skin friction between the existing steel piles and the soil will need to be relieved before the piles are extracted in order to prevent excessive vibration and possible damage to nearby existing underground and above ground facilities. The contractor shall submit a pile removal plan to the engineer for review and approval prior to removing the piles. The contractor's method shall ensure that the integrity of the soil is not compromised. A possible method that the contractor may employ, at his discretion, to relieve the skin friction is as follows:

1. Drill small diameter (8" minimum) open-holes around the piles to a depth of at least two feet below the pile tip. A minimum of three holes should be drilled in a triangular fashion around the pile to be extracted.
2. Once the holes are drilled around a given pile, the pile may be extracted using a vibratory hammer or other approved method.

The contractor is responsible for safeguarding all facilities both underground and above ground that are to remain or are in service at the time of pile removals. Any damage due to the contractor's operations shall be repaired at the contractor's expense. After the piles have been removed, the open holes, including the hole left by the pile, shall be filled with a two-sack cement-sand-fine-gravel slurry mix. The slurry shall have a minimum unconfined compressive strength of 800 psi at 28 days. After allowing at least 48 hours for the slurry mix to set up, drilled shafts shall be constructed at the locations shown on the contract plans.

#### **4. Method of Measurement:**

Measurement for removal of the existing steel piles shall be by force account in accordance with Subsection 109-5 of the Standard Specifications.

#### **5. Basis of Payment:**

The accepted quantities of this item, measured as provided above, will be paid for on a force account basis under Item No. 2020005.

**(203EARTH\_QUANT, 5/19/09)**

### **SECTION 203 - EARTHWORK**

**203-2 GENERAL** of the Standard Specifications is modified to add:

The bidding schedule quantities for roadway excavation, drainage excavation, and borrow, if applicable, will be considered to be the final quantities for payment, unless adjusted in accordance with the requirements of Subsections 104-2 or 203-2.01.

**203-2.01 Earthwork Adjustments** is hereby added to the Standard Specifications:

Adjustments in the bidding schedule quantities for roadway excavation, drainage excavation or borrow may be initiated by the Contractor or the Engineer, if evidence indicates that the required quantity varies by an amount greater than five percent of the bidding schedule quantity. The Contractor shall advise the Engineer prior to construction, in writing, submitting evidence in the form of a construction survey or photogrammetric survey with cross sections, along with the measurement for the proposed adjustment, substantiated in accordance with Subsections 203-3, 203-4 and 203-8, requesting an adjustment in quantities. The Engineer will evaluate the amount of adjustment requested for approval, if any. The quantity upon which payment will be based will be the bidding schedule quantity plus or minus only that portion of the adjustment that exceeds five percent of the bidding schedule quantity.

Neither variations in shrink or swell of materials from those shown on the project plans, nor variations of shrink or swell from Contractor obtained sources will be reasons for establishing a quantity adjustment.

Adjustments in earthwork quantities due to revisions ordered by the Engineer will be isolated by measurement or calculations, in accordance with the requirements of Subsections 203-3, 203-4 and 203-8. The bidding schedule quantities will be adjusted by the amount of the ordered change, and will not be included in any other adjustment of the bidding schedule quantities as specified in this subsection.

### **203-3 ROADWAY EXCAVATION**

**203-3.04 Method of Measurement** the first sentence of the first paragraph of the Standard Specifications is revised to read:

Measurement of roadway excavation for payment will not be required, unless adjustments are made in accordance with Subsection 203-2.01 herein. When adjustments are required, roadway excavation will be measured by the cubic yard in the original space occupied and the volume of the material removed will be computed by the average end area method.

**203-3.05 Basis of Payment** of the Standard Specifications is modified to add:

No adjustment to the contract unit price will be made because of increased excavation quantities resulting from the removal of unsuitable material.

### **203-4 DRAINAGE EXCAVATION**

**203-4.04 Method of Measurement** the first sentence of the first paragraph of the Standard Specifications is revised to read:

Measurement of drainage excavation for payment will not be required, unless adjustments are made in accordance with Subsection 203-2.01 herein. When adjustments are required, drainage excavation will be measured by the cubic yard in the original space occupied and the volume of the material removed will be computed by the average end area method.

### **203-8 BORROW**

**203-8.02 Materials:** of the Standard Specifications is modified to add:

Borrow placed within three (3) feet of the finished subgrade elevation shall meet the following requirements:

The Plasticity Index (PI) (AASHTO T90) and the percent passing the No. 200 Sieve (Minus 200) (Ariz. Test Method 201) when used in the equation below, shall give a value of X that does not exceed 58.

$$X = (\text{Minus 200}) + [2.83(\text{PI})]$$

**203-8.04 Method of Measurement** the first paragraph of the Standard Specifications is revised to read:

Measurement of borrow for payment will not be required, unless adjustments are made in accordance with Subsection 203-2.01 herein. When adjustments are required, borrow will be measured by one of two methods: (1) The cubic yard in the original space occupied, and the volume of the material removed will be computed by the average end area method. (2) The cubic yard in the final space occupied, and the volume of the material placed will be computed by the average end area method.

(203STRUC\_EXC&BKFL, 6/15/09)

## **SECTION 203 – EARTHWORK**

### **203-5 STRUCTURAL EXCAVATION AND STRUCTURE BACKFILL**

**203-5.01 Description** the second paragraph of the Standard Specifications is modified to add:

Backfill of bank protection toe down excavation shall be considered structure backfill.

#### **203-5.03 Construction Details.**

##### **(B) Backfill.**

**(2) Compaction of Backfill** of the Standard Specifications is modified to add:

Structure backfill in soil cement bank protection toe trenches shall be compacted to 85 percent of the maximum density.

## **SECTION 303 - AGGREGATE BASE COURSE**

**303-2 MATERIALS** of the Standard Specifications is modified to add:

Aggregate containing recycled asphaltic concrete material will be required to be blended at a maximum 50% ratio with the inert aggregate base course material. The final blended aggregate material shall form a uniform, homogenous mix, and comply with all requirements for aggregate base course material.

## **ITEM 4010001 - PORTLAND CEMENT CONCRETE PAVEMENT**

### **1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to construct a pavement surface using Portland cement concrete for the bus pullouts and guardrail aprons at the locations shown on the plans and in accordance with Details R7 and R32 shown on the plans and the requirements of these specifications.

### **2. Materials:**

Portland cement concrete shall conform to the requirements of Section 1006 of the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, 2008 Edition. Concrete shall be Class P.

Materials for expansion joint filler and joint seal shall conform to the requirements of Section 1011 of the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, 2008 Edition.

Liquid membrane curing compound shall conform to the requirements of Subsection 1006-2.05 of the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, 2008 Edition.

### **3. Construction Requirements:**

The Portland cement concrete pavement shall be constructed in conformance with the requirements of Section 401-3 of the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, 2008 Edition.

### **4. Method of Measurement:**

Portland cement concrete pavement will be measured by the square yard, calculated from the dimensions shown on the plans and adjusted by the amount of any change ordered by the Engineer. No allowance will be made for pavement placed in excess of the specified dimensions.

### **5. Basis of Payment:**

The accepted quantities of Portland cement concrete pavement, measured as provided above, will be paid for at the contract unit price per square yard, which price shall be full compensation for the work, complete in place, including excavating, backfilling, and fine grading. No separate payment will be made for joints, the cost being considered as included in the contract item for Portland cement concrete pavement.

## **SECTION 404 - BITUMINOUS TREATMENTS**

**404-5 BASIS OF PAYMENT** of the Standard Specifications is modified to add:

The term "bituminous material" used in accordance with this Section is not subject to price adjustment for fluctuating asphalt prices.

**(406AC\_RAP, 11/21/08)**

**SECTION 406 - ASPHALTIC CONCRETE** of the Standard Specifications is revised to read:

### **406-1 DESCRIPTION**

The work under this section shall consist of furnishing all materials, mixing at a plant, hauling, placing and compacting a mixture of aggregate, recycled asphalt pavement (RAP) if utilized, asphalt cement and approved mineral admixture to form a pavement course or for other purposes as specified and in accordance with the details shown on the project plans and the requirements of these specifications. Recycled asphalt pavement (RAP) may be utilized.

The Marshall Mix Design Method shall be the basic design for all proposed mix designs and testing procedures.

Asphaltic concrete shall be produced in a batch mixing plant, a continuous pugmill mixing plant or a drum drier mixing plant. Proportioning shall be either by hot-feed control or cold-feed control.

### **406-2 MATERIALS**

**406-2.01 General.** The Contractor may choose to utilize recycled asphalt pavement (RAP) in the production of hot mix asphalt concrete. If utilized, the RAP shall not exceed 15% of the total weight(s) of aggregate in the mix. The contractor shall obtain Agency approval of materials before any material is mixed at any plants. Approval of coarse and fine mineral aggregates shall be in accordance with Section 1001 - Material Source of the Standard Specifications.

**406-2.02 Composition of Asphaltic Concrete Mixtures.** The asphaltic concrete mix shall generally be composed of a mixture of aggregate, mineral admixture, asphalt cement and recycled asphalt pavement (RAP) if utilized.

For any asphaltic concrete mix required by the plans or special provisions, the contractor shall develop and submit to the Agency, a job mix formula that satisfies the general criteria listed herein.

The optimum asphalt cement content for the gradation proposed shall be determined by the contractor using the Marshall Mix Design Method.

The resultant mixture shall meet the following properties:

**TABLE 406-1**  
**MIX DESIGN PROPERTIES**

<u>Arizona Mix Property</u>	<u>Mix Criteria</u>	<u>Test Method</u>
Compaction (number of blows each end of specimen)	75	815
Wet Strength, psi ( <i>Mpa</i> ), min	150 ( <i>1.00</i> )	802
Index of Retained Strength, percent, min,	60	802
Stability, lb. ( <i>kN</i> ), min.	2000 ( <i>9.0</i> )	815
Flow, 0.01 in. ( <i>mm</i> )	8 - 16 ( <i>2 - 4</i> )	815
Effective Voids, %	Note 1	815
VMA, %	Note 2	815
Absorbed Asphalt, %	0 - 1.0	815

NOTE 1: Effective air voids shall be  $5.5 \pm 0.2\%$  for all arterial, collector and major street designations and  $4.0 \pm 0.2\%$  for local streets.

NOTE 2: PAG No.1 - 14.5% minimum  
PAG No.2 - 15.0% minimum  
PAG No.3 - 15.5% minimum

**406-2.03(A)Mineral Aggregate.** Coarse mineral aggregate shall consist of crushed gravel, crushed rock, or other approved inert material with similar characteristics, or a combination thereof, conforming to the requirements of these specifications.

Fine mineral aggregate or blend material shall consist of natural sand or sand prepared from rock, or other approved inert materials, or a combination thereof, conforming to either the requirements of these specifications or as may otherwise be approved by the Engineer.

Mineral aggregate furnished for mix designs shall be representative of the source(s) and sampled from the materials stockpiles to be utilized in asphaltic concrete production. Mix designs shall be performed utilizing mineral aggregate and recycled asphalt pavement (RAP) if utilized, which conforms to the grading limits in Table 406-2 or in the case of batch type plants, from bin samples if authorized by the Engineer.

**406-2.03(B)Recycled Asphalt Pavement (RAP).** RAP is reclaimed and/or salvaged asphalt pavement which has been processed and stockpiled to minimize segregation. Additional processing may be done. The stockpiles shall be placed on a base sufficient to prevent contamination and provide adequate drainage.

**TABLE 406-2**

**COMPOSITION OF ASPHALTIC CONCRETE MIXTURES**

<u>Mix Designation</u>	<u>Percent Passing</u>		
	<u>No. 1</u>	<u>No. 2</u>	<u>No. 3</u>
<u>Sieve Size</u>			
1" (25 mm)	100	--	--
3/4" (19 mm)	90-100	100	--
1/2" (12.5 mm)	72-90	90-100	100
3/8" (9.5 mm)	60-76	70-85	85-100
#4 (4.75 mm)	48-62	54-68	55-75
#8 (2.36 mm)	40-52 (Note 1)	44-52 (Note 1)	38-50 (Note 2)
#40 (425 μm)	12-24	13-23	16-26
#100 (150 μm)	--	--	--
#200 (75 μm) (Note 3)	3-7	3-8	3-8

Notes:

1. A minimum of 50 percent, by weight, of the material retained on the No. 8 (2.36 millimeters) sieve shall have at least one rough, angular surface, produced by crushing when tested in accordance with the requirements of Arizona Test Method 212a.
2. A minimum of 70 percent, by weight, of the material retained on the No. 8 (2.36 millimeter) sieve shall have at least one rough, angular surface produced by crushing when tested in accordance with the requirements of Arizona Test Method 212a.
3. The percent passing the No. 200 (75 micrometer) sieve shall include the amount of mineral admixture.

Mineral aggregate shall conform to the requirements found in Table 406-3 when tested in accordance with the applicable test methods.

**TABLE 406-3**

**MINERAL AGGREGATE CHARACTERISTICS**

<u>Characteristic</u>	<u>Test Method</u>	<u>Requirement</u>
Combined Bulk Specific Gravity	AASHTO T 85, Arizona Test Method 211	2.35 to 2.85
Combined Water Absorption	AASHTO T 85, Arizona Test Method 211	0.00 to 2.50
Sand Equivalent	AASHTO T 176	Note 2
Crushed Faces Table 406-2	Arizona Test Method 212	Minimum Values per
Abrasion (Note 1) 500 Rev., Max. 40%	AASHTO T 96	100 Rev., Max. 9%

Note (1): Abrasion shall be run on samples from each source of mineral aggregate.  
Note (2): Minimum 50 for non-RAP mixes; Minimum 55 for RAP mixes.

Tests on aggregates outlined in Table 406-3 shall be performed on materials furnished for mix design purposes and composited to the mix design gradation, excluding recycled asphalt pavement (RAP) if utilized.

Mineral aggregate from a source or combination of sources which does not meet the requirements, according to the contractor's mix design proposal, for combined bulk specific gravity and/or combined water absorption up to a maximum of 3.0 percent, but meets the other requirements of Table 406-3 will be further considered for acceptance by the Engineer if: a) the total estimated cost of all asphaltic concrete components, using the mix design unit weight, asphalt cement content and mineral admixture percentage, does not exceed the total amount bid for these items by more than 5.0 percent; or b) a supplemental agreement is executed adjusting the unit prices of asphaltic concrete components such that the total estimated cost does not exceed the total amount bid by more than 5.0 percent.

**406-2.04 Mineral Admixture.** The mix design shall include a mineral admixture. The amount of mineral admixture used shall be a minimum of 0.5 percent, by weight, of the mineral aggregate, with the exact amount to be specified in the mix design. A maximum of 2.0 percent admixture will be permitted. Mineral admixture shall be either portland cement, blended hydraulic cement or hydrated lime conforming to the requirements of Table 406-4.

**TABLE 406-4**  
**MINERAL ADMIXTURE**

<u>Material</u>	<u>Requirement</u>
Portland Cement, Type I or II	ASTM C 150
Blended Hydraulic Cement, Type IP	ASTM C 595
Lime	ASTM C 1097

A Certificate of Analysis, conforming to the requirements of Subsection 106-5, shall be submitted to the Engineer.

**406-2.05 Bituminous Material.** Unless otherwise specified in the Special Provisions, the bituminous material shall be an asphalt binder performance grade PG 70-10 when tested in accordance with the requirements of AASHTO Provisional Standard MP1. The pressure aging temperature shall be 100 °C.

A Certificate of Analysis conforming to the requirements of Subsection 106-5 shall be submitted and duplicate samples per shift shall be taken. In addition, the supplier shall determine the mixing and the compaction temperature ranges for each PG asphalt binder used for mix design purposes. The mixing temperature range is defined as the range of temperatures where the unaged asphalt binder has a rotational viscosity  $0.17 \pm 0.02$  pascal seconds measured in accordance with ASTM D 4402. The compaction temperature range is defined as the range of temperatures where the unaged asphalt binder has a rotational viscosity  $0.28 \pm 0.03$  pascal seconds measured in accordance with ASTM D 4402. The testing required by ASTM D 4402 shall be performed at 135 °C and 175 °C, and the results plotted on a semi-log graph with viscosity (logarithmic scale) versus temperature (arithmetic scale). PG asphalt binders that are polymer modified shall have mixing and compaction temperature ranges based on the manufacturer's recommendations if the mixing temperature range exceeds 163 °C and/or the compaction temperature range exceeds 149 °C as determined by the ASTM D 4402 procedure.

If it is determined by testing that bituminous materials used in asphaltic concrete production fails to meet the requirements of the AASHTO Provisional Standard MP1 for the specified grade, the contract unit price of the asphaltic concrete will be adjusted by the dollar amount per ton (*metric ton*) shown in Table 110-4, when the asphaltic concrete is allowed to remain in place. Should the bituminous material be in reject status, the Contractor shall, upon request by the Engineer, supply an engineering analysis of the expected performance of the material in which the bituminous material is incorporated. The engineering analysis shall detail any proposed corrective action and anticipated effect of such corrective action on the performance. Asphaltic concrete not allowed to remain in place shall be removed at no additional cost to the Agency and replaced with asphaltic concrete meeting the requirements of these specifications.

**406-2.06 Mix Design Proposal.**

**(A) New Mix Designs.** Utilizing mineral aggregate and recycled asphalt pavement (RAP), if utilized, which has been crushed, processed, separated and stockpiled, a mix design proposal shall be formulated and submitted by the contractor to the Engineer.

The proposal shall be based on the mix design criteria and other requirements herein specified, utilizing asphalt cement and mineral admixture of the type and from the sources proposed for use in the production of asphaltic concrete.

Marshall specimens shall be prepared and mix properties determined in accordance with Arizona Test Method 815 and Arizona Test Method 802. The mix design shall be prepared under the direct supervision of a Professional Engineer experienced in the development of asphaltic concrete mix designs and mix design testing.

The mix design proposal shall contain as a minimum:

- (1) The name and address of the testing organization and the individual responsible for the mix design development and testing.
- (2) The specific location(s) of the source(s) of mineral aggregate.
- (3) The supplier, refinery, and type of asphalt cement, and the source and type of mineral admixture, and the percentage of each to be used.
- (4) The anticipated mineral aggregate and recycled asphalt pavement (RAP) gradation in each stockpile.
- (5) Mix design gradation. The mix design shall contain the gradation of the mineral aggregate and recycled asphalt pavement (RAP), if utilized, as well as the mix gradation with the mineral admixture if it is used. If recycled asphalt pavement (RAP) is utilized, the mix design shall display both the gradation of the virgin aggregate without RAP and the virgin aggregate with RAP.
- (6) The results of all testing, determinations, etc., such as: specific gravity of each component, water absorption, sand equivalent, loss on abrasion, crushed faces, uncompacted void content, immersion compression results (Index of Retained Strength, wet and dry strengths), Marshall stability and flow, asphalt absorption, percent air voids, voids in mineral aggregate, and bulk density. Historical abrasion values may be supplied on existing sources.
- (7) The Viscosity-Temperature curve together with the laboratory mixing and compaction temperature ranges.

The mix design proposal shall be submitted and signed by a person authorized by the contractor to act in such matters on his/her behalf. The mix design proposal shall be submitted to the Agency a minimum of three weeks prior to the scheduled start of production.

The Engineer will review the mix design proposal to assure that it contains all required information. If it does not, it will be returned, within three working days, for further action and resubmission by the contractor.

**(B) Previously Utilized Mix Designs.** The contractor may propose to use an established mix design from a previously utilized source or a combination of sources. The previous mix design will be accepted upon request, within three working days, if acceptable evidence is provided with the request that the materials to be incorporated have not been changed and the mix design had been approved by the Agency within the last twenty four month period.

Evidence shall consist of analyses of stockpile gradations, sand equivalents and crushed faces and certification that crushing, screening or other processing methods are unchanged, that the asphalt

cement is of the same source and type, and mineral admixture, if required, is of the same type. Such evidence and certification shall be considered as a complete mix design proposal in lieu of the requirements of Subsection 406-2.06 (A).

If the Engineer questions the evidence provided, he may require that samples be obtained of the various stockpiles sufficient for testing to verify the above information. Should such testing indicate results not meeting the requirements outlined in Table 406-6, Items 1 through 10, the Engineer will inform the contractor within three working days of receipt of the samples, and a new mix design proposal conforming to the requirements of Subsection 406-2.06 (A) will then be required.

**406-2.07 Mix Design.** Following submission of a complete mix design proposal by the contractor, samples of the produced mineral aggregate stockpiles and recycled asphalt pavement (RAP) stockpiles, if utilized, including any blend material, shall be obtained by the contractor and witnessed by the Engineer so that both parties are satisfied that samples are representative of the mineral aggregates to be utilized in the asphaltic concrete production.

Samples shall consist of approximately 600 pounds (*275 kilograms*) of mineral aggregate and recycled asphalt pavement (RAP), if utilized, in proportion to the proposed stockpile usage, along with five 1 gallon (*4 liter*) cans of the proposed asphalt cement. Mineral admixture of the type to be used in the mix shall also be furnished by the contractor. These samples shall be placed in sample sacks in the presence of the Engineer and fully identified, and shall then be transported, by the contractor, to the Agency's laboratory where they will be split and one-half set aside for a period of 30 calendar days for possible referee testing, after which they will be discarded.

Utilizing the samples, the laboratory will determine if the proposed mix design meets the requirements of Subsection 406-2.08. If the proposed mix design meets all the requirements, it will be the approved mix design.

If the proposed mix design fails to meet all the requirements necessary, it will be disapproved by the Engineer. The contractor, upon notification that the proposal is disapproved, shall prepare, and submit for approval, a new mix design proposal; however, should the contractor wish to protest the Engineer's decision, on the basis of a written request from said contractor, the samples set aside will be provided by the Agency to an independent, approved laboratory, selected from a list of three Arizona Department of Transportation certified laboratories named by the contractor in his written request, for referee verification testing within two working days of the contractor's request. The results of such testing shall be binding upon the Agency and the contractor. Testing will be paid for by the contractor; however, should such testing prove the proposal to be satisfactory, the Agency will approve the mix design proposal, reimburse the contractor for the private laboratory costs and issue an extension of the contract time for the time required for such testing.

The approved mix design shall specify a single percent of material passing each required sieve; the approximate percent of material to be used from each source including the recycled asphalt pavement (RAP) source, if utilized; the type, source and percent of asphalt cement; the percent effective voids; the type and percent of any mineral admixture; the laboratory bulk density and any special treatment.

If approval of the mix design is contingent upon the use of a minimum or maximum percentage of special materials such as washed or imported aggregates, the approved mix design will also contain such stipulation.

**406-2.08 Verification Testing.** Mineral aggregate samples submitted for verification testing will be combined in the proportions specified in the contractor's proposed mix design. The resultant composite gradation will be compared to the proposed mix design gradation and the percentage deviations determined. The required action is determined from Table 406-5.

**TABLE 406-5**

<b>ALLOWABLE DEVIATIONS FROM PROPOSED TARGETS</b>			
<u>Sieve Size</u>	<u>Proceed</u>	<u>Adjust</u>	<u>Reject</u>
3/8 inch (9.5 mm) or larger	<u>+3</u>	> <u>+3</u> to <u>+8</u>	> <u>+8</u>
No. 4* (4.75 mm) (Note 1)	<u>+2</u>	> <u>+2</u> to <u>+6</u>	> <u>+6</u>
No. 8 and No. 40 (2.36 mm and 425 μm)	<u>+2</u>	> <u>+2</u> to <u>+6</u>	> <u>+6</u>
No. 200 (75 μm)	<u>+0.5</u>	> <u>+0.5</u> to <u>+3</u>	> <u>+3</u>

\*Note 1: No. 4 (4.75 mm) sieve size criteria is applicable to Mix No. 3 (Table 406-2) only.

If the deviations are such that they fall into the adjust column of Table 406-5, the contractor has the option to request artificial grading of the samples in accordance with the requirements of Arizona Test Method 244 or to resample the material. In lieu of resampling, the contractor may elect to submit new stockpile percentages.

When the final composite, including recycled asphalt pavement (RAP) if utilized, is determined, tests will be performed in accordance with Arizona Test Method 827 for conformance to the criteria of Table 406-6.

**TABLE 406-6**  
**VERIFICATION CRITERIA**

<u>Property</u>	<u>Allowable Deviation from Proposal Targets</u>	<u>Values</u>
1) Sand Equivalent	-10 (Note 1)	Note 3
2) Crushed Faces, Percent	-----	(Note 2)
3) Abrasion 100 Revolutions	-----	Note 3
500 Revolutions	-----	Note 3
4) VMA, Percent	± 1.0	Note 4
5) Effective Voids, Percent	± 1.5	3.8 Min.
6) Stability, Pounds ( <i>kN</i> )	-----	1,750 Min. (8.0 Min)
7) Flow, 0.01-Inch ( <i>mm</i> )	-----	7-17 (1.8-4.3)
8) Index of Retained Strength, Percent	-----	60 Min.
9) Wet strength, psi ( <i>MPa</i> )	-----	140 Min. (0.95 Min)
10) Absorbed Asphalt Percent	-----	1.0 Max.

Note 1: In verifying previously used mix designs only.

Note 2: Refer to Table 406-2.

Note 3: Refer to Table 406-3

Note 4: Refer to Table 406-1

Results of testing will be verbally furnished to the contractor within fifteen working days following the date of receipt of both an acceptable mix design proposal and the samples in the Agency laboratory. If the contractor elects to artificially adjust the gradation, then an additional two working days will be required for verification testing. The contractor will be verbally notified of failing test results within one working day of failure.

**406-2.09 Mix Design Revisions.** The contractor shall not significantly change his methods of crushing, screening, or stockpiling from that used during production of material used for mix design purposes without approval of the Engineer or submitting for approval, a new mix design proposal in accordance with Subsections 406-2.06 (A) and 406-2.07. Significant changes may include changes in the amount or type of materials rejected or wasted, changes in the amount of materials crushed, or reductions in the amount of crushed fines.

During production of asphaltic concrete, the Engineer shall independently test samples of the mineral aggregate. The mineral aggregate samples shall be obtained and tested in accordance with the requirements of Subsection 406-2.03 and Table 406-3. Should the results of the testing indicate values that fall outside the allowable deviation from the mineral aggregate characteristics specified

in Table 406-6, Items 1 through 10, paving operations shall cease until a new mix design proposal, addressing the deficiencies and conforming to the requirements of Subsection 406-2.06 (A), is approved.

At any time after a mix design has been approved, the contractor may submit a new mix design proposal to the Engineer in accordance with Subsections 406-2.06 (A) and 406-2.07. If the revised mix design proposal is determined to meet all the requirements, the Engineer will approve the proposal and it shall be the approved mix design.

During the production of asphaltic concrete, the contractor, on the basis of field test results, may request a change to the approved mix design Target Values. The Engineer will evaluate the proposed changes and notify the contractor verbally of his decision within three working days of the receipt of the request. This verbal notification will be promptly verified, in writing, by the Engineer. If approved, the revised Target Values will be applied to the samples immediately following the request for Target Value changes. If the Engineer determines that the test results indicate that the asphaltic concrete previously sampled will perform satisfactorily, the Engineer may apply the revised Target Values to samples taken prior to the request for the Target Value change(s).

If, at any time, changes are made in the source of asphalt cement, source(s) of mineral aggregate, or proportional changes, in violation of approved mix design stipulations, production shall cease until the contractor has approval for a new mix design or complies with the approved mix design.

**406-2.10 Time and Cost for Mix Designs and Verification Testing.** The number of working days established for completion of the work includes fifteen days for the required verification of the first mix design proposal. Should this proposal be disapproved, the contract time shall be extended, if requested, for no more than 15 working days for formulating one new mix design proposal and verification testing by the Agency. Additional contract time will not be granted for subsequent mix design proposals and associated verification testing.

Once a mix design proposal has been verified and approved by the Engineer, the costs associated with verification testing for subsequent mix design proposals requested by the contractor shall be borne by the contractor.

#### **406-2.11 Acceptance of Materials.**

**(A) General.** The contractor's attention is directed to the requirements of the Standard Specifications in Subsection 105-12 under Removal of Unacceptable and Unauthorized Work and Section 110, Corrective Requirements For Deficiencies. The Agency reserves the right to suspend the work should the following occur:

- (1) Three or more consecutive Mixture Property or Compaction sample test results that are subject to pay adjustment(s).
- (2) Five or more Mixture Property or Compaction sample test results that are subject to pay adjustments within any ten consecutive samples.

If the Agency elects to suspend the work for any of these conditions, the contractor shall either submit a revised mix design in accordance with Subsection 406-2.06, or submit an engineering analysis. The engineering analysis shall detail the course of action necessary to correct deficiencies in the contractor's present production methods such that further production can be accomplished without penalties. If approved by the Engineer, the revised mix design or course of action proposed

in the engineering analysis, shall be implemented, and the work may continue. Costs or delays due to the provisions of this subsection are not compensable.

The acceptance of the mineral aggregate gradation, the asphalt cement content and the effective voids shall be determined on the basis of the tests specified herein. The Engineer will determine the variance from the stated values of each mix characteristic based on the measured value of each characteristic. The Engineer shall use this variance to determine the appropriate monetary pay adjustment, or action, from Section 110, to be applied to the deficient mix quantity.

The Engineer, at any time, may increase the frequency of sampling and testing.

**(B) Mineral Aggregate Gradation in Asphaltic Concrete.** For each 500 tons (450 metric tons) or portion thereof of asphaltic concrete, at least one sample of mineral aggregate will be taken. The Engineer will split the sample in half, saving one half of the sample for 15 days. Samples will be taken in accordance with the requirements of Arizona Test Method 105 on a random basis, just prior to the addition of asphalt cement, by means of a sampling device which is capable of producing samples which are representative of the mineral aggregate. The device, which shall be approved by the Engineer, shall be furnished by the contractor. In any shift that the production of asphaltic concrete is less than 500 tons (450 metric tons), at least one sample will be taken.

Samples will be tested for conformance with the mix design gradation target values in accordance with the requirements of Arizona Test Method 201.

The sand equivalent will be determined by the Engineer in accordance with the requirements of AASHTO T 176. The percent of crushed faces will be determined in accordance with Arizona Test Method 212.

**(C) Asphalt Cement Content and Effective Voids.** For each 500 tons (450 metric tons) or portion thereof of asphaltic concrete, at least one sample of the asphaltic concrete will be taken on a random basis. The Engineer will split the sample in half, saving one half for 15 days. Samples will be taken in accordance with the requirements of Arizona Test Method 104, Section 2, or ASTM 3665 current on the date of bid award.

The asphalt cement content will be determined in accordance with the requirements of Arizona Test Method 421 or Interim Arizona Test Method 427, using an ignition furnace. The asphalt cement content obtained will be compared to the mix design target value.

Marshall density and maximum theoretical density shall be tested in accordance with the requirements of Arizona Test Method 416. Effective voids shall be determined in accordance with the requirements of Arizona Test Method 424, Section 2.

**(D) Referee Testing.** In the event the contractor elects to question the results obtained for a particular sample, the contractor may make a written request for additional testing of the sample within 15 days after the sample was obtained. The contractor may request additional testing for either the mineral aggregate gradation of the aggregate sample or the asphalt cement content and effective voids of the hot mix sample, or both. The additional testing shall be performed in an independent approved laboratory designated by the Engineer. The testing of the samples will be performed by the independent laboratory without knowledge of the specific project conditions such as the identity of the contractor or mix design laboratory, the test results obtained by the Agency or the mix design targets. The samples previously saved will be tested as specified in Subsection 406-2.11 (B) and (C). A new Total Pay Adjustment Amount will be determined for the sample. The results of the additional testing will be binding on both the contractor and the Agency. The Agency will pay for the testing; however, if the dollar pay adjustment amount of the sample does

not improve or is reduced, or the sample remains in reject, payment to the contractor for asphaltic concrete, after the application of all penalties shall be reduced by an amount equivalent to the cost of the testing.

### **406-3 CONSTRUCTION DETAILS**

**406-3.01 Quality Control.** Quality control shall be the responsibility of the contractor. The Engineer reserves the right to obtain samples of any portion of any material at any point of the operations for testing.

**406-3.02 Stockpiling.** The contractor will not be allowed to feed the hot plant from stockpiles containing less than two full days of production, unless only two days production or less remain to be done or special conditions exist where the Engineer deems this requirement waived.

Mineral aggregate and recycled asphalt pavement (RAP), if utilized, shall be separated and stockpiled so that segregation is minimized. Construction of stock piles shall conform to the requirements of Subsection 1006-2.06 (A) (1), (3) and (4).

**406-3.03 Proportioning.** Mixing plants shall conform to the requirements of AASHTO M 156, except as modified herein. The contractor shall provide documentation by calibration charts or other approved means that the mineral aggregate, recycled asphalt pavement (RAP), if utilized, asphalt cement and mineral admixture is being proportioned in accordance with the approved mix design.

If a mineral admixture is necessary to produce asphaltic concrete that meets the design criteria, the mineral admixture shall be mechanically mixed with the mineral aggregate prior to combining the mineral aggregate and asphalt cement. The Engineer may direct a spray of water be applied either to control the loss of the mineral admixture or to comply with any mix design requirements for set mixing of aggregate and admixture.

If a drum mix plant is used, the mineral admixture shall be added and thoroughly mixed by means of a mechanical mixing device prior to the mixture entering the drum drier. The mineral mixture shall be weighed across a weigh belt or an approved alternative weighing system, with a weigh totalizer prior to entry into the mechanical mixing device. The mechanical mixing device shall be a pugmill type mixer consisting of at least two motorized shafts with mixing paddles. The mixing device shall be designed such that the mixture of aggregate and admixture is moved in a near horizontal direction by the mixing paddles without the aid of conveyor belts for a distance of at least 3 feet (*1 meter*). Mixing devices which permit the aggregate to fall through mixing blades onto a belt or chute are not acceptable. The mixing device's rated capacity in tons per hour shall not be exceeded by the rate of aggregate feed to the mixer. The mixer shall be constructed to prevent the leakage of the contents. The mixer shall be situated in the aggregate delivery system at a location where the mixed material can be readily inspected on a belt prior to entry into the drum. The mixing device shall be capable of effective mixing in the full range of asphaltic concrete production rates. If a batch plant is used, the mineral admixture shall be added and thoroughly mixed in the pugmill prior to adding asphalt cement.

The contractor shall furnish daily documentation to the Engineer that the required amount of mineral admixture has been incorporated into the asphaltic concrete.

A positive signal system and a limit switch device shall be installed in drum drier plants at the point of introduction of the admixture. The positive signal system shall be placed between the metering device and the drum drier, and utilized during production whereby the mixing shall automatically be stopped if the admixture is not being introduced into the mixture.

Unless specified in the mix design approved for the project, no fine material which has been collected in the dust collection system shall be returned to the mixture unless the Engineer, on the basis of tests, determines that all or a portion of the collected fines can be utilized. If the Engineer so determines, he will authorize, in writing, the utilization of a specific proportion of the fines; however, authorization will not be granted unless the collected fines are uniformly metered into the mixture.

Mineral aggregate, recycled asphalt pavement (RAP), if utilized, mineral admixture, and asphalt cement shall be proportioned by volume, by weight, or by a combination of volume and weight.

When mineral aggregate, recycled asphalt pavement (RAP), if utilized, mineral admixture, and asphalt cement are proportioned by weight, all boxes, hoppers, buckets or similar receptacles used for weighing materials, together with scales of any kind used in batching materials, shall be insulated against the vibration or movement of the rest of the plant due to the operation of any equipment so that the error in weighing with the entire plant operating shall not exceed two percent for any setting nor one and on-half percent for any batch. Bituminous material shall be weighed in a heated, insulated bucket suspended from a springless dial scale system.

When mineral aggregate, recycled asphalt pavement (RAP), if utilized, mineral admixture, and asphalt cement are proportioned by volume, the correct portion of each mineral aggregate size introduced into the mixture shall be drawn from the storage bins by an approved type of continuous feeder which will supply the correct amount of mineral aggregate and recycled asphalt pavement (RAP), if utilized, in proportion to the asphalt cement and so arranged that the proportion of each mineral aggregate size can be separately adjusted. The continuous feeder for the mineral aggregate and recycled asphalt pavement (RAP), if utilized, shall be mechanically or electrically actuated.

**406-3.04 Drying and Heating.** A recording pyrometer or other approved recording thermometric instrument sensitive to a rate of temperature change not less than 10° F (-12 °C) per minute shall be placed at the discharge chute of the drier so as to record automatically the temperature of the asphaltic concrete or mineral aggregate. A copy of the recording shall be available to the Engineer at the end of each shift.

The moisture content of the asphaltic concrete immediately behind the paver shall not exceed one percent. The moisture content will be determined in accordance with Arizona Test Method 406. Drying and heating shall be accomplished in such a manner as to preclude the mineral aggregate and recycled asphalt pavement (RAP) from becoming coated with fuel oil or carbon.

**406-3.05 Mixing.** The production of the plant shall be governed by the rate required to obtain a thorough and uniform mixture of the materials. Mixing shall continue until the uniformity of coating, when tested in accordance with the requirements of AASHTO T 195, is at least 95 percent.

A positive signal system shall be provided to indicate the low level of mineral aggregate and recycled asphalt pavement (RAP), if utilized, in the bins. The plant will not be permitted to operate unless this signal system is in good working condition. Each bin shall have an overflow chute or a divider to prevent material from spilling into adjacent bins.

The temperature of asphaltic concrete upon discharge from the mixer shall not exceed 325° F (165 °C). If the asphaltic concrete is discharged from the mixer into a hopper, the hopper shall be constructed so that segregation of the asphaltic concrete will be minimized.

#### **406-3.06 Placing and Finishing.**

**(A) General Requirements.** The handling of asphaltic concrete shall at all times be such as to minimize segregation. Any asphaltic concrete which displays segregation shall be removed and replaced.

All wheels and tires of compactors and other equipment shall be wiped, when necessary, with an approved product in order to prevent the picking up of the asphaltic concrete.

Before asphaltic concrete is placed, the surface to be paved shall be cleaned of objectionable material, and a bituminous tack coat shall be applied, if directed by the Engineer.

A light coat of bituminous material shall be applied as directed to edges or vertical surfaces against which asphaltic concrete is to be placed.

The base or subgrade upon which the asphaltic concrete is to be placed shall be prepared in accordance with the applicable requirements for the material involved and maintained in a smooth and firm condition until placement. Asphaltic concrete shall not be placed on a frozen or excessively wet base or subgrade.

At any time, the Engineer may require that the work cease or that the work day be reduced in the event of weather conditions which would have an adverse effect upon the asphaltic concrete.

All asphaltic concrete shall be placed either as a leveling course or as a surfacing course. Leveling courses are defined as courses placed for the primary purpose of raising an existing paved or unpaved surface to a smooth plane. Surfacing courses are defined as courses placed to serve either as the traffic surface or as a surface upon which a finishing course or seal coat is to be placed.

The thickness of leveling and surfacing courses will be shown on the project plans. No change in thickness will be allowed without the written approval of the Engineer. When the plans indicate a leveling course or surfacing course thickness greater than 4 inches (*100 millimeters*), that course shall be placed in multiple lifts of equal thickness with no single lift having a compacted thickness of more than 4 inches (*100 millimeters*).

The contractor shall furnish a delivery ticket for each type of asphalt concrete used in the construction of any project. The minimum information to be shown on each delivery ticket shall be the ticket number, date, project name, truck number, truck tare weight, truck gross weight, net tons, time of loading, and type of mix by name. Contractor product code numbers will not preclude or be an acceptable substitute for this information. An authorized representative of the contractor shall be responsible for each delivery ticket and shall sign each delivery ticket accepting the contractor's responsibility for the asphaltic concrete. The contractor shall furnish the delivery ticket to the Engineer at the time of placement.

**(B) Hauling Equipment.** The mixture shall be transported from mixing plants to the work site in tight vehicles having clean, smooth beds.

The inside surface of the vehicles used for the transportation of plant mixes shall be lightly coated, just before the vehicles are loaded, with either a whitewash of lime and water, soap solutions or detergents, as approved by the Engineer.

After application, excess fluid shall be drained from the truck bodies.

**(C) Loading Asphaltic Concrete into the Paving Machine.** If the asphaltic concrete is dumped from the hauling vehicles directly into the paving machine from trucks, care shall be taken to avoid jarring the machine or moving it out of alignment. No vertical load shall be exerted on the paving machines by the trucks. Trucks, while dumping, shall be securely attached to the paving machine.

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

**(D) Placing and Finishing Asphaltic Concrete by Means of Self-Propelled Paving Machines.** All courses of asphaltic concrete shall be placed and finished by means of self-propelled paving machines except under certain conditions or at certain locations where the Engineer deems the use of self-propelled paving machines impracticable.

In order to achieve, as far as practicable, a continuous operation, the speed of the paving machine shall be coordinated with the production of the plant.

Self propelled paving machines shall be provided with an activated screed or strike-off assembly. The machine shall be capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thicknesses shown on the plans. When screed extensions are permitted by the Engineer for placement of mainline pavement, such extensions shall be of the same design as the main screed. The screed or strike-off assembly shall be heated as necessary to produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture. When laying mixtures, the paver shall be capable of operating at forward speeds consistent with satisfactory placement of the mixtures.

Screeds shall include any strike-off device operated by tamping or vibrating action which is effective without tearing, shoving or gouging the mixture and which produces a course with a uniform texture and density for the full width being paved. Screeds shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required.

Tapered sections not exceeding 8 feet (*2.4 meters*) in width, or widened sections not exceeding 4 feet (*1.2 meters*) in width may be placed and finished by other means as approved by the Engineer.

The mixture shall be laid upon an approved clean, dry surface, spread and struck off to the established grade and elevation. Approved bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable. Bituminous pavers shall be in the charge of an experienced operator.

If there are areas to be paved which are small and scattered, a paver may be dispensed with and the course spread by hand methods if approved by the Engineer. For such areas, the mixture shall be dumped, spread and leveled to give the required section and compacted thickness.

Before any rolling is started, the loose mat shall be checked, any irregularities adjusted, and all unsatisfactory material shall be removed and replaced.

**(E) Automatically Actuated Control System.** Except under certain conditions or at certain locations where the Engineer deems the use of automatic controls impracticable or unnecessary, all courses of asphaltic concrete shall be placed and finished by means of self-propelled paving machines equipped with an automatically actuated control system.

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

The controls shall automatically adjust the screed and increase or decrease the mat thickness to compensate for irregularities that are in the surface being paved. The controls shall be capable of maintaining the proper transverse slope and be readily adjustable so transitions and super-elevated curves can be satisfactorily paved. The controls shall operate from suitable fixed or moving references as prescribed herein.

The transverse slope and longitudinal grade screed controls of the bituminous paver may be manually adjusted, where permitted by the Engineer, and according to the requirements specified herein.

The paving machine(s) shall be at the job site or locally available sufficiently ahead of the start of paving operations to allow for examination by the Engineer. Any paving machine found worn or defective either before or during its use shall be immediately repaired to the satisfaction of the Engineer or replaced.

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

- Ski-type device at least 30 feet (*9 meters*) in length, supported throughout its entire length.
- Short ski.
- 500 feet (*150 meters*) of control line.
- Joint matcher shoe.

When the control line is used it shall be set and maintained taut by the contractor to the grade and alignment established by the Engineer.

Failure of the control system to function properly shall be cause for the suspension of the asphaltic concrete operations if so directed by the Engineer.

**406-3.07 Joints.** The finished pavement at all joints shall comply with the surface smoothness requirements, specified in Subsection 406-3.10, when tested with a straightedge placed across the joint, and exhibit the same uniformity of texture and compaction as other sections of the course.

The placement of successive courses shall be such that all joints are offset at least 6 inches (*150 millimeters*) from the joint of the lower pavement course, unless otherwise approved by the Engineer.

**(A) Transverse.** The placement of the courses shall be as continuous as possible to limit the number of transverse joints. The transverse joints in adjacent lanes shall be staggered a minimum of

10 feet (3 meters). The transverse joint shall be formed by cutting back on the previous run to expose the full depth of the course. The exposed edge of the existing course that will become part of the joint shall be the full thickness of the course, straight and vertical. The joint shall be formed by using a power driven saw or other approved apparatus to cut, in a neat line, the cold existing pavement course to its full thickness to expose a fresh face.

**(B) Longitudinal.** Placement of the surface course shall be carefully planned to assure that the longitudinal joints in the surface course will correspond with the edges of proposed traffic lanes. Other joint arrangements will require approval of the Engineer. When traffic is maintained on the roadway during paving operations, the mixture shall be laid such that no more than 100 feet (30 meters) of the pavement edge will be exposed at the end of the working day. The Engineer may permit an exposed edge of this type in excess of 100 feet (30 meters) providing that the edge is adequately protected against damage by vehicles and equipment.

Joints shall be vertical, formed by a slope shoe or hot lapped, and shall be compacted while the mixture is still hot.

The placement of longitudinal joints in successive courses shall be such that joints are offset at least one foot (*300 millimeters*) from the joint of the immediate underlying pavement course, unless otherwise approved by the Engineer.

#### **406-3.08 Compaction.**

**(A) Temperature Requirements.** Asphaltic concrete placed in nominal thicknesses of 1-1/2 inch (38 millimeters) or less shall be placed only when the temperature of the surface on which the asphaltic concrete is to be placed is at least 65° F (18 °C). Asphaltic concrete immediately behind the laydown machine shall be a minimum of 250° F (120 °C).

Asphaltic concrete placed in nominal thicknesses greater than 1-1/2 inches (*38 millimeters*) shall be placed only when the ambient temperature is at least 40° F (5 °C) and rising. Placement shall be stopped when the ambient temperature is below 45° F (7 °C) and falling. Asphaltic concrete immediately behind the laydown machine shall be a minimum of 250° F (120 °C).

**(B) Equipment.** Compacting and smoothing shall be accomplished by the use of self-propelled equipment. Compactors shall be pneumatic tired and/or steel wheel.

The rollers shall be in good mechanical condition, and capable of operating at speeds slow enough to avoid displacement of the mixture. The number and weight of rollers shall be sufficient to satisfactorily compact the mixture while it is still in a workable condition. The use of equipment which results in excessive crushing of aggregate will not be permitted. Vibratory rollers shall be of a type that are specifically designed for the compaction of bituminous concrete.

Compactors shall be operated in accordance with the manufacturer's recommendations. Compactors shall be designed and properly maintained so that they are capable of accomplishing the required compaction.

Static steel wheel compactors used on mainline paving shall weigh not less than eight tons (*7.25 metric tons*).

Pneumatic tired compactors shall be the oscillating type with at least seven pneumatic tires of equal size and diameter. Wobble-wheel compactors will not be permitted. The tires shall be spaced so that the gaps between adjacent tires will be covered by the following tires. The tires shall be capable

of being inflated to 90 pounds per square inch (*620 kilopascals*) and maintained so that the air pressure will not vary more than five pounds per square inch (*35 kilopascals*) from the designated pressure. Pneumatic tired compactors shall be constructed so that the total weight of the compactor will be varied to produce an operating weight per tire of not less than 5,000 pounds (*2270 kilograms*). Pneumatic tired compactors shall be equipped with skirt-type devices mounted around the tires so that the temperature of the tires will be maintained during the compaction process.

**(C) General Requirements.** Immediately after the bituminous mixture has been spread, struck off and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. The surface shall be rolled when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking or shoving. When the compaction procedure used by the contractor fails to produce results acceptable to the Engineer, the procedure shall be adjusted to obtain the desired results. Rollers shall move at a slow and uniform speed in accordance with the manufacturer's recommendations.

Any displacement occurring as a result of the reversing of the direction of a roller, or from other causes, shall be corrected at once by the use of rakes and addition of fresh mixture as required. Care shall be exercised in rolling not to displace the line and grade of the edges of the bituminous mixture. To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with small quantities of detergent or other approved material, but in no case shall a solvent having any affect upon the bituminous pavement be used.

Along forms, curbs, headers, walls and other areas not accessible to the rollers, the mixture shall be thoroughly compacted with mechanical tampers as directed by the Engineer.

Suitable means shall be provided to keep pavers and other equipment and tools free from bituminous accumulations. The surface of the pavement shall be protected from drippings of oil, kerosene, or other materials used in paving and cleaning operations.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture which shall be compacted to conform with the surrounding area. Any area showing the excess of deficiency of bituminous material shall be corrected to the satisfaction of the Engineer.

**(D) Rolling Method Procedure.** For courses of 1-1/2 inches (38 millimeters) or less in nominal thickness, compaction shall consist of an established sequence of coverage using specified types of compactors. A pass shall be defined as one movement of a compactor in either direction. Coverage shall be the number of passes necessary to cover the entire width being paved.

The rolling sequence, the type of compactor to be used and the number of coverages required shall be as follows:

Rolling Sequence	Type of Compactor Option		No. of Coverages Option	
	No. 1	No. 2	No. 1	No. 2
Initial	Static Steel	Vibrating Steel	1	1
Intermediate	Pneumatic Tired	Vibrating Steel	4	2-4*
Finish	Static Steel	Static Steel	1-3	1-3

\* Based on the roller pattern which exhibits the best performance.

The Engineer shall select the option for compaction and, when pneumatic tired compactors are used, will verify, the tire pressure is in accordance with the manufacturer's recommendations.

When option No. 1 is used, one pneumatic tired roller shall be furnished for each 300 tons (275 *metric tons*) of asphaltic concrete placed per hour.

Steel wheel compactors shall not be used in the vibratory mode for courses of 1 inch (25 *millimeters*) or less in nominal thickness nor when the temperature of the asphaltic concrete falls below 180° F (80 °C).

Initial and intermediate compaction shall be completed before the temperature of the asphaltic concrete falls below 200° F (95 °C). All edges shall be rolled by a method approved by the Engineer.

Compaction will be deemed to be acceptable on the condition that the asphaltic concrete is compacted using the type of compactors specified, ballasted and operated as specified and with the number of coverages of the compactors as specified.

**(E) Compaction Control.** Compaction control for courses greater than 1 1/2 inches (38 *millimeters*) in nominal thickness shall be defined as the responsibility of the contractor, and shall be based on the anticipated rate of production and placement to determine the number and types of compactors and the sequence and manner in which they are to be used to achieve the specified density.

Responsibility for compaction control shall rest solely with the contractor.

Compaction shall be determined from samples taken utilizing mechanical coring equipment in accordance with the requirements of Arizona Test Method 104, Section 3. Cores shall be a minimum of four inches in diameter. The core samples shall be tested for acceptance in accordance with the requirements of Arizona Test Method 415. Compaction of a course shall continue until the compacted density of the Asphaltic Concrete achieves a minimum of 95 percent of the laboratory compacted density as determined by Arizona Test Method 410a. The laboratory density shall be the average of the laboratory densities determined from samples taken from the same day's production.

Compaction, other than finish rolling, shall be completed before the temperature of the asphaltic concrete falls below 200° F (95 °C). All edges shall be rolled by a method approved by the Engineer.

**406-3.09 Compacting Miscellaneous Items and Surfaces.** Asphaltic concrete used in the construction of curbs, spillways, and spillway inlets, ditches, catch basin entrances, median strips, sidewalks or other similar miscellaneous items or surfaces shall be compacted using compactors, hot hand tampers, smoothing irons, mechanical vibrating hand tampers or with other devices to the extent considered necessary by the Engineer.

**406-3.10 Surface Requirements and Tolerances.** All courses of asphaltic concrete shall be compacted as required, smooth and reasonably true to the required lines, grades, and dimensions.

Leveling course surfaces shall not vary more than 1/4 inch (*6 millimeters*) from the lower edge of a 10 foot (*3 meter*) straightedge when the straightedge is placed parallel to the center line of the roadway.

Surfacing course surfaces shall not vary more than 1/8 inch (*3 millimeters*) from the lower edge of a 10 foot (*3 meters*) straightedge when the straightedge is placed parallel to the center line of the roadway, nor shall the surface vary more than 1/4 inch (*6 millimeters*) on any portion of the pavement surface when a 10 foot (*3.0 meters*) straightedge is placed transverse to the center line.

#### **406-4 METHOD OF MEASUREMENT**

Asphaltic concrete will be measured by the ton (*metric ton*) for mainline paving and by either the ton (*metric ton*) or the square yard (*square meter*) for miscellaneous areas of paving as noted in the bidding schedule, for the specific use listed therein. When measured on the basis of tonnage (*metric tonnage*), such measurement will be for asphaltic concrete actually used, complete-in-place, and shall include the weight of mineral aggregate, recycled asphalt pavement (RAP), if utilized, asphalt cement, and approved admixtures.

Measurement, as provided above, will include asphaltic concrete used in the construction of intersections, turnouts, driveways, median strips, sidewalks, bike paths or other miscellaneous items or surfaces.

#### **406-5 BASIS OF PAYMENT**

The accepted quantities of asphaltic concrete, measured as provided above, will be paid for under the appropriate bid items at the contract unit price or adjusted unit price, complete-in-place.

Should testing determine the asphalt cement deficient in meeting the requirements specified in Section 1005 of the Standard Specifications, the asphaltic concrete, representing the half-shift or half-shifts in which such a deficient material was utilized, shall be evaluated as to acceptance in accordance with the requirements of Subsection 110-2.03.

Deficiencies in mineral aggregate gradation, asphalt cement content, asphaltic concrete thickness or compaction will be evaluated in accordance with the criteria established in Subsection 110-2.

**(406BIT\_ADJUST, 6/15/09)**

## SECTION 406 - ASPHALTIC CONCRETE

**406-5 BASIS OF PAYMENT** the first paragraph of the Standard Specifications is revised to read:

The accepted quantities of asphaltic concrete, measured as provided above, will be paid for under the appropriate bid items at the contract unit price or adjusted unit price, complete-in-place.

Due to fluctuating asphalt cement prices the unit price for asphaltic concrete will be adjusted based on the criteria and formula below.

The price for bituminous material or asphalt cement used in the asphalt concrete mixture will be determined monthly by the Agency based on the selling prices of asphalt cement published by the Arizona Department of Transportation, Contracts and Specifications Section (ADOT memorandum). The established price for bituminous material used in the asphaltic concrete mixture will be made available by the Agency upon request.

The "initial cost" for asphalt cement of all types, grades, etc. on projects will be the established price based on the ADOT memorandum for the selling prices during the month the bids are opened.

An adjustment in compensation will be made for either an increase or decrease in the price of asphalt cement as shown in the latest memorandum, current as of the date of use, as compared to the "initial cost".

The tons of asphalt cement that are paid for on an invoice basis to which the adjustment will be applicable are the tons which have been delivered to the project and subsequently incorporated into the work. The adjustment will be applicable on the date of use.

No additional compensation will be made for any additional or increased charges, costs, expenses, taxes, etc., which the contractor may have incurred since the time of bidding and which may be the result of any increase in the "initial cost" of asphalt cement.

After the expiration of the specified completion time set forth in the contract or as may be extended in accordance with the provisions of Subsection 108-8 of the Standard Specifications any adjustment in compensation made for asphalt cement incorporated into the work will be on the basis of the price of asphalt cement shown in the latest memorandum on the date of the expiration of the specified completion time, as hereinbefore specified.

Adjustment Formula:

**("Date of Use" cost of asphalt cement - "Initial" cost of asphalt cement) x % asphalt cement in mix design**

**EXAMPLE:** "Initial" cost at bid opening = \$100 per ton  
"Date of Use" cost = \$120 per ton  
% asphalt cement in mix design = 5.2

Unit Price adjustment to Asphaltic Concrete =  $(120-100) \times 0.052$   
=  $20 \times 0.052$   
= \$1.04 increase in the contract unit price for  
asphaltic concrete.

## SECTION 413 - ASPHALTIC CONCRETE (ASPHALT-RUBBER)

Is hereby added

### 413-1 DESCRIPTION

Asphaltic Concrete (Asphalt-Rubber), hereinafter asphaltic concrete, shall consist of furnishing all materials, mixing at a plant, hauling, and placing a mixture of aggregate materials, mineral admixture, and bituminous material (asphalt-rubber) to form a pavement course or to be used for other specified purposes, in accordance with the details shown on the project plans and the requirements of these specifications, and as directed by the Engineer.

The contractor shall be responsible for all adjustments to its equipment necessary to properly accommodate the use of asphalt-rubber as a bituminous material.

### 413-2 ASPHALTIC CONCRETE MIX DESIGN CRITERIA

Mix designs will be performed in accordance with Arizona Test Method 815, modified as necessary for Asphaltic Concrete (Asphalt-Rubber). Mix designs shall meet the criteria in Table 413-1.

<b>Criteria</b>	<b>Requirement</b>
1. Effective Voids: %, Range	5.5 ± 1.0
2. Voids in Mineral Aggregate: %, Min.	19.0
3. Absorbed Asphalt-Rubber: %, Range	0 - 1.0

### 413-3 MATERIALS

For comparative purposes, quantities shown in the bidding schedule have been calculated based on the following data:

Unit Weight, pcf	137.0
Bituminous Material, %	8.5
Mineral Admixture, %	1.0

**413-3.01 Mineral Aggregate Source.** There is no Agency-furnished source of mineral aggregate. The contractor shall provide a source in accordance with the requirements of Section 1001.

When the contractor selects a source or sources, it shall notify the Engineer. The contractor shall be solely responsible for assuring that the mineral aggregate meets all requirements and, when processed, is fully capable of providing asphaltic concrete which meets all the requirements of these specifications.

**413-3.02 Mineral Aggregate.** Coarse and intermediate mineral aggregate shall consist of crushed gravel, crushed rock, or other approved inert materials with similar characteristics, or a combination

thereof, conforming to the requirements of these specifications.

Fine mineral aggregate shall be obtained from crushed gravel or crushed rock. All uncrushed material passing a No. 4 sieve shall be removed prior to the crushing, screening, and washing operations necessary to produce the specified gradation. The contractor shall notify the Engineer a minimum of 48 hours in advance of crushing the material to be used as mineral aggregate, so all crushing operations are inspected. Existing stockpile material which has not been inspected during crushing will not be permitted for use unless the contractor is able to document to the Engineer's satisfaction that the mineral aggregate has been crushed. Any material inspected by the Agency as crushed material shall be separated from the contractors other stockpiles and reserved for use by the Agency.

Mineral aggregate shall be separated into stockpiles by the contractor. No individual stockpile usage shall be less than three percent of the total mineral aggregate. No individual stockpile shall be permitted to contain more than 6.0 percent passing the No. 200 sieve when tested in accordance with Arizona Test Method 201. If necessary, the contractor shall wash the mineral aggregate to meet this requirement. Mineral aggregate furnished for mix designs shall be representative of the source(s), and sampled from the materials stockpiles to be utilized in asphaltic concrete production. Mix designs shall be performed utilizing mineral aggregate which conforms to the grading limits in Table 413-2.

<b>TABLE 413-2 MIX DESIGN GRADING LIMITS FOR MINERAL AGGREGATE (WITHOUT ADMIXTURE)</b>	
<b>Sieve Size</b>	<b>Percent Passing</b>
3/4 Inch	100
1/2 Inch	80 - 100
3/8 Inch	65 - 80
No. 4	28 - 42
No. 8	14 - 22
No. 200	0 - 2.5

Mineral aggregate shall conform to the requirements in Table 413-3 when tested in accordance with the applicable test methods.

Tests on aggregates outlined in Table 413-3, other than abrasion, shall be performed on materials furnished for mix design purposes and composited to the mix design gradation. Abrasion shall be performed separately on samples from each source of mineral aggregate. All sources shall meet the requirements for abrasion.

<b>TABLE 413-3 MINERAL AGGREGATE CHARACTERISTICS</b>		
<b>Characteristics</b>	<b>Test Method</b>	<b>Requirement</b>
Combined Bulk Specific Gravity	Arizona Test Method 815	2.35 - 2.85
Combined Water Absorption	Arizona Test Method 815	0 - 2.5%
Sand Equivalent	AASHTO T 176	Minimum 55
Fractured Coarse Aggregate Particles	Arizona Test Method 212	Minimum 85% (two Fractured Faces determined on plus No. 4 material)
Abrasion	AASHTO T 96	100 Rev., Max 9% 500 Rev., Max 40%

**413-3.03 Mineral Admixture.** Mineral admixture will be required. The amount shall be 1.0 percent, by weight of the mineral aggregate, and shall be either Portland Cement type II or hydrated lime, conforming to the requirements of Table 413-4.

<b>TABLE 413-4 MINERAL ADMIXTURE</b>	
<b>Material</b>	<b>Requirement</b>
Portland Cement, Type II	ASTM C 150
Hydrated Lime	ASTM C 1097

A Certificate of Analysis conforming to the requirements of Subsection 106.05 shall be submitted to the Engineer.

**413-3.04 Bituminous Material.** Bituminous material shall be asphalt-rubber conforming to the requirements of Section 1009 of the specifications. The type of asphalt-rubber shall be Type 2. The crumb rubber gradation shall be Type B conforming to the requirements of Section 1009.

In no case shall the asphalt-rubber be diluted with extender oil, kerosene, or other solvents. Any asphalt-rubber so contaminated shall be rejected.

Any kerosene or other solvents used in the cleaning of equipment shall be purged from the system prior to any subsequent use of that equipment.

**413-3.05 Blotter Material.** An application of blotter material may be required following the placement of the asphaltic concrete and prior to opening the roadway to traffic. The blotter material shall conform to the requirements of Section 404. The blotter material shall be applied in one or more applications for a total application of two pounds per square yard. The Engineer may reduce or eliminate blotter material if deemed to be unnecessary.

#### **413-4 MIX DESIGN**

Approximately 300 pounds of produced mineral aggregate, in proportion to the anticipated percent usage, shall be obtained by the contractor and witnessed by the Engineer so that both parties are satisfied that samples are representative of the mineral aggregate to be utilized in the asphaltic concrete production.

The contractor shall also furnish representative samples of the following materials: a five-pound sample of the crumb rubber proposed for use, one gallon of asphalt cement from the intended supplier, three gallons of the proposed mixture of asphalt and rubber, and a one-gallon can of the mineral admixture to be used in the asphaltic concrete.

Along with the samples furnished for mix design testing, the contractor shall submit a letter explaining in detail its methods of producing mineral aggregate including wasting, washing, blending, proportioning, etc., and any special or limiting conditions it may propose. The contractor's letter shall also state the source(s) of mineral aggregate, the source of asphalt cement and crumb rubber, the asphalt-rubber supplier, and the source and type of mineral admixture.

The contractor will determine the percentage of asphalt-rubber to be used in the mix, the percentage to be used from each of the stockpiles of mineral aggregate, the composite mineral aggregate gradation, the composite mineral aggregate and mineral admixture gradation, and any special or limiting conditions for the use of the mix. These items will be submitted for the Engineer's approval.

The contractor will provide the material to be used for calibration of nuclear asphalt content gauges. The material will be generated by the contractor utilizing asphalt-rubber submitted for mix design purposes.

#### **413-5 MIX DESIGN REVISIONS**

The contractor shall not change its methods of crushing, screening, washing or stockpiling from those used during production of material used for mix design purposes without approval of the Engineer, or without requesting a new mix design.

During production of asphaltic concrete, the contractor, on the basis of field test results, may request a change to the approved mix design. The Engineer will evaluate the proposed changes and notify the contractor of the Engineer's decision within two working days of the receipt of the request.

If, at any time, unapproved changes are made in the source of bituminous material, source(s) of mineral aggregate, production procedures, or proportional changes in violation of approved mix design stipulations, production shall cease until a new mix design is developed, or the contractor complies with the approved mix design.

At any time after the mix design has been approved, the contractor may request a new mix design.

The costs associated with the testing of materials in the developing of mix designs after a mix design acceptable to the Agency has been developed shall be borne by the contractor.

If, during production, the Engineer on the basis of testing determines that a change in the mix design is necessary, the Engineer will issue a revised mix design. Should these changes require revisions to

the contractor's operations which result in additional cost to the contractor, the contractor will be reimbursed for these costs. However, the Engineer reserves the right to modify the asphalt-rubber content without compensation being made to the contractor involving additional operation costs.

## **413-6 ACCEPTANCE OF MATERIALS**

**413-6.01 General.** If the production of asphaltic concrete is stopped either for failure to meet the requirements specified hereinafter under Subsection 413-6.03, or because changes are made in the mix design, samples will be taken for calculating new consecutive averages either after production resumes or after the changes in the mix design have been made. The acceptance of the mineral aggregate gradation and the bituminous material content will be determined on the basis of the tests as hereinafter specified under Subsection 413-6.03. The Engineer reserves the right to increase the frequency of sampling and testing upon the resumption of asphaltic concrete production.

**413-6.02 Mineral Aggregate.** Aggregate shall be free of deleterious materials, clay balls, and adhering films or other materials that prevent thorough coating of the aggregate with the bituminous material.

During asphaltic concrete production, the Engineer shall obtain and test samples of mineral aggregate for the determination of the sand equivalent and fractured coarse aggregate particles. The sample shall be obtained either from the cold feed prior to addition of mineral admixture, or from the stockpiles. Should such testing indicate results not meeting the requirements outlined in table 413-3 for sand equivalent and fractured coarse aggregate particles, operations shall cease and the contractor shall have the option of requesting a new mix design or correcting deficiencies in the aggregate stockpiles.

### **413-6.03 Asphaltic Concrete.**

**(A) Mineral Aggregate Gradation.** For each approximate 500 tons of asphaltic concrete, at least one sample of mineral aggregate will be taken. Samples will be taken in accordance with the requirements of Arizona Test Method 105 on a random basis just prior to the addition of mineral admixture and bituminous material by means of a sampling device which is capable of producing samples which are representative of the mineral aggregate. The device, which shall be approved by the Engineer, shall be furnished by the contractor. In any shift that the production of asphaltic concrete is less than 500 tons, at least one sample will be taken.

Samples will be tested for conformance with the mix design gradation without mineral admixture in accordance with the requirements of Arizona Test Method 201.

The gradation of the mineral aggregate will be considered to be acceptable unless the average of any three consecutive tests or the result of any single test varies from the mix design gradation percentages as follows:

Passing Sieve	Number of Tests	
	3 Consecutive	One
3/8 Inch and larger	±4	±6
No. 4	±4	±6
No. 8	±3	±5
No. 200	±1.0	±1.5

One hundred percent of the material shall pass the largest sieve size shown in Table 413-2.

At any time that test results indicate that the gradation of the mineral aggregate does not fall within all of the limits indicated, the production of asphaltic concrete shall cease immediately and shall not begin again until a calibration test indicates that the gradation is within the 3-consecutive test limits indicated.

**(B) Asphalt-Rubber Content.** During production of asphaltic concrete, the contractor shall maintain at the plant site a nuclear asphalt content gauge calibrated and operated in accordance with Arizona Test Method 421. The calibration shall be performed using material supplied by the Contractor as stated in Section 413-4. Under the observation of the Engineer, the contractor shall determine the asphalt-rubber content by means of the nuclear asphalt content gauge a minimum of four times per full shift. The contractor’s technicians performing the testing, including the calibration of the nuclear gauge, shall meet the technician requirements given in the ADOT’s System for the Evaluation of Testing Laboratories. The requirements may be obtained from ADOT Materials Group, 1221 North 21st Avenue, Phoenix, AZ 85009-3740. Production of asphaltic concrete shall cease immediately and the plant and/or the nuclear asphalt content gauges re-calibrated if the Engineer determines the percent of asphalt-rubber has varied by an amount greater than 0.5 percent from the amount directed by the Engineer.

**413-7 CONSTRUCTION REQUIREMENTS**

**413-7.01 Quality Control.** Quality control of mineral aggregate production and asphaltic concrete production shall be the responsibility of the contractor. The contractor shall perform sufficient testing to assure that mineral aggregate and asphaltic concrete are produced which meet all specified requirements. The Engineer reserves the right to obtain samples of any portion of any material at any point of the operations for the Engineer's own use.

**413-7.02 Stockpiling.** The contractor will not be allowed to feed the hot plant from stockpiles containing less than two full days of production unless only two days production remain to be done or special conditions exist where the Engineer deems this requirement waived.

Mineral aggregate shall be separated and stockpiled so that segregation is minimized. An approved divider of sufficient size to prevent intermingling of stockpiles shall be provided.

**413-7.03 Proportioning.** The contractor shall provide documentation by calibration charts or other approved means that the mineral aggregate, asphalt-rubber, and mineral admixture are being proportioned in accordance with the approved mix design.

Unless approved by the Engineer, no individual stockpile usage shall be less than three percent of the total mineral aggregate.

Changes in stockpile/hot bin use in excess of five percent from the approved mix design will not be permitted without the approval of the Engineer.

Mineral admixture shall be mechanically mixed with the mineral aggregate prior to combining the mineral aggregate and asphalt-rubber. The engineer may direct a spray of water be applied either to control the loss of the mineral admixture or to comply with any mix design requirements for wet mixing of the aggregate and admixture.

If a drum mix plant is used, the mineral admixture shall be added and thoroughly mixed by means of a mechanical mixing device prior to the mixture entering the drum drier. The mineral admixture shall be weighed across a weigh belt or an approved alternative weighing system, with a weight totalizer prior to entry into the mechanical mixing device. The mechanical mixing device shall be a pugmill type mixer consisting of at least two motorized shafts with mixing paddles. The mixing device shall be designed such that the mixture of aggregate and admixture is moved in a near horizontal direction by the mixing paddles without the aid of conveyor belts for a distance of at least three feet. Mixing devices which permit the mixture of aggregate and admixture to fall through mixing blades onto a belt or chute are not acceptable. The mixing device's rated capacity in tons per hour shall not be exceeded by the rate of material feed to the mixer. The mixer shall be constructed to prevent the leakage of the contents. The mixer shall be located in the system at a location where the mixed material can be readily inspected on a belt prior to entry into the drum. The mixing device shall be capable of effective mixing in the full range of asphaltic concrete production rates.

A positive signal system and a limit switch device shall be installed in the plant at the point of introduction of the admixture. The positive signal system shall be placed between the metering device and the drum drier, and utilized during production whereby the mixing shall automatically be stopped if the admixture is not being introduced into the mixture.

If a batch plant is used, the mineral admixture shall be added and thoroughly mixed in the pugmill prior to adding asphalt-rubber.

The contractor shall furnish daily documentation to the Engineer that the required amount of mineral admixture has been incorporated into the asphaltic concrete.

No fine material which has been collected in the dust collection system shall be returned to the mixture unless the Engineer, on the basis of tests, determines that all or a portion of the collected fines can be utilized. If the Engineer so determines, the Engineer will authorize in writing the utilization of a specific proportion of the fines; however, authorization will not be granted unless the collected fines are uniformly metered into the mixture.

Mineral aggregate, mineral admixture, and asphalt-rubber shall be proportioned by volume, by weight, or by a combination of volume and weight.

When mineral aggregate, mineral admixture, and asphalt-rubber are proportioned by weight, all boxes, hoppers, buckets, or similar receptacles used for weighing materials, together with scales of any kind used in batching materials, shall be insulated against the vibration or movement of the rest of the plant due to the operation of any equipment so that the error in weighing with the entire plant

operating shall not exceed two percent for any setting nor one and one half percent for any batch. Bituminous material shall be weighed in a heated, insulated bucket suspended from a springless dial scale system.

When mineral aggregate, mineral admixture, and asphalt-rubber are proportioned by volume, the correct portion of each mineral aggregate size introduced into the mixture shall be drawn from the storage bins by an approved type of continuous feeder which will supply the correct amount of mineral aggregate in proportion to the bituminous material and so arranged that the proportion of each mineral aggregate size can be separately adjusted. The continuous feeder for the mineral aggregate shall be mechanically or electrically actuated.

The introduction of asphalt-rubber shall be controlled by an automated system fully integrated with the controls for mineral aggregate and mineral admixture.

**413-7.04 Drying and Heating.** A recording pyrometer or other approved recording thermometric instrument sensitive to a rate of temperature change not less than 10 degrees F per minute shall be so placed at the discharge chute of the drier in order to record automatically the temperature of the asphaltic concrete or mineral aggregate. A copy of the recording shall be given to the Engineer at the end of each shift.

The moisture content of the asphaltic concrete shall not exceed 0.5 percent. The moisture content will be determined in accordance with Arizona Test Method 406. Drying and heating shall be accomplished in such a manner as to preclude the mineral aggregate from becoming coated with fuel oil or carbon.

**413-7.05 Mixing.** The production of the plant shall be governed by the rate required to obtain a thorough and uniform mixture of the materials.

A positive signal system shall be provided to indicate the low level of mineral aggregate in the bins. The plant will not be permitted to operate unless this signal system is in good working condition. Each bin shall have an overflow chute or a divider to prevent material from spilling into adjacent bins.

The temperature of asphaltic concrete upon discharge from the mixer shall not exceed 350 degrees F. If the asphaltic concrete is discharged from the mixer into a hopper, the hopper shall be constructed so that segregation of the asphaltic concrete will be minimized.

#### **413-7.06 Placing and Finishing**

**(A) General Requirements.** The handling of asphaltic concrete shall at all times be such as to minimize segregation. Any asphaltic concrete which displays segregation shall be removed and replaced.

Before asphaltic concrete is placed, the surface to be paved shall be cleaned of all objectionable material and tacked with asphalt cement in accordance with the requirements of Section 404 of the specifications. The cleaning of the surface, the tacking of the surface, and the amount and grade of asphalt cement used shall be as directed by and acceptable to the Engineer.

A light coat of asphalt cement shall be applied as directed to edges or vertical surfaces against which asphaltic concrete is to be placed.

The base or subgrade upon which the asphaltic concrete is to be placed shall be prepared in accordance with the applicable requirement for the material involved and maintained in a smooth and firm condition until placement. Asphaltic concrete shall not be placed on a frozen or excessively wet base or subgrade.

Asphaltic concrete shall be placed only when the temperature of the surface on which the asphaltic concrete is to be placed is at least 65 degrees F and the ambient temperature is at least 65 degrees F and rising. The placement shall be stopped when the ambient temperature is at or below 70 degrees F and falling.

At any time the Engineer may require that the work cease or that the work day be reduced in the event of weather conditions which would have an adverse effect upon the asphaltic concrete.

All asphaltic concrete shall be placed either as a leveling course or as a surfacing course. Leveling courses are defined as courses placed for the primary purpose of raising an existing paved or unpaved surface to a smooth plane. Surfacing courses are defined as courses placed to serve either as the traffic surface or as a surface upon which a finishing course or seal coat is to be placed.

Thickness of leveling and surfacing courses will be shown on the project plans. No change in thickness will be allowed without the written approval of the Engineer.

**(B) Loading Asphaltic Concrete into the Paving Machine.** If the asphaltic concrete is dumped directly into the paving machine from the hauling trucks, care shall be taken to avoid jarring the machine or moving it out of alignment. No vertical load shall be exerted on the paving machine by the trucks. Trucks, while dumping, shall be securely attached to the paving machine.

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

**(C) Placing and Finishing Asphaltic Concrete by Means of Self-Propelled Paving Machines.** All courses of asphaltic concrete shall be placed and finished by means of self-propelled paving machines except under certain conditions or at certain locations where the Engineer deems the use of self-propelled paving machines impractical.

In order to achieve, as far as practical, a continuous operation, the speed of the paving machine shall be coordinated with the production of the plant. If the paving machine is stopped for more than three minutes, or there is a three minute or longer interval between the completion of delivery by one truck and the beginning of delivery by the next truck, the paving machine shall be pulled away from the mat in order for the rollers to compact this area in accordance with the temperature limitations given hereinafter under Subsection 413-7.08(C). A transverse construction joint shall be made by a method approved by the Engineer.

Self-propelled paving machines shall spread the mixture without segregation or tearing within the specified tolerances, true to the line, grade, and crown indicated on the project plans. Pavers shall be

equipped with hoppers and augers which will distribute the mixture uniformly in front of adjustable screeds.

Screeds shall include any strike-off device operated by tamping or vibrating action which is effective without tearing, shoving or gouging the mixture and which produces a course with a uniform texture and density for the full width being paved. Screeds shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required.

Tapered sections not exceeding eight feet in width, or widened sections not exceeding four feet in width may be placed and finished by other means approved by the Engineer.

**(D) Automatically Actuated Control System.** Except under certain conditions or at certain locations where the Engineer deems the use of automatic controls impractical, all courses of asphaltic concrete shall be placed and finished by means of self-propelled paving machines equipped with an automatically actuated control system.

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

The control system shall be capable of working with the following devices which shall be furnished with the machine:

Ski-type device at least 30 feet in length, supported throughout its entire length.

Short ski.

500 feet of control line and stakes.

Joint matcher shoe.

The control line shall be set and maintained taut by the contractor to the grade and alignment established by the Engineer.

Failure of the control system to function properly shall be cause for the suspension of the asphaltic concrete operations.

**413-7.07 Joints.** Longitudinal joints of each course shall be staggered a minimum of one foot with relation to the longitudinal joint of the immediate underlying course.

The contractor shall schedule its paving operations to minimize exposed longitudinal edges. Unless otherwise approved by the Engineer, the contractor shall limit the placement of asphaltic concrete courses, in advance of adjacent courses, to one shift of asphaltic concrete production. The contractor shall schedule its paving operations in such a manner to eliminate exposed longitudinal edges over weekends or holidays.

Longitudinal joints shall be located within one foot of the center of a lane or within one foot of the centerline between two adjacent lanes. Joints shall be formed by a slope shoe or hot lapped, and shall be compacted while the mixture is still hot.

Before a surface course is placed in contact with a cold transverse construction joint, the cold existing asphaltic concrete shall be trimmed to a vertical face by cutting the existing asphaltic concrete back for its full depth and exposing a fresh face. After placement and finishing of the new asphaltic concrete, both sides of the joint shall be dense and the joint shall be well sealed. The surface in the area of the joint shall conform to the requirements hereinafter specified for surface tolerances when tested with the straightedge placed across the joint.

When surfacing courses are placed on ten-foot or wider shoulders that are to receive a rumble strip, any longitudinal joint between the shoulder and the travel lane shall be located at the travel lane edge of the rumble strip.

### **413-7.08      Compaction**

**(A) General Requirements.** The temperature of asphaltic concrete just prior to compaction shall be at least 275°F.

The wheels of compactors shall be wetted with water, or if necessary soapy water, or a product approved by the Engineer to prevent the asphaltic concrete from sticking to the steel wheels during rolling. The Engineer may change the rolling procedure if in the Engineer's judgment the change is necessary to prevent picking up of the asphaltic concrete.

**(B) Equipment.** For courses greater than one inch in nominal thickness, a minimum of one static steel-wheel compactor and two vibratory steel-wheel compactors shall be provided; however, sufficient vibratory steel-wheel compactors shall be provided to cover the entire width of the paving machine on the initial forward pass.

For courses of one inch or less in nominal thickness, a minimum of three static steel-wheel compactors shall be provided; however, sufficient compactors must be provided to cover the entire width of the paving machine on the initial forward pass while a static compactor remains to complete final rolling. If the asphaltic concrete production rate exceeds 250 tons per hour, an additional static steel-wheel compactor shall be provided.

The compactors shall weigh not less than eight tons.

The compactors shall be self-propelled and shall be operated with the drive wheel in the forward position. Vibratory rollers shall be used in the mode required by the Engineer. Vibratory compactors shall not be used in the vibratory mode for courses of one inch or less in nominal thickness.

**(C) Rolling Procedure.** Vibratory compactors shall be used for initial breakdown on courses greater than one inch in nominal thickness. Static steel wheel compactors, or vibratory compactors in the static mode, shall be used for initial breakdown on courses one inch or less in nominal thickness. Initial breakdown rollers shall be maintained no more than 300 feet behind the paving machine. The roller(s) for final compaction shall follow as closely behind the initial breakdown as possible. As many passes as are possible shall be made with the compactors before the temperature of the asphaltic concrete falls below 220°F.

All edges shall be compacted by methods approved by the Engineer, while the mixture is still hot.

**413-7.09 Surface Requirements and Tolerances.** All courses of asphaltic concrete shall be compacted as required, smooth and reasonably true to the required lines, grades, and dimensions.

Leveling course surfaces shall not vary more than 1/4 inch from the lower edge of a 10-foot straightedge when the straightedge is placed parallel to the center line of the roadway.

Surfacing course surfaces shall not vary more than 1/8 inch from the lower edge of a ten-foot straightedge when the straightedge is placed parallel to the center line of the roadway, or 1/4 inch when placed in the transverse direction across longitudinal joints.

**413-7.10 Acceptance.** Asphaltic concrete will be accepted complete in place, if, in the judgment of the Engineer, the asphaltic concrete reasonably conforms to the requirements specified herein. Asphaltic concrete that is not acceptable and is rejected shall be replaced to the satisfaction of the Engineer and at no expense to the Agency.

#### **413-8 METHOD OF MEASUREMENT**

Asphaltic concrete will be measured by the ton for the mixture actually used, which will include the weight of mineral aggregate, mineral admixture, and asphalt-rubber. Measurement will include any weight used in construction of intersections, turnouts, or other miscellaneous items or surfaces.

Asphalt-rubber material will be measured by the ton.

The weight of the asphalt-rubber material shall either be determined by weighing directly enroute from the reaction vessel to the point of delivery or be determined from the weight of the asphalt cement and the weight of the rubber minus wastage.

Mineral admixture will be measured by the ton.

#### **413-9 BASIS OF PAYMENT**

The accepted quantities of asphaltic concrete, measured as provided above, will be paid for at the contract unit price per ton, which price shall be full compensation for the work, complete in place, as specified herein.

Payment for the asphalt-rubber will be made by the ton, including asphalt cement and crumb rubber. The results of a nuclear asphalt content gauge shall not be used to determine the weight of asphalt-rubber material as the basis of payment.

Payment for mineral admixture will be made by the ton.

Adjustment to the unit price of Asphaltic Concrete due to fluctuations in asphalt cement prices shall be made in accordance with the formula shown in Section 406-5 of the Special Provisions.

## SECTION 501 - DRAINAGE PIPE

### 501-2 MATERIALS

**501-2.04 Bedding Material.** of the Standard Specifications is modified to add:

When pipe culverts or storm drains 36 inches in diameter or larger are placed in a trench, the bedding material from the bottom of the pipe to the springline shall be a cement-treated slurry, except for high density polyethylene pipe (HDPE) pipe. Cement-treated slurry bedding material shall conform to the gradation specified for bedding material in this Section and additionally shall have a cement content of one sack per cubic yard. Cement-treated slurry shall be thoroughly mixed in a mixer or at a concrete batch plant as approved by the Engineer and shall have a slump of eight to eleven inches.

When HDPE pipe culverts or storm drains 36 inches or greater in diameter or larger are placed in a trench, the bedding materials from the bottom of the pipe to the springline shall be a non-cement slurry.

Non-cement slurry material shall conform to the aggregate requirements herein before specified and may be compacted, jetted or placed as an aggregate slurry as herein specified.

The maximum water content in an aggregate slurry mixture shall be 35 gallons of water per ton of bedding material. Unless otherwise approved by the Engineer, the slurry shall be compacted with internal vibrators in accordance with the requirements of Subsection 601-3.03(D). Aggregate slurry shall be thoroughly mixed in a mixer approved by the Engineer.

**501-2.06 Trench Backfill Material.** of the Standard Specifications is modified to add:

Trench backfill material for drainage pipe within the roadway prism shall conform to the requirements of Subsection 501-2.05 - Shading Material, except that 100% of the material shall pass the 6 inch (*150 millimeters*) sieve.

### 501-3.02 Bedding.

**(A) Placement of Bedding Material.** of the Standard Specifications is modified to add:

Cement-treated slurry bedding material shall be placed in a uniform manner that will prevent voids in, or segregation of, the bedding material, and will not float or shift the culvert of pipe. Cement-treated slurry bedding material shall be placed from the bottom of the pipe-to-pipe springline. No backfilling above the cement-treated slurry shall be commenced until 24 hours after the cement-treated slurry has been placed.

Non-cement slurry bedding material shall be placed either in uniform horizontal layers not exceeding eight inches in depth before compaction or in uniform horizontal layers not exceeding four feet in depth when placed as a slurry. Bedding material may also be placed in uniform horizontal layers not exceeding four feet in depth when compaction is done by jetting.

**(B) Compaction of Bedding Material.** of the Standard Specifications is revised to read:

Bedding material shall be compacted to at least 95 percent of the maximum density determined in accordance with the requirements of the applicable test methods of the ADOT Materials Testing Manual, as directed and approved by the Engineer.

Compaction of bedding material shall be performed without damage to the pipe and surrounding in-place material. Special care shall be taken in placing, shaping, and compacting all bedding material under haunches of the pipe to prevent moving the pipe or raising it from its bedding.

Cement-treated slurry bedding material shall not require additional compaction after placement up to pipe springline if it meets the material requirements of Subsection 501-2.04 and is placed as outlined in Subsection 501-3.02(A). The Engineer may require the use of vibrators with cement-treated slurry bedding if the fluidity of the mixture is not sufficient to fill all voids. No density tests will be required in the cement-treated slurry bedding material as placed up to pipe springline.

Non-cement slurry bedding material shall be compacted to at least 95 percent of the maximum density determined in accordance with the requirements of the applicable test methods of the ADOT materials Testing Manual, as directed and approved by the Engineer.

When non-cement bedding material is placed as aggregate slurry or compacted by jetting, the material placed below the springline of the pipe shall be compacted prior to placement of material above the springline of the pipe.

Jetting shall not be used for any material placed more than one foot above the top of the pipe.

Ponding will not be permitted in any case.

Jetting shall be done in such a manner that water will not be impounded. Jetting methods shall be supplemented by the use of vibratory or other compaction equipment when necessary to obtain the required compaction. Bedding material compacted by jetting shall use the least amount of water that will properly consolidate the material and move the material under the pipe to eliminate voids. A jetting probe shall be inserted into the material. It shall be of such length as to reach the material under the pipe. Water shall be provided to the jetting probe at a minimum pressure of 30 pounds per square inch. The jetting probe shall be inserted at uniformly spaced intervals on both sides of the pipe, a maximum spacing of three feet.

The contractor shall excavate holes in the compacted aggregate slurry or jetted bedding material to the depths and at the locations designated by the Engineer. These holes shall be of such size as to allow the required density testing to be performed in a safe manner. Upon completion of the tests, the contractor shall refill the excavated areas and compact the material to the required density in a manner satisfactory to the Engineer.

### **501-3.04 Backfilling and Compacting.**

**(A) Backfill.** of the Standard Specifications is modified to add:

Based on the geotechnical report it has been determined that native material is suitable for trench backfill and may be used as such providing it does not exceed 8" in greatest dimension, with

**exception** of the following locations;

La Cholla Station 40+25 to Sta 61+00  
Ruthrauff Station 89+30 to Sta 107+70

For these locations Trench Backfill shall be as per Subsection 501-3.04 (A) of the Standard Specifications. (See the geotechnical report on file with Pima County Department of Transportation, but note that this report is based on limited investigations and is provided for informational purposes only. It is the contractor's responsibility to verify existing ground conditions and to perform supplementary investigations as necessary at no additional cost to Pima County.)

### **ITEM 5011499 - PIPE, TRANSITION STRUCTURE**

#### **1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to construct a pipe transition structure at the locations shown on the plans and in accordance with Detail DM shown on the plans and the requirements of these specifications.

#### **2. Materials:**

Concrete shall be Class S,  $f'c = 3000$  psi and shall conform to the requirements of Section 1006 of the Standard Specifications.

Reinforcing steel shall be Grade 40 or 60 and shall conform to the requirements of Section 1003.

#### **3. Construction Requirements:**

The pipe transition structure shall be constructed in accordance with the requirements of Detail DM shown in the plans and Sections 203, 601 and 605 of the Standard Specifications.

#### **4. Method of Measurement:**

The pipe transition structure will be measured as a unit for each structure.

#### **5. Basis of Payment:**

The accepted quantity of each pipe transition structure will be paid for at the contract unit price for each structure, which price shall be full compensation for the work, complete in place, including excavating, backfilling, compacting, structural concrete, steel reinforcement, and connections to the new pipes.

## **ITEM 5030070 – CONCRETE PIPE COLLAR**

### **1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to construct concrete pipe collars at the location shown on the plans and in accordance with ADOT Standard Drawing C-13.80 and the requirements of these specifications.

### **2. Materials:**

Concrete shall be Class B and shall conform to the requirements of Section 1006 of the Standard Specifications.

Reinforcing steel shall be Grade 40 or 60 and shall conform to the requirements of Section 1003.

### **3. Construction Requirements:**

The concrete pipe collars shall be constructed in accordance with the requirements of ADOT Standard Drawing C-13.80 and Sections 203, 601 and 605 of the Standard Specifications.

### **4. Method of Measurement:**

The concrete pipe collars will be measured as a unit for each collar.

### **5. Basis of Payment:**

The accepted quantity of each concrete pipe collar will be paid for at the contract unit price for each collar, which price shall be full compensation for the work, complete in place, including excavating, backfilling, grading, compacting, structural concrete, steel reinforcement, and connection to the new pipes. Pipe connections constructed per ADOT Standard Drawing C-13.70 will not be paid for under this bid item, but shall be included in the cost of the pipe bid items per Subsection 501-5 of the Standard Specifications.

## **ITEM 5030203 – DRAINAGE STRUCTURE (SCUPPER)**

### **1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to construct a concrete scupper at the location shown on the plans and in accordance with Detail DO shown on the plans and the requirements of these specifications.

### **2. Materials:**

Concrete shall be Class B and shall conform to the requirements of Section 1006 of the Standard Specifications.

Reinforcing steel shall be Grade 40 or 60 and shall conform to the requirements of Section 1003.

Structural steel parts shall conform to the requirements of Section 1004.

### **3. Construction Requirements:**

The concrete scupper shall be constructed in accordance with the requirements of Detail DO shown in the plans and Sections 203, 601 and 605 of the Standard Specifications.

### **4. Method of Measurement:**

The concrete scupper will be measured as a unit for each structure.

### **5. Basis of Payment:**

The accepted quantity of each concrete scupper will be paid for at the contract unit price for each structure, which price shall be full compensation for the work, complete in place, including excavating, backfilling, grading, compacting, structural concrete, steel reinforcement, structural steel, and connection to the new catch basin.

- ITEM 5030775 - CATCH BASIN (SPECIAL NO. 1)**
- ITEM 5030776 - CATCH BASIN (SPECIAL NO. 2)**
- ITEM 5030777 - CATCH BASIN (SPECIAL NO. 3)**
- ITEM 5030778 - CATCH BASIN (SPECIAL NO. 4)**

**1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to construct new concrete catch basins shown on the plans. The catch basins will be paid for under the following bid items:

<b>Item No.</b>	<b>Special Detail</b>
5030775	DF, Single Wing
5030776	DF, Double Wings
5030777	DI
5030778	DB

The catch basins shall be constructed at the locations shown on the plans and in accordance with Details DB, DF and DI shown on the plans and the requirements of these specifications.

**2. Materials:**

Concrete shall conform to the requirements of Section 1006 of the Standard Specifications.

Reinforcing steel shall conform to the requirements of Section 1003.

Structural steel parts shall conform to the requirements of Section 1004. Grating units and frames shall be fabricated from ASTM A 36 steel.

**3. Construction Requirements:**

Catch basins shall be constructed in accordance with the requirements of Details DB, DF and DI shown in the plans and Subsection 503-3.01 of the Standard Specifications.

**4. Method of Measurement:**

Catch basins will be measured as a unit for each catch basin, including frames, grates and aprons.

**5. Basis of Payment:**

The accepted quantities of catch basins will be paid for at the contract unit price each, which price shall be full compensation for the work, complete in place, including excavating, backfilling, compacting, structural concrete, steel reinforcement, aprons, temporary construction drains and connections to the new pipes.

## **ITEM 5080001 – FLOW MANAGEMENT PLAN NO. 1**

### **1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to prepare and implement a flow management plan for the sanitary sewer system. This plan shall meet the requirements of Standard Detail WWM A-5.

### **2. Construction Requirements:**

The flow management plan shall cover all locations where trenching will be within six feet horizontally or two feet vertically of an existing public sewer. The plan will be broken down by phases with a separate phase for each location where a trench is close to an existing sewer line. Each phase shall be implemented prior to that section of trench being excavated and shall meet the requirements of Standard Detail WWM A-5.

### **3. Method of Measurement:**

Flow Management Plan No. 1 will be measured on a lump sum basis.

### **4. Basis of Payment:**

The accepted quantities of Flow Management Plan No. 1 will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete in place, including all material, equipment and labor required to divert and/or transfer existing sewage flows.

## **ITEM 5090201 – SEWER MANHOLE FRAME AND COVER RESET**

### **1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to replace existing sanitary sewer manhole frame and covers with new watertight frame and covers at the locations shown on the plans and in accordance with Standard Detail WWM 213.2 and the requirements of these specifications.

### **2. Materials:**

Frames and covers shall conform to the requirements of Standard Detail WWM 213.2 and Section 509-2.06 of the Standard Specifications.

### **3. Construction Requirements:**

The new watertight frame and cover shall be installed in accordance with the requirements of Standard Detail WWM 213.2 and Section 509-3.02(E) of the Standard Specifications.

### **4. Method of Measurement:**

Sewer manhole frame and cover reset will be measured as a unit for each watertight frame and cover furnished and installed.

## **5. Basis of Payment:**

The accepted quantity of each sewer manhole frame and cover reset will be paid for at the contract unit price for each watertight frame and cover furnished and installed, which price shall be full compensation for the work, complete in place, including excavating, backfilling, grading, compacting, concrete, grout, steel reinforcement, brick, frame and cover.

### **SECTION 510 - POTABLE WATER SYSTEMS**

**510-2.05 Trench Backfill Material:** of the Standard Specifications is revised to read:

Trench backfill material for potable water pipe shall not contain organic material, rubbish, debris, and other deleterious material, shall not contain solid material which exceeds 6 inches (*150 millimeters*) in greatest dimension, and shall be soil selected from excavation or imported from a source selected by the contractor and approved by the Engineer. Milled asphaltic concrete shall not be used in potable water pipe trenches.

Trench backfill material within the roadway prism shall conform to the requirements of Subsection 501-2.05 - Shading Material, except that 100% of the material shall pass the 6 inch (*150 millimeters*) sieve.

### **ITEM 5100001 – GENERAL REQUIREMENTS**

#### **1. Description:**

The work under this contract shall consist of furnishing all labor, equipment and materials required to install or modify City of Tucson, Tucson Water Department Facilities for the Pima County DOT's La Cholla Boulevard, River Road to Ruthrauff Road project, plan 4LCITR. The City of Tucson Water Department's plan number is 5-056-2009. All work shall be in accordance with the City of Tucson/Pima County Standard Specifications for Public Improvements, 2003 Edition, the requirements of these Special Provisions, and any details shown on the plans.

This work shall be done at the locations shown on the project plans. Any references to sections and details in these Special Provisions refer to City of Tucson, /Pima County Standard Specifications for Public Improvements, 2003 Edition.

#### **2. Materials:**

All materials shall conform to the requirements of the City of Tucson, /Pima County Standard Specifications for Public Improvements, 2003 Edition, except as modified by these Special Provisions or approved by the Engineer.

#### **3. Construction Requirements:**

Installation or modifications of water facilities shall conform to the City of Tucson, /Pima County Standard Specifications for Public Improvements, 2003 Edition, except as modified by these Special Provisions or approved by the Engineer.

**4. Method of Measurement:**

The Method of Measurement will be as prescribed by these Special Provisions.

**5. Basis of Payment:**

The accepted quantities, measured as prescribed by these Special Provisions, shall be paid for at the contract unit bid price. The unit bid price shall be full compensation for all materials and work, complete in place.

**ITEM 5100010 – EXCAVATION, INSTALLATION OF WATER MAINS AND BACKFILL**

**1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to provide excavation, installation of water mains and appurtenances, bedding, and backfill in accordance with the requirements of these Special Provisions.

**2. Materials:**

All materials shall conform to Subsections 510-2.04 (pg. 318) and 510-2.05 (pg. 318) with the exception that asphalt millings will not be allowed as backfill material or as an additive to any bedding or backfill material in any trenches intended for water pipes.

**3. Construction Requirements:**

All construction requirements shall conform to Subsections 510-3.01 (pg. 318) and 510-3.03 (pg. 321).

**4. Method of Measurement:**

Excavation, Installation of Water Mains and Backfill shall be considered incidental to the cost of the new water facilities. Any Excavation, Installation of Water Mains and Backfill required for a complete installation, but not called for on the plans, shall also be considered incidental to the cost of the new water facilities.

**5. Basis of Payment:**

Payment for the installation of any Excavation, Installation of Water Mains and Backfill is considered incidental to the cost of installing new water facilities.

**ITEM 5100020 – HYDROSTATIC PRESSURE TESTING OF WATER FACILITIES**

**1. Description:**

The work under this item shall consist of furnishing all labor, and equipment required for Hydrostatic Pressure Testing of Water Facilities installed under this contract in accordance with the requirements of these Special Provisions.

**2. Materials:**

None.

**3. Construction Requirements:**

Hydrostatic Pressure Testing of Water Facilities shall be as per Subsection 510-3.10 (pg. 344).

**4. Method of Measurement:**

Hydrostatic Pressure Testing of Water Facilities shall be considered incidental to the cost of the new water facilities. Any Hydrostatic Pressure Testing of Water Facilities required for a complete installation, but not called for on the plans, shall also be considered incidental to the cost of the new water facilities.

**5. Basis of Payment:**

Payment for Hydrostatic Pressure Testing of Water Facilities is considered incidental to the cost of installing new water facilities.

**ITEM 5101104 – PIPE DUCTILE IRON (DI), 4” (CLASS 350)**  
**ITEM 5101106 – PIPE DUCTILE IRON (DI), 6” (CLASS 350)**  
**ITEM 5101112 – PIPE, DUCTILE IRON (DI), 12” (CLASS 350)**

**1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to install Ductile Iron (DI) pipe at the locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All pipe materials shall conform to the requirements of Subsection 510-3.04(D)(1) (pg. 326).

Joint restraint shall be included as described in section 5101801 JOINT RESTRAINT of these Special Provisions.

The materials and costs related to connecting to existing pipe shall be bid as separate items described in the 5106000, Connections, series of these Special Provisions.

**3. Construction Requirements:**

Installation of the pipe shall be in accordance with the requirements of Subsection 510-3 (pg. 318), and these Special Provisions.

All DI pipe shall be encased in polyethylene per the requirements of Subsection 510-3(D)(1) (pg. 326).

**4. Method of Measurement:**

Ductile Iron pipe shall be measured in by the unit Linear Foot (LF) in accordance with Subsection 510-4 (pg.349) with the following exceptions:

- a. Subsection 510-4, eighth paragraph, first bullet, "All testing, except those tests specifically noted as being paid for by the Agency." and third bullet "De-watering." shall part of separate bid items described in the 5106000, Connections, series of these Special Provisions.

**5. Basis of Payment:**

The accepted quantities of Ductile Iron pipe, measured as provided above, shall be paid for at the contract unit price Linear Foot as described in Subsection 510-5 (pg. 350) with the following exceptions:

- a. Subsection 510-5, first paragraph, (pg. 350) "...de-watering..." This work shall be part of separate bid items described in the 5106000, Connections, series of these Special Provisions.
- b. Subsection 510-5, fourth paragraph, (pg. 351) "...preliminary flushing, all testing, including leakage tests, disinfections, final flushing, microbiological testing..." This work shall be part of separate bid items described in the 5106000, Connections, series of these Special Provisions.
- c. Subsection 510-5, fourth paragraph, (pg. 351) "...removing or abandoning existing water systems..." This work shall be part of separate bid items described in the 5104000, Abandon or 5105000, Remove and Dispose series of these Special Provisions.

**ITEM 5101404 – PIPE, POLYVINYL CHLORIDE (PVC), 4” (CLASS .305)**

**ITEM 5101406 – PIPE, POLYVINYL CHLORIDE (PVC), 6” (CLASS 305)**

**ITEM 5101408 – PIPE, POLYVINYL CHLORIDE (PVC), 8” (CLASS 305)**

**ITEM 5101412 – PIPE, POLYVINYL CHLORIDE (PVC), 12” (CLASS 305)**

**1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to install Polyvinyl Chloride (PVC) pipe at the locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All pipe materials shall conform to the requirements of Subsection 510-3.04(D)(4) (pg. 330).

Joint restraint shall be included as described in section 5101801 JOINT RESTRAINT of these Special Provisions.

The materials and costs related to connecting to existing pipe shall be bid as a separate item described in the 5106000 Connections series of these Special Provisions.

### **3. Construction Requirements:**

Installation of the pipe shall be in accordance with the requirements of Subsection 510-3 (pg. 318), AWWA Manual 23, and these Special Provisions.

### **4. Method of Measurement:**

PVC pipe will be measured by the unit Linear Foot (LF) in accordance with Subsection 510-4 (pg.349) with the following exceptions:

- a. Subsection 510-4, eighth paragraph, first bullet, "All testing, except those tests specifically noted as being paid for by the Agency." and third bullet "De-watering." shall part of separate bid items described in the 5106000, Connections, series of these Special Provisions.

### **5. Basis of Payment:**

The accepted quantities of PVC pipe, measured as provided above, shall be paid for as described in Subsection 510-5 (pg. 350) with the following exceptions:

- a. Subsection 510-5, first paragraph, (pg. 350) "...de-watering..." This work shall be part of separate bid items described in the 5106000, Connections, series of these Special Provisions.
- b. Subsection 510-5, fourth paragraph, (pg. 351) "...preliminary flushing, all testing, including leakage tests, disinfections, final flushing, microbiological testing..." This work shall be part of separate bid items described in the 5106000, Connections, series of these Special Provisions.
- c. Subsection 510-5, fourth paragraph, (pg. 351) "...removing or abandoning existing water systems..." This work shall be part of separate bid items described in the 5104000, Abandon or 5105000, Remove and Dispose series of these Special Provisions.

**ITEM 5101603 – PIPE, COPPER, ¾" W/FITTINGS**  
**ITEM 5101604 – PIPE, COPPER, 1" W/FITTINGS**  
**ITEM 5101606 – PIPE, COPPER, 1½" W/FITTINGS**  
**ITEM 5101608 – PIPE, COPPER, 2" W/FITTINGS**

### **1. Description:**

The work under this item shall consist of furnishing all labor equipment and materials required to install Copper Pipe and Fittings at the locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

### **2. Materials:**

All pipe materials shall conform to the requirements of Subsection 510-3.04(D)(6) (pg. 331).

All Copper Pipe shall be installed with tracer wire as called for in Standard Details W-330 and W-331.

**3. Construction Requirements:**

Installation of the pipe shall be in accordance with the requirements of Subsection 510-3 (pg. 318), and these Special Provisions.

**4. Methods of Measurement:**

Copper Pipe w/Fittings shall be measured by the Linear Foot (LF) in accordance with Subsection 510-4 (pg.349).

Tracer wire as called for in Standard Details W-309, W-310, W-311, W-312, W-330 and W-331 shall be considered incidental to cost of the Copper Pipe.

**5. Basis of Payment:**

The accepted quantities of Copper Pipe, measured as provided above, shall be paid for at the contract unit price, Linear Foot as described in Subsection 510-4, (pg. 350).

**ITEM 5102117 – TAPPING SLEEVE & VALVE, 16"x 12"**

**1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to install Tapping Sleeves & Valves, riser piping, and valve boxes and covers. New Tapping Sleeves & Valves and appurtenances shall be installed at the locations shown on the project plans, in accordance with any details shown on the project plans, and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All materials shall conform to the requirements Subsection 510-3.04(E)(2), (pg. 331), Detail W-300, and these Special Provisions.

All PVC pipe for use as riser pipe called for in Detail W-300, Sheet 1 of 4, shall be a minimum of Class 200.

All new valve boxes and covers shall conform to the requirement of Subsection 510-3.07(B) (pg. 341) and Standard Detail W-300, Sheet 3 of 4.

**3. Construction Requirements:**

Installation of Tapping Sleeves & Valves, shall be in accordance with the requirements of Subsection 510-3 (pg. 318), Detail W-300, and these Special Provisions.

**4. Method of Measurement:**

Tapping Sleeves and Valves shall be measured by the unit Each (EA) for the actual number of Tapping Sleeves and Valves and related appurtenances installed.

**5. Basis of Payment:**

The accepted quantities of Tapping Sleeves and Valves, measured as provided above, shall be paid for at the contract unit price Each, which price shall be full compensation for the work, complete in place.

**ITEM 5102204 – GATE VALVE, 4”**  
**ITEM 5102206 – GATE VALVE, 6”**  
**ITEM 5102208 – GATE VALVE, 8”**  
**ITEM 5102212 – GATE VALVE, 12”**

**1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to install new Gate Valves, riser piping, and, valve boxes and covers. New Gate Valves and appurtenances shall be installed at the locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All new Gate Valves shall conform to the requirements of Subsection 510-3.04(E)(3) (pg. 332) and Standard Detail W-300.

All new Valve Box Covers shall conform to the requirement of Subsection 510-3.07(B) (pg. 341) and Standard Detail W-300, Sheet 3 of 4.

All PVC pipe for use as riser pipe called for in Detail W-300 shall be a minimum of Class 200.

**3. Construction Requirements:**

Installation of Gate Valves shall be in accordance with the requirements of Subsection 510-3 (pg. 318), Detail W-300, AWWA Manual 23, and these Special Provisions.

**4. Method of Measurement:**

Gate Valves shall be measured by the unit Each (EA) for the actual number of Gate Valves and related appurtenances installed.

**5. Basis of Payment:**

The accepted quantities of Gate Valves, measured as provided above, shall be paid for at the contract unit price Each, which price shall be full compensation for the work, complete in place.

## **ITEM 5102412 – GATE VALVE, CUT IN, 12”**

### **1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to install new Gate Valves, boxes and covers in existing water mains. New Gate Valves, Cut In and appurtenances shall be installed at the locations shown on the project plans, in accordance with any details shown on the project plans, and in accordance with the requirements of these Special Provisions.

### **2. Materials:**

All new Gate Valves shall conform to the requirements of Subsection 510-3.04(E)(3) (pg. 332) and Standard Detail W-300.

All new Valve Box Covers shall conform to the requirement of Subsection 510-3.07(B) (pg. 341) and Standard Detail W-300, Sheet 3 of 4.

All PVC pipe for use as riser pipe called for in Detail W-300 shall be a minimum of Class 200.

Any connecting devices required for a complete installation shall be considered incidental to this item.

Any main line pipe required for a complete installation shall be bid as a separate item.

### **3. Construction Requirements:**

Installation of Gate Valves shall be in accordance with the requirements of Subsection 510-3 (pg. 318), Detail W-300, AWWA Manual 23, and these Special Provisions.

Removal and disposal any existing main line pipe and appearances required for a complete installation shall be considered incidental to this item.

### **4. Method of Measurement:**

Gate Valves, Cut In and related appurtenances all shall be measured by the unit Each (EA) for each Gate Valve, Cut In installed.

### **5. Basis of Payment:**

The accepted quantities of Gate Valves, Cut In measured as provided above shall be paid for at the contract unit price Each, which price shall be full compensation for the work, complete in place.

## **ITEM 5102603 – COMBINATION AIR RELEASE VALVE, 3/4”**

### **1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to install Combination Air Release Valves and meter box. New Combination Air Release Valves and

appurtenances shall be installed at the locations shown on the project plans, in accordance with the details shown on the project plans, and the requirements of these Special Provisions.

## **2. Materials:**

All materials shall conform to the requirements of Subsection 510-3.04(E) (5)(pg. 332) and Standard Detail W-330.

Working pressure for Combination Air Release Valve assemblies shall be 150 psi unless otherwise noted on the plans.

Copper pipe with fittings is required for air release piping.

High Density Polyethylene (HDPE) or Polyvinyl Chloride (PVC) pipe for air release piping shall not be allowed on this project.

The screen material for covering the ends of the two 90° bends called for in Standard Details W-330 shall be metal or fiberglass mesh with 1/8" maximum size openings.

## **3. Construction Requirements:**

Installation of Combination Air Release Valve assemblies and meter boxes shall be in accordance with the requirements of Subsection 510-3.04(E) (5) (pg. 332), Standard Detail W-330 and these Special Provisions.

Tracer wire shall be installed as detailed on the drawings.

## **4. Method of Measurement:**

Combination Air Release Valve assemblies shall be measured by the unit Each (EA) for the actual number of Combination Air Release Valve assemblies and related appurtenances installed.

Costs related to the following components shall be bid as separate items:

ITEM 5101603 – PIPE, COPPER, 3/4" W/FITTINGS

## **5. Basis of Payment:**

The accepted quantities of Combination Air Release Valves measured as provided above, shall be paid for at the contract unit price, Each, which price shall be full compensation for the work, complete in place.

### **ITEM 5102802 – DRAIN VALVE ASSEMBLY, 2"**

#### **1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to install Drain Valve Assemblies and meter boxes. New Drain Valve Assemblies and appurtenances shall be installed at the locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All materials shall conform to the requirements of Standard Detail W-400.

**3. Construction Requirements:**

Installation of the Drain Valve Assemblies shall conform to detail W-400 and as approved by the Engineer.

**4. Method of Measurement:**

Drain Valve Assemblies shall be measured by the unit Each (EA) for the actual number of Drain Valve Assemblies and related appurtenances installed.

**5. Basis of Payment:**

The accepted quantities of Drain Valve Assemblies, measured as provided above, will be paid for at the contract unit price, Each, which price shall be full compensation for the work, complete in place.

**ITEM 5103101 – ADJUST EXISTING VALVE BOX AND COVER**

**1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to install Adjusting Existing Valve Boxes and Covers. All existing valve boxes and covers shall be replaced with new valve boxes and covers. New valve boxes and covers shall be installed and adjusted to finished grade at the existing valve locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All materials shall conform to the requirements Subsection 510-3.07(B) (pg. 341) and Standard Detail W-300.

All new polyvinyl chloride (PVC) pipe for use as riser pipe called for in Detail W-300 shall be a minimum of Class 200.

**3. Construction Requirements:**

The Contractor shall furnish and install new valve boxes and covers at all locations where Adjusting Existing Valve Boxes and Cover are called for on the plans.

The contractor shall adjust water main valve boxes and covers to the level of the new finished grade. This work shall be done in accordance with detail W-300 and details on the drawings.

New valve boxes on existing valves shall not be installed in temporary paving. Existing valve boxes shall be adjusted to grade in temporary paving. When the final paving is installed to finished grade, new valve boxes shall be installed.

Valve boxes not scheduled for adjustment shall be protected from any damage during the course of the work.

Existing riser pipe may remain in place and be shortened in length to allow for the proper installation of a new valve box and cover. Any lengthening of the riser pipe shall require the installation of a new riser pipe meeting the requirements of Standard Detail W-300.

#### **4. Methods of Measurement**

Adjustment of Existing Valve Boxes and Covers shall be measured by the unit Each (EA) for the actual number of Adjusted Valve Boxes and Covers installed.

Multiple adjustments to valve boxes in temporary pavement shall be considered incidental to the cost of adjusting valve boxes to the finished grade.

New valve boxes and covers called for as part of new valves are not a part of this bid item.

#### **5. Basis of Payment:**

The accepted quantities of Adjusted Existing Valve Boxes and Covers, measured as provided above, will be paid for at the contract unit price Each, which price shall be full compensation for the work, complete in place.

### **ITEM 5103205 – FIRE HYDRANT**

#### **1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to install Fire Hydrants. New Fire Hydrants shall be installed at the locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

#### **2. Materials:**

All materials shall conform to the requirements of Subsection 510-3.06, (pg. 340)

#### **3. Construction Requirements:**

Installation of the Fire Hydrants shall conform to standard detail W-500 and as approved by the Engineer.

Existing fire hydrants, fire hydrant barrel extensions and other appurtenances shall be disposed of in accordance with Section 5105310 REMOVE & DISPOSE FIRE HYDRANT of these Special Provisions.

**4. Methods of Measurement:**

Fire Hydrants shall be measured by the unit Each (EA) for the actual number Fire Hydrants and related appurtenances installed.

**5. Basis of Payment:**

The accepted quantities of Fire Hydrants, measured as provided above, shall be paid for at the contract unit price Each, which price shall be full compensation for the work, complete in place.

**ITEM 5105010 – NON CEMENT-ASBESTOS WATER PIPE REMOVAL AND DISPOSAL  
TEN INCH (10”) AND SMALLER**

**1. Description:**

The work under this item shall consist of furnishing all labor and equipment required to remove and properly dispose of non cement-asbestos (CA) water pipe, ten inches (10”) and smaller, and any water related appurtenances in accordance with the requirements of these Special Provisions.

**2. Materials:**

None.

**3. Construction Requirements:**

The Contractor shall be responsible for the proper removal and disposition of water related materials from the construction site in accordance with Subsection 510-3.02 (pg. 320) and Standard Detail W-105, note 11, C.

**4. Method of Measurement**

Non Cement Asbestos Water Pipe Removal and Disposal, Ten Inch (10”) and smaller shall be measured by the unit Linear Foot (LF) for the actual Linear Feet of CA pipe removed and disposed.

**5. Basis of Payment:**

The accepted quantities of Non Cement Asbestos Water Pipe Removed and Disposed, Ten Inch (10”) and Larger, measured as provided above, shall be paid for at the contract unit price Linear Foot which price shall be full compensation for the work, complete in place.

**ITEM 5105110 – CEMENT-ASBESTOS WATER PIPE REMOVAL AND DISPOSAL TEN-  
INCH (10”) AND SMALLER**

**1. Description:**

The work under this item shall consist of furnishing all labor and equipment required to remove and properly dispose of off site cement-asbestos (CA) water pipe, ten inches (10”) and smaller, and any CA water related appurtenances in accordance with the requirements of these Special Provisions.

**2. Materials:**

None.

**3. Construction Requirements:**

The Contractor shall be responsible for the proper removal and disposition of water related CA materials from the construction site in accordance with Subsection 510-3.02 (pg. 320) and Standard Detail W-105, note 11, C.

**4. Method of Measurement**

Cement Asbestos Water Pipe Removal and Disposal, Ten Inch (10") and Smaller shall be measured by the unit, Linear Foot, (LF) for the actual Linear Feet of CA pipe removed and disposed.

**5. Basis of Payment:**

The accepted quantities of Cement Asbestos Water Pipe Removal and Disposal, Ten Inch (10") and Smaller, measured as provided above, shall be paid for at the contract unit price Linear Foot which price shall be full compensation for the work, complete in place.

**ITEM 5105112 – CEMENT-ASBESTOS WATER PIPE REMOVAL AND DISPOSAL  
TWELVE INCH (12") AND LARGER**

**1. Description:**

The work under this item shall consist of furnishing all labor and equipment required to remove and properly dispose of cement-asbestos (CA) water pipe, twelve inches (12") and larger, and any CA water related appurtenances in accordance with the requirements of these Special Provisions.

**2. Materials:**

None.

**3. Construction Requirements:**

The Contractor shall be responsible for the proper removal and disposition of water related CA materials from the construction site in accordance with Subsection 510-3.02 (pg. 320) and Standard Detail W-105, note 11, C.

**4. Method of Measurement**

Cement Asbestos Water Pipe Removal and Disposal, Twelve Inch (12") and Larger shall be measured by the unit Linear Foot (LF) for the actual Linear Feet of CA pipe removed and disposed.

**5. Basis of Payment:**

The accepted quantities of Cement Asbestos Water Pipe Removed and Disposed, Twelve Inch (12") and Larger, measured as provided above, shall be paid for at the contract unit price Linear Foot which price shall be full compensation for the work, complete in place.

**ITEM 5105310 – EXISTING FIRE HYDRANT REMOVAL AND DISPOSAL**

**1. Description:**

The work under this item shall consist of furnishing all labor and equipment required to remove and properly dispose of existing fire hydrants and any water related appurtenances in accordance with the requirements of these Special Provisions.

**2. Materials:**

None.

**3. Construction Requirements:**

The Contractor shall be responsible for the proper removal and disposition of water related materials from the construction site in accordance with Subsection 510-3.02 (pg. 320) and Standard Detail W-105, note 11, C.

**4. Method of Measurement**

Existing Fire Hydrants shall be measured by the unit each (EA) for the actual number of fire hydrants removed and disposed.

**5. Basis of Payment:**

The accepted quantities of Existing Fire Hydrants Removed and Disposed, measured as provided above, shall be paid for at the contract unit price Each which price shall be full compensation for the work, complete in place.

**ITEM 5106004 – CONNECTIONS, 4"**  
**ITEM 5106006 – CONNECTIONS, 6"**  
**ITEM 5106008 – CONNECTIONS, 8"**  
**ITEM 5106012 – CONNECTIONS, 12"**

**1. Description:**

The work under this item shall consist of furnishing all labor, equipment and materials required to install Connections between new water pipe and existing water pipe. Connections shall be installed at the locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All materials shall conform to the requirements of Subsection 510-3 (pg. 318).

See section 5101900 FITTINGS, CAST IRON AND DUCTILE IRON of these Special Provisions for pipe fittings.

Polyvinyl Chloride (PVC) fittings shall not be allowed.

### **3. Construction Requirements:**

Existing water mains shall be located by the Contractor at the connection point. If exploratory excavation does not find the existing pipe within the accepted variances from Blue Stake markings, Potholing may be required. See section 5100050 of these Special Provisions for Potholing.

Water shutoffs shall conform to the requirements Standard Detail W-110. *Subsection 510-3.04 (B) (pg. 324) shall not apply.*

Existing water mains shall be de-watered by the Contractor. All water shall be removed from the connection location to provide a reasonably dry working environment for connection to the existing water main. If large quantities of water are anticipated due to unforeseen field conditions, the Contractor shall notify the Engineer and the Tucson Water Department field representative before starting the de-watering process.

Preliminary Flushing shall conform to Subsection 510-3.10 (pg. 344).

Hydrostatic Pressure Testing shall conform to Subsection 510-3.11 (pg. 344).

Disinfection shall conform to Subsection 510-3.13 (pg. 349).

Connection to existing water mains shall be made with a minimum of water system down time. See the Water System Modifications Notes on the plans for special shutdown times and conditions.

### **4. Method of Measurement:**

Connections shall be measured by the unit Each (EA) for the actual number of Connections and related appurtenances installed. The size of the new pipe being installed shall be the size of the Connection regardless of the size of the existing pipe.

If Potholing is required, any costs related to Potholing shall be incidental.

### **5. Basis of Payment:**

The accepted quantities of Connections, measured as provided above, shall be paid for at the contract unit price, Each, as described in Subsection 510-5 (pg. 350).

## **ITEM 5108106 – TIE OVER, (T) 1 ½”**

### **1. Description:**

A Tie Over shall be installed when a new water main is installed and a new connection to an existing copper service is needed. The contractor shall install a new corporation on the new main and install new copper pipe from the new corporation to the connection point on the existing copper service line as shown on the plans. The existing meter, meter box and adjacent service line will not be disturbed.

The work under this item shall consist of furnishing all labor, equipment and materials required to install Tie Overs at the locations shown on the project plans and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All materials shall conform to the requirements of Subsection 510-3.04 (H) (pg. 337), Subsection 510-3.04 (I) (pg. 338) and Standard Details W-309, W-310 and W-312. High Density Polyethylene (HDPE) is not allowed for any service lines.

**3. Construction Requirements:**

Installation of Tie Overs shall include, but not be limited to the removal of all obstructions; all excavation, backfill and compaction; installation of service saddle, corporation, tap on new or existing main, all fittings and adapters; all testing and flushing; and connection to the existing service line.

**4. Method of Measurement:**

Tie Overs shall be measured by the unit Each (EA) for the actual number of Tie Overs and related appurtenances installed.

Costs related to the following components shall be bid as separate items:  
ITEM 5101606 PIPE, COPPER, 1½” W/FITTINGS

**5. Basis of Payment:**

The accepted quantities of Tie Overs, measured as provided above, shall be paid for at the contract unit price, Each, which price shall be full compensation for the work complete in place.

**ITEM 5108114 – METER RELOCATION, SERVICE LINE RENEWAL (M/R), 1”**

**1. Description:**

A Meter Relocation, Service Line Renewal shall be installed when a new water main is installed and the existing service must be moved. The contractor shall install a new corporation on the new main and install new copper pipe from the new corporation to the new meter location shown on the plans. A new meter box shall be installed and new copper pipe from the relocated meter shall be connected to the customers existing plumbing.

The work under this item shall consist of furnishing all labor, equipment and materials required to install Meter Relocations, Service Line Renewals. New Meter Relocations, Service Line Renewals and appurtenances shall be installed at the locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All materials shall conform to the requirements of Subsection 510.304 (H) (pg. 337), Subsection 510-3.04 (I) (pg. 338) and Standard Details W-309 and W-310.

A new # 2 meter box per Standard Detail W-318, sheet 2 of 3 shall be provided by the contractor for each Meter Relocations, Service Line Renewal.

All new service lines shall be copper pipe. High density polyethylene (HDPE) will not be accepted for service lines on this project.

Copper pipe with fittings required for this work shall be bid as a separate item.

### **3. Construction Requirements:**

Installation of Meter Relocations, Service Line Renewals shall include, but not be limited to, the following:

- a. Removal of all obstructions, all excavation, compaction and backfill.
- b. Relocation and re-connection of the existing meter.
- c. Tap on the existing or new water main, installation of service clamps, corporation stops, copper pipe with fittings, angle meter stop, all fittings, and ball valves as called for in detail W-310.
- d. Installation and adjustment of a new # 2 meter box and lid to the finished grade per Standard Detail W-318, sheet 2 of 3, and per section 5108302 METER BOX, #2 of these Special Provisions.
- e. If the renewal is off an existing main, the existing service line piping shall be removed and a threaded cap or plug installed on the threaded end of the existing corporation. If the corporation valve is leaking, the corporation and related saddle shall be removed and a repair clamp intended for the existing main size and material shall be installed on the main line.
- f. Renew the customer's existing plumbing from the ball valve to within one foot of the property line with new copper pipe and fittings. Re-connect the new copper pipe to the customer's existing plumbing. The size of new copper pipe from the meter to the customer's existing plumbing shall be equal to the size of the meter outlet or equal to the size of the customer's existing plumbing at the re-connection, which ever is greater.
- g. If the customer's plumbing is unstable the contractor shall contact the City of Tucson Water Department Construction Section Representative for instructions.
- h. After all work is done on the service line and before the existing meter is reinstalled, the contractor shall flush the service line to remove all debris. After the service line is flushed the contractor shall reinstall the meter.

**4. Method of Measurement:**

Meter Relocations, Service Line Renewals shall be measured by the unit Each (EA) for the actual number of Meter Relocations, Service Line Renewals and related appurtenances installed.

Costs related to the following components shall be bid as separate items:

ITEM 5101604 – PIPE, COPPER, 1” W/FITTINGS

**5. Basis of Payment:**

The accepted quantities of Meter Relocations, Service Line Renewals measured as provided above, shall be paid for at the contract unit price, Each, which price shall be full compensation for the work complete in place.

**ITEM 5108118 – METER RELOCATION, SERVICE LINE RENEWAL, (M/R) 2”**

**1. Description:**

A Meter Relocation, Service Line Renewal shall be installed when a new water main is installed and the existing service must be moved. The contractor shall install a new corporation on the new main and install new copper pipe from the new corporation to the new meter location shown on the plans. A new meter box shall be installed and new copper pipe from the relocated meter shall be connected to the customers existing plumbing.

The work under this item shall consist of furnishing all labor, equipment and materials required to install Meter Relocations, Service Line Renewals. New Meter Relocations, Service Line Renewals and appurtenances shall be installed at the locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All materials shall conform to the requirements of Subsection 510.304 (H) (pg. 337), Subsection 510-3.04 (I) (pg. 338) and Standard Details W-309 and W-312.

A new # 3 meter box per Standard Detail W-318, sheet 3 of 3 shall be provided by the contractor for each Meter Relocations, Service Line Renewal.

All new service lines shall be copper pipe. High density polyethylene (HDPE) will not be accepted for service lines on this project.

Copper pipe with fittings required for this work shall be bid as a separate item.

**3. Construction Requirements:**

Installation of Meter Relocations, Service Line Renewals shall include, but not be limited to, the following:

- a. Removal of all obstructions, all excavation, compaction and backfill.
- b. Relocation and re-connection of the existing meter.
- c. Tap on the existing or new water main, installation of service clamps, corporation stops, copper pipe with fittings, angle meter stop, all fittings, and ball valves as called for in detail W-312.
- d. Installation and adjustment of a new # 3 meter box and lid to the finished grade per Standard Detail W-318, sheet 3 of 3, and per section 5108303 METER BOX, #3 of these Special Provisions.
- e. If the renewal is off an existing main, the existing service line piping shall be removed and a threaded cap or plug installed on the threaded end of the existing corporation. If the corporation valve is leaking, the corporation and related saddle shall be removed and a repair clamp intended for the existing main size and material shall be installed on the main line.
- f. Renew the customer's existing plumbing from the ball valve to within one foot of the property line with new copper pipe and fittings. Re-connect the new copper pipe to the customer's existing plumbing. The size of new copper pipe from the meter to the customer's existing plumbing shall be equal to the size of the meter outlet or equal to the size of the customer's existing plumbing at the re-connection, which ever is greater.
- g. If the customer's plumbing is unstable the contractor shall contact the City of Tucson Water Department Construction Section Representative for instructions.
- h. After all work is done on the service line and before the existing meter is reinstalled, the contractor shall flush the service line to remove all debris. After the service line is flushed the contractor shall reinstall the meter.

**4. Method of Measurement:**

Meter Relocations, Service Line Renewals shall be measured by the unit Each (EA) for the actual number of Meter Relocations, Service Line Renewals and related appurtenances installed.

Costs related to the following components shall be bid as separate items:

5101608 PIPE, COPPER, 2" W/FITTINGS

**5. Basis of Payment:**

The accepted quantities of Meter Relocations, Service Line Renewals measured as provided above, shall be paid for at the contract unit price, Each, which price shall be full compensation for the work complete in place.

**ITEM 5108134 – SERVICE LINE RENEWAL (R) 1”**  
**ITEM 5108138 – SERVICE LINE RENEWAL (R) 2”**

**1. Description:**

A Service Line Renewal shall be installed when a new water main is installed and a new connection to the existing service is needed from the new main to the existing meter. The contractor shall install a new corporation on the new main and install new copper pipe from the new corporation to the existing meter location shown on the plans. The existing meter, meter box and customer’s service line will not be disturbed.

The work under this item shall consist of furnishing all labor, equipment and materials required to install Service Line Renewals. Service Line Renewal and appurtenances shall be installed at the locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All materials shall conform to the requirements of Subsection 510-3.04 (H) (pg. 337), Subsection 510-3.04 (I) (pg. 338), Subsection 510-3.05 (pg. 339) and Standard Details W-309 and W-310.

All new service lines shall be copper pipe. High density polyethylene (HDPE) will not be accepted for service lines on this project.

Copper pipe with fittings required for this work shall be bid as a separate item.

**3. Construction Requirements:**

Installation of Service Line Renewals shall include, but not be limited to, the following:

- a. Removal of all obstructions, all excavation, compaction and backfill.
- b. Tap on the existing or new water main, installation of service clamps, corporation stops, copper pipe with fittings, angle meter stop, all fittings, and ball valves as called for in detail W-310.
- c. If the renewal is off an existing main, the existing service line piping shall be removed and a threaded cap or plug installed on the threaded end of the existing corporation. If the corporation valve is leaking, the corporation and related saddle shall be removed and a repair clamp intended for the existing main size and material shall be installed on the main line.
- d. Connect the new angle meter stop to the existing water meter.
- e. After all work is done on the service line and before the existing meter is reconnected, the contractor shall flush the service line to remove all debris. After the service line is flushed the contractor shall reconnect the meter.

**4. Method of Measurement:**

Service Line Renewals shall be measured by the unit Each (EA) for the actual number of Service Line Renewals and related appurtenances installed.

Costs related to the following components shall be bid as separate items:

5101604 PIPE, COPPER, 1" W/FITTINGS  
5101608 PIPE, COPPER, 2" W/FITTINGS

**5. Basis of Payment:**

The accepted quantities of Service Line Renewals measured as provided above, shall be paid for at the contract unit price, Each, which price shall be full compensation for the work complete in place.

**ITEM 5108156 – SERVICE STUB, 1½" (S)**

**1. Description:**

A Service Stub is installed when the agency requests a new meter or the adjacent property owner request a new or upsized service. The contractor shall install a new corporation on the new or existing main and install new copper pipe from the new corporation to the new meter location shown on the plans. A new appropriately sized meter box shall be installed and an angled meter stop shall be installed on the end of the copper pipe. The contractor, or the adjacent property owner, shall make application for a new service to the City of Tucson Water Department after the stub is accepted by the Water Department.

Work under this item shall consist of furnishing all labor, equipment and materials required to install Service Stubs. Service Stubs and appurtenances shall be installed at the locations shown on the project plans, in accordance with the details shown on the project plans, and in accordance with the requirements of these Special Provisions.

**2. Materials:**

All materials shall conform to the requirements of Subsection 510-3.04 (H) (pg. 337), Subsection 510-3.04 (I) (pg. 338), Subsection 510-3.05 (pg. 339) and Standard Details W-309 and W-312.

A new # 3 meter box per Standard Detail W-318, sheet 3 of 3 shall be provided by the contractor for each Service Stub.

All new service lines shall be copper pipe. High density polyethylene (HDPE) will not be accepted for service lines on this project.

Copper pipe with fittings required for this work shall be bid as a separate item.

**3. Construction Requirements:**

Installation of service stubs shall include, but not be limited to, the following:

Removal of all obstructions, all excavation, compaction and backfill.

- a. Tap on the existing or new water main, installation of service clamps, corporation stop, copper pipe with fittings, angle meter stop, and all fittings, as called for in detail W-312.
- b. Installation and adjustment of a new #3 meter box and lid to the finished grade per Standard Detail W-318, sheet 3 of 3, and per section 5108303 METER BOX, #3 of these Special Provisions.
- c. All testing and flushing. After all work is done on the service line, the contractor shall flush the service line to remove all debris. After the service line is flushed the contractor shall close the angle meter stop.

**4. Method of Measurement:**

Service Stubs shall be measured by the unit Each (EA) for the actual number of Service Stubs and related appurtenances installed.

Costs related to the following components shall be bid as separate items:

5101606 PIPE, COPPER, 1½" W/FITTINGS

**5. Basis of Payment:**

The accepted quantities of Service Stubs measured as provided above, shall be paid for at the contract unit price Each, which price shall be full compensation for the work complete in place.

**SECTION 515 - MISCELLANEOUS UTILITY RELOCATIONS**

Is hereby added

**515-1 DESCRIPTION**

The work under this Section is intended to cover work added to the contract by the Engineer for miscellaneous relocation of utilities that are encountered during the course of construction. Miscellaneous work shall be work that was not covered by other items included in the project and shall be performed at the direction of the Engineer.

**515-2 MATERIALS (None Specified)**

**515-3 CONSTRUCTION DETAILS (None Specified)**

**515-4 METHOD OF MEASUREMENT**

The work under this Section shall be completed on a force account basis as specified in Subsection 109-5.

**515-5 BASIS OF PAYMENT**

Payment for miscellaneous utility relocation will be made in accordance with the provisions of Subsection 109-5.

**(515UTLPH, 5/01/09)**

**ITEM NO. 5150005 - UTILITY POTHOLING, Depth less than Twelve Feet (12')**  
**ITEM NO. 5150007 - UTILITY POTHOLING, Depth Twelve Feet (12') and greater**

**1. DESCRIPTION**

The work under these bid items, herein after referred to as “potholing”, consists of furnishing all labor, equipment, and materials required in the construction of the project including, excavation and exposing utility facilities per Arizona “Blue Stake” requirements.

**2. MATERIALS**

All materials shall conform to the requirements of the Agency for backfilling and patching existing roadway surfaces.

**3. CONSTRUCTION REQUIREMENTS**

All procedures for potholing such as, but not limited to, traffic control, cutting existing roadway surfaces, backfill, and patching existing roadway surfaces, shall conform to the requirements of the Agency.

Areas disturbed during potholing are to be restored to their original condition.

Forty-eight (48) hours prior to potholing, the contractor shall provide in writing to the Engineer pothole locations for review and approval. The contractor shall maintain a record of pothole information including utility name, horizontal location, vertical elevation, size and material type of utility facility uncovered. If a pothole does not uncover a utility facility, the pothole should be noted as “dry”. All pothole locations are to be surveyed and tied to a horizontal and vertical control approved by the Engineer. The contractor shall provide pothole information to the Engineer upon request.

**4. METHOD OF MEASUREMENT**

Potholing will be measured as a unit for each pothole whether or not an underground utility facility was uncovered.

No measurement will be made for potholes not approved by the Engineer.

**5. BASIS OF PAYMENT**

The accepted quantities of potholing, measured as provided above, will be paid for at the contract unit price per each. The price shall include full compensation for the work complete, including traffic control, area restoration, pavement cutting, excavating, backfilling, pavement patching, and surveying unless construction surveying is provided by the Agency.

No payment will be made for potholes not approved by the Engineer.

Price adjustment for variation in total bid quantity per Subsections 109-3 and 109-4 of the Standard Specifications do not apply to work under these bid items.

## SECTION 601 - CONCRETE STRUCTURES

**601-1 DESCRIPTION:** of the Standard Specifications is modified to add:

### **Form liners:**

#### **(A) General**

This work shall include furnishing all materials, personnel, test samples and equipment to construct the patterned concrete surfaces as shown in the Plans, to include the construction and use of both custom and standard form liners in accordance with the details shown in the Plans and the requirements of the Special Provisions.

Close coordination with the Project Engineer and the Project Artist will be required in the development of the custom form liners as described in these Special Provisions. A pre-activity meeting is required for the Contractor, Engineer and Artist to review the schedule, recommended materials and procedures. The Engineer has final approval authority over all art and formliners.

Form liners shall be used on shaped agave walls, transitional walls, barrier walls, piers, park entrance walls and drainage structure headwalls and wingwalls as noted on the project plans. (Note: shaped agave walls and transitional walls are patterned on both sides: front and back.)

Barrier walls, piers, park entrance walls, and drainage structure headwalls & wingwalls use standard form liners and may not require the same amount of lead time as the agave walls and transitional walls.

### **601-2 MATERIALS:**

**601-2.01 Portland Cement Concrete:** the first sentence is revised to read:

Portland cement concrete shall conform to the requirements of Section 1006 for Class S or Class X as shown on the project plans.

A special mix design will be required for the concrete parapet agave walls as noted in Item Specification Number 6010660.

**601-2 MATERIALS:** of the Standard Specifications is modified to add:

#### **601-2.07 Release Agent:**

Form Release Agent: The form release agent shall be as specified by the form liner manufacturer, or an approved equal. The release agent shall be formulated as specified by the manufacturer and shall prevent bonding of the form liners to the concrete surface. Prior to initial use, each form liner shall be primed with two (2) coats of form-release agent.

## **601-3 CONSTRUCTION DETAILS:**

**601-3.02 (C) Forms Construction:** of the Standard Specifications is modified to add:

### FORM LINER FABRICATOR REQUIREMENTS

Eligible Fabricators shall be the following:

1) Fitzgerald Formliners  
1500 E. Chestnut Ave  
Santa Ana, CA 92701  
PH: 714-547-6710  
FX: 714-245-9715  
[formliners.com](http://formliners.com)

2) Scott System Inc.  
10777 East 45th Ave.  
Denver, CO 80239  
PH: 303-373-2500  
FX: 303-373-2755  
[info@scottsystem.com](mailto:info@scottsystem.com)

3) Symons  
200 East Touhy Ave.  
Des Plaines, IL 60018  
800-800-SYMONS  
[info@symons.com](mailto:info@symons.com)

If the Contractor would like to use a form liner fabricator other than the ones named, the Contractor shall obtain approval from the County prior to bid opening.

### QUALITY ASSURANCE

A. Shop Drawings, Mock-ups, and Field Samples: Prepare and submit as outlined in these Special Provisions.

### FORM LINER CONSTRUCTION

A. The form liners shall be constructed by one of the three form liner fabricators listed above or approved equal, and shall be resistant to cracking, swelling and shrinkage. The elastomeric material is to be (hydro-backed) bonded to wood or fiberglass for rigidity and durability. Depending on the size of the liner, this backing may be applied at the form liner facility or in the field. The form liner fabricator will recommend the specific backing treatment for each liner type, based on its size and thickness. The form liners shall be of the quality acceptable for a minimum of 100 reuses. The form liners shall conform to the specifications shown on the project plans and shall be approved by the Engineer.

B. The custom form liners shall be produced by one of the three formliner manufacturers listed above. The use of the Artist's designs is limited to the work for this project. The manufacturer of the form liners shall certify that the design will not be reproduced for any other use without the expressed permission of the Artist (Vicki Scuri).

C. The Artist's Copyright Symbol: Vicki Scuri Siteworks, © 2009 or current year, must be included on a beveled perimeter edge of each pattern unit, in 16 point readable typeface or permanently marked onto the back of each form liner.

The custom form liner shall be hydro-backed or adhered to the plywood backing with sheet metal screws through the back of the forms into the back of the liner. Threaded inserts may also be added to the back of the liner and bolts may be used to fasten the liner through the forms. The liner may also be bolted through the face of the liner with flat-head bolts through the liner and forming system with approval from the Engineer. Minimize visibility and use of flat-head bolts inserted through the face of the liner. All blemishes must be discretely patched. The Contractor may not seam through the pattern face.

All architectural formed flat surfaces must be elastomeric, HDO or MDO board to create crisp, clean surfaces. All liners must include a 10 degree draft for release.

The construction of the molds, the application of the form liners, the release agents, the water base cure, and all other elements of construction and installation shall conform to the form liner manufacturer's specifications, or approved equal.

During placement of the concrete for structures, forms shall be kept in place for a minimum of 24 hours to ensure proper molding. Refer to details for specific dimensions and surface texture of form liners to be used for the concrete structures.

#### SPECIAL CONSIDERATIONS AND FORM LINER DETAILS

Shop drawings will be required for each discreet pattern unit and the north and south elevation layouts. The Engineer will review and approve the shop drawings before allowing the Form Liner Fabricator to begin fabricating the work.

The pattern work is sculptural and 3D diagrams/images of the proposed pattern relief cutting techniques are required for each pattern unit. These 3D simulations of the proposed cutting techniques shall be created by a CNC CAM Cutting Specialist, provided by the Form Liner Fabricator. The Contractor will arrange to have the Artist work with the Cutting Specialist to produce all CNC CAM Cut sculptural pattern work required for the production of the master positives. The first approval step will be the review and approval of electronically imaged, 3D relief images of the proposed units and the proposed cutting methods. The Artist will work with the Cutting Specialist to determine the character of the completed Artwork.

The contractor will arrange to have the Artist review the full pattern layouts at the Form Liner Fabricator's facility during the master mold fabrication process. The Engineer will have final approval authority of the full pattern layouts.

The finished form liners will carry a pattern code on the back of each liner to illustrate location and placement as defined by the shop drawings.

The General Contractor will provide two weeks notice to proceed, and will allow minimally 4-8 weeks of lead time for the Artist and the Form Liner Fabricator to schedule their work and to create the relief parts. The Contractor will allow up to 8 weeks for the production of relief parts, once the work is scheduled. The Form Liner Fabricator will provide a

production schedule for the fabrication of master molds and liners based on the approval process and coordination with the subcontractors and the Artist.

**601-3.03 Placing Concrete:** of the Standard Specifications is modified to add:

**(G) Placement of Form Liners:**

The Contractor shall give special attention to providing continuous and uninterrupted vibration of the concrete in order to thoroughly consolidate concrete in the pattern details of the form liners so that the form liners are uniformly filled and without aggregate pocks or any other noticeable concrete finish blemishes.

The construction of the master molds, the application of the formliners, the release agents, the water base cure, and all other elements of construction and installation shall conform to the formliner manufacturer's recommendations and specifications.

Following completion of concrete placement, the forms shall be kept in place for a minimum of 24 hours to ensure proper molding.

**601-3.05 (D) Finishing Bridge Deck:** the first, second and third paragraph of the Standard Specifications are revised to read:

Bridge sidewalks shall be finished to a medium broom finish that is transverse to the direction of pedestrian traffic.

Where the surface will be exposed directly to traffic, it shall be textured transversely, after final floating of the plastic concrete or after the completion of the curing period to produce a uniformly grooved surface.

The textured surface shall be completed by the use of a tining procedure. Sawcutting of grooves for the surface texturing will not be allowed. The timing of the texturing operation of the plastic concrete is critical. The texturing shall be completed before the surface of the concrete can be torn or unduly roughened by the texturing operation. Grooves that close following the texturing (tining) operation will not be permitted and will be cause for rejection of the bridge deck. Grooves provided by the tining operation shall be as noted in Section 601-4.01 of these Special Provisions.

The apparatus producing the textured grooves in the plastic concrete shall be mechanically operated from an independent self-propelled bridge. The bridge shall be used for texturing only and shall be supported on the same steel rails used for the screed equipment.

**601-3.05 (D) Finishing Bridge Deck:** the seventh paragraph of the Standard Specifications is revised to read:

Fogging equipment shall be provided and shall be capable of applying water to the area above the concrete in the form of a fine fog mist of sufficient quantity to inhibit the effects of rapid evaporation of mixing water from the concrete on the deck resulting from wind, high temperature, low humidity or any combination of these factors. Fogging equipment shall be placed on both sides of the bridge deck such that the entire deck being constructed is adequately covered by the misting process. The use of windbreaks may be required as directed by the Engineer at the time of deck concrete

placement. The Contractor shall be prepared to have windbreaks available, if needed, prior to the placement of deck concrete.

**601-3.06 Curing Concrete:** of the Standard Specifications is modified to add:

The Contractor shall provide adequate labor and materials dedicated solely to the curing operations of the bridge deck so as to prevent any shrinkage cracking from occurring.

**601-3 CONSTRUCTION DETAILS:** of the Standard Specifications is modified to add:

**601-3.09 Mock-ups:**

MOCK-UPS: Designated on Pattern Elevations

The Contractor will pour an on-site mock-up test wall of the agave panel and the transitional panel to check each unique form liner pattern unit and to determine the appropriate mix design, vibration, and technical expertise required to successfully reproduce the form liner patterning into concrete. The mock-up test wall (demonstrating all unique units) must be approved by the Engineer, before the parapet wall construction is begun. Any adjustments to the liner relief must be requested in writing, and must occur at the time of review and approval of the test wall. This mock-up wall will be on site, but it will not be part of the job. The Contractor is responsible for designing and constructing suitable foundations and bracing to safely support the mock-ups during construction.

A) The mock-up test wall(s) will be minimally the size of two full pattern units: one agave shaped panel and one transitional end panel: see Architectural Treatment details in the bridge plans. This mock-up must demonstrate the conditions of the job, including the placement of form ties. Form ties must avoid marring the pattern face. All liners are to have "mated backs" with ties located to avoid marring the face of the form liner. The Contractor may be required to pour this test wall more than once in order to refine the work.

B) Several sample panels may be required to adjust the form, release agent, joints, and chamfers in order to finalize acceptable form liners as defined in the plans and special provisions. The Engineer will review and approve the sample panels.

C) The Approval of these mock-up walls will be made by the Engineer.

D) Once all the mock-up walls are approved, the Contractor may begin construction of the work.

E) All unacceptable, rejected samples shall be removed from the site. The acceptable samples will serve as visual/physical standards for the evaluation and quality control of the form liner patterns on the final structures. After the completion of all concrete work, the mock-up walls shall be removed from the site.

**601-3.10 General Construction Requirements:** The following subsection is added to the Standard Specifications:

The Contractor shall provide independent testing for inspection and certification of the construction of the project bridge girders, if they are to be fabricated outside of Pima County. The independent

testing laboratory to be used requires approval by Pima County. The independent testing laboratory shall provide necessary construction inspection, materials sampling and testing services in accordance with ADOT testing procedures. The Contractor shall provide the cost of these services and they are considered incidental to the cost of the project. If the bridge girders are fabricated in Pima County, materials sampling and testing, inspection and verification testing services will be performed by Pima County.

**601-4 Tests on Finished Structures:** of the Standard Specifications is modified as follows:

**601-4.01 Surface Texture:** of the Standard Specifications is modified as follows:

The grooves for decks exposed directly to traffic shall be 1/16 to 1/8 inch in width and shall be 3/32 to 6/32 inch in depth. The textured groove depth will be measured in accordance with the requirements of Arizona Test Method 310. The center to center spacing of the grooves completed by the tining operation shall be 1/2 inch to 1 inch.

**601-5 METHOD OF MEASUREMENT:** the third paragraph of the Standard Specifications is revised to read:

No measurement or direct payment will be made for fogging or tining of the bridge deck. The cost shall be considered as incidental to the cost of the bridge deck.

**601-5 METHOD OF MEASUREMENT:** of the Standard Specifications is modified to add:

The formliners, mock-ups, shop drawings, and all associated labor, equipment and materials, shall be considered incidental to the costs of the concrete structures.

**601-6 BASIS OF PAYMENT:** the second paragraph of the Standard Specifications is revised to read:

No measurement or direct payment will be made for fogging or tining of the bridge deck. The cost shall be considered as incidental to the cost of the bridge deck.

**601-6 BASIS OF PAYMENT:** of the Standard Specifications is modified to add:

The cost of the molds, formliners, mock-ups, design, layout, 3D imaging, shop drawings, CAM Cutting, fabrication, installation and removal of form liners, release agents and sealers, paint, and all associated labor, equipment and materials, shall be included in the contract unit price for the concrete structures, which price shall be full compensation for the work, complete in-place.

## **ITEM 6010201 - RETAINING WALL (ADOT STD. B-18.10)**

### **1. Description:**

The work under this item consists of furnishing all materials, equipment and labor to construct cast-in-place retaining walls RW-1 and RW-2 (Details R21 and R22) at the locations and in accordance with the details shown in the plans.

**2. Materials:**

All materials shall conform to the requirements of the Standard Specifications, ADOT Standard Drawings and as shown on the plans.

**3. Construction Requirements:**

The retaining wall shall be constructed in accordance with the plans, ADOT Standard Drawings, these Special Provisions, and as directed by the Engineer.

The subgrade soils within a prism of depth of three feet below the footing of the retaining wall and 2 feet around the perimeter of the wall footing footprint shall be overexcavated and replaced with aggregate base course without asphaltic material in accordance with Section 303 of the Standard Specifications. The aggregate base course shall be compacted to achieve a maximum dry density corresponding to 100% of the Standard Proctor effort according to Arizona Test Method 225 (ARIZ, 1996) with compaction moisture content within  $\pm 2\%$  of the optimum moisture content. In addition, the top 6 inches of the subgrade at the bottom of the overexcavated zone shall be moistened and proof-rolled with a 10-ton heavy vibratory or impact roller before the construction of the footings. Any soft areas found after proof-rolling shall be remediated by overexcavation and replacement with aggregate base course material as per Section 303 of the Standard Specifications.

**4. Method of Measurement:**

The retaining wall will be measured by the square foot. Measurement for payment will be based on the vertical height and length of the wall shown on the plans and measured along the front face. The vertical height will be taken as the difference in elevation measured from top of footing to top of wall.

**5. Basis of Payment:**

The accepted quantities of the retaining wall measured as provided above, will be paid for at the contract unit price per square foot, which shall be considered full compensation for the work, complete in place, including all concrete, reinforcing steel, excavation, fill, geocomposite wall drain system, overexcavation, aggregate base course material and compaction, as specified herein. The price shall include all necessary labor, equipment and materials to accomplish the work in accordance with the plans and these Specifications.

**ITEM 6010210 – PARK ENTRY MONUMENT WALLS**

**1. DESCRIPTION:**

The work under this item consists of furnishing all equipment, labor and materials required to construct cast-in-place reinforced concrete park entry monument walls with architectural treatments in accordance with the details shown on the Project Plans and these Special Provisions.

**2. MATERIALS:**

Concrete shall be Class S,  $f'c = 3000$  psi and shall conform to the requirements of Section 1006 of the Standard Specifications

Reinforcing steel shall be Grade 60 and shall conform to the requirements of Section 1003.

Paint Primer shall be a premium acrylic semi-transparent sealer for concrete and shall conform to the requirements of Section 1002. Paint Primer shall be Dunn Edwards Eduraseal W360, or approved equal.

Paint for concrete walls shall be exterior acrylic low sheen paint and shall conform to the requirements of Section 1002. Paint shall be Dunn Edwards Spartasheen W7300, or approved equal. Color shall be as specified on the project plans.

### **3. CONSTRUCTION REQUIREMENTS:**

The architectural treatments shall include formed lettering and textured surfaces as shown on the project plans. Formliner edge treatment and detailing shall be as shown on the bridge architectural treatment details and special provisions. Priming, Painting and Graffiti Barrier Coating shall be performed in accordance with product manufacturer's specific instructions and Section 610. The concrete paint shall extend to the base of the wall footing.

### **4. METHOD OF MEASUREMENT:**

Park Entry Monument Walls will be measured by the square foot of wall constructed including architectural treatments and shall be measured along the front face of the wall from the top of the footing to the top of the wall.

### **5. BASIS OF PAYMENT:**

The accepted quantities of Park Entry Monument Walls, measured as provided for above, will be paid for at the contract unit price per square foot of wall, which shall be considered full compensation for the work, complete in place, including all work involved in constructing the walls, and footings, including excavation and backfilling, concrete and reinforcing steel, architectural treatments and coatings as specified herein. The price shall include all labor, equipment and materials to accomplish the work in accordance with the plans and these Specifications.

#### **ITEM 6010632 - CONCRETE BRIDGE BARRIER (TYPE F) (32")**

#### **ITEM 6010642 - CONCRETE BRIDGE BARRIER (TYPE F) (42")**

##### **(1) Description:**

The work under these items consist of furnishing all materials, equipment and labor to construct concrete bridge barriers at the locations and in accordance with the details shown in the plans. The 32" barrier shall be constructed in accordance with ADOT Standard Drawing SD-1.01. The 42" barrier shall be constructed in accordance with ADOT Standard Drawings SD-1.02. The contractor shall reference both the plans and ADOT Standard Drawings to construct the barriers.

##### **(2) Materials:**

All materials shall conform to the requirements of the Standard Specifications, ADOT Standard Drawings and as shown on the plans.

**(3) Construction Requirements:**

The barrier shall be constructed in accordance with the plans, these Special Provisions, Section 910 of the Standard Specifications and as directed by the Engineer.

The reinforcing steel shall be placed in accordance with the details shown in the ADOT Standard Drawings and to the requirements of the Specifications.

**(4) Method of Measurement:**

Concrete barrier will be measured by the linear foot along the face of barrier at the top surface of the bridge deck or support including transition sections.

**(5) Basis of Payment:**

The accepted quantities of concrete barrier measured as provided above, will be paid for at the contract unit price per linear foot, which shall be considered full compensation for the work, complete in place, including all concrete, reinforcing steel and transitions as specified herein and shown on the plans. Reinforcing steel embedded below the barrier or transition shall be included in the cost of the barrier. The price shall include all necessary labor, equipment and materials to accomplish the work in accordance with the plans and these Specifications.

**ITEM 6010660 - CONCRETE BRIDGE PARAPET**

**(1) Description:**

The work under this item consists of furnishing all materials, equipment and labor to construct a Concrete Bridge Parapet with artistic treatment at the locations and in accordance with the details shown in the plans.

**(2) Materials:**

All materials shall conform to the requirements of the Standard Specifications and as shown on the plans and in these Special Provisions. Formliners shall conform to Section 601 of these Special Provisions.

Concrete shall have 3/8" maximum size aggregate and a minimum compressive strength of 4,000 psi at 28 days. Self-consolidating concrete may be used at the Contractor's option if approved by the Engineer and shall be at no additional cost to the County. Contractor shall submit a concrete mix design for review and approval prior to construction.

Mock-up panels shall be constructed as shown on the architectural treatment details in the bridge plans and as specified in Section 601 of these Special Provisions. The mock-up panels must be approved by the Engineer prior to constructing the remaining panels. The Contractor may be required to construct more than one mock-up in order to refine the work and to obtain a high quality panel that is acceptable for use. The approved mock-ups of the concrete parapets shall not be used as part of the finished product.

**(3) Construction Requirements:**

The concrete bridge parapet shall be constructed in accordance with the plans, these Special Provisions and as directed by the Engineer. The parapet shall be cast-in-place concrete with expansion joints spaced as shown on the plans. The parapet shall not be constructed out of precast units.

The reinforcing steel shall be placed in accordance with the details shown in the plans and to the requirements of the Specifications.

The Contractor shall give special attention to providing continuous and uninterrupted vibration of the concrete in order to thoroughly consolidate concrete in the pattern details of the form liners so that the form liners are uniformly filled and without aggregate pocks or any other noticeable concrete finish blemishes.

**(4) Method of Measurement:**

The Concrete Bridge Parapet will be measured by the linear foot along the face of parapet at the top surface of the bridge deck or support.

**(5) Basis of Payment:**

The accepted quantities of Concrete Bridge Parapet measured as provided above, will be paid for at the contract unit price per linear foot, which shall be considered full compensation for the work, complete in place, including all concrete and reinforcing steel, dowels, blockouts, formliners, as specified herein. The price shall include all necessary labor, equipment and materials to accomplish the work in accordance with the plans and these Specifications. No payment will be made for mock-up panels, the cost being considered incidental to this item.

**ITEM 6016080 - MINOR STRUCTURE**

**1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to construct a pipe outlet structure at the location shown on the plans and in accordance with Detail DH shown on the plans and the requirements of these specifications.

**2. Materials:**

Concrete shall be Class S,  $f'c = 3000$  psi and shall conform to the requirements of Section 1006 of the Standard Specifications.

Reinforcing steel shall be Grade 60 and shall conform to the requirements of Section 1003.

Bituminous joint filler shall conform to the requirements of AASHTO M 213.

**3. Construction Requirements:**

The minor structure shall be constructed in accordance with the requirements of Detail DH shown in the plans and Sections 203, 601 and 605 of the Standard Specifications.

**4. Method of Measurement:**

The minor structure will be measured as a unit for each structure.

**5. Basis of Payment:**

The accepted quantity of the minor structure will be paid for at the contract unit price for the structure, which price shall be full compensation for the work, complete in place, including drainage excavation, structural excavation, structure backfill, compacting, structural concrete, steel reinforcement, form liner, and disposal of unsuitable or excess material. The barricade railing and soil cement bank protection will be paid for under separate items.

**ITEM 6016087 - CONCRETE HEADWALL**

**1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to construct concrete headwalls at the locations shown on the plans and in accordance with Detail DE shown on the plans and the requirements of these specifications.

**2. Materials:**

Concrete shall be Class S,  $f'c = 3000$  psi and shall conform to the requirements of Section 1006 of the Standard Specifications.

Reinforcing steel shall be Grade 40 or 60 and shall conform to the requirements of Section 1003.

**3. Construction Requirements:**

The concrete headwalls shall be constructed in accordance with the requirements of Detail DE shown in the plans and Sections 203, 601 and 605 of the Standard Specifications.

**4. Method of Measurement:**

The concrete headwalls will be measured as a unit for each headwall.

**5. Basis of Payment:**

The accepted quantity of each headwall will be paid for at the contract unit price each, which price shall be full compensation for the work, complete in place, including drainage excavation, structural excavation, structure backfill, compacting, structural concrete, steel reinforcement, and disposal of unsuitable or excess material. The barricade railing will be paid for under a separate item.

## ITEM 6016110 - WINGWALL

### 1. Description:

The work under this item consists of furnishing all equipment, labor and materials required to construct concrete wingwalls at the locations shown on the plans and in accordance with Detail DD shown on the plans and the requirements of these specifications.

### 2. Materials:

Concrete shall be Class S,  $f'c = 3000$  psi and shall conform to the requirements of Section 1006 of the Standard Specifications.

Reinforcing steel shall be Grade 40 or 60 and shall conform to the requirements of Section 1003.

### 3. Construction Requirements:

The concrete wingwalls shall be constructed in accordance with the requirements of Detail DD shown in the plans and Sections 203, 601 and 605 of the Standard Specifications.

### 4. Method of Measurement:

The concrete wingwalls will be measured as a unit for each wingwall.

### 5. Basis of Payment:

The accepted quantity of each wingwall will be paid for at the contract unit price each, which price shall be full compensation for the work, complete in place, including drainage excavation, structural excavation, structure backfill, compacting, structural concrete, steel reinforcement, and disposal of unsuitable or excess material.

## SECTION 604 - STEEL STRUCTURES

**604-1 DESCRIPTION:** of the Standard Specifications is modified to add:

The work under this section includes furnishing and installing strip seal expansion joints in accordance with the project plans, this Special Provision, and the manufacturer's recommendations and instructions. Work shall include, but is not necessarily limited to, cleaning surfaces, furnishing and installation of frame rail with attachment devices, erection angles to maintain joint width and set level, providing and placement of elastomeric concrete, providing level strip seal expansion joint seating surface, furnishing and installing continuous neoprene strip seal, providing upturn at each end of the joint (if required), providing blackout in the concrete barrier for joint upturns (if required), miscellaneous steel cover plates, anchor bolts, and other miscellaneous items in accordance with the project plans and the requirements of these Special Provisions.

**604-2 MATERIALS** of the Standard Specifications is modified to add:

**604-2.11 Steel Frame Rails**

All steel frame rails shall be fabricated from ASTM A588 or A36 steel and shall provide a cross sectional area of 1.94 in<sup>2</sup>.

The profile of the steel extrusion shall not contain horizontal legs in order to promote concrete consolidation.

Frame rails welded together in any manner to gain their final shape are not allowable. Only steel retainer rails of one-piece construction will be permitted for this project.

**604-2.12 Neoprene Gland** of the Standard Specifications is modified to add:

The manufacturer that supplies the expansion joint metal shall also be the manufacturer of the associated neoprene gland.

The sealing element shall be an extruded synthetic rubber utilizing virgin polychloroprene (neoprene) as the only polymer. The gland shall be tested and certified by the manufacturer to obtain the following properties:

**Gland Specification:**

**MATERIAL - POLYCHLOROPRENE**

<b>PROPERTY</b>	<b>REQUIREMENT</b>	<b>METHOD</b>
Tensile Strength, Min., psi (Mpa)	2000 (13.8)	D-412-62T
Elongation at break, Min.	250%	D-412-51T
Hardness, Durometer A	60 ± 5	D-2240 Modified
Ozone Resistance, 20% Elongation 300 pphm 104°F (40°C) (70 hrs.) Wipe surfaces with solvent to remove contamination	No cracks	D-1149
Heat Aging 70 hours at 212°F (100°C) Tensile Strength, Max. % decrease Elongation, Max % decrease Hardness, Max. Change	20 20 +10/-0	D-573
Oil Swell, ASTM Oil #3 70 hours at 212°F (100°C) Max weight increase	45%	D-471
Compression Set, 70 hours at 212°F (100°C)	40% max.	D-395 (B)
Low Temperature	Not brittle	D-746
Low Temperature Stiffening 7 days at +14°F (-10°C) Hardness Type A Durometer, Points change	0 to +15	

The gland shall be fabricated in the shop to fit the final dimensions of the joint as it occurs in the roadway. No field splices will be permitted.

Except as noted otherwise in this paragraph, the neoprene gland shall be shipped from the factory as one continuous piece. Molded shop splices, if any, for horizontal and vertical turns will be at the discretion of the manufacturer of the strip seal expansion joint system.

**604-3 CONSTRUCTION DETAILS:** of the Standard Specifications is modified to add:

**604-3.01 Shop and Working Drawings** of the Standard Specifications is modified to add:

The Contractor shall submit shop drawings for review and approval prior to fabrication of the deck joint system. The shop drawings shall detail all dimensions, anchorages, welding procedures, elastomeric concrete mix designs, and test data, along with qualifications of the technical advisor.

The shop drawings shall explicitly set forth mixing procedures, placing and finishing requirements, and the means by which the strip seal expansion joint is to be aligned and set to grade so as to match bridge deck grades and provide a smooth ride over the joint when completed.

**604-3.02 Fabrication** of the Standard Specifications is modified to add:

Fabrication of the strip seal expansion joint shall be performed by an AISC certified fabricator. All welding shall be performed in accordance with the Standard Specifications and D-1.5 of the AWS welding code. In the event of conflict between these two authorities, the AWS welding code shall govern.

The manufacturer of the strip seal expansion joints shall be a certified AISC Major Steel Bridge fabrication facility.

Welding procedures shall be submitted with shop drawings pursuant to Section 604-3.01 of these Special Provisions. The welding procedures shall identify in detail the procedures to be performed in fabricating the joint.

All steel surfaces not embedded in concrete shall be treated for corrosion protection by metalizing all of the steel surfaces. Backer rod shall be placed in the rail's seat cavity if painting is required.

The metal cavity of the expansion joint is to be fabricated utilizing a hot rolled technique. The cavity of the expansion joint shall not be machined.

The strip seal expansion joint manufacturer shall submit shop drawings for approval prior to fabrication. The shop drawings shall detail all dimensions, anchorages, welding procedures, and other data necessary to fabricate the joint. The shop drawings shall explicitly set forth the recommended means by which the strip seal expansion joint is to be aligned and set to grade.

**604-3.08 Erection** of the Standard Specifications is modified to add:

The Contractor shall strictly follow the manufacturer's recommendations and instructions as set forth in the shop drawings for setting the joint.

The neoprene gland will be shipped concurrent with the steel retainer rails and will be clearly identified as to the joint location corresponding to the gland. The Contractor shall be responsible for installing the neoprene gland in the field.

The contractor shall follow the manufacturer's installation instructions as set forth in the shop drawings and other published literature.

Polyurethane backer rods shall be placed in the seal cavity of the steel frame rails by the Contractor prior to placing concrete. The backer rod will remain in place until such time as the joint has been placed and final concrete placement has been made.

### **604-3.09 Supervision and Certification**

The strip seal expansion joint system shall be installed by the Contractor and continuously supervised by a qualified technical advisor for the joint manufacturer, from the approved bridge joint manufacturer.

A qualified technical advisor from the approved bridge joint manufacturer shall have recent experience in the installation of this type of strip seal joint system, and the Contractor shall submit to the Engineer written information on this experience for approval prior to the start of this work. The technical advisor shall provide a letter certifying the joint installation following completion.

**604-4 Method of Measurement:** of the Standard Specifications is modified to add:

Strip seal expansion Joints shall be measured as the distance along the center line of the joint and at the surface of the roadway or sidewalk from face-of-curb or barrier to face-of-curb or barrier. Measurement will be to the nearest linear foot. No measurement will be made for that portion of the deck joint assembly required by plan details to extend through the face-of-curb or barrier, such being considered as incidental to the sealing of the joint.

**604-5 Basis of Payment:** of the Standard Specifications is modified to add:

The accepted quantities of strip seal expansion joints, measured as described above, will be paid for under Item No. 6040201 – Deck Joint Assembly at the contract price per lineal foot, which shall include full payment for furnishing all labor, materials, tools, equipment, incidentals for doing all the work complete-in-place as shown on the project plans.

## **ITEM 6040501 – BRIDGE RAILING**

### **1. Description:**

The work under this item shall consist of furnishing all materials, tools, equipment and labor and painting and installing a metal bridge railing attached to the top of the 32" concrete bridge barrier as shown on Sheet S47 of the bridge plans. The work includes steel posts, rails, fittings, embedded plates, and anchorages.

## **2. Materials:**

Structural steel tubing shall conform to ASTM A500, Grade B. Structural steel plates and shapes shall conform to ASTM A36.

All structural steel shall be primed and painted in accordance with Sections 610 and 1002 of these Special Provisions. Finish coat shall be Sherwin Williams SW 7742 Agate Green or approved equal.

## **3. Construction Requirements:**

Railing shall conform to Section 604 of the Standard Specifications. All welding shall conform to the requirements of the American Welding Society, ANSI/AWS D1.5-2008 Structural Welding Code. All butt welds on exposed surfaces shall be ground flush with adjacent surfaces. Field welds and any damaged or marred surfaces shall be touch-up painted.

Railing shall be straight and true to dimensions. Posts shall be constructed vertical.

For structures on curves, either horizontal or vertical, the railing shall conform to the curvature of the structure.

Contractor shall submit shop drawings to the Engineer for review and approval prior to fabrication of the railing. The shop drawings shall contain complete information for construction of the railing; including sizes of material, type of material, post layout plans, fabrication details, welds, and dimensions.

## **4. Method of Measurement:**

Bridge Railing will be measured to the nearest linear foot along the centerline of the railing between the centerline of the first post to the centerline of the last post.

## **5. Basis of Payment:**

The accepted quantities of Bridge Railing measured as provided above, will be paid for at the contract unit price per linear foot, which shall be considered full compensation for the work, complete in place, as shown on the project plans and as defined and described herein. Payment shall include all fasteners, embedded plates, post anchors, expansion joints, painting and other work necessary to deliver the railing complete-in-place.

## **SECTION 607 - ROADSIDE SIGN SUPPORTS**

is hereby added:

### **607-1 Description**

The work under this section shall consist of furnishing and installing roadside sign supports in accordance with the details shown on the plans and the requirements of these specifications.

Sign supports shall consist of breakaway, perforated and U-channel signposts. The type, size and installation location of the signposts will be shown on the project plans.

## **607-2 Materials**

**607-2.01 General.** Certificates of Analysis conforming to the requirements of Subsection 106.05 shall be submitted for breakaway signpost shapes.

Certificates of Compliance conforming to the requirements of Subsection 106.05 shall be submitted for perforated signposts and U-channel signposts.

**607-2.02 Breakaway Signpost Shapes.** Posts shall be fabricated from structural steel conforming to the requirements of ASTM A 572, Grade 50 or ASTM A 588 at the option of the contractor. Base plates for the breakaway connections and friction fuse plates and back plates for the post hinge assembly shall be fabricated from the same type of structural steel selected for the signposts.

All plate holes shall be drilled and all plate notches shall be saw cut, except that flame cutting will be permitted provided all edges are ground. Flange holes shall be drilled or sub-punched and reamed. The posts shall be saw cut for the hinge and bolted as detailed on the plans.

Bolts, nuts and washers shall conform to the requirements of ASTM A 325.

Posts and plates shall be galvanized after fabrication in accordance with the requirements of ASTM A 123. Bolts, nuts and washers shall be cadmium plated in accordance with the requirements of ASTM B 766, or zinc plated in accordance with the requirements of ASTM B 633.

**607-2.03 Perforated Signposts.** Single and telescoping perforated posts shall be square tube fabricated from galvanized sheet steel. The sheet steel shall have a thickness of 0.105 inches (12 gauge) or 0.135 inches (10 gauge) as required by the project specifications. Sheet steel shall conform to the requirements of ASTM A 653 for either SQ Grade 40 or SQ Grade 50 Class 1, and be galvanized in accordance with the requirements of Coating Designation G-90. The posts shall have a wall thickness, including coating, of 0.097 to 0.116 inches for 12 gauge and 0.127 to 0.146 inches for 10 gauge.

Posts shall be welded directly in the corner by high frequency resistance welding or equal. The outside edges of the posts shall be scarfed as necessary to produce a standard corner radii of  $5/32 \pm 1/32$  inch.

External welded surfaces and scarfed areas shall be re-galvanized after fabrication.

Holes  $7/16 \pm 1/64$  inch in diameter shall be provided on one-inch centers along all four sides over the entire length of the post. The holes shall be laterally centered on the longitudinal centerline of each face. Hole positioning and spacing shall be the same on all four faces, such that the hole centerlines for each group of four holes shall pass through a common point on the longitudinal centerline of the tube. For telescoping posts, holes shall be in proper alignment to allow 3/8-inch diameter bolts to pass through the entire post.

The finished posts shall be straight and have a smooth, uniform finish. All consecutive sizes of posts shall be freely telescoping for not less than 10 feet of their length without the necessity of matching any particular face to any other face.

Perforated signposts shall be manufactured by an approved manufacturer. A list of approved manufacturers of perforated signposts is shown on the Department's Approved Products List (APL). Copies of the most current version of the APL are available on the internet at <http://www.dot.state.az.us/ABOUT/atrc/apl.htm>.

Bolts shall conform to the requirements of SAE Specification J 429, Grade 5, or ASTM A 449, Type 1. Nuts shall conform to the requirements of ASTM A 563, Grade A. Washers shall conform to the requirements of ASTM F 844.

Bolts, nuts and washers shall be zinc coated in accordance with the requirements of ASTM B 633 or cadmium plated in accordance with the requirements of ASTM B 766.

**607-2.04 U-Channel Signposts.** U-channel posts shall be fabricated from rerolled rail steel or hot-rolled carbon steel bars. U-channel posts, when used, shall be painted FHWA green. Prior to rerolling the rail steel, the rail nominal weight shall be 91 pounds per yard and shall meet the requirement of ASTM A 1 pertaining to quality assurance.

Yield Point of the steel shall be 80,000 pounds per square inch minimum.

The cast heat analysis of the steel shall conform to the following requirements:

Element	Composition (Percent)
Carbon	0.67 – 0.82
Manganese	0.70 – 1.10
Phosphorus: Max.	0.04
Sulfur: Max	0.05
Silicon	0.10 – 0.25

Posts shall be a uniform, modified, flanged channel-section as shown in the plans. Weight of the posts shall be three pounds per lineal foot, plus or minus five percent. The post shall be punched with continuous 3/8-inch diameter holes on one-inch centers. The first hole shall be one inch from the top and bottom of post.

The post shall consist of two parts, a signpost and a base post. The signpost lengths shall be supplied in six-inch increments up to 12 feet as required for the installation location. The base posts shall be 60 inches in length, pointed at one end, and have at least eighteen holes in the base post, starting one inch from the top and continuing at one-inch increments.

Posts shall be machine straightened to have a smooth uniform finish, free from defects affecting their strength, durability, or appearance. All holes and rough edges shall be free from burrs. The permissible tolerance for straightness shall be within 1/16 inch in three feet.

Posts shall be galvanized after fabrication in accordance with the requirements of ASTM A 123. Bolts, nuts, washers and spacers shall be cadmium plated in accordance with the requirements of ASTM B 766 or zinc plated in accordance with the requirements of ASTM B 633.

For shipment, the posts shall be nested and fastened in such a manner that they will not slip. Care shall be taken during shipping to minimize the rubbing of posts together resulting in damage to the galvanized finished surface. Excessive damage to the finish of the posts during shipping or handling will result in rejection of the damaged posts. Posts shall be bundled in groups of no more than 100.

U-channel base posts shall be driven into the ground to a depth of 24 - 30 inches. Where rock is encountered, the rock shall be cored, drilled or removed to a minimum diameter of eight inches and to a depth sufficient to place Portland cement concrete two inches below the bottom of the base post and fill the hole to within one inch of the top. Solid rock coring or drilling is not required to continue beyond 24 inches in depth regardless of the depth at which the rock is encountered. The base post may be cut at the bottom prior to being set in Portland cement concrete where rock does not permit use of full-length base post.

**607-2.05 Concrete.** Concrete for breakaway signpost foundations shall be Class B, except that utility concrete may be used for foundations using stub post sizes S 3 x 5.7 and S 4 x 7.7. Class B concrete shall conform to the requirements of Section 1006 and utility concrete to requirements of Section 922. Concrete for perforated signpost foundations and U-channel signpost foundations, when required, shall conform to the requirements of Subsections 922-2 and 922-3.

Foundation stub posts shall be fabricated from the same type of steel selected for the appropriate signposts. Breakaway stub posts shall be galvanized a minimum of 12 inches down from the top of the stub. Galvanizing shall be in accordance with the requirements of ASTM A 123.

Reinforcing steel bars for breakaway signpost foundations shall conform to the requirements of ASTM A 615, Grade 40. Reinforcing steel wire shall conform to the requirements of ASTM A 82.

### **607-3 Construction Requirements**

Fabrication of the breakaway signposts, stub posts and base plates shall conform to the requirements of Subsection 604-3.02, except that shop drawings will not be required.

Breakaway signpost lengths will be determined by the Engineer at the time of construction staking and will be furnished to the contractor prior to ordering fabrication of the signposts.

Perforated and U-channel signpost lengths shall be determined by the contractor at the time of construction staking. Posts shall be cut to the proper lengths in the field. Splicing will be permitted for single perforated posts; however, splices will be limited to one per each post installation and the splicing shall be accomplished in accordance with the details shown on the plans. The minimum length of any spliced piece of post shall be two feet. U-channel posts, when used, shall be painted FHWA green.

Foundations for the breakaway signposts, perforated signposts and when required, U-channel posts shall be constructed to the details and dimensions shown on the plans. Concrete shall be placed in accordance with the requirements of Section 601 or 922, as the case may be. Excavation shall conform to the requirements of Subsection 203-5.03(A).

#### **607-4 Method of Measurement**

Breakaway signposts will be measured by the linear foot for each size of post furnished and erected. The length of each size of post will be measured from the bottom of the upper base plate to the top of the post, measured to the nearest 0.1 feet. The total length of all posts of the same size will be rounded to the nearest foot.

Perforated signposts will be measured by the linear foot of each type of post furnished and installed. The length of each type of post will be measured from the top of the concrete post foundation to the top of the post, measured to the nearest 0.1 feet. The total length of all posts of the same type will be rounded to the nearest foot. Telescoping post members will be considered as one post after installation and will be measured separately. U-channel posts will be measured as each.

Foundations for signposts will be measured by the unit for each type of foundation constructed, except that concrete and excavation, when required for setting U-channel base posts, will be considered as part of the post.

#### **607-5 Basis of Payment**

The accepted quantity of breakaway posts, perforated posts, U-channel posts and foundations for the signposts, measured as provided above, will be paid for at the contract unit prices complete in place.

The contract unit price paid per linear foot for each size of breakaway signpost, each type of perforated signpost and each installation of U-channel post designated in the bidding schedule shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in furnishing and erecting the signposts, complete in place, including galvanizing and furnishing all metal plates and hardware, all as shown on the plans and as specified herein.

The contract unit price paid per unit for each type of sign foundation designated in the bidding schedule shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in constructing foundations, complete in place, including the steel stub posts, lower base plate and steel reinforcement (except for stub posts S 3 x 5.7 and S 4 x 7.7) for the breakaway signpost foundation; the portion of perforated post within the foundations; galvanizing the posts; and excavation, all as shown on the plans and specified herein.

### **SECTION 608 - SIGN PANELS**

is hereby added:

#### **608-1 Description**

The work under this section shall consist of furnishing and installing sign panels in accordance with the details shown on the plan and requirements set forth herein.

The sign panels shall be of the following types:

- Extruded Aluminum Sign Panels with Demountable Characters
- Overhead Sign Panels

- Overlaid Sign Panels
- Flat Sheet Aluminum Sign Panels with Demountable Characters
- Flat Sheet Aluminum Sign Panels with Direct-Applied or Silk-Screened Characters
- Overlaid Plywood Sign Panels with Direct-Applied or Silk-Screened Characters
- Warning, Marker, and Regulatory Sign Panels
- Route Shields for Installation on Sign Panels
- EXIT ONLY for Installation on Sign Panels

## **608-2 Materials**

**608-2.01 General.** Certificates of Compliance, conforming to the requirements of Subsection 106.5, shall be submitted for all materials required for fabricating sign panels, including retroreflective sheeting.

Shipment, storage, and handling of sign panels shall conform to the recommendations of the manufacturers of the sign panel components. Fabricated signs and overlay sheets shall be shipped on edge. Damage to the sign panel or legend resulting from banding, crating or stacking may be cause for rejection of the signs.

Characters shall not be attached to overlay sheets during shipment.

**608-2.02 Extruded Aluminum Sign Panels With Demountable Characters.** Panels shall be fabricated from 12-inch wide aluminum extrusions formed from Aluminum Alloy 6063-T6 conforming to the requirements ASTM B 221 and fastened together by bolt connections as shown on the plans.

Panel facing shall be covered with retroreflective sheeting of the color specified on the plans. The retroreflective sheeting shall conform to the requirements of Section 1007.

The letters, numerals, symbols, borders and other features of the sign message shall conform to the requirements of Subsection 608-2.14, Demountable Characters.

Panel surfaces to be covered with retroreflective sheeting shall be prepared in accordance with the recommendations of the sheeting manufacturer. Panel surfaces not covered with sheeting shall be etched in accordance with the recommendations of the extrusion manufacturer to reduce glare from reflected sunlight.

After all fabrication has been completed, including the cutting and punching of holes, except holes for demountable letters, numerals, symbols and borders, the aluminum extrusions shall be degreased and the retroreflective sheeting applied.

Aluminum extrusions shall be flat with 1/4 inch of tolerance allowed in an eight-foot length, with proportionally greater tolerances permitted on lengths greater than eight feet. Flatness tolerance across the face of each extrusion shall be 0.5 percent of the width.

Aluminum extrusions shall be bolted together on 12-inch centers with a maximum allowable gap of 1/32 inch between extrusions.

Shop-fabricated sub-assemblies shall be rigidly braced for transportation and erection. Hardware utilized to fasten panels to supports shall conform to the panel manufacturer's recommendations.

Each completed sign panel shall be provided with a side trim molding fabricated from extruded Aluminum Alloy 6063-T6 conforming to the requirements of ASTM B 221. The trim molding shall be fastened to each individual 12-inch aluminum extrusion with two 5/32-inch diameter self-plugging aluminum blind rivets, 2-1/2 inches from either edge. The exposed surface of the side trim molding shall be treated by etching as recommended by the manufacturer to reduce glare from reflected sunlight.

Each completed sign panel shall be shipped with sufficient bolt clamps placed to install the panel on the signposts as shown in the plans. Bent bolt channels will be cause for rejection of the sign panel.

### **608-2.03 Blank**

**608-2.04 Overhead Sign Panels.** Panels, except Warning and Regulatory Sign Panels, installed over traffic lanes or shoulders on Overhead Sign Structures shall consist of overlaying new extruded aluminum sign panels. The extruded aluminum sign panel substrate shall conform to the requirements specified in Subsection 608-2.02, except that retroreflective sheeting shall not be applied. The new panels shall be prepared as specified in Subsection 608-2.05, Overlaid Sign Panels.

The letters, numerals, symbols, borders and other features of the sign message shall conform to the requirements of Subsection 608-2.14, Demountable Characters.

The panels shall be shop-fabricated and shipped complete or as sub-assemblies with the overlay panels and characters rigidly attached.

Shop-fabricated sub-assemblies shall be rigidly braced for transportation and erection. Hardware utilized to fasten panels to shipping braces shall conform to the panel manufacturer's recommendations.

### **608-2.05 Overlaid Sign Panels**

**(A) General.** Panels shall be fabricated by attaching three- and four-foot widths of 0.063-inch thick, 5052-H38 aluminum overlay sheets to new or existing sign panel substrates, as called for in the plans. The sheets shall be equal in length to the height of the sign to which applied.

One surface of the overlay sheet shall be prepared and covered with retroreflective sheeting, conforming to the requirements of Section 1007, in accordance with the recommendations of the reflective sheeting manufacturer. The color of sheeting shall be as called for in the plans. The retroreflective sheeting on overlay sheets for each sign panel shall be color matched and shall be from the same manufacturing lot and run.

Panels having a minimum dimension not greater than four feet shall be overlaid with a one-sheet overlay with no splices.

All rivets used shall be 5/32-inch diameter self-plugging aluminum blind rivets. Fasteners and bolts used on signs need not be painted the same color as the sign. Rivets placed in the characters shall be shoulder rivets at least 3/4 in length. Rivets placed in the panel face shall be straight rivets at least 1/2 inch in length. All rivets shall extend through the panel face and be set tight.

**(B) Overlaying Existing Sign Panels.** When the plans call for overlaying existing sign panels, the panels may be overlaid using any of the following procedures:

- (1) In place on the existing posts. If the signs are overlaid in place, the contractor shall not place ladders against the face of the new sign sheeting or use other devices that might be detrimental to the new surface.
- (2) By removing the panels from the existing supports or by detaching the existing supports at the base or hinge plate and transferring the existing sign to a truck with a framework of sufficient size to provide complete back bracing for the sign panel while holding it in an erect, or nearly erect, position. The framework may be inclined at an angle not to exceed 20 degrees from the vertical. If the panels are removed from the existing supports, they shall be braced on the back by attaching the panels with post clamps to steel shapes of equal or greater weight than that of the existing supports.
- (3) By detaching the existing supports at the base or hinge plate, placing the sign structure on the ground face up and supporting it by dunnage such that the panel is rigidly held and uniformly supported to prevent twisting or distortion.
- (4) By removing the existing sign panel from its supports and transferring it to a central plant or workshop where the overlay may be accomplished. During the overlaying process, the sign panel shall be placed on a stable, level working platform that fully supports the sign panel so that no twisting or distortion may take place.

If either method (3) or (4) above is utilized, the contractor shall take such measures as are necessary to ensure that adequate tension is placed on the overlay sheets during installation to prevent bubbles, ripples, or other distortions in the sign panel surface from occurring when the signs are erected.

Existing embossed borders and sign message characters and any prior overlays shall be removed by drilling through the heads of the mounting rivets or by shearing the rivets with a flathead shovel or trowel.

Edge trim moldings do not require removal unless the plans call for modifying the panel, in which case the edge moldings shall be removed and replaced with new edge molding. Existing characters shall not be reused.

Before overlaying, holes, dents and minor bent sections of existing substrate panels shall be flattened with a hammer so that the sign face is free of projections or large indentations.

Overlay sheets shall be installed as shown in the plans, one at a time, on the substrate panels, starting at the side farthest from the roadway center line, approximately one inch from the edge. The overlay sheets shall be fastened at the top edge with three aluminum blind rivets: one at the center, and one between three and four inches from each side. Working from top to bottom, a single row of rivets, approximately one foot apart, shall be installed down the center of the overlay sheet. New legend and border shall then be, installed as indicated on the sign format drawings in the plans. Existing copy shall not be reused.

The remaining overlay sheets shall be installed in the same manner, except that rivets shall also be installed at one-foot intervals along the lap spliced joint between adjacent sheets in the same

sequence as described above. After all border and copy are installed, all open edges on the panels shall be riveted at approximately one-foot intervals.

Overlay sheets shall be stored as described in Subsection 608-2.01.

**608-2.06 Flat Sheet Aluminum Sign Panels With Demountable Characters:** Panels shall be fabricated from one-piece, 0.080-inch thick, 5052-H38 Aluminum Alloy conforming to the requirements of ASTM B209.

Panel facing shall be prepared and covered with retroreflective sheeting in accordance with the recommendations of the sheeting manufacturer. The color shall be as specified on the plans or as shown in the ADOT Manual of Approved Signs.

All surfaces not covered shall be etched to reduce glare from reflected sunlight.

The retroreflective sheeting shall conform to the requirements of Section 1007. Splicing of retroreflective sheeting shall not be allowed on sign panels having a minimum dimension up to and including four feet.

The letters, numerals, symbols, borders and other features of the sign message shall conform to the requirements of Subsection 608-2.14, Demountable Characters.

**608-2.07 Flat Sheet Aluminum Sign Panels With Direct-Applied or Silk-Screened Characters.** Panels shall be fabricated from 0.080-inch thick, 5052-H38 Aluminum Alloy conforming to the requirements of ASTM B 209.

Panel facing shall be prepared and covered with retroreflective sheeting in accordance with the recommendations of the sheeting manufacturer. The color of the sheeting shall be as specified on the plans or as shown in the Manual of Approved Signs.

All surfaces shall be etched to reduce glare from reflected sunlight.

The retroreflective sheeting shall conform to the requirements of Section 1007. Splicing of retroreflective sheeting shall not be allowed on sign panels having a minimum dimension up to and including four feet.

Messages shall be reflectorized white or, if called for on the plans, opaque black and shall be produced by either silk-screening or direct-applying lettering as specified under Subsection 608-2.15.

**Section 608-2.08 Overlaid Plywood Sign Panels With Direct-Applied or Silk-Screened Characters.** Panels shall consist of 5/8-inch thick, medium density overlaid Douglas Fir grade A-A or B-B plywood conforming to the requirements of Product Standard PS-1 published by the American Plywood Association and the U.S. Department of Commerce. The medium density overlay shall consist of a smooth resin-fiber surface of beater-loaded CreZon with phenolic formaldehyde resin content not less than 17 percent by weight. Each CreZon sheet shall weigh not less than 58 pounds per 1,000 square feet of single face. The thickness of the overlay shall be not less than 0.012 inches after application.

The back of the sign panels shall be covered with two coats of light gray enamel (Color Chip No. 36187) conforming to the requirements of Section 1002.

The edges of the sign panels shall be coated with a pigmented phenolic varnish matching the color of the back of the sign. Color match will be by visual inspection.

The retroreflective sheeting shall conform to the requirements of Section 1007. The color shall be as called for in the plans or as shown in the Manual of Approved Signs. Splicing of retroreflective sheeting shall not be allowed on signs having a minimum dimension up to and including four feet. Messages shall be reflectorized white or, if called for on the plans, opaque black and shall be produced by either silk-screening or direct-applying characters, as specified under Subsection 608-2.15.

Panels shall be attached to the posts with 5/16-inch diameter elevator bolts with a flat washer and two hex nuts on the back.

**608-2.09 Warning, Marker, and Regulatory Sign Panels.** Panels shall be fabricated from flat sheet aluminum and shall be reflectorized as specified herein.

Panels shall be fabricated in one piece from 0.080-inch thick, 5052-H38 or 6061-T6 Aluminum Alloy conforming to the requirements of ASTM B 209.

All surfaces of panels to be covered with retroreflective sheeting shall be prepared in accordance with the recommendations of the sheeting manufacturer. Surfaces not covered shall be etched to reduce glare from reflected sunlight. Retroreflective sheeting shall conform to the requirements of Section 1007.

Warning signs shall be reflectorized with yellow retroreflective sheeting.

Regulatory signs shall be reflectorized with silver-white retroreflective sheeting.

Reflectorized red signs shall be reflectorized with silver-white retroreflective sheeting. The red color shall be produced by silk-screening.

Regulatory signs with reflectorized red circles and slashes shall be reflectorized with silver-white retroreflective sheeting. The red color shall be produced by silk-screening.

Interstate route markers shall be cut to shape. The colors and legend shall be as shown on the plans and shall be reflectorized with silver-white retroreflective sheeting. The Interstate route colors shall be silk-screened. The numerals may be silk-screened or direct-applied characters. United States, State Route, and Cardinal Direction markers shall be reflectorized with silver-white retroreflective sheeting unless otherwise shown on the plans.

Splicing of retroreflective sheeting shall not be allowed on sign panels having the minimum dimension up to and including four feet.

Sign panels shall be attached to the posts with bolts as shown in the plans. A nylon washer, conforming to ANSI Standard and having a diameter two times the bolt head diameter, shall be placed between the bolt head and panel face. Fastening nuts shall be heavy hex; however, standard nuts may be used if a flat wash is placed between the nut and signposts.

## **608-2.10 Blank**

**608-2.11 Route Shields (For Installation on Signposts).** Route shields shall be cut to shape and shall consist of 0.063-inch thick, 5052-H38 Aluminum Alloy conforming to the requirements of ASTM B 209. The aluminum shall be degreased and etched in accordance with the recommendations of the sheeting manufacturer. Retroreflective sheeting shall be silver-white and shall conform to the requirements of Section 1007. The size of the numerals shall be half the height of the shield.

Route shields shall be attached to the sign panel with self-plugging aluminum blind rivets with a 1/4-inch thick nylon spacer on each rivet between the route shield and the sign panel.

**608-2.12 EXIT ONLY (For Installation on Sign Panels).** EXIT ONLY panels shall be fabricated from 0.063-inch thick, 5052-H38 Aluminum Alloy conforming to the requirements of ASTM B 209 with yellow retroreflective sheeting adhered to the face side. The aluminum shall be degreased and etched in accordance with the recommendations of the sheeting manufacturer. Retroreflective sheeting shall conform to the requirements of Section 1007.

EXIT ONLY panels shall be attached to the sign panel with self-plugging aluminum blind rivets with a 1/4-inch thick nylon spacer on each rivet between the EXIT ONLY panel and the sign panel.

The letters, arrows, and borders shall consist of black embossed aluminum frames or flat sheet aluminum frames with no reflectors. The height of the letters shall be 12 inches unless otherwise specified in the plans. The panel shall be 36 inches in height unless otherwise specified in the plans.

**608-2.13 Retroreflective Sheeting.** Retroreflective sheeting shall conform to the requirements of Section 1007.

The colors specified for retroreflective sheeting shall match visually and be within the color tolerance limits shown on the appropriate Highway Color Tolerance Charts issued by the Federal Highway Administration.

**608-2.14 Demountable Characters.** The letters, numerals, symbols, borders, and other features of the sign message shall consist of embossed aluminum frames in which prismatic reflectors are installed so as to be an integral part of the character or otherwise affixed to prevent their displacement in handling or service. Reflectors that are held in frames by means of tape or adhesive will not be accepted. All items shall be fabricated from 0.040-inch thick sheet Aluminum Alloy 3003-H14, conforming to ASTM B 209. Mounting holes shall be provided within frames to permit the use of screws, rivets, or other common fasteners. The size and spacing of reflector holes shall be such as to afford maximum night legibility and visibility to the finished cut-out figure. The reflectors shall conform to the requirements of Section 1008. The embossed aluminum frames shall be porcelain enameled white, baked enameled white, or triglycidyl isocyanurate thermosetting polyester powder coated white.

If black characters are called for in the plans, they shall consist of embossed aluminum frames without reflectors or flat sheet aluminum. The frames shall be black porcelain enameled, baked enameled, or triglycidyl isocyanurate thermosetting polyester powder coated. The frames shall be fabricated from 0.040-inch thick sheet Aluminum Alloy 3003-H14, conforming to ASTM B 209. Mounting holes shall

be provided within flat sheet aluminum frames to permit the use of screws, rivets, or other common fasteners.

Porcelain enameling shall conform to the requirements of the Porcelain Enamel Institute. For baked enameling, the frames shall be chemically cleaned, deoxidized, and coated with a light, tightly adherent, chromate conversion coating free of any powdery residue in conformance with Section 5, "Recommended Processing Methods," of ASTM B 449. After the chromate finish is obtained, legend frames shall receive an electrostatic application of white thermosetting primer of 0.005-inch thickness. The white thermosetting primer shall be an epoxy-ester resin cross linked with an amino resin which properties include corrosion resistance, high adhesion, flexibility, and impact resistance to prevent chipping and flaking.

After priming, frames shall be finished with a high-gloss ceramic white thermosetting enamel or a high-gloss ceramic black thermosetting enamel, as required, using the electrostatic application method. The high-gloss ceramic white thermosetting enamel shall be a non-oxidizing alkyd resin cross linked with an amino resin to produce a non-yellowing, gloss-retentive coating. It shall contain sufficient chalk-resistant titanium dioxide necessary to meet the requirements of ASTM D 476, Types III and IV. The high-gloss ceramic black thermosetting enamel shall be a non-oxidizing alkyd resin cross linked with an amino resin to produce a gloss-retentive coating. Coating thickness shall be a minimum of 0.001 inches. The specular gloss shall be 50 minimum when tested in accordance with ASTM D 523. For triglycidyl isocyanurate thermosetting polyester powder coating, the front and back surfaces of the aluminum frames shall be chemically cleaned, deoxidized, and coated with a light, tightly adherent, chromate conversion coating free of any powdery residue in conformance with Section 5, "Recommended Processing Methods," of ATM B 449. The triglycidyl isocyanurate thermosetting polyester powder coat shall be applied in accordance with the specifications issued by the manufacturer and shall have a minimum thickness of 0.002 inches. The specular gloss shall be 50 minimum when tested in accordance with ASTM D 523.

Letter design of the upper-case and lower-case letters and numerals shall be Series E of the Standard Alphabets for Highway Signs, modified by widening the stroke width to approximately one-fifth of the letter or numeral height. The upper-case letter shall be one and one-third times the loop height of the lower case letters.

Letter design of the capital letters shall be Series D of the Standard Alphabets for Highway Signs modified by widening the stroke width to approximately one-fifth of the letter or numeral height.

Self-plugging aluminum blind shoulder rivets or round-head wood screws, when used in black frames, shall be anodized black. All rivets used in embossed frames shall be 5/32-inch in diameter, self-plugging aluminum blind rivets. The length of the rivets placed in the characters shall be at least 3/4 inch. All rivets shall extend through the panel face and be set tight. Rivets used in flat sheet aluminum characters shall be 5/32 inch in diameter and at least 5/8 inch in length.

**608-2.15 Silk-Screened or Direct-applied Characters.** Silk-screened letters, numerals, symbols, and borders, shall be applied on the retroreflective sheeting background of the sign by direct or reverse screen process. Messages and borders of a color darker than the background shall be applied to the retroreflective sheeting by direct process. Messages and borders of a color lighter than the sign background shall be produced by the reverse screen process.

Opaque or transparent colors, inks, and paint used in the screen process shall be of the type and quality recommended by the manufacturer of the retroreflective sheeting.

The screening shall be performed in manner that results in a uniform color and tone, with sharply defined edges of legends and borders and without blemishes on the sign background that will affect intended use.

Signs, after screening, shall be air-dried or baked in accordance with the manufacturer's recommendations to provide a smooth hard finish. Any signs on which blisters appear during the drying process will be rejected.

Direct-applied letters, numerals, symbols, borders, and other features of the sign message shall be cut from black opaque or retroreflective sheeting of the color specified and applied to the retroreflective sheeting of the sign background in accordance with the instructions of the manufacturer of the retroreflective sheeting and shall be applied by heat activation of the adhesive.

The retroreflective sheeting used for characters shall meet or exceed the minimum Specific Intensity Per Unit Area (SIA) of the background sheeting.

### **608-3 Construction Requirements**

**608-3.01 Fabrication.** Fabrication of the sign panels shall be in accordance with the details shown on the plans and the requirements of these specifications. If additional details for sign panel fabrication are required, the contractor shall submit shop drawings in accordance with the requirements of Subsection 105.03.

Panels shall be cut to size and shape and shall be free of buckles, warps, dents, cockles, burrs and defects resulting from fabrication.

Fabricated signs and overlay sheets shall be stored indoors and kept dry during storage. If packaged signs become wet, all packaging material shall be removed immediately and the signs allowed to dry. The signs may be repackaged using new dry materials. If outdoor storage is necessary, all packaging materials shall be removed. Signs shall be stored on edge, above ground, in an area where dirt and water will not contact the sign face. Materials used to support stored signs shall not contact the sign faces.

**608-3.02 Installation of Sign Panels.** The sign panels shall be installed on overhead sign structures and roadside sign supports in accordance with the details shown on the plans and in accordance with the recommendations of the manufacturers of the sign panel components.

Minor scratches and abrasions resulting from fabrication, shipping and installation of the panels may be patched; however, patching shall be limited to one patch per 50 square feet of sign area with the total patched area being less than five percent of the sign area. Panels requiring more patching than the specified limit will be rejected. Patches shall be edge sealed by a method approved by the retroreflective sheeting manufacturer.

Fasteners and bolts used on signs need not be painted the same color as the sign. The sign manufacturer's name and date of installation shall be placed on the back of each sign in black, one-inch block letters. Use of felt markers for this purpose will not be permitted. Bolts shall be

tightened from the back by holding the bolt head stationary on the face of the panel. Twisting the bolt head on the panel face will not be allowed.

**608-3.03 Miscellaneous Work (Sign Panels).** The work under this section shall also include furnishing all miscellaneous materials, tools, equipment and labor necessary to relocate exit panels to the right side of the parent sign panel; removing, cutting, and installing side trims and new or salvaged aluminum extrusions on existing sign panels; relocated large guide and exit gore signs; and cutting post tops on existing installations, as required on the plans.

**608-3.04 Inspection.** An inspection of the completely installed sign panels will be made by the Engineer during the daytime and at night for proper appearance, visibility, color, specular gloss and proper installation.

Each sign panel face shall be cleaned thoroughly just prior to the inspection by a method recommended by the manufacturer. The cleaning solvent and cleaning material shall in no way scratch, deface or have any adverse effect on the sign panel components.

All apparent defects disclosed by the inspection shall be corrected by the contractor at no additional cost to the Department. If color variations or blemishes between sign panel increments are visible from a distance of 50 feet either during the day or at night, the panels shall be removed and replaced at no additional cost to the Department.

#### **608-4 Method of Measurement**

Sign panels will be measured by the square foot for each type or types of sign panels furnished and installed. The area of each sign panel, except for warning, regulatory and marker sign panels, will be measured per plans dimensions.

For warning, regulatory and marker sign panels the area of each sign panel will be measured to the nearest square foot and the areas will be determined as follows:

The areas of each rectangular, square or triangular sign panel will be determined from the dimensions shown on the plans. The area of irregular shaped signs, such as stop signs and route markers, will be determined by multiplying the maximum height in feet by the maximum width in feet, using the dimensions shown on the plan.

Miscellaneous Work (Sign Panels) will be measured on a lump sum basis.

**608-5 Basis of Payment.** The accepted quantities each type of sign panel designated in the bidding schedule, measured as provided above, will be paid for at the contract unit price per square foot, complete in place.

Payment shall be made on the total area of each type of sign panel to the nearest square foot, except Route Shields and EXIT ONLY (for Installation on Sign Panels) which shall be paid for as part of the overall panel.

The contract unit price shall be full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for performing all work involved in furnishing and installing the sign panels, complete in place, including furnishing and applying retroreflective sheeting, all fastening hardware, all necessary sign supports, stringers and post ties, all as shown on the plans and as specified herein.

The accepted quantities of Miscellaneous Work (Sign Panels), measured as provided above will be paid for at the contract lump sum price, which price shall be full compensation for the work complete in place as shown on the plans and as described and specified herein.

**SECTION 609 - DRILLED CAISSONS**  
of the Standard Specifications is replaced by the following:

The Arizona Department of Transportation (ADOT) Standard Specifications for Road and Bridge Construction, 2008 Edition, **Section 609 – Drilled Shaft Foundations**, together with the following revisions or additions.

**609-2.03 Casing:** the fourth paragraph of the ADOT Standard Specifications is revised to read:

The contractor shall compensate for loss of frictional capacity in the cased zone if temporary casing is abandoned in the shaft. If permanent side-support such as casing and/or grout rings is used for more than 10% of the length of the shaft, then the Engineer shall be contacted for re-analysis of the shaft length that will result in longer shafts. Such modifications shall be at no additional cost to the Department.

**609-2.03 Casing:** of the ADOT Standard Specifications is modified to add:

If temporary casing is used in conjunction with slurry and the casing extends to below the top of the slurry level, then before the casing is withdrawn, the level of fresh concrete in the casing shall be a minimum 5-ft above either the hydrostatic water level in the formation or the level of the drilling fluid in the annular space behind the casing, whichever is higher. As the casing is withdrawn, care shall be exercised to maintain an adequate level of concrete within the casing so that the fluid trapped behind the casing is displaced upward and discharged at the ground surface without contaminating or displacing the shaft concrete.

If the contractor elects to remove a casing and substitute a longer or larger-diameter casing through caving soils, the excavation shall be either stabilized with slurry or backfilled before the existing casing is removed.

**609-3.02 Confirmation Shafts:** the second paragraph of the ADOT Standard Specifications is revised to read:

The confirmation shaft shall be a sacrificial shaft drilled at a location determined by the Engineer. The confirmation shaft hole shall have a diameter of 5-ft and extend to the design tip elevation of the deepest shaft. The confirmation shaft shall be completed in the same manner as that proposed for the production shafts with the following exceptions: (1) reinforcing cage is not required, and (2) the backfill for the shaft may be 1-sack aggregate base course lean mix concrete. The contractor shall revise its methods and equipment as necessary at any time during the construction of the confirmation shaft hole to satisfactorily complete the excavation. When the contractor fails to satisfactorily demonstrate the adequacy of its methods, procedures, or equipment; or when unforeseen conditions require revision, such as the need for different side-support means (e.g., different slurry, casing, etc.), the installation plan shall be revised and another confirmation shaft be developed as per the revised installation plan at a location approved by the Engineer and at no additional cost to the Department.

**609-3.03 Excavation:** the fifth paragraph of the ADOT Standard Specifications is revised to read:

Temporary surface casing shall be used to aid in alignment of shafts, prevent surface sloughing or raveling and for ensuring personnel safety. A minimum 15-ft long temporary surface casing with at least 2-feet length above the ground surface shall be used. As necessary, the contractor shall provide longer casing from a personnel safety perspective and to prevent undermining of the casing. The diameter of the surface casing shall not be more than 12-inches larger than the nominal size of the shaft. Where temporary casing is used to stabilize excavations that include rock sockets, the temporary casing shall be six inches larger than the rock socket diameter and centered on the rock socket.

**609-3.03 Excavation:** the tenth paragraph of the ADOT Standard Specifications is revised to read:

After the completion of the drilled shaft excavation and prior to the placement of the reinforcing steel cage and concrete, all loose material shall be machine cleaned from the shaft. A minimum of two passes of a spin-bottom cleanout bucket, approved for use by the Engineer, shall be used to remove the loose material from the dry shaft.

For shafts where slurry has been used, the shaft bottoms shall be cleaned with a cleanout bucket such that the slurry properties are within allowable limits. A minimum of three-passes with an appropriately sized cleanout bucket over the entire bottom of the shaft shall be used.

**609-3.04(A) General Requirements:** of the ADOT Standard Specifications is modified to add:

For the case of synthetic (polymer) or blended mineral-polymer slurries, the sand content prior to concreting must be less than 1% by volume using the API Sand Content kit, the pH shall be between 8 and 10 using the pH Paper or pH Meter, the density shall be limited to a maximum value of 64 pcf using the density (mud) balance and the viscosity shall be according to the manufacturer's recommendation.

If flocculants are added to the synthetic (polymer) or blended mineral-polymer slurries to aid in collecting suspended fine grained soils at the bottom of the shaft, then concrete placement shall not commence until at least 8 hours after the addition of the flocculants and after the shaft bottom has been cleaned adequately such that the slurry properties are within the allowable limits described above.

A minimum of two tanks shall be used for managing slurry. One tank shall be used for mixing and the other tank shall be used for sedimentation and decanting. A third tank may be used for storage purposes. Mixing of slurry in the shaft hole and/or open pits shall not be allowed. The slurry shall be disposed in accordance to an approved environmental permit.

The synthetic (polymer) or blended mineral-polymer slurry shall be pre-mixed in a tank for at least 4 hours prior to its introduction into a shaft excavation. Mineral slurry shall be premixed for at least 12 hours. The slurry viscosity shall be monitored every 30 minutes and a chart of time versus viscosity shall be plotted. The slurry shall be introduced in the shaft excavation only when the chart of time versus viscosity indicates that the viscosity has stabilized to within plus or minus 2 seconds/quart of the target value. Mixing of the slurry shall be achieved by agitation such that a uniform slurry mix is achieved.

**609-3.05 Integrity Testing:** of the ADOT Standard Specifications is revised to read:

**(A) General:**

Whether completed by wet or dry excavation method, or a temporary or permanent casing method, each drilled shaft foundation completed shall be inspected by means of a cross-hole sonic logging survey and a gamma-gamma logging survey. The drilled shaft contractor shall furnish and install 2-inch internal diameter Schedule 80 PVC pipes for the surveys. The minimum number of PVC-pipe inspection tubes shall be equal to the diameter of the drilled shaft, measured in feet, and rounded-up to the next whole integer, but not less than four, or as specified in the plans. The inspection tubes shall be uniformly distributed along the inside circumference of the reinforcing steel cage. The pipes shall be joined to provide a clean, watertight, and unobstructed opening as specified in Subsection 609-3.05(B). If testing cannot be performed because of blockage of the tubes, the contractor shall core drill or otherwise determine the extent of any potential anomalies in the concrete, as approved by the Engineer, at no additional cost to the Department.

Cross-hole sonic log testing and gamma-gamma log testing shall be performed by a qualified subcontractor selected by the contractor and approved by the Engineer. The subcontractor shall provide the equipment meeting the minimum requirements listed herein, and shall have at least one year experience in cross-hole sonic logging survey and gamma-gamma logging survey evaluation. The subcontractor performing the gamma-gamma logging shall provide proof that it is licensed to possess and use radioactive material in accordance with the Arizona Radiation Regulatory Agency. Recorded measurements shall be interpreted and the required reports shall be prepared and sealed by a licensed professional engineer, registered in the State of Arizona, with at least three years of experience in cross-hole sonic logging survey and gamma-gamma logging survey evaluation. Resumes of proposed personnel shall be submitted to the Engineer for approval at least four weeks prior to commencement of work.

Integrity testing shall be performed no sooner than 48 hours after placement of the concrete. Cross-hole sonic logging tests shall be completed within four days after concrete placement, and gamma-gamma tests shall be completed within seven days of concrete placement.

The cross-hole sonic logging survey and the gamma-gamma survey requirements shall be as specified in Subsection 609-3.05(B). Inspection reports containing the acquired raw data, and evaluation reports, shall be provided as specified in Subsection 609-3.05(B). All reports shall be provided to the Engineer within three days of test completion.

If the testing indicates the presence of anomalies, as defined herein, or the Engineer determines that construction defects may have occurred, the contractor shall conduct remedial testing and make repairs, as specified in Subsection 609-3.05(B)(4), at no additional cost to the Department.

Concrete volumetric charts shall be completed for every drilled shaft. A copy shall be delivered to the Engineer within three days of the completion of the associated drilled shaft.

After all inspection has been completed and a given shaft has been accepted, all holes and test pipes in the accepted shaft shall be filled with an approved grout from the bottom up.

**(B) Testing Requirements:**

**(1) General:**

The inspection tubes shall have a round, regular, internal diameter free of defects or obstructions, including at any pipe joints, in order to permit the free, unobstructed passage of source and receiver probes from top to bottom. The tubes shall be watertight and free from corrosion, with clean internal and external faces, to ensure passage of the probes and to ensure a good bond between the concrete and the tubes. Standard glue-on PVC couplings shall be used. No compression, rubber, or clamp fittings will be allowed. Care shall be taken during reinforcement installation operations to not damage the tubes or break the fasteners of the tubes. Before placement of concrete, pipes shall be checked to ensure they are free from blockages, bends, crimps or other impediments to the free passage of the testing probes. The tubes' exterior surfaces shall be roughened by abrasion prior to installation to ensure a good bond between the tube surface and surrounding concrete.

Each pipe shall be fitted with a watertight shoe on the bottom and a removable cap on the top. The bottom cap of each tube shall be adequately secured such that it can withstand the hydrostatic pressure for the full depth of the shaft without water leakage. The pipes shall be securely attached to the interior of the reinforcement cage in a straight line, and in a regular, symmetrical pattern. The tubes shall be adequately secured to the reinforcing cage—such that the tubes stay in position during placement of the rebar cage and concrete placement. At a minimum, the tubes shall be securely fastened to the reinforcing cage at least every 10 feet vertically. The tubes shall be as near to vertical and parallel as possible. The tubes shall extend from one-half foot above the bottom of the shaft to at least four feet above the shaft top, or approximately two feet above the top of the rebar cage if above the ground. Under no circumstance shall the tubes be allowed to rest on the bottom of the drilled excavation. If the shaft top is subsurface, the tubes shall extend at least two feet above the ground surface. Any joints required to achieve full length tubes shall be made watertight. Care shall be taken to not damage the tubes during reinforcement installation operations in the drilled shaft hole.

The tube tops shall be bare clean pipe (no pipe joints), level cut, and capped to keep debris out of the tubes. If the rebar cage extends above the top of the tubes, the circular or spiral tie-raps shall temporarily be cleared away from one foot below the tube top to approximately three feet above. After placement of the reinforcement cage, the tubes shall be filled with clean water as soon as possible, immediately before or after concrete placement, but not later than one hour after placement. Care shall be exercised in the removal of caps or plugs from the pipes after installation so as to not apply excess torque, hammering, or other stresses which could break the bond between the tubes and the concrete.

Before the start of testing, the contractor shall:

- Run a 1.5" diameter six-foot long rigid cylinder through the complete length of each access tube to check for tube blockage.
- Clean the top of the shaft. The shaft top shall serve as the reference zero depth for all cross-hole sonic and gamma-gamma testing. Therefore, the shaft top must be level and, if mud covered, be cleaned before testing.
- Provide proper access to the shafts so that the testing subcontractor can park their logging truck within two to three feet of each access tube.
- Provide any special safety equipment required.
- Make sure the access tubes extend to at least four feet from the top of the concrete, and are capped and filled with water all the way to the top.

- Make sure each access tube is bare (no pipe joints) clean pipe (grind edges and concrete residue), level cut, and capped.
- Provide an independent and stable source of 110 Volt, 1000-Watt power.
- Using a permanent pen marker, mark each access tube with the shaft designation and tube number. For example, P2S3-T4 denotes Pier 2 Shaft 3 Tube 4. By definition, Tube 1 is the Northernmost tube, with other tubes referenced in a clockwise direction from Tube 1. Tube 1 shall also be marked in the field with paint.

The contractor shall also provide documentation that the testing equipment has been calibrated and is functioning properly.

**(2) Requirements for Cross-hole Sonic Logging (CSL) Tests:**

The minimum equipment requirements for cross-hole sonic logging shall be as follows:

- (a) The ultrasonic source and receiver probes shall be capable of producing records with good signal amplitude and energy through uniform, good quality concrete. The probes shall be of a diameter and have cabling such that they descend freely through the two-inch internal diameter Schedule 80 PVC pipe for the full depth of the shafts shown on the plans. Probes shall allow a generated or detected pulse within four inches of the bottom of the access tubes, and the transmitter probe shall generate an ultrasonic pulse with a minimum pulse frequency of 40,000 Hz. The weight of each probe shall in all cases be sufficient to allow it to sink under its own weight in the access tubes. The probe housing shall be waterproof to at least 1.5 times the maximum depth of the testing. The receiver probe shall be of a similar size and compatible design to the transmitter probe, and be used to detect the arrival of the ultrasonic pulse generated by the transmitter probe.
- (b) The depth of the probes shall be recordable with a measurement wheel or other suitable measuring device.
- (c) The cross-hole sonic logging equipment shall include a microprocessor-based system for analog to digital conversion and recording of data, for display of individual records, and for analysis of receiver responses and printing of logs.
- (d) The cross-hole sonic logging system shall have an appropriate filter for amplification of data and cable systems.
- (e) Synchronized triggering of the recording system with the ultrasonic pulse shall be a feature of the cross-hole sonic logging system.
- (f) The system shall be able to indicate zero depth at the shaft top and not at the bottom of access tubes. In addition, the system shall be able to log both from the top of the shaft to the bottom as well as from the bottom to the top.
- (g) The winch unit shall be motorized and capable of recording logging speed in the data records.

The minimum testing procedure requirements for cross-hole sonic logging shall be as follows:

- (a) **Preparation of the tubes for Cross-hole Sonic Logging Tests:** All inspection tubes shall be filled with water prior to testing. During testing, the water level in any tube shall not drop below the top of the tube.
- (b) **Cross-hole Sonic Logging Procedure:** Information on the shaft bottom and top elevations, tube lengths and position, along with construction dates, shall be provided by the contractor to the cross-hole sonic logging subcontractor prior to the logging being performed.

All possible tube pairs shall be tested. The tests shall be carried out with the source and receiver probes in the same horizontal plane unless test results indicate potential defects, in which case the questionable zone shall be further evaluated with angled tests (source and receiver vertically offset in the tubes).

The electronic circuit shall be thoroughly checked. The choice of time base will be such that the “zero signal” and first arrival time are 2-3 divisions apart on the horizontal axis. Amplitude shall be such that the signal fills 2/3 to 3/4 of the screen vertically.

Once the slack is taken up out of the cables to provide accurate depth measurements of the logs, the probes shall be pulled simultaneously and uniformly with a motorized winch from the bottom of the tubes over the depth wheel or other measuring device. All slack shall be taken out of the cables before the analyzer is switched on. The speed of ascent should be less than 20 to 25 feet per minute. The cross-hole sonic measurements shall be taken at two-inch intervals or less from the bottom to top of shaft.

- (c) **Anomaly Identification:** Anomaly in a drilled shaft shall be determined by evaluating the pulse arrival times and amplitude/energy signals. Zones where the measured sonic velocity is 10 percent or more lower than the local mean measured sonic velocity within a five-foot interval above and below the suspected anomalous zone shall be reported to the Engineer. The Engineer may require further tests such as offset elevation cross-hole sonic logging or tomographic testing to evaluate the extent of such defects. Any such additional testing shall be considered as included in the contract item for drilled shafts.
- (d) **Cross-hole Sonic Logging Results:** Results of the cross-hole sonic logging completed at a given substructure element shall be submitted to the Engineer in a report(s) within three working days of completion of testing at that given substructure element. The Engineer will review the report within three working days of the contractor’s submittal. The report shall include:
  - 1. Dates of shaft construction; shaft diameters; shaft lengths; shaft tip elevations; shaft cutoff elevations; type and size of drilling equipment; type of slurry if used; description of concrete mix; reinforcement details; inspection tube placement; concrete placement method; shaft layout with shaft numbers.

2. Dates of logging; brief description of the testing equipment; number of shafts logged; location of obstructions in PVC tubes; location of PVC couplers; calibration date, data and plot; summary of any unusual occurrences during testing; description and explanation of adjustments made to instrumentation or data (if any); identification of anomalies using the criteria described herein; delineation of affected tubes; vertical location and extent of anomalies; and estimated percentage of anomalous cross-sectional area.
3. The cross-hole sonic logs expressing the results in terms of velocity and pulse amplitude/energy versus depth. The cross-hole sonic logs shall be presented for each tube pair with all anomalous zones indicated on the logs.
4. Analyses of the initial pulse arrival time versus depth, velocity versus depth, and pulse amplitude/energy versus depth.
5. Appropriate discussion of the results in the text of the report shall be included.
6. Tomography of anomalous zones.

**(3) Requirements for Gamma-Gamma Logging (GGL) Tests:**

The minimum equipment requirements for gamma-gamma logging shall be as follows:

- (a) The gamma-gamma probe shall consist of a rigid cylinder containing a gamma particle emitting source and a gamma particle detector. The probe shall be suspended by a cable of sufficient design and length that it is safely capable of raising and lowering the gamma-gamma probe within a two-inch internal diameter Schedule 80 PVC inspection pipe to the desired test depths.
- (b) The cables affixed to the probe shall be of sufficient strength and durability to raise and lower the probe safely and at a controlled rate of speed. The winch mechanism shall be such that it does not damage the cables or compromise data collected in the test. A means of determining and recording probe depth shall be provided.
- (c) The gamma particle emitting source shall be Cesium-137 in a sealed source form.
- (d) The gamma-gamma probe detector shall consist of a proven method of gamma detection, such as Geiger Mueller or scintillation-based counters.
- (e) The detector shall be connected to a readout device that is capable of displaying and/or recording counts, densities, and sampling duration or probe speed.
- (f) The gamma-gamma probe shall possess a minimum density precision of 1.0 pounds per cubic foot.

- (g) The gamma-gamma probe shall have a minimum radius of detection of 4.0 inches in concrete with density between 140 and 160 pounds per cubic foot. The probe shall have the capability of varying the radius of detection up to seven inches in concrete with density between 140 and 160 pounds per cubic foot. The radius of detection is defined as one half of the center to center distance between the source and the detector. The actual radius of detection used in the test shall be subject to the approval by the Engineer.
- (h) Prior to use for gamma-gamma logging, the contractor shall provide the Engineer with the calibration of the gamma-gamma probe and readout unit to correlate count rate and concrete density. The calibration shall not be more than one year old, and shall be performed using the same source and detector combination as that proposed for the GGL testing on the project. Furthermore, the calibration shall have been conducted in an environment (e.g., water-filled, Schedule 80 PVC pipes) similar to the shafts being tested for the project. Gamma-gamma logging shall not be performed until the Engineer has approved the calibration records. Upon approval, the contractor shall perform the gamma-gamma tests exactly in the manner as the calibration of the probe and readout unit was performed.

The minimum testing procedure requirements for gamma-gamma logging shall be as follows:

- (a) **Preparation of Gamma-Gamma Logging Access Tubes:** A gamma-gamma logging survey may be performed by an experienced subcontractor using inspection tubes completely filled with water only if the gamma-gamma probe has been calibrated in concrete calibration samples that contained inspection tubes filled with water, and the radius of detection and density precision calibration have been performed under water and found to be within the prescribed limits. In the event of gamma-gamma testing in water filled tubes, the water level during testing in any tube shall not drop below the top of the tube.
- (b) **Gamma-Gamma Logging Procedure.** Information on the shaft bottom and top elevations, tube lengths and position, along with construction dates shall be provided by the contractor to the gamma-gamma logging subcontractor prior to the logging being performed.

The test shall be started by lowering the probe to the bottom of the access tube. When extracting the probe, the readings shall be taken at depth intervals not exceeding 1.5 inches and within the density precision of 1.0 pounds per cubic foot. The probe shall be extracted at a rate of between 8 to 10 feet per minute, and recorded.

To evaluate the repeatability of the GGL tests, the contractor shall perform one repeat log for each shaft in which GGL tests have been performed. After all the tubes in a given shaft have been GGL tested, the repeat log shall be performed in the first tube that was tested.

- (c) **Gamma-Gamma Logging Data Analysis:** The following steps shall be used in the analysis of the gamma-gamma logging data:

1. Apply the approved calibration parameters from the concrete calibration samples to the raw count readings and obtain bulk concrete densities. Verify that the data set contains no logging errors, duplicated data or skipped data points.
2. Determine the arithmetic mean of a set of bulk densities and record it on each log. A set shall consist of data collected from a single inspection pipe, using the same equipment, within the same time period. Data that shall not be included in the calculation of the mean density are: (1) repetitive data points collected at a single depth, (2) data collected at the top of the drilled shaft where the reading(s) were influenced by the gamma detector component exiting the shaft concrete, (3) data collected in the access tube above the top of the drilled shaft, (4) data affected by the anomalous zones of concrete, and (5) data that cause the population distribution to be statistically non-normal.
3. In the event that a known difference in the steel reinforcement layout (e.g., splices using overlapping bars) exists in a segment of a drilled shaft that affects the apparent mean, a separate mean shall be generated and utilized as the mean for that portion of the data.
4. Subtract the mean from each data point in the set to obtain a data set that reflects the variation from the mean.
5. Repeat the above 4 steps for all inspection tubes contained within an individual shaft and plot and present that data as (1) a single plot from all tubes, and (2) an individual plot for each tube.

**(d) Gamma-Gamma Logging Standard Deviation Analysis:** The following steps shall be used in the standard deviation analysis of the gamma-gamma logging data:

1. Determine the standard deviation (SD) of a compilation of bulk densities. A compilation shall consist of data collected from the test drilled shaft using the same equipment, within the same time period. Data that shall not be included in the calculation of the mean density are: (1) repetitive data points collected at a single depth, (2) data collected at the top of the drilled shaft where the reading(s) were influenced by the gamma detector component exiting the shaft concrete, (3) data collected in the access tube above the top of the drilled shaft, (4) data affected by the anomalous zones of concrete, and (5) data that cause the population distribution to be statistically non-normal.
2. The SD value that is used in step 3 shall be between 2.5 pounds per cubic foot and 3.75 pounds per cubic foot. If the calculated value is below 2.5 pounds per cubic foot, then 2.5 pounds per cubic foot shall be used in step 3. If the calculated value is above 3.75 pounds per

cubic foot, then 3.75 pounds per cubic foot shall be used in step 3.

3. Multiply the value obtained for SD from the above step by -2.0 and -3.0 to obtain values of “Minus Two Standard Deviations” (-2SD) and “Minus Three Standard Deviations” (-3SD), respectively.

(e) **Anomaly Identification:** Anomaly in a drilled shaft shall be determined by evaluating the data points developed by the above processes to the -3SD deviation criterion as follows:

1. In a single inspection tube over any 0.5-foot or greater depth interval, all of the density readings have a value less than the determined value for -3SD.
2. In the same inspection tube identified anomalous by the above step, any data point that falls below the value for -3SD within a one-foot vertical extent immediately above or below, then that depth shall be considered as anomalous in addition to the depth identified in the previous step.
3. In all inspection tubes adjacent to inspection tubes already identified as anomalous, if at least one data point within two feet vertically above or below the adjacent tube anomaly falls below the value for the -3SD, then the depth in that tube at which the anomaly is found is also anomalous, in addition to the depths identified in the previous two steps.

(f) **Gamma-Gamma Logging Results:** Results of the gamma-gamma logging completed at a given substructure element shall be submitted to the Engineer in a report(s) within three working days of completion of testing at that given substructure element. The Engineer shall review the reports within three working days of the contractor’s submittal. The report shall include:

1. Dates of shaft construction; shaft diameters; shaft lengths; shaft tip elevations; shaft cutoff elevations; type and size of drilling equipment; type of slurry if used; description of concrete mix; reinforcement details; inspection tube placement; concrete placement method; shaft layout with shaft numbers.
2. Dates of logging; brief description of the testing equipment; number of shafts logged; location of obstructions in PVC tubes; location of PVC couplers; calibration date, data and plot; summary of any unusual occurrences during testing; description and explanation of adjustments made to instrumentation or data (if any); identification of anomalies using the criteria described herein; delineation of affected tubes; vertical location and extent of anomalies; and estimated percentage of anomalous cross-sectional area.
3. Plots of each individual tube with the data points and the values of -

2SD and -3SD. The plots shall indicate these points and values at all depths. Utilize symbols or line formats that permit lines corresponding to -2SD and -3SD to be distinguishable from data points.

4. Appropriate discussion of the results in the text of the report shall be included.

**(4) Procedures in Case of Anomalies:**

If the testing indicates the presence of anomalous zones, as identified by the sonic cross-hole and gamma-gamma tests, in the drilled shaft foundation, or if the Engineer determines that construction defects may have occurred, the contractor shall conduct three-dimensional tomographic surveys of the anomalies, at no additional cost to the Department. The results of the tomographic surveys shall be presented in the form of concrete velocity images in two-dimensions (2-D) between each pair of tubes, and in three-dimensions (3-D) for the whole shaft. The costs for any analysis and design required by the Department as a result of anomalous zones shall be deducted from monies due the contractor. Should the Engineer determine that the anomalous zones reveal defects, the contractor shall submit a plan to repair, replace, or supplement the defective work in a manner approved by the Engineer, which may include constructing one or more additional drilled shafts at the locations directed by the Engineer. After review and acceptance by the Engineer, the contractor shall perform the work specified in the approved plan at no additional cost to the Department.

**609-3.07(A) General:** the first sentence of the first paragraph of the ADOT Standard Specifications is revised to read:

The reinforcing cage shall be placed in the drilled shaft within one (1) hour after the shaft bottom has been cleaned. The shaft bottom shall be inspected immediately prior to lifting the cage and re-cleaned if deemed necessary by the Engineer. The Contractor shall begin placement of concrete within 24 hours after the completion of the drilled shaft excavation and within one (1) hour after placement of the reinforcing cage.

**609-4 Method of Measurement:** of the ADOT Standard Specifications is modified to add:

The confirmation shaft, as accepted by the Engineer, will be measured by the lineal foot of embedment from the completed bottom of the shaft as established by the Engineer to the top of the shaft as completed.

**609-5 Basis of Payment:** the first paragraph of the ADOT Standard Specifications is revised to read:

The accepted quantities of drilled shafts and rock sockets, measured as provided above, will be paid for at the contract unit price per lineal foot for the diameter designated in the bidding schedule, complete in place, including excavation and disposal of spoils; drilling slurry; metal casing; steel reinforcing within the shaft between the bottom of shaft and the drilled shaft cut-off elevation; Portland cement concrete; any needed forming, curing and finishing; exposing of concrete and the subsequent repair of foundations; furnishing all materials, equipment, and labor for splicing of reinforcing steel; all labor, conduit, and equipment for sonic cross-hole logging and gamma-gamma

logging; and all required testing and test reports. No additional payment will be made for metal casing that is to remain in place. No additional payment will be made for providing a manufacturer's representative for the drilling slurry, the costs considered to be included in the cost of constructing the drilled shaft foundation.

The confirmation shaft, measured as provided above, will be paid for by the lineal foot under Item No. 6090011 Demonstration Caisson.

## SECTION 610 - PAINTING

**610-3.02 Cleaning of Surfaces** of the Standard Specifications is modified to add:

The following modifications apply to the Metal Mesh Pedestrian Railing, Metal Overlook Pedestrian Railing, Steel Barrier on top of the 32" Concrete Barrier, Steel Barricade Railing on top of the retaining wall at the northeast corner of the northbound bridge (Detail R21), Steel Barricade Railing approaching the southbound and northbound bridges that terminates at the bridge wingwalls, the railing on top of the retaining/entry wall along the bike path near the northeast corner of the northbound bridge (Detail R22), and the steel signs attached to the side of the bridge girders:

### Preparation for Shop Coating

Surface Preparation Prior to Abrasive Blast Cleaning: Weld flux and spatter shall be removed by power tool cleaning. Sharp projections shall be ground to a smooth contour. All welds shall be ground to a smooth contour as per National Association of Corrosion Engineers (NACE) Standard RP0178:

1. Butt Welds: Shall be ground smooth and free of all defects, designation "D."
2. Lap Welds: Shall be ground smooth and blended, designation "C," excepting that visual imperfections and ripples are allowable.
3. Fillet Welded Tee Joint: Shall be ground smooth and blended, designation "D."

Surface Preparation: Surfaces shall be clean, dry, and free of oil, grease, and other contamination.

1. Ungalvanized Surfaces: Prepare surfaces as per Steel Structures Painting Council SSPC-SP10, Near White Blast Cleaning. Anchor profile shall be 1.5 to 2.0 mils as per ASTM D 4417, Method C or NACE Standard RP0287. Prepare field welded and/or damaged shop primed surfaces as per SSPC-SP6, Commercial Blast Cleaning, or SSPC-SP11, Power Tool Cleaning to bare Metal. Spot prime prepared welded and damaged areas using approved zinc-rich urethane primer applied at a dry film thickness of 2.5 - 3.5 mils.
2. Galvanized Surfaces and Stainless Steel: Prepare surfaces as per SSPC-SP-7, Brush-Off Blast Cleaning, or achieve 1.5 mil profile.

Mixing and Thinning:

The mixing and thinning of coating materials shall be made in accordance with manufacturer's latest printed instructions. Materials shall not be used beyond manufacturer's recommended shelf life. Mixed materials shall not be used beyond manufacturer's recommended pot life.

**610-3.05 Painting Structural Steel** of the Standard Specifications is modified to add:

The following modifications apply to the Metal Mesh Pedestrian Railing, Metal Overlook Pedestrian Railing, Steel Barrier on top of the 32" Concrete Barrier, Steel Barricade Railing on top of the

retaining wall at the northeast corner of the northbound bridge (Detail R21), Steel Barricade Railing approaching the southbound and northbound bridges that terminates at the bridge wingwalls, the railing on top of the retaining/entry wall along the bike path near the northeast corner of the northbound bridge (Detail R22), and the steel signs attached to the side of the bridge girders:

Applying the Primer: Dry film thickness measurements will be made in accordance with Section 1002-3 of the Standard Specifications. Dry mil thickness for the zinc-rich urethane primer coat shall be 2.5 - 3.5 mils.

Application of shop or field coatings shall be in accordance with the manufacturer's instructions for coating application and the following. Where these are in conflict, the most stringent requirements apply as determined by the Engineer.

Coating application shall conform to the requirements of the Steel Structure Painting Council Paint Application Specification SSPC-PA1, latest revision, for "Shop, Field and Maintenance Painting." Each application of coating shall be applied evenly, free of brush marks, sags, runs, with no evidence of poor workmanship. Care shall be exercised to avoid lapping on hardware. Coatings shall be sharply cut to lines. Finished surfaces shall be free from defects or blemishes.

Protective coverings or drop cloths shall be used to protect other surfaces. Care shall be exercised to prevent coatings from being spattered onto surfaces which are not to be coated or painted. Report to the Engineer surfaces from which materials cannot be satisfactorily removed.

When two or more coats of coating are specified, the first coat shall contain sufficient approved color additive to act as an indicator of coverage, or the following coats must be of contrasting color.

Apply field-applied coatings to the following dry film thicknesses:

1. 2nd Coat - epoxy polyamide primer: 3.0 to 5.0 mils
2. 3rd Coat - acrylic polyurethane enamel finish: 3.0 - 5.0 mils

Painted surfaces, where the integrity of the shop applied coats has been compromised through field welding or mechanical means, shall be touched up in the field. If necessary to obtain a uniform painted surface, a fourth coat may need to be applied in the field. Touch up painting shall be applied in accordance with this section and the manufacturer's recommendations to the above-specified thicknesses.

Total Film Thickness per SSPC-PA2 dry film inspection standards:

1. Ungalvanized Steel: Total dry film thicknesses (including zinc-rich urethane primer) shall be a minimum of 11 mils.
2. Galvanized and Stainless Steel: Total dry film thicknesses shall be a maximum of 5 mils.

Dry film thickness measurements will be made in accordance with Section 1002-3 of the Standard Specifications. If roller application is deemed necessary and is approved by the Engineer, the Contractor shall apply additional coats as to achieve the specified thickness.

**SECTION 701 - MAINTENANCE AND PROTECTION OF TRAFFIC**

**701-4 METHOD OF MEASUREMENT** of the Standard Specifications is modified to add:

The Agency will reimburse the contractor for the work under this section on the basis of bid prices or the predetermined reimbursement rates as specified in the Special Provisions.

**701-4.02 Construction Area Elements** of the Standard Specifications is modified to add:

**(A) Elements of Work (Complete in Place):** The elements of work listed under this subsection will be measured for payment upon the satisfactory completion of the initial installation or obliteration. Except as hereinafter specified under Basis of Payment, no subsequent measurements will be made:

<u>Item No.</u>	<u>Elements of Work</u>	<u>Unit</u>	<u>Rate</u>
7010010	Temporary Concrete Barrier (Installation & Removal)	L.F.	BID
	Temporary Impact Attenuation (Sand Barrel) (Installation & Removal)	Each	\$5.00
	Specialty Sign with Installation, Use & Removal	Each	INVOICE
	Embedded Sign Post with Installation, Use & Removal	Each	\$35.00
	Preformed Pavement Marking (Type II)	L.F.	\$1.60
	Preformed Pavement Marking (Type III)	L.F.	\$1.00
	Temporary Pavement Marking (Painted Line)	L.F.	\$0.13
	Pavement Marking, Preformed (Type I), Legend	Each	\$125.00
	Pavement Marking, Preformed (Type I), Single Arrow	Each	\$100.00
	Pavement Marking, Preformed (Type I), Merge Arrow	Each	\$115.00
	Obliterate Pavement Marking	L.F.	\$0.25
	Obliterate Pavement Legends	Each	\$25.00
	Obliterate Pavement Arrows (Single, double or Merge)	Each	\$22.00
	Delineator (ADOT Std. Dwg. 4-M-4.01)(Temporary)	Each	\$20.00
	Reflective Raised Pavement Marker (Temporary)	Each	\$4.00
	Reflective Raised Pavement Marker (Permanent)	Each	\$4.50
	(Used as Temporary)		
	Non Reflective Raised Pavement Markers (Temporary)	Each	\$2.50
	Remove Raised Pavement Markers	Each	\$1.00
	Chip-Seal Pavement Marker (Single Capped)	Each	\$2.00
	Chip-Seal Pavement Marker (Double Capped)	Each	\$3.00

**(B) Elements of Work (In-Use) and Flagging:** The elements of work listed under this subsection will be measured for payment from the time at which the element is put into active use on the project and accepted by the Engineer until such time that the Engineer determines that the element is no longer required. Individual flags and sandbags used in conjunction with the traffic elements of work shall be considered incidental items. No separate payment shall be made for flags or sandbags and their cost shall be included in their respective elements of work. The work shall also include all maintenance, cleaning, and repair of all elements. The Engineer must also approve the use of Flagging Services. Flagging Services will be paid as indicated in this subsection as well as the Bidding Schedule.

<u>Item No.</u>	<u>Elements of Work</u>	<u>Unit</u>	<u>Rate</u>
	Temporary Concrete Barrier (In Use)	L.F./Day	\$0.04
	Temporary Impact Attenuation (Sand Barrel)(In-Use)	Each/Day	\$0.20
	Drum (18" x 36")	Each/Day	\$0.20
7010025	Flashing Arrow Panel	Each/Day	BID
7010027	Changeable Message Board	Each/Day	BID
	Pilot Truck and Driver	Hour	\$30.00
	Attenuator Truck and Driver	Hour	\$30.00
	Traffic Cones (18 inch)	Each/Day	\$0.10
	Traffic Cones (28 inch)	Each/Day	\$0.15
7010030	Vertical Panels	Each/Day	BID
7010035	Barricade (Type II)	Each/Day	BID
7010038	Barricade (Type III)	Each/Day	BID
7010040	Flashing Warning Light (Type A)	Each/Day	BID
7010043	Flashing Warning Light (Type B)	Each/Day	BID
7010050	Steady-Burning Warning Light (Type C)	Each/Day	BID
7010055	Standard Intensity Reflective Sheeting, Small Sign (Less Than 10 S.F.)	Each/Day	BID
7010057	Standard Intensity Reflective Sheeting, Medium Sign (10-16 S.F.)	Each/Day	BID
7010059	Standard Intensity Reflective Sheeting, Large Sign (Greater Than 16 S.F.)	Each/Day	BID
7010063	Portable Sign Stand (Spring Type)	Each/Day	BID
7010065	Portable Sign Stand (Small Sign, Less Than 10 S.F.)	Each/Day	BID
7010067	Portable Sign Stand (Medium Sign, 10-16 S.F.)	Each/Day	BID
7010069	Portable Sign Stand (Large Sign, Greater Than 16 S.F.)	Each/Day	BID
	High Level Flag Tree Sign Stand	Each/Day	\$0.40
	Chain Link Fence	L.F./Day	\$0.04
	Orange Safety Fence (4ft. min. by 50 ft.)	Each/Day	\$1.50
7010075	Flagging Services (Civilian)	Hour	BID
7010077	Flagging Services (Uniformed Officer)(Off Duty)	Hour	BID
7010079	Official Police Vehicle (Off Duty)	Hour	BID

**ITEM 7020002 - IMPACT ATTENUATION DEVICE (SPECIAL)**

**1. Description:**

The work under this item shall consist of furnishing all materials, equipment and labor necessary for constructing a QuadGuard Crash Cushion System, as shown on the plans, including the Quadbeam to thrie-beam transition assembly, the tension strut and diagonal brace assembly as manufactured by Energy Absorption Systems, Inc. The QuadGuard System shall have a minimum design speed of 45 mph, be tested to NCHRP-350 redirective, non-gating terminals, and Crash Cushion Standards and be approved by the Federal Highway Administration (FHWA). The Contractor may substitute an alternate crash cushion system that meets the requirements of the QuadGuard Crash Cushion System, with the approval of the Engineer.

**2. Materials:**

QuadGuard Crash Cushion materials shall be as manufactured by Energy Absorption Systems, Incorporated, of Chicago, Illinois.

Concrete shall be Class S,  $f'c = 4000$  psi and shall conform to the requirements of Section 1006 of the Standard Specifications.

Reinforcing steel shall be Grade 60 and shall conform to the requirements of Section 1003.

### **3. Construction Requirements:**

Prior to fabrication, the Contractor shall submit shop drawings and test results to the Engineer for review and approval, in accordance with the requirements of Subsection 105-2 of the Standard Specifications. Shop drawings shall include, but not be limited to: test results showing that the system has been tested to NCHRP-350, monorail layout and anchorage system, quadguard system assembly, tension strut assembly, diagonal brace assembly, and quad-beam to thrie-beam transition assembly. The monorail shall be anchored to the concrete pad with anchor bolts as specified by the manufacturer. Installation of the attenuator shall be performed in accordance with the recommendations of the manufacturer.

### **4. Method of Measurement:**

Impact attenuation devices will be measured as a unit for each attenuator installed, including concrete pad and anchor block.

### **5. Basis of Payment:**

The accepted quantity of impact attenuation devices, measured as provided above, will be paid for at the contract unit price each. The unit price paid shall be full compensation for the work complete-in-place, as described in the contract documents. Work paid under this item will include, but not be limited to: anchor bolts, monorail, nose assembly, QuadGuard cartridges, diaphragms, fender panels, tension strut backup, diagonal brace assembly, transition panel, and other such incidental items as are necessary for the delivery of a complete and functioning Crash Cushion System, including the excavation, 6" reinforced concrete pad and anchor block which support the crash cushion system.

## **SECTION 705 - PREFORMED PLASTIC PAVEMENT MARKING**

### **705-2 MATERIALS**

**705-2.01 Preformed Pavement Markings - Type I (Permanent).** is modified to add:

The following are approved Type I Preformed Pavement Marking Materials:

Stamark Brand Series 5730/5731  
3M Corporation  
St. Paul, Minnesota 55144

Stamark Brand Series 350/351

3M Corporation  
St. Paul, Minnesota 55144

Ferro/Cataphote  
Ferro Corporation  
P.O. Box 2369  
Jackson, Mississippi 39225-2369

Materials other than those listed above may be used but must be approved by the Agency prior to use.

## **SECTION 706 - RAISED PAVEMENT MARKERS**

### **706-2 MATERIALS**

**706-2.05 Bituminous Adhesive** of the Standard Specifications is modified to add:

The bituminous adhesive for pavement markers shall be a hot-melt adhesive manufactured by:

Avery Dennison Reflective Films Division 6565 West Howard Street Niles, Illinois 60714 Product: Stimsonite 2202031	Crafco, Incorporated 420 North Roosevelt Avenue Chandler, Arizona 85226 Product: Crafco 34269	Gulf State Asphalt Company, LP 300 Christy Place South Houston, Texas 77587 Product: Evergrip Bituminous Marker
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Materials by manufacturers other than those listed above may be used but must be approved by the Agency prior to use.

**706-3 CONSTRUCTION REQUIREMENTS** of the Standard Specifications is modified to add:

It shall be the contractor's responsibility to reset those markers that become detached from the pavement at no additional cost to the Agency.

Where the Engineer determines markers are in need of repair, such repairs shall be made by the contractor and will be paid for in accordance with the provisions of Subsection 109-5.

Where the Engineer determines markers need to be replaced, such replacement shall be made by the contractor and additional payment will be made at the contract unit price.

**706-5 BASIS OF PAYMENT** of the Standard Specifications is modified to add:

No measurement or direct payment will be made for removing, hauling and stockpiling salvaged markers, the cost being considered as included in the cost of the contract item.

## **SECTION 708 - PAINTED PAVEMENT MARKINGS**

**708-1 DESCRIPTION** of the Standard Specifications is modified to add:

Work under this section also includes the installation of temporary striping that is placed prior to the final thermoplastic striping, as indicated on the plans under the pavement marking general notes.

## **708-2 Materials**

### **708-2.01 Pavement Marking Paint**

(E) **Qualitative Requirements** of the Standard Specifications is modified to add:

(12) **Road Service Rating:** Test stripes of the paint shall be applied transversely across the road, four inches in width and approximately 12 feet long at a location approved by the Engineer.

Wet film thickness of the test stripes shall be approximately 15 mils (*375 micrometers*) as determined according to ASTM D 4414 and ASTM D 713 prior to test stripe application. To aid in obtaining the correct film thickness, a length of roofing paper placed by the side of the road can be used. Place a rigid metal test panel on the roofing paper in the path of a test line. Immediately after the test line is applied by the striper, measure the wet film thickness. If not satisfactory, adjust the spray pressure and repeat until the target wet film thickness is attained. It is important that no glass beads be present that would give a false wet film thickness. When the wet film thickness is correct, apply a test line across a tared metal test panel. After this, apply another test line across a different tared metal test panel, this time also adding the beads. These samples are necessary to determine the initial bead retention.

Glass beads conforming to the requirements of Subsection 708-2.02 of the Standard Specifications (moisture proof type) will be applied after the paint has been applied, but during the same striping operation at a rate such that the initial bead retention on the test line is a minimum of six pounds of beads per gallon wet paint (*0.7 Kilograms of beads per liter*). The initial bead retention will be determined analytically by Agency concurrently with the determination of the dry paint thickness utilizing tared metal test panels. The paint shall accept the glass beads so that the spheres are embedded into the paint film to a depth of 50 percent of their diameter. Test stripes will be observed for a period of 180 days from date of application. Paints will be evaluated for wear according to ASTM D 913.

After 180 days of service, on a visual rating scale of 0 to 100 percent, paints must have a rating of 92 percent or better to be acceptable. All ratings will be taken in the wheel track area. Glass beads shall show no more than a 30 percent loss after 180 days of test. This will be determined by taking close-up photographs of the paint film and by count determining the average bead loss.

The road service test may be waived at the option of the Engineer or evaluated for a period of time less than 180 days.

## **SECTION 732 - ELECTRICAL MATERIAL AND SERVICE**

**732-1 DESCRIPTION** of the Standard Specifications is modified to add:

The work under this section shall also include the furnishing and installing of a traffic signal battery backup system. The battery backup power system, or BBS, is also referred to as an uninterrupted power supply system (UPS).

**732-2 MATERIALS** the following subsections of the Standard Specifications are hereby modified or added:

**732-2.01 Electrical Conductors.**

**(B) Cable.**

**(3) ISMA Cable.** the ISMA Utility Cable Table of the Standard Specifications is revised to read:

**ISMA UTILITY CABLE TABLE**

Cond. No.	Base Color	Tracer Color	Use
1	Black	---	Spare
2	White	---	Spare
3	Red	---	Spare
4	Green	---	Spare
5	Orange	---	Ped. Push Button
6	Blue	---	Spare
7	White	---	Low Voltage Common (Black Tape)

**732-2.05 Messenger and Tether Cables.** the first sentence of the Standard Specifications is revised to read:

The messenger cable, used for suspending vehicular traffic signal assemblies and anchoring, in span wire installations shall be 3/8 inch (10 millimeters) in diameter 7-strand, utility grade, galvanized steel messenger cable of the diameter required by the plans and/or special provisions.

**732-2 MATERIALS** the following sections are hereby added to the Standard Specifications:

**732-2.07 Fiber Optic Cable Polyvinyl Chloride (PVC) Conduit.** All conduit shall be listed by Underwriters Laboratory (UL) and conform to NEC standards. Unless otherwise specified, all conduits to be installed underground or installed concrete structures shall be 4-inch diameter, rigid Polyvinyl Chloride (PVC) non-metallic conduit. The PVC conduit shall be schedule 40, heavy wall, sunlight resistant, manufactured from high impact material and shall be rated for use at 90 degrees centigrade. The conduit shall meet the specifications of UL 651 and NEMA TC-2, and shall be furnished with interface fit bell ends. Fittings shall be schedule 40 PVC, meeting the specifications of NEMA TC-3 and UL 514. PVC bends of 30 degrees or greater may be used when necessary. Field bends should not have a radius of less than 50 feet. Factory bends shall have a radius of not less than 12 times the nominal diameter of the conduit.

**732-2.08 Fiber Optic Cable Rigid Steel Conduit Bends.** Conduit bends shall be listed by UL and conform to NEC standards. The bends shall be steel, hot dipped zinc coated, meeting the requirements of UL 6 and ANSI C80. 1, and shall carry the Underwriters Laboratory label. Non-thread couplings shall not be used. Bend shall have a minimum radius of 12 times the nominal diameter of the conduit. Steel conduit bends shall have a factory applied 40 mil PVC coating or be double (half overlap)

wrapped with a 10 mil PVC plastic tape specifically manufactured for corrosion protection of metallic conduits installed below grade.

**732-2.09 Fiber Optic Cable Detectable Warning Tape.** On open trenching an electronically detectable 6-inch Fiber Warning tape shall be installed 18-inches above the conduit. Tape shall be acid and alkali-resistant polyethylene film, with a minimum thickness of 0.004 inch. The tape shall have a minimum strength of 7500psi lengthwise and 1,500psi crosswise. The tape shall be manufactured with integral wires, foil backing, or other means to enable its detection by a metal detector when the tape is buried up to a depth of 3 feet deep. The tape shall be orange in color and have the following continuous inscription, "CAUTION - FIBER OPTIC CABLE BURIED BELOW". The inscription shall be 2 inch black letters on an orange background.

**732-2.10 Fiber Optic Cable Tracer Wire.** The cable and wire shall be listed by UL and conform to NEC standards. The wire shall be a continuous unspliced stranded CU 6AWG, rated for 600 volts, and shall have THW or XHHW insulation. The color of the insulation shall be green. The wire shall be of the required length to eliminate all splices within the conduit.

**732-2.11 Fiber Optic Cable Pull Boxes.** Pull boxes and covers shall be constructed of precast reinforced concrete, or approved composite material, and shall be of the size and configuration shown on the plans. The Portland cement shall conform to the requirements of Section 1006, Class S, 3000 psi at 28 days. The reinforcement shall conform to the requirements of Section 1003, Grade 40. The boxes shall be designed for AASHTO HS-15 loading. The covers shall be constructed of galvanized diamond plate, or approved composite material, and shall be of a "bolt down" type. When requested by the Engineer, boxes and covers shall be furnished to the Engineer for testing at the contractor's expense.

The covers shall be lockable by means of a rotating cam or hasp and padlock. The cover shall be marked "COMMUNICATIONS". The markings shall be clearly defined and uniform in depth and height. The letters shall be placed parallel to the long side of the box. The assigned box number shall be painted on the box at the time of installation.

Chipped, cracked, or otherwise damaged boxes and covers will not be accepted.

**732-2.12 Battery Backup Power System (BBS).** The battery backup power system equipment shall include an Airpax Dimensions, Inc. 24M11 with 2 (two) 105 Ah, group 31 AGM batteries installed in an Airpax Dimensions 392614 enclosure with 2 (two) removable shelves or approved equal. The shared or common concrete foundation for the electric service pedestal and the battery backup power system shall be a minimum of 66" in length by 36" in width and 24" in depth. The battery backup power system cabinet uses 1/2" x 6" wedge anchors. The service pedestal shall have one 30A 1-pole branch circuit breaker for the signal circuit and one 50A 1-pole branch circuit breaker for street lighting. Electrical conductors shall be 1#8 AWG black, 1#10 AWG white and 1#10 AWG bare.

### **732-2.13 Fiber Optic Cable Rigid Steel Conduit**

Conduit shall be listed by UL and conform to NEC standards. The conduit shall be steel, hot dipped zinc coated, meeting the requirements of UL 6 and ANSI C80. 1, and shall carry the Underwriters Laboratory label. Non-thread couplings shall not be used. Steel conduit shall have a factory applied 40 mil PVC coating or be double (half overlap) wrapped with a 10 mil PVC plastic tape specifically manufactured for corrosion protection of metallic conduits installed below grade. All steel conduit shall include 4-1" inter-ducts.

## **732-2 Construction Details**

### **732-2.01 Conduit.**

#### **(G) Placement**

**(2) Boring and Jacking.** the first sentence of the Standard Specifications is revised to read:

At locations where existing pavement would otherwise not be disturbed, conduit runs crossing existing pavement shall be placed by jacking and boring method.

**(I) Conduit for Fiber Optic System.** of the Standard Specification is modified to add:

#### **(1) Cuts and Connections.**

The conduit shall be cut square; de-burred, and trimmed to remove all rough edges.

PVC conduit connections shall be of the solvent weld type. Wipe conduit dry and clean before joining. Apply a full coat of primer to the pipe and coupling per the manufacturer's recommendations. Apply a full and even coat of solvent cement to the entire area inserted into the fitting. Prevent excess cement from accumulating in the interior of the conduit. Allow join to cure a minimum of 20 minutes. The complete join shall be water tight. Where a connection is made to a steel bend, the coupling used shall be a PVC female adapter.

Expansion fittings shall not be installed in PVC conduit runs unless otherwise specified. Expansion fittings shall be installed in conduit runs where both ends are fixed in-place, such as between two foundations, and within concrete structures. Expansion fittings shall allow for a minimum linear expansion of 6-inches.

#### **(2) Bends.**

All bends shall be constructed of rigid steel conduit. Bend shall be factory bends or conduit formed in the field. Bends shall have a radius of not less than 10 times the nominal diameter of the conduit. Conduit shall be bent without crimping or flattening, using the longest radius practicable. The sum of the deflection angles of all bends in any conduit run shall not exceed 270 degrees between termination and/or junction points. For the purpose of calculating the sum of the deflection angles, bends with a radius for 500 feet or greater may be excluded from this criteria.

#### **(3) End Treatment.**

Conduit ends shall be capped with conduit end caps at all times when work is not in progress. Rigid steel bends terminating in pull boxes shall terminate with an approved plastic bushing.

#### **(4) Placement.**

Conduit runs shown on the plans shall be changed only to avoid underground obstructions and only as directed by the Engineer. Conduits shall be installed along the straightest horizontal and vertical alignment practicable. Variations in the alignment shall be accomplished with smooth transitions maximizing the radius of the bends. Should discovered field conditions necessitate additional bends in the conduit run, the location and number of pull boxes shall be adjusted as directed by the Engineer.

Conduit penetrations into pull boxes shall be made using the knockouts, or shall be cored in the structure. Conduits entering through the side wall of pull boxes shall be located approximately three inches above the floor and three inches away from the end wall of the box. Conduit entering the bottom of pull boxes shall be located in the near side corner of the box, approximately 3 inches away from the side and end walls. The conduit shall be sloped towards the top center of the box to facilitate pulling of the cables and interduct. Conduits terminating in pull boxes shall terminate a minimum of three inches inside the box wall. The void between the conduit and the box shall be completely filled with mastic to form a watertight seal.

Fiber optic communications conduit should be installed in a common trench with street lighting conduit as much as possible. Refer to standard drawings contained in Appendix C of these special provisions for conduit installation and joint trench installation requirements.

**(5) Testing and Cleaning.**

The completed conduit runs shall be cleaned and tested prior to final acceptance. Cleaning shall consist of pulling a swab through the conduit and removing all foreign material from within the conduit. The vaults and pull boxes shall be cleaned of all debris. Upon completion of the cleaning operations the ends of the conduit shall be plugged.

All conduit runs shall be clearance tested. This test shall consist of pulling a mandrel through the conduit run. The mandrel shall have a diameter of 1/4 inch less than the inside diameter of the conduit, and shall be 13 inches in length. The test shall be considered acceptable when the mandrel can be passed through the entire conduit run with a pulling force of 300 pounds, or less.

All testing of the system shall be scheduled with, and conducted in the presence of Department of Operations Technical Planning and Resources Division personnel.

**(6) Tracer Wire.**

Pull a tracer wire into each conduit run. The ends of the wire shall extend into each pull box, or vault, a minimum of 5 feet. No splicing of the tracer wire shall be permitted in the conduit runs. Connect the ends of all tracer wires within a pull box together to a common lug.

**732-3.04 Wiring Procedures**

**(B) Splices.** the sixth paragraph of the Standard Specifications is revised to read:

Where the project plans call for “future” phases, conductors shall be installed and spliced as necessary from the end-of-arm signal on the mast arm, and pole-top signals on 10 foot poles, to the controller cabinet to provide a usable complete circuit. These “future” conductors shall be coiled and taped in the middle section of the signal heads with adequate length to the terminal strips.

**732-3.06 Service.** of the Standard Specifications is modified to add:

**(A) Description.** The work under this item shall consist of furnishing all labor, equipment and materials required for securing and installing electrical service at locations noted on the plans. The work shall include the securing of required permits related to the electric service and trenching/backfill between the service point and metered electric service pedestal for installation of cable in conduit by the utility company. The work to coordinate the service installation, meter

enclosure installation, permit fee(s) documentation and coordination time and expenses borne by the contractor is intended to be covered by this bid item.

**(B) Materials.** All materials shall conform to the requirements of the Standard Specifications, the Electrical Service Requirements published by the utility company, and as approved by the Engineer.

**(C) Construction Requirements.** The contractor shall secure the necessary utility company permits, pay the related fee(s) for said permit, and coordinate the installation of the required power service. The contractor shall be responsible for trenching and backfill for the service hookup as required for this project and as specified on the plans.

**732-3.07 Battery Backup Power System (BBS)** is hereby added to the Standard Specifications:

The service pedestal and battery backup power system cabinet shall be mounted on a shared or common concrete foundation. Run 2" PVC conduit between the service pedestal and the battery back-up power system cabinet. Extend the following conductors from the service pedestal to the BBS cabinet, 1#8 AWG black, 1#10 AWG white and 1#10 AWG bare. Extend 1#8 AWG black from the BBS cabinet to the control cabinet. The Contractor will pull in the wire and install the BBS equipment, and Pima County DOT forces will terminate the connections.

**732-4 METHOD OF MEASUREMENT** of the Standard Specifications is modified to add:

Electric service installations will be measured as lump sum. The work related to the securing of the required utility company permits, coordination of the installation of the service, trenching and backfilling, and the related fee(s) for new service and meter enclosures is intended to be compensated by this bid item.

Battery backup power systems (BBS) and cabinets shall be measured as a unit for each battery backup power system and cabinet furnished and installed.

**732-5 BASIS OF PAYMENT** of the Standard Specifications is modified to add:

The accepted quantities of battery backup power system and cabinet, measured as provided above, shall be paid for at the contract unit price each, which price shall be full compensation for the work complete in place.

## **SECTION 733 - SIGNAL INDICATIONS AND MOUNTING ASSEMBLIES**

### **733-2 MATERIALS**

**733-2.04 Pre-Empt Sensors and Beacons.** the Standard Specifications are modified to delete the first paragraph.

## **SECTION 734 - TRAFFIC SIGNAL CONTROLLER ASSEMBLY**

### **734-2 MATERIALS**

**734-2.02 Traffic Signal Controllers.** of the Standard Specifications is revised to read:

A traffic signal controller shall consist of an electronic device dedicated to the selection and timing of traffic movements. Each controller shall provide all the features, functions and phasing operations as indicated on the plans and the Special Provisions.

**(A)** This specification sets forth the minimum requirements for a shelf-mountable, two through twelve phase, fully actuated, digital, solid-state traffic controller. The controller shall meet, as a minimum, all applicable sections of the NEMA Standards Publication No. TS2-1998. Where differences occur, this specification shall govern.

- (1) The controller unit shall be capable of operating as a NEMA TS1 controller or NEMA TS2 Type 2 controller without the addition of hardware or changes to the controller firmware/software.
- (2) The controller shall have demonstrated functional NTCIP operation on at least one ATMS, at least 60 days prior to the RFP.
- (3) The controller shall have a software option to support ECPIP, AB3418+, and NTCIP and shall have been previously interfaced with the ICONS operating system. All controller parameters shall be uploaded and downloaded within the ICONS operating system. The database format shall match that configuration already chosen for the system.

AB3418+ or NTCIP must be supported on both Port 2 and 3 at the same time. NTCIP support provided shall, as a minimum, meet the NTCIP Level 1 conformance requirements of TS2-1998.

## **(B) HARDWARE**

### ENCLOSURE

- (1) The controller shall be compact so as to fit in limited cabinet space. It shall be installable on a shelf that is not more than 7" deep. External dimensions shall not be larger than 10" x 15" x 7 1/2" (H x W x D).
- (2) The enclosure shall be constructed of sheet aluminum and shall be finished with an attractive and durable protective coating. Model, serial number, and program information shall be permanently displayed on the top surface.
- (3) The enclosure shall open along a vertical stainless steel hinge so as to provide ready access to the electronics in case of service.

### ELECTRONICS

- (1) The electronics shall be modular and shall consist of vertical circuit boards. Horizontal circuit cards are not acceptable.
- (2) A microprocessor shall be used for all timing and control functions. Continuing operation of the microprocessor shall be verified by an independent monitor circuit, which shall set an output to FALSE and indicate an error message if a pulse is not received from the microprocessor within a defined period.
- (3) A built-in, high-efficiency switching power supply shall generate all required internal voltages as well as 24 VDC for external use. All voltages shall be regulated and shall be monitored with control signals. Fuses shall be mounted on the front of the controller for 120 VAC input and 24 VDC output.

(4) Timing of the controller shall be derived from the 120 VAC power line. A rechargeable lithium battery shall be used to maintain the time-of-day clock and digital data during a power outage. Lead-acid, nickel-cadmium, or alkaline batteries shall not be acceptable.

(5) User-programmed settings and intersection configuration data shall be stored in an electrically erasable programmable read-only memory (EEPROM). Designs using a battery to maintain user data shall not be acceptable. Write-protection shall be provided for the portion of the EEPROM used to store intersection configuration data.

(6) To facilitate the transfer of data from one controller to another, the EEPROM shall be mounted on an easily removable sub-module, which shall be connected to the processor module via a DIN printed circuit board connector. One complete spare data module with EE PROM shall be furnished with each controller.

(7) All printed circuit boards shall meet the requirements of the NEMA Standard plus the following requirements to enhance reliability:

- a. All plated through holes and exposed circuitry shall be plated with solder.
- b. Both sides of the printed circuit board shall be covered with a solder mask material.
- c. The circuit reference designation for all components and the polarity of all capacitors and diodes shall be clearly marked adjacent to the component. Pin 1 for all integrated circuit packages shall be designated on both sides of all printed circuit boards.
- d. All electrical mating surfaces shall be gold-plated.
- e. All printed circuit board assemblies, except power supplies, shall be coated on both sides with a clear moisture-proof and fungus-proof sealant.
- f. To increase the reliability of the controller, surface mount technology shall be utilized for the I/O and processor printed circuit boards and for the display/keyboard modules.

## FRONT PANEL & CONNECTORS

(1) The front of the controller shall consist of a panel for the display and keyboard plus a separate panel for the connectors.

(2) A 16-line by 40-character/line alphanumeric liquid crystal display (LCD) shall show program and status information. The display area shall have nominal measurements of 2 1/2" x 4 1/2" (H x W) or larger. For ease of viewing, backlighting by light emitting diodes and multiple levels of contrast adjustment shall be provided.

(3) Front-panel operator inputs shall be via clearly labeled and environmentally sealed elastomeric keys. These shall include a 10-digit numeric keypad, eight function keys, an oversize ENTER key, and an oversize four-arrow cursor control key. All keys shall provide positive tactile and programmable audio feedback.

(4) The display shall have two modes of operation, dynamic and program. The dynamic mode shall display operational status information, while the programming mode shall display user-programming information.

Dynamic displays shall provide a visual status of real time intersection controller operations. These displays shall be accessible via the front panel keyboard. Dynamic displays shall be provided for the following major functions:

- a. Intersection status
- b. Controller status
- c. Coordinator status
- d. Preemptor status
- e. Time Base status
- f. Telemetry status
- g. Detector status
- h. MMU read back

The programming displays shall aid the operator in entering data from the keyboard. These displays shall be arranged in a menu format. The main menu shall allow the user to select one of the major functions of the intersection controller. A submenu shall then be displayed to allow selection of a specific area within that function. Cursor keys shall allow the user to scroll through the data pages of that submenu to reach the data entry position desired. It shall be possible to return to the main menu or submenu by depressing a single key.

Traffic engineering terminology shall be used throughout the programming displays. Display organization and data entry approach shall allow traffic engineers or technicians to program the intersection controller without using reference cards or manuals. Mnemonic usage shall be minimized and limited to recognized traffic engineering terms.

(5) All interface connectors shall be accessible from the front of the controller. At a minimum the controller units shall be supplied with the following connectors:

- i) NEMA A, B & C connectors per TS2-1998.
- ii) Port 1,2 & 3 connectors per TS2-1998.
- iii) D connector (AMP CPC # 205843-1) for a minimum of 6 pre-empt inputs and active status outputs, 8 expanded detectors, split demand, dual coord, and free inputs, external cycle-offset-split commands and 8 spares.
- iv) 25 pin telemetry connector including I/O for transmit 1&2, receive 1&2, 8 system detector inputs, 5 alarm inputs and 4 special function outputs

(6) To facilitate special applications the controller shall have the capability of assignment of any input or output function to any input or output pin respectively on the interface connectors.

## SERVICEABILITY

(1) All electronic modules other than the power supply shall be easily removable from the front of the controller using a standard screwdriver as the only tool. All power and signal connections to the circuit boards shall be via plug-in connectors.

(2) The controller layout shall allow the removal and replacement of any circuit board without unplugging or removing other circuit boards. All boards shall be keyed to prevent improper installation. No more than two boards shall be attached together to form a circuit assembly. Attaching hardware shall use captive screws or 1/4-turn fasteners to secure circuit assemblies to the enclosure.

(3) The controller enclosure shall allow complete disassembly using a standard screwdriver. It shall be designed so that one side of any circuit board is accessible for troubleshooting and testing while the controller is still in operation. This capability shall be accomplished without the use of extender cards or card pullers.

## TELEMETRY REQUIREMENTS

(1) The controller shall have the capability of utilizing Port 3 as an RS232 port and shall allow the use of an external twisted pair OR fiber optic modem without any physical or firmware/software changes to the controller.

(2) It shall be possible for the telemetry board to be removed from the controller without having to remove power from the controller. Each controller shall have an internal FSK Modem.

### **(C) OPERATING DISPLAYS**

(1) The dynamic displays listed below shall be provided to show the operational status of the controller. Additional displays shall be offered for programming. It shall be possible to place vehicle, pedestrian and preemption calls from the keyboard while displaying status information.

An intersection status display shall indicate a summary of ring, phase, coordination, preemption and time-based control status.

(2) A controller status display shall indicate current interval, pedestrian, density, maximum, and maximum extension timing by phase and ring. The status of vehicle and pedestrian signal outputs shall be displayed in combination with vehicle and pedestrian calls. The display shall also indicate the status and timing of each overlap.

(3) A coordinator status display shall indicate the command source, current coordination pattern information, local/system cycle count, commanded/actual offset, offset correction, time-based control status, hold, force-off, permissive, and green band indications.

(4) A preemptor status display shall indicate priority (rail-road, fire, emergency) preemptors and bus preemptors with calls, preemptor active, inhibit, delay, and bus reservice timer status. When a preemptor is active, the display shall also indicate preemptor interval, timing, duration, and hold status. A portion of the display shall indicate the controller status during preemption including current status, interval, and timing by phase and ring and the status of vehicle and pedestrian signals for each phase.

(5) A time base status display shall indicate the current time and date, the current day and week program, the active program step for both coordination pattern and time-of-day functions, the start time of the next program step, and the highest step used. The programmed selections of the active coordination pattern and time-of-day pattern shall also be displayed.

(6) A telemetry status display shall indicate system detector call activity, status of mode and special function commands, telemetry address, transmit and valid data status, and speed trap velocities.

(7) A detector status display shall indicate activity for up to 64 detectors. The display shall show detector calls as they are processed by the controller.

(8) A malfunction management unit (MMU) status display shall indicate MMU channel, conflict, and monitoring function status.

### **(D) PROGRAMMING**

#### **PROGRAMMING DISPLAYS**

(1) Programming displays in the form of menus shall aid the operator in entering data from the front-panel keyboard.

(2) A main menu shall allow the user to select a major function of the controller. A submenu shall then be displayed to allow the user to select a sub-function within the major function. A four-arrow cursor key shall allow the user to scroll through all menus and submenus.

(3) English language and traffic engineering terminology shall be used throughout to facilitate programming. The display organization shall allow traffic personnel to program the controller without using reference cards or manuals.

(4) Programming entries shall consist of numerical values, YES/NO and ON/OFF entries. During program entry, the new data shall be displayed as it is entered. Entries shall only be validated and stored when the ENTER key or the cursor key is pressed.

(5) The keyboard entry software shall include context sensitive help screens. Help information shall be accessed by placing the cursor on the data entry in question then pressing the HELP key. Help screens shall be provided for all keyboard entered data and shall include at a minimum range, description, and functional operation information for the data entry.

## PROGRAMMING METHODS

The methods listed below shall be available for controller programming. The manufacturer shall be able to provide as off-the-shelf items all of the firmware and software required to effect the listed programming methods and to implement network operation with system masters and host PCs.

- a. Manual data entry via the front panel keyboard.
- b. Data downloading via telemetry from the central office ICONS operating system.
- c. Data downloading from a portable PC-compatible computer via null-modem cable.
- d. Data downloading from a PC-compatible computer via modem.
- e. Data downloading from one controller to another using a serial port on each controller.
- f. Transfer of the EEPROM data module from one controller to another.

## PROGRAMMING SECURITY

A minimum of three access levels shall be available to provide programming security. The highest or supervisor level shall have access to all programming entries including setting access codes. The second or data change level shall have access to all programming entries except access codes. The third or data display level shall only have access to displayed data. No access code shall be required to display data. User selectable, four-digit access codes shall be provided for the supervisor and data change access levels. Access codes shall initially be set to provide unrestricted access.

## PROGRAMMING UTILITY FUNCTIONS

(1) A copy function shall permit copying all timing data from one phase to another. It shall also permit copying all coordination pattern data from one pattern to another. This feature will facilitate data entry when programming any two or more phases with the same timing values and/or two or more coordination patterns with the same pattern data.

(2) The controller unit shall contain a backup database stored in non-volatile memory. A copy function shall permit transferring the backup database to the active database.

(3) A memory-clear function shall permit the user to clear data entries for the following controller functions, either individually or all at once:

- a. Coordinator
- b. Preemptor
- c. Time base
- d. Detectors

(4) A print function shall allow the printing of controller unit data and detector count, detector failure, and event logs. The controller shall be capable of interfacing with any printer with an RS-232 interface and capable of a minimum width of 80 columns. The communication rate shall be selectable from 1200 to 19,200 bps.

(5) A sign-on message shall allow the user to view the controller software version number. This message shall be displayed upon power-up until a key is depressed. It shall also be possible to display the sign-on message by keyboard selection. The sign-on display shall allow a user-defined message of up to two lines with 38 characters per line.

(6) The controller shall have the capability to output a memory image of the user-programmed settings and intersection configuration data in Motorola S record format. This shall allow transferring the memory image data to another EEPROM device using appropriate programming equipment.

## **(E) ACTUATED CONTROL FUNCTIONS**

The controller shall provide all actuated control functions and operations required by the NEMA TS2 Standard. In addition, it shall provide the features described in the following paragraphs.

### **(1) PHASE SEQUENCE**

a. The phase sequence of the controller shall be programmable in any combination of twelve phases, eight concurrent groups and two timing rings.

b. Phase sequence information shall be changeable from the keyboard and stored in EEPROM data memory.

c. The standard phase sequence of the controller shall also be capable of being altered by coordination, time-of-day or external alternate sequence command. The alternate sequence commands shall allow reversing the normal phase sequence of each phase pair as shown below:

1. Command A reverses phases 1 and 2.
2. Command B reverses phases 3 and 4.
3. Command C reverses phases 5 and 6.
4. Command D reverses phases 7 and 8.
5. Command E reverses phases 9 and 10.
6. Command F reverses phases 11 and 12.

### **(2) TIMING INTERVALS**

a. Timing intervals shall be programmable from 0-255 in one second increments or from 0-25.5 in one-tenth second increments, depending on the function.

b. Guaranteed minimum interval values shall be specified at the time of purchase and shall not be changed or overridden from the keyboard. Values shall be provided for the following intervals:

1. Minimum green
2. Walk
3. Pedestrian clearance
4. Yellow
5. Red
6. Red revert

c. Two vehicle extension intervals shall be provided for each phase. The active vehicle extension interval shall be selected by time-of-day.

d. Volume density intervals shall include actuations before added and cars waiting. Actuations before added shall provide a user-specified number of actuations that must occur before adding variable (added) initial time. Cars waiting shall provide a user-specified number of actuations, or cars waiting that must occur before starting gap reduction. Gap reduction shall be initiated by either time before reduction or cars waiting, whichever reaches its maximum value first.

e. The controller shall be capable of dynamically extending the maximum green time for each phase based on vehicle demand. Three maximum green intervals shall be selectable per phase based on either time-of-day or external input. The initial interval shall be selectable as either Max 1 or Max 2. If the phase terminates due to max-out for two successive cycles, then the maximum green time in effect shall automatically be extended by a maximum green extension interval on each successive cycle until it is equal to Max 3. If the phase gaps out for two successive cycles, then the maximum green time shall return to the original Max 1 or Max 2 value.

f. Each phase shall include a detector failure maximum green time. This maximum green shall be selectable to be in effect whenever a detector assigned to the phase has been diagnosed as failed.

### **(3) OVERLAPS**

a. The controller shall provide four internally generated overlaps (A, B, C, D). These shall be individually programmable as standard, protected/permissive or negative. The green, yellow and red intervals shall be individually programmable following termination of the parent phase. Programming flexibility shall permit assigning the overlap to lead, lag, or provide an advanced green time for a parent phase(s).

b. The controller shall be capable of an additional twelve standard overlaps by assigning each phase output to an overlap.

c. Overlap functions shall be programmable from the controller keyboard. As an option, the four internally generated standard overlaps may be programmed with a NEMA overlap card.

### **(4) CONDITIONAL SERVICE**

a. The controller shall provide a programmable conditional service feature. When selected, the controller shall service an odd-numbered phase once normal service to that phase has been completed and enough time for additional service exists on the concurrent even phase.

b. A conditional service minimum green time shall be programmable for each phase. This interval shall ensure a minimum green if the phase is conditionally served.

c. It shall be possible to program the controller to reservice the even phase after conditionally serving an odd phase. Once an even phase has been conditionally reserviced, the odd phase shall not be conditionally served again until returning to the concurrent group that is timing.

**(5) ADDITIONAL FEATURES**

a. The following features shall be programmable for each phase:

1. Phase in use
2. Locking/non-locking detector memory
3. Vehicle recall
4. Pedestrian recall
5. Maximum recall
6. Soft recall
7. No-rest phase

b. Soft recall shall return the controller to the programmed phase in the absence of other calls.

c. If a phase is designated as a no-rest phase the controller shall not rest in the phase.

d. The controller shall permit power start and external start to be individually programmed by phase and interval. Start intervals shall be green, yellow red, or yellow with overlaps forced yellow.

e. During a power start condition, the controller shall be capable of timing an all-red or flash interval before the power start phase(s) and intervals are displayed.

f. The controller shall provide guaranteed passage operation on a per phase basis. When selected, this feature shall provide a full passage (vehicle extension) interval when a phase gaps out with a gap in effect less than the vehicle extension interval (preset gap).

g. The controller shall provide both single and dual entry operation. When selected, dual entry shall cause the controller to ensure that one phase is timing in each ring.

h. It shall be possible via keyboard selection to inhibit the service of a phase with other phase(s) within the same concurrent group.

i. The controller shall provide the following additional selectable pedestrian functions:

1. Actuated phase rest in WALK.
2. Flashing WALK output.
3. Pedestrian clearance protection during manual control.
4. Pedestrian clearance through yellow.
5. Pedestrian indications remain dark with no call.
6. Pedestrian timing shall be capable of being carried over from one phase to another.

j. Programming shall be provided to inhibit reservice of odd phases (left turns) within the same concurrent group.

k. The controller shall provide a programmable simultaneous gap termination feature. When programmed, phases in both rings shall gap out together in order to terminate the green interval and cross the barrier.

l. The controller shall provide control of five-section, protected/permissive left turn heads. When selected, this feature shall cause the through (even) phase yellow to inhibit display of the left turn (odd) phase yellow.

m. The controller shall provide automatic flash selection per the requirements of the MUTCD. Both the flash entrance and exit phases shall be programmable through the keyboard, and flashing shall be controlled by either setting the fault/voltage monitor output to be FALSE or by flashing through the load switch driver outputs. Automatic flash shall be selectable by external input, system command, or time of day.

n. The controller shall provide dimming for selectable load switch outputs. Dimming shall be accomplished by inhibiting the selected outputs for alternate half cycles of the 120 VAC line. Dimming shall be controllable by time of day and an external input; both functions must be TRUE for dimming to occur. Programming shall permit individual dimming of the Green/Walk, Yellow/Ped Clear, Red/Don't Walk outputs for each load switch.

## **(F) COORDINATION**

Coordination functions to control intersection cycle lengths, system offset relationships, and phase split percentages shall be provided as a standard feature, with no need for additional modules or software.

### **(1) COORDINATION PATTERNS**

a. A minimum of 64 coordination patterns shall be provided. Each pattern shall allow selection of an independent cycle length, offset and split. The coordination patterns shall be selected using telemetry (system), hardwire, or non-interconnected (time base) coordination commands.

b. The coordination patterns shall be selected by the coordination command using the following formats:

1. Plan - This format shall allow selecting the coordination patterns directly, that is, commanding Plan 1 selects Pattern 1. This format shall be the only format used for selecting non-interconnected coordination commands.

2. Standard - This format shall allow selecting the coordination patterns using a cycle-offset-split command. Each pattern shall be assignable to a specific cycle-offset-split combination. The coordination pattern shall then be selected by matching the coordination command to the cycle-offset-split assigned to the pattern. The cycle-offset-split assignment shall allow pattern selection as a function of six cycles, five offsets, and four splits or one of 32 alternate plan commands. Alternate plan commands shall be selected by assigning the coordination pattern to cycle seven and the offset and split to correspond to the desired plan number. When an alternate plan command is in effect the coordinator shall operate in a time-based, non-interconnected coordination mode.

3. TS2 - This format shall allow selecting the coordination patterns as a function of Timing Plan and one of three offsets. With this format a minimum of 20 Timing Plans shall be available for selection of one of sixty coordination patterns.

- c. The following functions shall be programmable in each coordination pattern: cycle length, offset, split interval for twelve phases, permissive timing, coordinated phase split extension, alternate-phase sequence, phase reservice, split demand pattern, crossing artery pattern, coordinated phases, phases to omit and phases to be placed on recall.
- d. It shall be possible to omit selected phases during any coordination pattern. A phase shall also be omitted if the phase split value is zero for the current coordination pattern.
- e. The following recall modes shall be selectable on a per phase basis for each coordination pattern:
  - 1. Vehicle recall
  - 2. Pedestrian recall
  - 3. Maximum recall

## **(2) CYCLE LENGTH**

- a. One cycle length shall be provided for each coordination pattern. The cycle shall be adjustable over a range of 30-255 seconds in 1-second increments.
- b. The cycle length shall serve as the reference time for all coordination timing.

## **(3) SYNCHRONIZATION**

- a. For systems with a single system sync pulse, coordination timing shall be synchronized to the leading edge of that pulse, which shall serve as the master zero reference for all offset timing.
- b. For hardware systems with multiple sync pulses, the coordinator shall lock onto the correct sync by trying different syncs and checking for reoccurrence during successive cycles.
- c. After a valid system sync pulse has been received the coordinator shall check for the proper occurrence of the system sync pulse during each subsequent cycle. If a sync pulse does not occur, the coordinator shall self-sync and continue to operate with the last set of coordination commands for a programmable number of cycles from 0-255. If a sync pulse does not occur within the programmed period (or until the first sync pulse is received), the coordinator shall revert to the non-interconnected coordination mode.

## **(4) OFFSET**

- a. Offset shall normally be defined as the time period from the system sync pulse to the beginning of the leading coordinated phase green (local zero). The coordinator

shall also be capable of referencing the offset to either the coordinated phase yield or force off point.

b. Offsets shall be programmable using both percent and seconds. The range shall be from 0-99% of the cycle length in 1% increments or 0-254 seconds in 1-second increments.

c. Offset changes shall be achieved by adding or subtracting cycle time over a maximum of three cycle periods to allow a smooth transition to the new offset. Offset correction using dwell shall also be selectable.

d. If the controller is resting in the coordinated phase when the offset point occurs, the local cycle timer shall be immediately set to zero, thus achieving the quick establishment of the new offset.

## **(5) SPLIT**

a. Each split shall provide a split interval for each of twelve phases. The split interval shall be programmable using percent or seconds. The range shall be from 0-99% of the cycle length in 1% increments or 0-254 seconds in 1-second increments.

b. Split interval settings shall determine the maximum time, including vehicle clearance (yellow and red), for a non-coordinated phase, or the minimum time for a coordinated phase. Phase termination shall be controlled by establishing a force-off point for each phase within the cycle. Except for the coordinated phases, the force-off point shall be selectable to be a fixed point within the cycle or allowed to float. If floating force-offs are selected, each phase shall time no more that its own split interval.

c. During coordination, it shall be possible to operate a coordinated phase as actuated or non-actuated. If a coordinated phase is actuated, vehicle detections shall permit the coordinator to extend a phase beyond the normal yield point. Extended coordinated phase green shall be selectable using the same range as split interval settings (percent or seconds). If actuated coordinated phases are used they shall be able to have actuated or non-actuated (walk rest) pedestrian movements.

## **(6) PERMISSIVE PERIODS**

a. Permissive periods shall be provided to control the time period during which coordinated phases are released to service calls on non-coordinated phases.

b. All permissive timing shall begin at the lead coordinated phase yield point. A yield point shall be automatically computed for the coordinated phase in each ring. The coordinated phase yield points shall allow the coordinated phases to yield independent of each other. The yield point shall be the point at which the coordinated phase is released to allow the controller to service calls on non-coordinated phases. The computation shall take into account the coordinated phase split interval plus pedestrian and vehicle clearance times.

c. Automatic permissive period operation shall be provided by automatically calculating a permissive period for each non-coordinated phase. The permissive period shall consist of a separate vehicle and pedestrian period computed from the phase-split interval and the vehicle/pedestrian minimum time. The controller shall answer a call only during the associated phase permissive period. However, once the controller has been released to answer a call, all remaining phases shall be served in normal sequence.

d. Single permissive period operation shall be provided by defining a single time period per cycle beginning with the yield point during which the controller is allowed to answer phase calls for any phase. The duration of this period shall be selectable in each coordination pattern.

e. Dual-permissive period operation shall also be provided. During the first permissive period, the controller shall answer only vehicle or pedestrian calls on the phases following the coordinated phase. If the controller yields to a call during this period, calls on the remaining phases are served in normal rotation. During the second permissive period, the controller shall answer calls on all remaining phases except the first permissive phase. The duration of the two permissive periods and the time at which to start the second permissive period (displacement) shall be selectable in each coordination pattern.

## **(7) PHASE RESERVICE**

a. If actuated coordinated phases are in use it shall be possible to reservice non-coordinated phases within the same cycle if sufficient time remains. A phase shall be reserviced only if the permissive period for the phase indicates there is sufficient time remaining in the cycle to service the phase.

b. Phase reservice shall be capable of being enabled/disabled in each coordination pattern. During phase reservice the coordinated phase pedestrian timing shall be inhibited until local zero.

## **(8) TRANSITION CYCLES**

a. The controller shall provide a smooth and orderly transition when changing from free operation to coordinated operation and from one coordination command to another.

During a free-to-coordinated transition, the controller shall initiate a pick-up cycle beginning upon receipt of a sync pulse and a valid coordination command. The controller shall then enter coordination mode upon crossing a barrier or if resting in the coordinated phases.

b. Each coordination command shall select a cycle, offset and split. A command change shall be implemented concurrent with a sync pulse. Cycle, offset, and split changes shall not take effect until local zero.

## **(9) CROSSING ARTERY CONTROL**

- a. The coordinator shall be capable of implementing dual coordination at an intersection where two arterials are under control of separate masters.
- b. An external input shall enable dual coordination. Once enabled, the coordinator shall place a continuous call on the crossing artery phases so as to ensure that these remain green for their full split interval.
- c. The coordinator shall output a crossing artery sync signal to indicate the beginning of the crossing artery phase split interval.
- d. Dual coordination shall force a selectable crossing artery split plan to be used so as to allow a particular split to be optimized for dual coordination in each coordination pattern.

#### **(10) LOCAL SPLIT DEMAND**

- a. The coordinator shall provide a minimum of two split demand detector inputs, which shall allow the selection of a preferred split plan based on intersection demand.
- b. If the split demand detector indicates continuous vehicle presence during a programmed monitoring period beginning with the onset of a selected phase green, the coordinator shall force a selectable split plan to be in effect during the next cycle. This split plan shall remain in effect for a selected number of cycles from 0-255. A specific split plan shall be capable of being selected in each coordination pattern.

#### **(11) FREE MODE**

- a. The coordinator shall provide a free mode of operation, where all coordination control is removed.
- b. Free mode operation shall be selectable by coordination commands, by external input or by keyboard entry.
- c. The coordinator shall revert to the free mode when active controller inputs or functions would interfere with coordination. Such inputs or functions shall include the following:
  1. Manual control enable
  2. Stop time
  3. Automatic flash
  4. Preemption
- d. The coordinator shall provide an active free mode, where coordination control is removed but the coordinator continues to monitor system sync so as to keep its timing in step with the system master.

#### **(12) MANUAL CONTROL**

The controller shall allow manual override of the current coordination command from the keyboard. The manual command shall allow selection of any coordination pattern to be in effect.

### **(13) INTERCONNECT MODES**

a. The coordinator shall be capable of operating with any of the following interconnect types:

1. Non-interconnected coordination (time-based)
2. Telemetry
3. Hardwired

b. The coordinator shall be compatible with fixed-time interconnect, which provides the sync pulse superimposed on the offset lines. It shall also operate within an interconnected system using a separate sync line. The non-interconnected coordination mode shall serve as a backup when using telemetry or hardwired interconnect.

### **(14) MASTER COORDINATOR**

The coordinator shall output the coordination command, including sync pulse. This feature shall permit the controller to be used as a time-of-day master in a hard-wired interconnected system.

### **(G) PREEMPTION**

The controller shall provide a minimum of six railroad-fire-emergency vehicle preemption sequences plus four bus preemption sequences. Preemption capability shall be standard and shall not require additional modules or software.

#### **(1) RAILROAD-FIRE-EMERGENCY VEHICLE PREEMPTION**

- a. The six railroad-fire-emergency vehicle preemptors shall be selectable as a priority or non-priority type. Priority preemptor calls shall override non-priority preemptor calls. Low-numbered priority preemptors shall override higher-numbered priority preemptor calls. Non-priority preemptor calls shall be serviced in the order received.
- b. Each preemptor shall provide a locking and non-locking memory feature for preemptor calls. If a preemptor is in the non-locking mode and a call is received and dropped during the delay time, the preemptor shall not be serviced.
- c. Preemptor timing intervals shall be programmable from 0-255 in one second increments or 0-25.5 in one-tenth second increments, depending on function.
- d. A programmable delay time interval shall be provided to inhibit the start of the preemption sequence. This interval shall begin timing upon receipt of a preemption call.
- e. An inhibit time shall be provided as the last portion of the delay time interval. During this time, phases that are not part of the preempt sequence shall be inhibited from service.

- f. A programmable duration time shall be provided to control the minimum time that a preemptor remains active. This time shall be programmable from 0-999 in one second increments.
- g. A programmable maximum time shall be provided to control the maximum time that a preemptor remains in the hold interval. The preemptor maximum time interval shall be inhibited if the preemptor is programmed as a priority preemptor.
- h. Phases timing at the beginning of a preemption sequence shall remain in effect for a minimum time before the controller advances to the next sequential interval. If the phase has been timing for longer than the programmed preemptor minimum time, the controller shall immediately advance to the next sequential interval. Minimum times shall be programmable for the following intervals:
  - 1.Green/pedestrian clearance
  - 2.Yellow
  - 3.Red
- i. A phase shall advance immediately to pedestrian clearance if it has been timing a WALK interval at the beginning of a preemption sequence. It shall be possible to time the minimum pedestrian clearance through the yellow interval, or alternately to advance immediately to yellow. During preemption, pedestrian indicators shall be selectable as being a solid DON'T WALK, OFF (blank) or fully operational.
- j. If an overlap is in effect when the preemption sequence begins, it shall be possible to terminate the overlap so that it remains red for the remainder of the preemption sequence. Overlaps terminating or forced to terminate shall time the preemptor minimum yellow and red clearance times.
- k. Each preemptor shall provide user-programmable green, yellow and red track clearance intervals. These shall begin timing immediately after the preemptor minimum red interval.
- l. Up to two permissive phases shall be selectable as track clearance phases. During the track clearance period, the selected phases shall time the track clearance green, yellow and red intervals once, and then advance to the hold interval. If track clearance phases are not selected the track clearance interval shall be omitted from the preempt sequence. Controller interval timing shall be used if track clearance interval times have been programmed as zero.
- m. The preemption hold interval shall begin immediately after track clearance. It shall remain in effect until the preemptor duration time and minimum hold times have elapsed and the preemptor call has been removed or the preemptor maximum time has been exceeded. During the preemption hold interval, any one of the following conditions shall be selectable:
  - 1. Hold phase green
  - 2. Limited phase service
  - 3. All red
  - 4. Flash

- n. Any valid phase, except a track clearance phase, shall be selectable as a hold phase. If hold phases are not selected, the controller shall remain in all red during the hold interval. If flash is selected for the hold interval, up to two permissive phases shall be selectable to flash yellow, and the remaining phases shall flash red. Overlaps associated with the phases flashing yellow shall also flash yellow unless they have been forced to terminate, in which case they shall remain red.
- o. Each preemptor shall provide a user-programmable green, yellow and red hold interval, during which the hold phase(s) shall operate normally, except that the minimum green interval time shall equal the hold green time. At the completion of the hold green interval, the controller shall time the hold yellow and red clearance intervals prior to transfer to the exit phases.
- p. Up to two permissive exit phases shall be selectable to time after the preemption sequence has been completed. These shall serve as transition phases to return the controller to normal operation. It shall also be possible to place calls on selected phases upon exiting preemption.
- q. Each preemptor shall provide a user-programmable exit maximum time. Upon exiting the preemption sequence, this time shall serve as the maximum green time in effect for one controller cycle for all phases except hold phases.
- r. Preemptor linking shall permit preemption sequences, where lower-priority preemptors may call the higher-priority preemptors upon termination of their preemption sequence.
- s. Preemptor active outputs shall be provided for each of the preemptors. The output shall be set to ON when the preemption sequence begins and shall remain ON for the duration of the sequence. It shall also be possible to program preempt active outputs to be ON only during preempt hold intervals. Additionally, it shall be possible to program the non-active, non-priority preemptor outputs to flash while another preemptor is active.
- t. Preemptors shall normally override automatic flash. It shall be possible to inhibit this feature for each preemptor.

**(2) BUS PREEMPTION**

- a. Four bus preemptors shall provide control for bus or other low-priority vehicles. Bus preemptors shall have low priority and shall be overridden by railroad-fire-emergency vehicle preemptor calls.
- b. A 6.25 pulse-per-second signal with a 50% duty cycle shall identify a bus preemptor call. Bus preemptor calls shall be capable of preemptor call memory and shall be served in the order received.
- c. Bus preemptor timing intervals shall be programmable from 0-255 in one second increments or 0-25.5 in one-tenth second increments depending on the function.
- d. A reservice time shall be provided to avoid excessive utilization of the same bus preemptor. If a call is received before the reservice time has elapsed, the bus preemptor shall not be reserviced. If reservice time has not been entered then all phases with a call when leaving the bus preemption sequence shall be

serviced before the bus preemptor may be served again.

- e. Bus preemptors shall provide delay, inhibit, and maximum time functions similar to those for railroad-fire-emergency vehicle preemptors described above.
- f. Bus preemptors shall provide the following entrance intervals:
  - 1. Green/pedestrian clearance
  - 2. Yellow
  - 3. Red
- g. At the completion of the entrance red clearance, the bus preemptor shall advance to the hold green interval. During this interval, up to two permissive phases shall be selectable to remain green until the minimum hold time has elapsed and the bus preemptor call has been removed or the preemptor maximum time has been exceeded.
- h. It shall be possible to program the controller to allow concurrent phases to be serviced for a bus preemptor with only one phase selected as the hold interval phase.

#### **(H) PREEMPTION SAFEGUARDS**

- (1) If a preemptor call is active when power is restored to a controller, the fault/voltage monitor output shall be set to FALSE, placing the intersection in flash.  
  
Similarly, if external start is applied during a preemption sequence, the intersection shall be set to flash. Intersection flash shall remain in effect until the preemptor call has been removed and the preemptor duration time has elapsed.
- (2) An input shall be provided to stop timing of the current active preemptor under control of the MMU/CMU.
- (3) A preemptor safety interlock shall be provided to cause the intersection to go into flash whenever the controller has been removed or has not been programmed for preemption. This shall be achieved with an appropriate signal to the MMU/CMU.

#### **(I) TIME-BASED CONTROL & NON-INTERCONNECTED COORDINATION**

The controller shall include time-based control. This capability shall be a standard feature and shall not require additional modules or software.

##### **(1) CLOCK/CALENDAR FUNCTIONS**

- a. The controller shall provide a time-of-day (TOD) clock, which shall be used for all time-based control functions. The only required clock settings shall be the current time (hour, minute and second) and date (month, day and year). Day of week and week of year shall be automatically computed from the date setting.
- b. During normal operation, the TOD clock shall use the power line frequency as

its time base. When power is removed, the time shall be maintained by a crystal oscillator for up to 30 days. The oscillator shall have a timing accuracy of +/- 0.005% over the entire NEMA temperature range as compared to the Universal Coordinated Time Standard.

- c. In addition to entering time and date via the keyboard, it shall be possible to download the information from another controller, a computer or a system master.
- d. The controller shall include a time reset input. This feature shall reset the TOD clock to 03:30 whenever the time reset input is TRUE.
- e. The TOD clock shall automatically compensate for leap year and shall be programmable to automatically switch to daylight savings time.

**(2) TIME-BASED CONTROL**

- a. Time-based control shall utilize a yearly program format. The year program shall consist of 53 programmable weeks, each assignable to one of ten week-programs. For each week-program, one of sixteen day-programs shall be capable of being assigned for each day of the week. Each day program shall consist of a variable number of program steps that define a program for the entire day.
- b. There shall be a minimum of 36 holiday or exception day programs, which override the normal day program. Holiday programs shall be capable of being set as floating (occurs on a specific day and week of the month) or fixed (occurs on a specific day of the year). It shall be possible to program a fixed holiday so that it automatically repeats in the following year.
- c. Separate program step control shall be provided for non-interconnected coordination (NIC) and TOD functions.
- d. It shall be possible to manually force any of the non-interconnected or TOD program steps to override the current program step. The forced step shall be entered from the keyboard and shall remain in effect until removed.

**(3) NON-INTERCONNECTED COORDINATION**

- a. A minimum of 100 (or 200 with optional expanded data module) non-interconnected coordination program steps shall be available for the day-programs. These shall not have to be entered in any special sequence. It shall be possible to add and delete steps from a day-program without affecting any other day-program. Each of the program steps shall permit selection of the following functions:
  - 1. Day program assignment
  - 2. Start time
  - 3. Coordination pattern
  - 4. System override
- b. Selection of system override shall allow the coordination pattern selected by the program step to override the current telemetry or hardwire system commanded coordination pattern.
- c. When operating in the non-interconnected coordination mode the

synchronization point for all cycles shall be referenced to a user selected reference time (sync reference), last event or last sync as selected from the keyboard. The sync reference time is that time at which all cycles shall be reset to zero.

- d. If the sync reference time is selected, the synchronization point for the cycle selected by the current program step, shall be computed using the present time, sync reference time, and cycle length. The synchronization point shall occur whenever the present time is such that an even number of cycle length periods have occurred since the sync reference time.

**(4) TIME-OF-DAY FUNCTIONS**

- a. A minimum of 50 (or 100 with optional expanded data module) TOD program steps shall be available for the day-programs. These program steps shall be separate from the non-interconnected coordination program steps described above. TOD program steps shall not have to be entered in any special sequence. It shall be possible to add and delete steps from a day-program without affecting any other day-program. Each of the TOD program steps shall permit selection of the following functions:

- 1. Day program assignment
- 2. Start time
- 3. Automatic flash
- 4. Red Rest
- 5. Dimming
- 6. Alternate vehicle extension interval
- 7. Detector logging
- 8. Detector diagnostic plan
- 9. Alternate phase sequence
- 10. Control of eight special functions
- 11. Control of the following by phase functions: Max 2, Max 3, Vehicle Recall, Max Recall, Pedestrian Recall, Condition Service, and Phase Omit.

**(J) DETECTOR FUNCTIONS**

- (1) The controller shall provide a minimum of 32 (or 64 with optional expanded data module) vehicle detector inputs. Each input shall be assignable to any phase and be programmable as to detector function. Extend and delay timing shall be provided for each detector. Each detector shall be capable of operating in a lock or non-lock mode.
- (2) The controller shall provide detector cross switching, which permits all vehicle detectors to alternately place calls on their assigned phases and their assigned cross-switch phases. If the assigned phase is not green and the cross-switch phase is green, the detector shall place calls on the cross switch phase. If the assigned phase is omitted by the coordinator, the detector shall place calls on the cross switch phase.
- (3) Each vehicle detector shall be user-programmable to operate as one of the following 9 detector types:
  - a. Type 0 - Detector shall operate as a standard detector providing one call per actuation.

- b. Type 1 Extend/Delay - Detector shall operate as follows: When the phase is green and a call is detected then dropped (indicating passage of a vehicle), the extend timer shall begin timing and the call shall be held for the length of the extend time. When the phase is not green and a call is detected, the call shall not be acknowledged by the controller until the delay time has elapsed.
- c. Type 2 Extend/Delay Call - Detector shall operate as follows: When the phase is green and a call is detected then dropped (indicating passage of a vehicle), the extend timer shall begin timing and the call shall be held for the length of the extend time. If a gapout occurs further calls shall not be placed on the controller until the delay time has elapsed. When the phase is not green the detector shall operate as a Type 0 detector.
- d. Type 3 Stop Bar - Detector shall operate as follows: Vehicle calls shall be accepted only when the phase is not green. When a call is detected, it shall be held until the detection area is empty. Once the detection area is empty no further calls shall be accepted until the phase is again not green.
- e. Type 4 Stop Bar - Detector shall operate as follows: Vehicle calls shall be accepted only when the phase is not green. When a call is detected, it shall be held until the detection area is empty. The extend timer shall begin timing with the phase green. Once the extend timer times out OR the detection area is empty, no further calls shall be accepted until the phase is again not green.
- f. Type 5 Stop Bar - Detector shall operate as follows: Vehicle calls shall be accepted only when the phase is not green. When a call is detected, it shall be held until the detection area is empty. The extend timer shall begin timing with the phase green. If a call is received before the extend timer has timed-out, the timer shall be reset. Timer reset shall occur until a gap between the calls is large enough to allow the extend timer to time-out. Once time-out has occurred, no further calls shall be accepted until the phase is again not green.
- g. Type 6 Calling - Detector shall accept one call while the phase is red.
- h. Type 7 Bicycle - Detector shall operate like a Type 0 detector except that it shall enable a bike minimum green interval on the assigned phase.
- i. Type 8 Dilemma Zone - Detector shall use two detectors and shall operate as follows: While the phase is green a vehicle entering the first detection zone shall start the extension timer of the first detector. If the vehicle enters the second detection zone before the first extension time expires, a call shall be placed on the phase and extended by the second detector extension time period. If the vehicle arrives at the second detection zone after the first extension timer expires, a call shall not be placed on the phase until after the delay time of the first detector has expired. When the phase is not green the first detector shall place no calls and the second detector shall act as a Type 0 detector.
- (4) Each detector input shall be capable of functioning as one of 16 system detectors.
- (5) Vehicle detectors shall be capable of being assigned to a minimum of 16 speed detectors. Speed shall be detected using both one and two detector configurations. Speed shall be computed using a keyboard entered average vehicle length and loop length for a one detector configuration. When using

two detectors, speed shall be calculated using a keyboard entered distance between detectors and travel time between detectors.

- (6) The controller shall provide a minimum of 12 pedestrian detector inputs. Each pedestrian detector shall be assignable to any phase.

### **(K) SYSTEM COMMUNICATIONS**

- (1) The controller shall be capable of communicating with an on-street system master. This capability shall be provided by a separate telemetry module, which shall be included in the controller when required by the plans and specifications. The telemetry module shall receive system master commands and data transmissions. In addition, it shall transmit the controller status, data base and system detector information to the system master.

#### **(2) SYSTEM COMMANDS**

a. The telemetry module shall allow the controller to receive, as a minimum, the following commands:

1. Cycle, offset, and split (coordination pattern)
2. System sync
3. Special function commands (minimum of four)
4. Free and flash mode commands
5. Time and date
6. Request for local status
7. Recall to Max

b. All commands must occur more than once in any three-second period in order to be recognized.

c. All mode and special function commands shall be cleared after 20 minutes of loss of communication between controller and system master.

#### **(3) STATUS DATA**

a. The status of each of the following functions shall be transmitted to the system master in response to a local status request:

1. Green and yellow status for all phases and overlaps
2. Walk and pedestrian clearance status for all phases
3. Vehicle and pedestrian detector status
4. Phase termination status
5. Local time
6. Coordination status
  - (a) Command source
  - (b) Sync or transitioning status of coordinator
7. Conflict flash status
8. Local flash status
9. Preempt activity and calls
10. Volume and occupancy data from a minimum of 16 system detectors
11. Speed data from a minimum of two speed detectors
12. Maintenance required (cabinet door open) status
13. Status of two user-defined alarms

- b. Split Reporting
- c. The status of each of the following parameters shall be calculated on a per-cycle basis and transmitted to the system master:
  - 1. Actual time spent in each phase
  - 2. Time of day at end of cycle
  - 3. Phases forced off during cycle
  - 4. Type of coordination operation
  - 5. Whether transitioning to new offset
  - 6. Cycle, offset, and split in effect during last cycle
  - 7. Flash status if operation is Free

(4) UPLOAD/DOWNLOAD CAPABILITY

- a. The telemetry module shall provide the capability to upload/download the entire intersection database. Phase assignments for overlaps and preemptors shall not be downloaded to preclude unsafe controller operation. It shall be possible to inhibit downloading of phases in use and left-turn head control.

(5) TELEMETRY

- a. Telemetry shall utilize TDM/FSK data transmission at 1200 baud over two pairs of wires. These may be leased lines (Type 3002, voice grade, unconditioned) or dedicated cable. Optional fiber optic communications capability shall also be available.
- b. The nominal transmitter output level shall be 0 dbm into a 600-ohm load. The receiver sensitivity shall be -34 dbm and shall be adjustable from -40 to +6 dbm.
- c. Parity and error checking shall be employed to assure transmission and reception of valid data. Indicators shall be provided on the telemetry module to show telemetry activity as follows: transmit, receive carrier, and valid data.
- d. In the event of a telemetry failure, the controller shall revert to the non-interconnected coordination mode after it has self-synchronized for a number of cycles, which shall be selectable from 0-255.

**(L) DIAGNOSTIC FEATURES**

- (1) The controller shall include both automatic and operator-initiated diagnostics. This capability shall be a standard feature and shall not require additional modules or software.
- (2) Automatic diagnostics shall verify memory, MMU compatibility programming, and microprocessor operation each time power is reapplied to the controller. After power has been applied, diagnostics shall continually verify the operation of essential elements of the controller including at a minimum: PROM, EEPROM, communications, and the microprocessor.
- (3) Operator initiated diagnostics shall allow the operator to verify proper operation of all controller input, output, communications, keyboard, and

display functions. Both manual and automatic test modes shall be provided.

(4) DETECTOR DIAGNOSTICS

- a. Time-of-day controlled detector diagnostics shall be provided that allows testing vehicle and pedestrian detectors for no activity, maximum presence, and erratic output.
- b. A minimum of eight detector diagnostic plans shall be provided. These plans shall be selectable on a time-of-day basis. This shall allow varying the detector diagnostic intervals to correspond with changes in detector activity.
- c. If a detector is diagnosed as failed, the associated phase shall be placed in one of the following keyboard selectable modes:
  1. Minimum Recall
  2. Maximum Recall
  3. Maximum Recall using detector failure maximum green time
- d. Diagnostics for NEMA TS2 detectors connected to the controller using a Bus Interface Unit (BIU) shall also include detection of watchdog, open and shorted loop, and excessive inductance change failures.

**(M) LOGGING FEATURES**

The controller shall be capable of logging and reporting detector activity, detector failures, and the occurrence of selected events or alarms. Logs shall be capable of being printed or displayed on the front of the controller.

(1) DETECTOR LOGGING

- a. The controller shall include a detector log buffer capable of logging volume, occupancy and average speed for selected vehicle and speed detectors.
- b. The detector-logging interval shall be keyboard selectable as 5, 15, 30, or 60 minutes.
- c. Detector logging shall be capable of being enabled or disabled by time-of-day.

(2) DETECTOR FAILURE LOGGING

- a. The controller shall include a detector failure log buffer capable of storing a minimum of 100 time and date-stamped detector failure events. Once logged, detector failure events shall remain in the log until cleared or the log buffer capacity is exceeded at which time the oldest detector failure events shall be overwritten.
- b. All detector diagnostic failures shall be recorded in the detector failure log including: no activity, maximum presence, erratic output, watchdog failure, open loop, shorted loop, and excessive inductance change. If a detector recovers after a diagnostic failure, a detector on-line event shall be stored in the detector failure log.

- c. Detector failure logging shall be capable of being disabled.

(3) **EVENT LOGGING**

- a. The controller shall include an event log buffer capable of storing a minimum of 200 time and date-stamped events or alarms. Once logged, events shall remain in the buffer until cleared or the log buffer capacity is exceeded at which time the oldest events shall be overwritten.
- b. At a minimum the following events shall be logged: communication failures, coordination faults, MMU and local flash status, preempt, power ON/OFF, low battery, and status of a minimum of two alarm inputs. An on-line event shall be logged when an event or alarm returns to normal status.
- c. Event logging shall be capable of being enabled or disabled for each category of event or alarm.

**(N) FIRMWARE INSTALLATION & UPDATES**

- (1) The controller shall use flash memory for the storage of all operating software. The use of conventional EPROMs, PROMs, or similar devices shall not be acceptable. In no case shall it be acceptable to change memory devices in the controller to update or change the controller software.
- (2) In order to facilitate the update of the controller firmware/software, a separate software utility shall be supplied on 3.5 inch diskette. The interface utility shall allow the field technician to load updated firmware/software into the controller via a laptop personal computer connected to the controller via a serial cable.
- (3) In addition to updating the controller firmware/software, the installation utility shall provide the following capabilities:
  - i) Simulate controller keyboard entry remotely via the laptop PC and allow the field technician to manipulate all of the data within the controller in real time.
  - ii) Allow the technician to retrieve event, detector event, detector log and MMU event logs stored within the controller.
- (4) A firmware/software installation module (SIM) shall be supplied with each 50-controller units delivered. The SIM shall contain the controller firmware. The SIM shall plug directly into the controller and through a utility menu resident in the controller, shall allow the field technician to upload updated firmware/software.
- (5) **Warranty Statement**

a. **WARRANTY COVERAGE**

The supplier of the equipment shall warranty their product to be free from defect in design and operation and that it meets all the requirements of this specification and those incorporated in this document.

b. LENGTH OF WARRANTY

The term of warranty shall be a minimum of three (3) years from date of shipment. Any software revisions to the controller shall be provided free of charge during the warranty period.

c. RELIABILITY CLAUSE

While under warranty, the isolation and repair of any unit malfunction shall be the responsibility of the supplier.

NOTE: Malfunctions do not include damage caused by lightning, power surges, negligence, acts of God, or use of equipment in a manner not originally intended by its manufacturer.

d. SHIPPING & HANDLING

During the warranty period shipping shall be handled as follows: The Pima County will pay for shipping the unit to the vendor and the vendor will pay for return shipping of the repaired unit to the City.

**734-2.03 Cabinet Operational Standards** of the Standard Specifications is revised to read:

**(A) Cabinet Construction**

A complete NEMA TS-2 Type 1 eight-phase cabinet, and NEMA TS-2 Type 2 controller, specifically, an ASC/2-2100 shall be supplied and installed. The controller and cabinet assembly shall be provided by the same manufacturer. The size of the cabinet shall be TS-2 Size 6 (52"). Cabinets shall meet, as a minimum, all applicable sections of the NEMA Standard Publication No. TS-2 1998. Where differences occur, this specification shall govern. The cabinets shall meet the following criteria:

- (1) Material shall be 5052-H32 0.125-inch thick aluminum.
- (2) Paint Specifications:

- Description

Cabinet shall be painted with high gloss white paint on the interior and exterior. The white paint must be Polyurethane capable of resisting graffiti and withstand repeated cleanings. This paint should be able to protect smooth non-porous surfaces of metal electrical cabinets. The anti-graffiti coating shall retain the excellent exterior durability, chemical and solvent resistance of its polyurethane base while providing a surface which makes graffiti difficult to adhere to.

- Mix Ratios and VOC Content

340 Grams/Liter	VOC	420 Grams/ Liter	VOC
6409 G	4 Parts	6409 G	4 Parts
340 HP Catalyst	1 Part	340 HP Catalyst	1 Part
1800 Reducer	None	1600 Reducer	1 Part

Ratios are by volume.

1600 reducers vary by evaporation rate.

1600, fast-02, medium; 1600-03, slow.

- Specifications of Separate Components

% Solids by Volume	Density lbs/gal	VOC grms/l	Content lbs/gal
6409 G	53%	8.5-11.0	395 3.30
340 HP	87.2	9.6	112 0.93

- Graffiti Removal

To remove graffiti, the use of non-abrasive commercial cleaners such as DuBois Chemical's "Gangbuster" is recommended.

- (3) The door hinge shall be of the continuous type with a stainless steel hinge pin.
- (4) All external fasteners shall be stainless steel.
- (5) The door handle shall be cast aluminum.
- (6) All seams shall be sealed with RTV sealant or equivalent material on the interior of the cabinet.
- (7) The cabinet shall include a pullout shelf installed on the second shelf to support laptop and schematics.

### TESTING

- (1) The manufacturer shall ensure that the cabinet and controller is fully tested prior to being delivered to the Electric Shop for turn on.
- (2) The inside door panel shall contain three (3) switches: AUTO/FLASH, STOP TIME and CONTROLLER EQUIPMENT POWER ON/OFF. Door panel switches shall be hard wired only and printed circuit boards shall **NOT** be used for the door panel switches.
  - a. AUTO FLASH SWITCH. When in the flash position, power shall be maintained to the controller and the intersection shall be placed in flash. The controller shall not be stop timed when in flash.
  - b. STOP TIME SWITCH. A three position toggle switch shall be provided. The switch positions shall function as follows: Stop Time (up) activates control stop time input, Run (center) disconnects all stop time inputs, Normal (down) permits the malfunction management unit to activate the stop time input.
  - c. CONTROL EQUIPMENT POWER ON/OFF. This switch shall control the controller, MMU, and cabinet power supply AC power.

### POLICE PANEL SWITCH

- (1) The Police Panel shall contain four (4) switches: The SIGNALS ON/OFF, AUTO/FLASH, AUTO/MANUAL and MANUAL/OFF/PHOTO SWITCH. All police panel switches shall be hard wired.

## **(B) SHELF HEIGHT**

The cabinet shall be supplied with two removable shelves manufactured from 5052-H32 aluminum. The shelves must have the ability of being removed and reinstalled **WITHOUT** the use of hand tools. **The shelves shall extend the full length of the cabinet.**

## **(C) CABINET ELECTRICAL**

### **CABINET LIGHT ASSEMBLY**

- (1) The cabinet shall be a florescent lighting fixture that shall be mounted on the inside top of the cabinet near the front edge. The fluorescent light shall be activated by an on/off switch when the cabinet door is opened and off when it is closed.

### **CONVENIENCE OUTLET**

- (1) A 120 volt AC, 15 Amp NEMA 5-15 GFI duplex outlet shall be mounted in the lower right corner of the cabinet facing the inside of the cabinet door and within 6" of the front edge of the opening of the door.

### **INSIDE CONTROL PANEL SWITCHES**

(1) The inside door panel shall contain three (3) switches: AUTO/FLASH, STOP TIME and CONTROLLER EQUIPMENT POWER ON/OFF. Door panel switches shall be hard wired only and printed circuit boards shall **NOT** be used for the door panel switches.

- a. **AUTO FLASH SWITCH.** When in the flash position, power shall be maintained to the controller and the intersection shall be placed in flash. The controller shall not be stop timed when in flash.
- b. **STOP TIME SWITCH.** A three position toggle switch shall be provided. The switch positions shall function as follows: Stop Time (up) activates control stop time input, Run (center) disconnects all stop time inputs, Normal (down) permits the malfunction management unit to activate the stop time input.
- c. **CONTROL EQUIPMENT POWER ON/OFF.** This switch shall control the controller, MMU, and cabinet power supply AC power.

### **POLICE PANEL SWITCH**

(1) The Police Panel shall contain four (4) switches: The SIGNALS ON/OFF, AUTO/FLASH, AUTO/MANUAL and MANUAL/OFF/PHOTO SWITCH. All police panel switches shall be hard wired.

- a. **SIGNALS ON/OFF SWITCHES.** In the OFF position, power shall be removed from signal heads in the intersection. The controller shall continue to operate. In the OFF position, the MMU shall not conflict or require reset.
- b. **AUTO/FLASH SWITCH.** In the flash position, power shall not be removed from the controller and stop time shall be applied.
- c. **AUTO/MANUAL SWITCH.** Cabinet wiring shall include provisions for an AUTO/MANUAL switch and a momentary push-button or hand cord. The AUTO/MANUAL switch and push-button or hand cord shall not be provided unless it is called for in the special provisions.

- d. PHOTO/OFF/MANUAL SWITCH. The lighting contactor shall be controlled by a three position double pole, double throw switch. The switch positions shall be: up - MANUAL, center - OFF, and down - PHOTO.

## **(D) VENTILATION**

### **VENTILATING FAN**

The cabinet shall be provided with two (2) thermostatically controlled (adjustable between 80-150 degrees Fahrenheit) ventilation fans and shall be installed in the top of the cabinet plenum.

### **AIR FILTER ASSEMBLY**

The cabinet Air Filter shall be a one-piece removable, non-corrosive, vermin and insect-proof air filter and shall be secured to the air entrance of the cabinet.

## **(E) HIGHWAY LIGHTING CONTROL**

A lighting contactor shall be required in all cabinets and shall be three (3) pole in design type to be used for Highway lighting requirements. Each pole of the contactor shall be protected by a 20 ampere single pole circuit breaker. The lighting contactor and its associated equipment shall be shielded to prevent any hazardous contact with live voltages.

### **LIGHTNING SUPPRESSION**

The cabinet shall be equipped with an EDCO model SHP-300-10 or approved equivalent surge arrester.

### **POWER PANEL**

The Power Panel shall house the following equipment:

- A 50-amp main breaker shall be supplied. This breaker shall supply power to the controller, MMU, signals, cabinet power supply and auxiliary panels.
- A 15-amp auxiliary breaker shall supply power to the fan, light and GFI outlet.
- An EDCO model SHP-300-10 or approved equivalent surge arrester.
- A 50 amp, 125 VAC radio interference line filter.
- A normally open, 60-amp, mercury contactor Durakool model BBC-7032 or approved equivalent.

### **BELOW POWER PANEL**

Install line protector type HS-P-SP-120A-60A-RJ and shall be shielded to prevent hazardous contact with live voltage.

## **(F) CABLES**

- (1) All Controller and Malfunction Management Unit cables shall be of sufficient length to access any shelf position. All cables shall be encased in a protective sleeve along their entire free length.

- (2) COLOR CODING

All cabinet wiring shall be color coded as follows:

Purple	=	MMU Wiring
Orange	=	Flash color programming
Brown	=	Green Signal Wiring
Yellow	=	Yellow signal wiring
Red	=	Red signal wiring
Blue	=	Controller wiring
Gray	=	DC ground
AC+	=	Black
AC-	=	White
Chassis Ground	=	Green

## **(G) WIRING**

### **MAIN PANEL AND WIRE TERMINATIONS**

All wires terminated behind the main panel and other panels shall be **SOLDERED**. No pressure or solderless connectors shall be used. Printed circuit boards shall **NOT** be used on main panels, with the only exception being on the Bus Interface Units.

### **FLASHING OPERATION**

All cabinets shall be wired to flash red for all phases, but programmable to flash yellow and red when needed. Flashing display shall alternate between phases 1,2,5,6 and phases 3,4,7,8.

### **EMERGENCY VEHICLE PREEMPT RACK**

One emergency vehicle preempt rack panel shall be provided in each cabinet wired for County furnished discriminators. The rack shall support two 2-channel or one 4-channel preemption devices, and one (1) BIU. The rack may be combined with the detector rack.

### **MAIN PANEL CONFIGURATION**

The main panel shall be fully wired in the following configuration:

- 12 Load Switch Sockets
- 6 Flash Transfer Relay Sockets
- 1 Flasher Socket
- 2 Bus Interface Units Slots
- 1 Configuration 2 Detector rack and a Type 16 Malfunction Management Unit.

### **FIELD TERMINAL LOCATIONS**

Field terminals shall be located at the bottom of the backboard. Their order shall be left to right beginning with phase one green, phase one yellow, phase one red, phase one flash and following the order of the load switches. Field terminals shall be of the Screw type per NEMA TS2 5.3.6.

### **CABINET POWER SUPPLY**

The cabinet power supply shall as a minimum meet all TS-2 1998 section 5.3.5 requirements. All power supplies shall also provide a separate front panel indicator LED for each of the four outputs. Front panel banana jack test points for 24VDC and logic ground shall also be provided.

### **ADDITIONAL CABINET FEATURES**

- (1) A door actuated, normally closed switch shall be installed to activate the controller alarm log when the cabinet door is opened or closed.
- (2) The cabinet shall have power connectors for TS-2 Type 1 and TS-2 Type 2 controllers.

**734-2.04 Auxiliary Control Equipment.** of the Standard Specifications is revised to read:

**(A) Malfunction Management Unit (MMU).** Cabinets shall be equipped with a NEMA TS-2 Type 16 Malfunction Management Unit (MMU). When a component is of such special design (proprietary) that it precludes the purchase of identical component from a parts distributor or component manufacturer, one spare duplicate component shall be furnished with each unit.

**(B) Load Switch.** All load switches shall comply with NEMA TS-2, Section 6 requirements and shall be EDI model 510 or approved equal.

**(C) Flasher Unit.** All flasher units shall comply with NEMA TS-2 1992, Section 6 requirements and shall be EDI model 810 or approved equal.

**(D) Bus Interface Unit.** Bus interface units (BIUs) shall comply with TS2, Section 8 requirements. BIUs shall provide a separate front panel indicator light emitting diode (LEDs) Valid Data. When a component is of such special design (proprietary) that it precludes the purchase of identical component from a parts distributor or component manufacturer, one spare duplicate component shall be furnished with each unit.

**(E) Flash Load Relays.** Flash load relays shall be for the purpose of providing special circuitry or operational requirements. The relays shall be NEMA type.

The relay shall be covered with a clear dust cover which shall be secured to the relay base with a fastening device.

The relay contact points shall be of fine silver or silver alloy, or a superior alternate material, and shall be capable of carrying a load of 20 amperes per contact, unless otherwise specified, at 120 volts AC.

The relay shall show no failure while making, carrying, and breaking a 20 ampere, 120 volt, traffic signal lamp load through 10,000 cycles at the rate of 10 cycles per minute and a 50 percent duty cycle. Each relay shall be capable of making, breaking, and carrying all the current for a 1,000 watt tungsten lamp load without burning, pitting, or otherwise failing for at least one million operations.

The relay shall be electrically and mechanically operative after a momentary current of 100 amperes at 120 volts is applied to the set of closed contacts at least five times with a minimum of two minutes between applications of current. The relay shall not break down or flash over while carrying a load

of 20 amperes at 120 volts for at least 50 cycles at the rate of five cycles per minute. The duty cycle shall be 50 percent on and 50 percent off.

The relay shall withstand 1,500 volts at 60 Hz between insulated parts and between current carrying parts and grounded or non-current carrying parts.

**(F) Auxiliary Control Relays.** These types of relays shall be utilized in circuits to provide special operations.

Auxiliary control relays shall have a pin type connector on the base. The relay shall be removable without the use of tools.

The relay shall be covered with a removable dust cover. The relay coil shall be rated at 120 VAC, 28 volts AC/DC, or 12 volts AC/DC as required. The contacts shall be single or double pole. The number of contacts shall be as required by the relay's operational functions. The contacts shall be properly rated for the circuit load and shall be constructed of gold and/or silver plated material.

**(G) Street Lighting Control Contactor.** A street lighting control contactor, meeting the requirements of 736-2.01 (C) (2), shall be provided in each controller cabinet.

**734-2.06 Service Pedestal Cabinet.** Is hereby added:

The service pedestal cabinet(s) furnished shall satisfy the plans and Special Provisions, these specifications, the standard drawings or Standard Details of the Agency regarding equipment construction and installation, and any utility company requirements. The service pedestal cabinets provided shall be "metered".

The service pedestal cabinet shall be UL approved and rated for 125 amp, 120/240 VAC, 60 Hz, single phase, 3- or 4-wire service, unless otherwise specified. The cabinet shall be equipped with a 125 amp, double pole main breaker and, in addition, shall provide for at least 12 plug-in breakers of the type manufactured by Bryant, GE, Westinghouse, ITE, or Crouse-Hinds, as specified in the plans or the Special Provisions. Copper bussed circuit breaker interiors and factory installed copper wiring shall be used. One or two 120/240 volt, single phase, 3-wire lighting arrester(s) shall be provided as required. Metered service pedestal cabinets shall be equipped with factory installed test blocks for use by the serving utility company.

The cabinet shall have separate sections for the Agency and the utility company. The service pull section shall be 4-1/2 inches (113 millimeters) deep and shall be located in the back of the cabinet. An access opening in the cabinet shall be provided at the bottom of the service pull section and shall be capable of being sealed by the utility company.

The cabinet shall be of NEMA 3R, tamperproof construction and shall have the nominal dimensions shown on the referenced standard drawing or standard detail of the Agency. The cabinet construction shall be, at a minimum, 12 gauge (2.8 millimeters) steel with 14 gauge (2 millimeters) steel doors. Stainless steel fasteners shall be used. The doors or covers shall be capable of padlocking. The cabinet shall be treated on the inside and the outside with one coat of zinc chromate primer and painted with two coats of white enamel conforming to the requirements of Section 1002. Each cabinet shall be supplied with a detachable base for attachment to a concrete foundation. The base shall attach to the cabinet with bolts and have anchor bolts or rebar set into the concrete foundation per the standard drawings or standard details.

**734-3.02 Test Requirements.** of the Standard Specification is revised to read:

All specified traffic controller assembly items shall meet the applicable environmental and testing standards of NEMA Publication TS-2-1998. All traffic signal controller units tested shall utilize the procedures required by these specifications.

**734-4 METHOD OF MEASUREMENT** Subsection 734-4(B) of the Standard Specifications is revised to read:

(B) Deliver to the Agency for testing, pick up from the Agency after testing and install the controller assembly. A minimum of 14 days shall be permitted for testing.

## **SECTION 735 - DETECTORS**

### **735-2 MATERIALS**

#### **735-2.01 Vehicle Detectors**

(C) **Image Sensor** of the Standard Specifications is modified to read:

##### **(1) Video Detection**

(a) **General.** This specification sets forth the minimum requirements for a system that monitors vehicles on a roadway via processing of video images. The detection of vehicles passing through the field of view of an image sensor shall be made available to a large variety of end user applications as simple contact closure outputs that reflect the current real time detector or alarm states (on/off) or as summary traffic statistics that are reported locally or remotely. The contact closure outputs shall be provided to a traffic signal controller and comply to the NEMA (National Electrical Manufacturers Association) type C or D detector rack or a 170 input file rack standards.

The system architecture shall fully support networking of system components through a variety of industry standard and commercially available infrastructure that are used in the traffic industry. The serial data communications shall support direct connect, [modem,] and multi-drop interconnects. Simple twisted pair wiring shall be supported to minimize overall system cost, improve reliability, utilizing existing infrastructure and ease of system installation and maintenance. Both video communications and serial data communications shall optionally be interconnected over long distances through repeat and daisy chain configurations. A single serial data communications multi-drop link on twisted pair shall extend up to 2 miles and include up to 24 units on a drop before the signal(s) must be repeated.

On the software application side of the network, the system shall be integrated through a client-server relationship. A communications server application shall provide the data communications interface between as few as one to as many as hundreds of machine vision processor (MVP) sensors and a number of client applications. The client applications shall either be hosted on the same PC as the communications server or may be distributed over a local area network of PCs using the industry standard TCP/IP network protocol. Multiple client applications shall execute simultaneously on the same host or multiple hosts, depending on the network configuration.

**(b) System Hardware.** The machine vision system hardware shall consist of four components: 1) a Color, zoom, Machine Vision Processor (MVP) sensor, 2) a modular cabinet interface unit, 3) a communication interface panel, and 4) a personal computer (PC). The PC shall host the server and client applications that are used to program and monitor the other system components. The real-time performance shall be observed by viewing the video output from the sensor with overlaid flashing detectors to indicate the current detection state (on/off). The MVP sensor shall optionally store cumulative traffic statistics, internally in non-volatile memory, for later retrieval and analysis.

The MVP shall communicate to the modular cabinet interface unit, communications panel and the software applications using the industry standard TCP/IP network protocol. The MVP shall have a built in Internet Protocol (IP) address and shall be addressable with no plug in devices or converters required. The MVP shall include an optional enclosed CPU board with 32MB of memory that provides dedicated Wavelet video compression processing. Achievable frame rates shall vary from 1 to 11 frames/sec. as a function of video quality, color or black and white, communication channel throughput and full frame viewing or ROI (Region of Interest). The enclosed video compression CPU board shall support rectangular region of interest (ROI) as well as full frame. The MVP CPU board shall include an extra communications port for pan-tilt control.

The modular cabinet interface unit shall communicate directly with up to eight (8) MVP sensors and shall comply with the form factor and electrical characteristics to plug directly into a NEMA type C or D detector rack or a 170 input file rack providing up to eight (8) contact closure inputs and sixteen (16) contact closure outputs to a traffic signal controller.

The communication interface panel shall provide the electrical termination of wiring for video, data and power for the MVP that is mounted on a pole or mast arm with a traffic signal cabinet or junction box. The communication interface panel shall provide high-energy transient protection to electrically protect the modular cabinet interface unit and connected MVP sensors. The communications interface panel shall be available in two models: a four-sensor model or a single-sensor model.

**(c) System Software.** The MVP sensor embedded software suite shall incorporate multiple applications that perform a variety of diagnostic, installation, fault tolerant operations and vehicle detection processing. The detection shall be reliable, consistent, and perform under all weather, lighting and traffic congestion levels.

There shall be a suite of client applications that reside on the host client / server PC. The applications shall execute under Microsoft Windows 98, 2000 or Windows NT. Available client applications shall include:

- Network Browser: Learn a network of connected modular cabinet interface units and MVPs then show the topology in a logical hierarchical relationship
- Detector Editor: Create and modify detector configurations to be executed on the MVP sensor.
- Operation Log: Extract the MVP run-time operation log of special events that have occurred.
- Software Installer: Reconfigure one or more MVP sensors with a newer release of embedded system software.
- Ability to play and record streaming video with flashing detectors
- Full Duplex
- Support 230Kbps communications

## (2) Functional Capabilities

**(a) MVP Image Sensor.** The MVP image sensor shall be an integrated imaging color CCD array with optics, high-speed, image processing hardware and a general purpose CPU bundled into a sealed enclosure. The CCD array shall be directly controlled by the general purpose CPU, thus providing high video quality for detection that has virtually no noise to degrade detection performance. It shall be possible for the user to zoom the lens, as required for operation. It shall provide software JPEG video compression. The MVP shall provide direct real-time iris and shutter speed control. The MVP image sensor shall be equipped with an integrated 16x zoom lens that can be changed using either configuration computer software or a hand-held controller.

The MVP sensor shall output full motion color video through the means of a differential video port in NTSC format. The differential video is transmitted over a single twisted pair.

**(b) Power.** The MVP sensor shall operate on 24 VAC, 50/60Hz at a maximum of 25 watts. The camera and processor electronics shall consume a maximum of 10 watts and the remaining 15 watts shall support an enclosure heater.

**(c) Detection Zone Programming.** Placement of detection zones shall be by means of a supervisor computer (PC) operating in the Windows 98, 2000 or Windows NT graphical environments, a keyboard, and a mouse. The VGA monitor shall be able to show the detection zones superimposed on images of traffic scenes.

The detection zones shall be created by using a mouse to draw detection zones on the supervisor computer's VGA monitor. Using a mouse and the keyboard it shall be possible to place, size, and orient detection zones to provide optimal road coverage for vehicle detection. It shall be possible to download detector configurations from the supervisor computer to the MVP, to retrieve the detector configuration that is currently running in the MVP, and to back up detector configurations by saving them to the supervisor computer's removable or fixed disks.

The supervisor computer's mouse and keyboard shall be used to edit previously defined detector configurations to permit adjustment of the detection zone size and placement, to add detectors for additional traffic applications, or to reprogram the sensor for different traffic applications or changes in installation site geometry or traffic rerouting.

**(d) Optimal Detection.** The video detection system shall optimally detect vehicle passage and presence when the MVP sensor is mounted 30 feet (10m) or higher above the roadway, when the image sensor is adjacent to the desired coverage area, and when the distance to the farthest detection zone locations are not greater than ten (10) times the mounting height of the MVP. The recommended deployment geometry for optimal detection also requires that there be an unobstructed view of each traveled lane where detection is required. Although optimal detection may be obtained when the MVP is mounted directly above the traveled lanes, the MVP shall not be required to be directly over the roadway. The MVP shall be able to view either approaching or receding traffic or both in the same field of view. The preferred image sensor orientation shall be to view approaching traffic since there are more high contrast features on vehicles as viewed from the front rather than the rear. The MVP sensor placed at a mounting height that minimizes vehicle image occlusion shall be able to monitor a maximum of six (6) to eight (8) traffic lanes simultaneously.

**(e) Modular Cabinet Interface Unit.** The modular cabinet interface unit shall provide the hardware and software means for up to eight (8) MVP sensors to communicate real-time detection states and alarms to a local traffic signal controller. It shall comply with the electrical and protocol specifications of the detector rack standards. The card shall have 1500 Vrms isolation between rack logic ground and street wiring.

The modular cabinet interface unit shall be a simple interface card that plugs directly into a 170 input file rack or a NEMA type C or D detector rack. The modular cabinet interface unit shall occupy only 2 slots of the detector rack. The modular cabinet interface unit shall provide 8 phase inputs and 16 detector outputs.

**(f) Communications Interface Panel.** The communications interface panel supports one to four MVPs. The communications interface panel consists of a predefined wire termination block for MVP power, data and video connections, a power transformer for the MVP, electrical surge protectors to isolate the modular cabinet interface unit and MVP, and an interface connector to cable directly to the modular cabinet interface unit.

The interface panel shall provide power for one (1) MVP through a step-down transformer, taking local line voltage and producing 28 VAC, 50/60 Hz, at about 30 watts. A ½ amp slow-blow fuse shall individually protect the step-down transformers.

### **(3) Warranty, Service and Support**

The supplier shall warrant the video detection system for a minimum of two (2) years. Ongoing software support by the supplier shall include software updates of the MVP sensor, modular cabinet interface unit and supervisor computer applications. These updates shall be provided free of charge during the warranty period. The supplier shall maintain a program for technical support and software updates following expiration of the warranty period. This program shall be available to the contracting agency in the form of a separate agreement for continuing support

**735-2.02 Pedestrian Push Button Detectors.** of the Standard Specifications is modified to add:

Diameter of casting back shall adjust to pole diameter. Pole installation bolts, sign screws and washers shall be furnished with unit. Color shall be Federal Yellow.

**735-4 METHOD OF MEASUREMENT** of the Standard Specifications is revised to read:

Loop detectors and pedestrian detectors will be measured as a unit for each type of detector furnished and/or installed.

The Video Detection System will be measured for each individual intersection as a unit for each completely installed video detection system, which includes the installation of all mountings, machine vision processors, hardware, software, and any associated material required for a complete and operational system.

**735 - 5 BASIS OF PAYMENT** of the Standard Specifications is modified to read:

Each Video Detection System measured as provided in these special provisions will be paid for at the contract unit price per intersection for each complete video detection system complete in place, which will be full compensation for the work and material specified herein and on the plans.

## **SECTION 737 - INCIDENTAL ELECTRICAL WORK**

Is hereby revised to read:

### **737-1 DESCRIPTION**

The work under this section shall consist of maintaining existing traffic signals and lighting systems, furnishing and installing complete and functioning temporary traffic signal systems, and removing and salvaging or reinstalling electrical equipment all in accordance with the project plans and the requirements of these specifications.

### **737-2 MATERIALS**

**737-2.01 Maintaining Existing Traffic Signals and Lighting Systems.** Replacement items necessary for maintaining existing traffic signal and lighting systems shall be of similar make and manufacture and meet the minimum material requirements of those items they are to replace.

#### **737-2.02 Temporary Traffic Signals.**

(A) **General.** Agency approved pole-line hardware shall be utilized in the installation of poles, messenger cable, pole anchors, etc.

(B) **Wood Poles.** Wood poles shall be 40 feet (12.2 meters) in length, Class 3, unless otherwise specified, and meet the requirements of Section 731 of these specifications. Holes for poles shall be dug at an angle with the vertical to allow for proper raking of the top of the pole. Poles shall be set 10 feet (3 meters) deep in the ground, be well tamped, and raked 1 foot (300 millimeters) out from the vertical position and in line with the pull of the cable.

The wood poles for temporary signals and their associated cables, wires, supports, etc. shall be located so as to provide clearance for all permanent construction.

(C) **Messenger Cable.** The messenger cable used for aerial signals and anchoring shall be 3/8 inch (10 millimeters) minimum, 7-strand, high-strength grade, galvanized steel messenger cable securely attached to the poles and anchors in an approved manner.

(D) **Agency Furnished Material.** The Agency will be responsible for any changes required in the control cabinet. The existing pedestrian units shall be used on the temporary traffic signals. The existing controller cabinet shall be used. All other equipment and materials necessary for the temporary signals shall be furnished by the contractor, unless otherwise specified.

**737-2.03 Removing and Salvaging or Reinstalling Electrical Equipment.** Replacement parts for salvaged or reinstalled electrical equipment shall meet the material requirements for like items as herein before specified, as directed by the Engineer, or as designated in the special provisions.

### **737-3 CONSTRUCTION DETAILS**

**Maintaining Existing Traffic Signals and Lighting Systems.** The contractor shall furnish the name and telephone number of the designated contractor qualified electrician who is to be contacted by the Police, Department of Public Safety, Engineer, or Agency personnel in case of emergency maintenance requirements. The response time for the contractor designated electrician is to be 20 minutes during normal work hours and 1 hour for all other times. The contractor shall have labor and the necessary equipment available at all times for such emergency maintenance.

All existing traffic signal and lighting systems, or other designated electrical systems, shall be kept in effective operation for the benefit of the traveling public during the progress of the work, except when shutdown is permitted by the Engineer to allow for alterations or final removal of the systems. The contractor shall provide to the Agency, for approval, a schedule of operations for maintaining existing traffic signals and street lighting during construction. The contractor shall follow the approved schedule of operations. Wherever possible, the contractor shall construct temporary traffic signals or relocate existing traffic signals to clear the construction area prior to beginning construction on the roadway. The work shall also include the relocation and/or modification of existing traffic signals and lighting systems as required during construction.

The traffic signal system removals and shutdowns shall be limited to the normal working hours or after normal hours as directed, in advance, by the Engineer. During periods of shutdown, off-duty police officers shall be employed by the contractor to manually direct traffic. At all times, the traffic signal systems shall remain operational.

All traffic signal heads not in use shall be covered with burlap only and shall be unmistakably out of service when observed by an approaching driver.

During construction, the maintenance, care and control of the existing traffic signal control cabinet will be the responsibility of the Agency. All other maintenance of the existing traffic signal system shall be accomplished by the contractor.

The contractor shall maintain full nighttime operation of the existing lighting system for the duration of the construction project.

The contractor shall maintain telephone service to the central monitoring system when such service exists.

**737-3.02 Temporary Traffic Signals.** Messenger cable shall have a maximum sag of five percent of the distance of spans. The lowest point of any backplate shall initially be 18 feet (5.5 meters) above the roadway to allow for settling of poles and anchors. Backplates shall be maintained so that the clearance between the lowest point of any backplate and the future finished roadway grade shall not be less than 17 feet (5.2 meters). The contractor shall check each day to insure that the minimum clearance is maintained and shall take corrective measures if necessary.

Cable rings, on 24 inch (600 millimeters) maximum spacing, shall be used to secure the signal wires to the messenger cable. The wires shall also be taped to the cable if necessary to prevent excessive and unsightly slack in the line(s).

The continuous operation of traffic signals shall be in accordance with the requirements of Subsection 737-3.01.

The contractor shall maintain the electrical systems for the duration of the construction project. The contractor shall designate a person who will be available for emergency maintenance calls after normal working hours. The contractor shall furnish this person's name and telephone number to the Engineer. The contractor shall have labor and the necessary equipment available at all times for such emergency maintenance.

When required, the contractor shall remove and salvage all material associated with the temporary traffic signal. All salvaged material shall be the property of the Agency and shall be dismantled and stockpiled as directed by the Engineer. Material broken or damaged by the contractor shall be replaced with new and like material at the contractor's expense. It shall be the responsibility of the contractor to remove and dispose of all traffic signal equipment and materials not salvaged.

Cavities resulting from the removal of pull boxes, foundations or other material shall be backfilled and compacted with material equivalent to or better than the surrounding material.

### **737-3.03 Removing and Salvaging or Reinstalling Electrical Equipment**

The contractor shall carefully remove and relocate the traffic signal poles and attached equipment as specified on the plans. All existing conductors within the poles shall be removed and not reused.

The contractor shall carefully remove, disassemble, and salvage all traffic signal equipment that is not to remain or be relocated. The salvaged equipment shall be returned as directed by the Engineer. This shall include all existing equipment, except conduit, pull boxes, conductors, and span wire.

The contractor shall remove and salvage all existing traffic signal and lighting equipment not reused as specified in the special provisions, project plans, or as directed by the Engineer. The work shall also include the removal and disposal of foundations. All equipment and materials to be salvaged shall be the property of the Agency. Salvageable material shall be dismantled and stockpiled, prior to project completion, as directed by the Engineer, and shall be delivered to the Agency by the contractor upon 48 hour prior notice to the Engineer.

All equipment damaged or destroyed by improper care or handling shall be replaced with new equipment by the contractor. Unless otherwise specified, it shall be the responsibility of the contractor to remove and dispose of all discarded materials not salvaged. Holes resulting from removal of pull boxes, foundations, and other material shall be backfilled and compacted with material equivalent to the surrounding area as designated by the Engineer.

When salvaged equipment is to be reinstalled, the contractor shall furnish and install all necessary materials, equipment, and hardware as required to complete the new installation. Reinstalled poles, pull boxes and cabinets shall be relocated as shown on the plans, with conduit and conductors installed, and all circuit connections complete and operational. Signal faces, mounting assemblies and backplates shall be cleaned and repainted when reinstalled. All traffic signal faces, either to be reinstalled or part of a modified system, shall be relamped. Luminaires to be reinstalled shall be cleaned and relamped.

Existing materials to be relocated and found to be unsatisfactory by the Engineer shall be replaced with new material and will be paid for in accordance with the requirements of Subsection 109-5.

#### **737-4 METHOD OF MEASUREMENT:**

Maintaining existing traffic signals and lighting systems will be measured as a single, complete unit of work.

Temporary traffic signal will be measured as a single, complete unit of work.

Removing and salvaging or reinstalling electrical equipment will be measured as a single, complete unit of work.

Relocation of traffic signal equipment shall include removal and relocation of existing signal poles with attached equipment to new foundations, and the removal of existing conductors within each pole. Installation of new foundations and conductors are included under separate bid items.

Removal and salvage of equipment shall be measured as a lump sum and shall include removal and transport to the Agency's yard.

#### **737-5 BASIS OF PAYMENT:**

The accepted quantities of maintaining existing traffic signals and lighting systems, measured as provided above, will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete, as specified and described herein, and as shown on the project plans.

The accepted quantities of temporary traffic signal, measured as provided above, will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete in place, as specified and described herein, and as shown on the project plans.

The accepted quantities of removing and salvaging or reinstalling electrical equipment, measured as provided above, will be paid for at the contract lump sum price, which price shall be full compensation for the work, complete in place, as specified and described herein, and as shown on the project plans.

Relocation of existing traffic signal equipment shall be paid per the contract lump sum price and shall include full compensation for the work as specified on the plans and within these specifications.

Removal and salvage of existing traffic signal equipment shall be paid per the contract lump sum price and shall include full compensation for the work as specified on the plans and within these specifications.

The accepted quantities of Electrical Services, measured as provided above, will be paid for at the contract lump sum price, which shall be full compensation for the work, complete in place.

**(802LAND\_GRADING, 4/08)**

**SECTION 802 - LANDSCAPE GRADING**

**802-1 DESCRIPTION** of the Standard Specifications is modified to add:

The work under this section shall consist of fine grading, contouring, smoothing, or otherwise shaping of landscaped areas. Included shall be: all areas to be seeded, all areas to receive decomposed granite or other aggregate surfacing, and all designated raked-earth areas.

**802-3 CONSTRUCTION DETAILS** of the Standard Specifications is modified to add:

All project areas to be seeded, to be surfaced with decomposed granite surfacing, or to be left as raked earth areas shall be graded as required to provide a generally smooth appearance conforming to the shapes and cross sections indicated on the project plans. The final surfaces shall be raked. All objectionable materials, trash, brush (not-designated to be preserved-in-place), weeds, and stoned larger than two inches (2") in diameter shall be removed from the site and disposed of in an off-site location.

**802-4 METHOD OF MEASUREMENT** of the Standard Specifications is modified to add:

Landscape grading will be measured by the square yard of landscaped area actually graded.

**802-5 BASIS OF PAYMENT** of the Standard Specifications is modified to add:

The accepted quantities of landscape grading, measured as provided for above, will be paid for at the contract unit price per square yard including in the Bidding Schedule.

**SECTION 803 - LANDSCAPE BORROW AND PLATING MATERIAL**

**803-2 MATERIALS**

**803-2.02 Decomposed Granite** of the Standard Specifications is modified to add:

The decomposed granite shall be screened to remove all particles larger than two inches (2" minus gradation). The color of the decomposed granite shall be "Desert Gold" as provided by Kalamazoo Materials, or approved equal. The contractor shall deliver a sample of 5 pounds to the project site as directed by the Engineer for approval prior to delivery and installation.

The gradation of the Decomposed Granite shall be as follows:

<b>Sieve Size</b>	<b>Percent Passing</b>
2 inch	100
1-1/2 inch	65-85
¾ inch	35-65

¼ inch	10-20
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**803-2.03 Rock Mulch** of the Standard Specifications is modified to add:

**803-2.03 Rock Mulch** The rock mulch shall be angular, fractured rock material and shall be screened to remove all particles larger than six inches (6" minus gradation). Rock mulch color shall be "Apache Brown" as supplied by Kalamazoo Materials, or approved equal. The Contractor shall submit a 1.0 cubic foot sample of the rock mulch for approval prior to the delivery and/or installation of rock mulch material on the project site.

The gradation of the Rock Mulch shall be as follows:

Sieve Size	Percent Passing
6 inch	90-100
4.5 inch	70-85
3 inch	30-50
2 inch	5-15
1 inch	0-5

**803-2.04 Pre-Emergent Herbicide** of the Standard Specifications is modified to add:

Pre-emergent herbicide shall be "Surflan" or approved equal. The Contractor shall submit copies of the manufacturer's product data for the herbicide prior to its delivery and/or application on the project site.

### **803-3 CONSTRUCTION DETAILS**

**803-3.02 Decomposed Granite** of the Standard Specifications is modified to add:

The decomposed granite shall not be placed until the subgrade has been brought to the lines and grades shown on the project plans and details and accepted by the Engineer. Prior to placing decomposed granite, the area shall be totally free of grasses and weeds, using mechanical means or herbicides, in accordance with the Standard Specifications. All dead grass and weeds shall be removed and disposed of by the contractor as approved by the Engineer.

The decomposed granite shall be installed 2 inches deep in the locations shown on the project plans.

The decomposed granite shall be rolled and compacted to 90% after installation.

**803-3.03 Rock Mulch - Native Stone Rip-Rap** of the Standard Specifications is modified to add:

The rock mulch (native stone rip-rap) shall not be placed until the subgrade has been brought to the lines and grades shown on the project plans and details and accepted by the Engineer. Prior to placing the rock mulch, the subgrade shall be treated with pre-emergent herbicide. Rock mulch (native stone riprap) shall be hand placed to minimize the voids between adjacent stones and to present a uniform surface. Rock mulch installation shall be as approved by the Engineer.

Rock mulch shall be installed 6 inches deep in the locations shown on the project plans.

**803-3.04 Pre-Emergent Herbicide** of the Standard Specifications is modified to add:

The pre-emergent herbicide shall be applied by an Arizona licensed applicator. Site and atmospheric conditions at the time of installation, and procedures for applying the pre-emergent herbicide shall be in accordance with the manufacturer's written instructions and in accordance with applicable state and federal regulations.

#### **803-4 METHOD OF MEASUREMENT**

Decomposed granite will be measured by the square yard as determined by the areas where the decomposed granite is placed to the minimum thickness.

Rock mulch will be measured by the square yard as determined by the areas where the rock mulch is placed to a minimum thickness.

No measurement will be made for the herbicide or mechanical means to remove the grass and weeds.

**803-5 BASIS OF PAYMENT** of the Standard Specifications is modified to add:

The accepted quantities of decomposed granite, measured as provided above, will be paid for at the contract unit price as specified in the bidding schedule, complete-in-place.

The accepted quantities of rock mulch, measured as provided above, will be paid for at the contract unit price as specified in the bidding schedule, complete-in-place.

No separate payment will be made for the herbicide or mechanical means to remove the grass and weeds, the cost being considered as included in the price of the contract items.

### **SECTION 806 - TREES, SHRUBS, AND PLANTS**

**806-1 DESCRIPTION** of the Standard Specifications is modified to add:

The work under this section shall consist of furnishing and planting trees, shrubs and cacti and the transplant of existing landscape trees, shrubs and cacti as designated on the project plans. The work shall include the delivery, storage, and handling of plants and other landscape materials, the excavation and backfill of plant pits, the watering, staking, guying and pruning of plants, cleanup of the work area, disposal of unwanted or deleterious materials, and initial care and maintenance of landscape improvements all in accordance with the details shown on the project plans and the requirements of the Specifications.

#### **806-2 MATERIALS:**

**806-2.02 NURSERY STOCK** of the Standard Specifications is modified to add:

Some plant material called for on the plans must be acquired through the Pima County native plant nursery (commonly known as “Sweetwater nursery”), currently located at 3145 W. Camino del Cerro. The contractor shall arrange for pickup from this site and delivery to the site. The contractor must notify Sherrie Barfield at Pima County Natural Resources Parks and Recreation (520-887-6270) one month prior to the pickup date.

Pima County Native Plant Nursery will not warranty the plants provided. The landscape contractor has the option to refuse selected plants from the Native Plant Nursery stock due to ill health or poor form or other specific reason. Once the Native Plant Nursery plants are delivered and accepted by the contractor, the contractor bears responsibility for the survival and health of that plant, and shall replace it if it dies. Pima County Native Plant Nursery has historically provided high quality plant material, but due to the demands of multiple ongoing projects plants are not held in reserve at the nursery.

All plant containers that are salvageable shall be returned to the native plant nursery

**806-2.02 (A) Plant Size** of the Standard Specifications is modified to add:

All trees provided as part of this project shall meet the minimum size standards of the “Arizona Nursery Association Growers Committee Recommended Tree Specifications.” Plants which do not meet these size specifications will be rejected by the Engineer.

**806-2.02 (B) Branch Clearance for Trees** of the Standard Specifications is modified to add:

All trees planted as part of this project located within ten feet (10') of a sidewalk or multi-use path shall be single trunk, or upright multi-trunk specimens with a minimum clearance of five (5) feet measured from the final finish grade at the base of the trunk to the lowest branch of the tree. Trees that do not meet this requirement shall not be planted in the locations noted.

**806-2.06 Prepared Soil** of the Standard Specifications is modified to add:

The material used for the backfill of tree and shrub plant pits shall be “Prepared Soil” as defined by the Standard Specifications (most recent edition). The Prepared Soil is referred to on the project plans as “prepared soil backfill.” In addition to the materials listed in the Standard Specifications, the prepared soil shall also include three (3) lbs. of fertilizer per cubic yard of prepared material. Fertilizer shall be Ammonium Phosphate (16-20-0).

The soil material used for the backfill of cacti and ocotillo plant pits shall be as noted on the project plans.

**806-2.09 Chemical Fertilizer** of the Standard Specifications is modified to add:

Fertilizer for prepared soil shall be Ammonium Phosphate (16-20-0) commercial fertilizer in pelleted or granular form and of recent manufacture. It shall be delivered to the site in original, unopened containers bearing the manufacturer's guaranteed statement of analysis.

### **806-3 CONSTRUCTION DETAILS:**

**806-3.01 Planting Season** of the Standard Specifications is modified to add:

Within the overall project phasing and completion requirements, the schedule for planting of trees and shrubs shall be at the discretion of the Contractor. Planting during extremely cold, hot, or windy periods shall be performed at the Contractor's risk. Plants which are damaged or die prior to Final Acceptance as a result of extreme weather conditions, shall be removed and replaced by the Contractor at no additional cost to the Owner.

**806-3.02 Excavation** of the Standard Specifications is modified to add:

The Contractor shall request that the project site be blue-staked prior to the start of any plant pit excavation work. Blue staking shall be kept current during the course of the project. All utilities damaged by the Contractor shall be repaired or replaced by the Contractor, as required by the Owner or appropriate utility company, at the Contractor's expense.

**806-3.04 (B) Nursery Stock** of the Standard Specifications is modified to add:

Backfill material shall be Prepared Soil conforming to the requirements of Subsection 806-2.06 with the addition of fertilizer as specified herein. Backfill material placed below the root ball of the new plants shall be water settled and adequately tamped to prevent settlement after plant installation and irrigation system operation.

**806-3.04 (D) Miscellaneous Planting** of the Standard Specifications is modified to add:

The Contractor shall transplant existing plant material (irrigated streetscape and river path landscape) in one move to a location outside the project grading limit as shown on the project plans. Plants shall be excavated in a manner that maintains an intact root ball and soil mass. Planting pits shall be prepared as detailed on the project plans and backfill material prepared as specified herein. The final location of transplants shall be approved by the project engineer before work can begin. Plants which are damaged or die prior to Final Acceptance as a result of improper transplant methods shall be removed and replaced by the Contractor at no additional cost to the Owner.

**806-3.04 (E) Transplant Saguaro**

All saguaro listed on the project plans to be transplanted shall be salvaged using bare-root transplanting techniques. The extent of the root system retained with the plant shall be normal for the industry and shall be as required for successful bare root transplanting.

All salvaged saguaro shall be transported in one move to the permanent location as staked by the Contractor and approved by the project engineer.

**806-3.05 Pruning and Staking** of the Standard Specifications is modified to add:

All 24" box size trees shall be staked as detailed on the project plans and as specified.

All 15 gallon container size trees shall NOT be staked except as may be noted on the project plans or as directed by the Engineer. In instances where staking is required, the work shall be performed as detailed on the project plans and as specified.

All salvaged specimen trees shall NOT be staked except as may be noted on the project plans or as directed by the Engineer. In instances where staking is required, the work shall be performed as detailed on the project plans and as specified.

All trees shall be pruned as-needed prior to the start of the Landscaping Establishment Period. Pruning work shall be performed in accordance with ANSI-A-300-1995.

**806-4 METHOD OF MEASUREMENT** of the Standard Specifications is modified to add:

Miscellaneous Planting will be measured on a lump sum basis, complete-in-place.

Transplanting Saguaro and new Saguaro will be measured by the linear foot of cacti transplanted, complete-in-place.

Planted trees, shrubs, cacti, and other plants will be measured on a per each basis for each type and size of plant listed in the Bidding Schedule, complete-in-place.

Tree staking will be measured on a per each tree staked basis, complete-in-place. Staking will be measured independently of tree planting.

Landscape pruning will be measured per hour of work required to complete the pruning work as directed by the engineer and described herein. Pruning will be measured independently of tree planting

**806-5 BASIS OF PAYMENT** of the Standard Specifications is modified to add:

The accepted quantity of miscellaneous planting, measured as provided for above, will be paid for at the contract unit price included in the Bidding Schedule.

The accepted quantity of transplanted saguaro, measured as provided for above, will be paid for at the contract unit price included in the Bidding Schedule.

The accepted quantities of each size and type of tree, shrub, cacti, and other plant, measured as provided for above, will be paid for at the contract unit prices identified in the Bidding Schedule.

The accepted quantities of trees staked, measured as provided for above, will be paid for at the contract unit price included in the Bidding Schedule.

The accepted quantities of pruning work, measured as provided for above, will be paid for at the contract unit price included in the Bidding Schedule.

## **SECTION 807 - LANDSCAPING ESTABLISHMENT**

**807-3 CONSTRUCTION DETAILS** of the Standard Specifications is modified to add:

### **807-3.01 General**

The landscaping establishment period shall be three hundred and sixty-five (365) consecutive calendar days. The Prime Contractor (or the Landscape/Irrigation Subcontractor responsible for the initial installation) shall be the only contractor that performs the Landscaping Establishment work. Subcontracting of this work will not be permitted except for weed eradication with herbicides, because of special licensing requirements.

Median plantings that are not connected to the permanent irrigations system shall be truck watered once per month during the landscape establishment period. Enough water shall be applied at each application to wet the soil to a 12" depth in an area 1-1/2 times the width of the plant canopy.

Water used during project construction and the Landscaping Establishment period shall be paid for by the Contractor as specified in Section 8.08-3.09.

**807-4 METHOD OF MEASUREMENT** of the Standard Specifications is modified to add:

No measurement will be made for the watering of non-irrigated plant materials during the establishment period.

**807-5 BASIS OF PAYMENT** of the Standard Specifications is modified to add:

No separate payment will be made for the watering of non-irrigated plant materials during the establishment period, the cost being considered as included in the price of the contract items.

## **SECTION 808 - LANDSCAPE IRRIGATION SYSTEM**

**808-1 DESCRIPTION** of the Standard Specifications is modified to add.

Work under this item shall consist of furnishing all materials and labor required to modify existing irrigation systems as shown on the project plans, including but not limited to the reconfiguration of existing reclaimed irrigation mainlines at River Park entries, the locating and capping of existing lateral lines, multiport emitters and associated equipment supplying existing plants that will be transplanted to a new location and the relocation of existing lateral lines, multiport emitters and associated equipment that are within the project grading limit but must remain in service during construction.

### **808-2 MATERIALS**

**808-2.01(B) PVC Pipe** of the Standard Specifications is modified to add:

Color Coding of Pipe Conveying Reclaimed Water: All mainline and lateral line pipe used to convey reclaimed irrigation water shall be integrally color-coded purple pipe

All main line pipe shall be Schedule 40 PVC pipe and shall comply with the requirements of ASTM D 1785.

All lateral line pipe shall be Schedule 40 PVC pipe and shall comply with the requirements of ASTM D 1785.

All PVC sleeving shall be Schedule 40 PVC pipe and shall comply with the requirements of ASTM D 1785.

All main line pipe under bridges shall be ductile iron pipe and shall comply with the requirements of Subsection 511-3.04 (D) (1) of the Standard Specifications.

Primers for use in conjunction with PVC pipe solvent weld connections shall comply with the requirements of ASTM F 656. Primer shall be as manufactured by IPS Weld-On, Type P-70 or approved equal.

Solvent weld cement used for making PVC connections shall comply with ASTM D 2564. The type and set-up time shall be as recommended by the manufacturer for the class, schedule and size of pipe being joined. Solvent weld cement shall be as manufactured by IPS Weld-On, Type 711, or approved equal.

Plastic pipe shall be delivered to the site in unbroken, banded or tied bundles, and shall be so packaged as to prevent damage to pipe barrels or ends. If pipe is delivered from a local warehouse the pipe need not be bundled or wrapped.

Upon delivery to the site, the Contractor shall inspect all pipe for possible shipping damage. All damaged pipe shall be immediately removed from the project site. Plastic pipe shall be handled and stored in accordance with the manufacturer's written instruction and recommendations.

**808-2.01 (C) PVC Fittings** of the Standard Specifications is modified to add:

PVC fittings shall be made from Type I, Grade I, PVC compounds. Fittings shall be installed in accordance with the manufacturer's recommendations and these Specifications. Solvent weld fittings for main line (pressurized) pipe shall be Schedule 40 PVC and shall comply with the requirements of ASTM D 2467.

Solvent weld fittings for lateral line pipe shall be Schedule 40 PVC and shall comply with the requirements of ASTM D 2466.

Threaded PVC fittings and fittings used in the construction of remote control valve assemblies shall be Schedule 80 PVC fittings and shall comply with the requirements of ASTM D 2464.

Ductile Iron fittings shall flanged.

Expansion joints for ductile iron mainline on bridge shall be slip type joints with a slip pipe at each end to accommodate axial pipe movement. The expansion joints shall be manufactured from carbon steel and furnished with a hard chrome-plated slip pipe. The expansion joints shall be as manufactured by Smith-Blair, model 612 or approved equal. The size shall be six-inch (6").

**808-2.03 Gate Valves** of the Standard Specifications is modified to add:

Gate valves shall be constructed with a brass body and non-rising stem. Gate valve shall have FPT threaded inlet and outlet and shall be equipped with a hand wheel. Gate valves shall be as manufactured by Watts. Model WGV, or approved equal. Valve size shall be as noted or, if not

noted, incoming line size. Gate valves shall be used for mainline (and remote control valve assembly) isolation valves that are 2" size and larger.

**808-2.03(A) Ball Valves** of the Standard Specifications is modified to add:

Ball valves shall be constructed with a brass body, stainless steel ball, and FPT threaded ends. Ball valves shall be equipped with a handle with a 90 degree swing for full closure and opening of the valve. Ball valves shall be as manufactured by Watts, Model FBV Series, or approved equal. Valve size shall be as noted, or of not noted, incoming line size. Ball valves shall be used for mainline (and remote control valve assembly) isolation valves that are 1-1/2" size and smaller.

**808-2.04(A) Electric Remote Control Master Valve** of the Standard Specifications is modified to add:

The Master Valve shall be of the electric remote control valve type. The valve shall have a normally closed configuration. The valve shall have a brass body with threaded (FPT) inlet and outlet. The valve shall be equipped with a contamination proof, self-flushing screen. The Master Valve shall be as manufactured by Buckner, Model VB-series, or approved equal.

**808-2.04(C) Electric Remote Control Valve Assembly for Drip Zones** of the Standard Specifications is modified to add:

Remote control valve assemblies for drip zones shall consist of a ball valve (or gate valve for sizes 2" and larger), screen filter, electric control valve, inline pressure regulator, access box, and related fittings.

Electric remote control valves shall be constructed of heavy duty glass-filled nylon and shall be pressure rated to 200 pounds per square inch. Valve shall be as manufactured by Rain Bird, Model PESB Series (Potable) or Rain Bird, Model PESB-R (Reclaimed), or approved equal. Valve size shall be as noted on the project plans.

Ball valves shall be as specified in Section 808-2.03(A), herein. Gate valves shall be as specified in Section 808-2.03, herein.

Screen filter shall be as specified in Section 808-2.08, herein.

Inline pressure regulator shall be constructed of durable, heat resistant plastic capable of being installed below grade. Regulator shall have a preset outlet pressure of 40 psi and have 1" FPT threaded inlet and outlet. Inline pressure regulator shall be as manufactured by Senninger, Model PMR-MF-30, or approved equal.

**808-2.06 Backflow Prevention Unit** of the Standard Specifications is modified to add:

Backflow preventer shall be of the reduced pressure principle type and shall be as manufactured by Febco, Model 825-Y Series, or approved equal. Backflow preventer size shall be as noted on the drawings.

**808-2.06 (A) Backflow Preventer Security Enclosure** of the Standard Specifications is modified to add:

The backflow preventer security enclosure shall be fabricated from 1-1/2" x 3/16" steel angle and No. 9 expanded metal panels. The enclosure shall be equipped with hinges and U-bolt hasp for padlocking. The enclosure shall be as manufactured by Lemeur model LBF99, or approved equal. Color shall be "Desert Tan."

**808-2.07 Emitter Assembly** of the Standard Specifications is modified to add:

Multi-outlet emitter assembly shall consist of a 1/2" PVC riser, emitter, distribution tubing, and access box as detailed on the drawings. Emitters shall be multi-outlet, pressure compensating with self-cleaning flush action. Emitter shall have six 1-GPH outlets and a 1/2" FPT threaded inlet. Emitter shall be as manufactured by Rain Bird, Model XBT-10-6, or approved equal.

Single-outlet emitter assembly shall consist of a 1/2" PVC riser, emitter, distribution tubing, and access box as detailed on the drawings. Emitters shall be single-outlet, pressure compensating with self-cleaning flush action. Emitter shall have one 1-GPH outlet and a 1/2" FPT threaded inlet. Emitter shall be as manufactured by Rain Bird, Model XBT-10, or approved equal. Single outlet emitters shall be used for the irrigation of individual shrubs, only.

**808-2.07(A) Emitter Distribution Tubing** of the Standard Specifications is modified to add:

Emitter distribution tubing shall be constructed of UV resistant polyvinyl materials and shall have an outside diameter of 0.22" and an inside diameter of 0.16". Tubing shall be as manufactured by Rain Bird Model DT-025, or approved equal.

**808-2.08 Filter** of the Standard Specifications is modified to add:

The filter shall be of the "wye" pattern inline screen type filter with FPT threaded inlet and outlet. Filter body shall be constructed of durable non-corrosive components and shall be of the two-piece design to allow for the removal of the filter screen. Filter screen shall be 200 mesh and constructed of polyester with polypropylene frame. Size of filter shall be 1" unless otherwise noted. Screen filter shall be as manufactured by Agricultural Products, Model 4E-1. Filter shall be equipped with a stainless steel screen as manufactured by Agricultural Products, Model 4E-series or approved equal.

**808-2.10 Controller** of the Standard Specifications is modified to add:

Controller A shall be as manufactured by Rainmaster Model EGI-T. The number of stations shall be as noted on the drawings.

Controller B shall be as manufactured by Irritrol, Model MC Elite Series. The number of stations shall be as noted on the drawings.

The controller shall be grounded using a ground wire and three ground rods as recommended by the controller manufacturer. The size and gauge of the grounding wire and rods shall be in accordance with the controller manufacturer's written instructions. All ground rod connections shall be made using mounting brackets and/or hardware as manufactured or approved by the controller manufacturer

All materials required to provide electrical service to the controllers shall conform to the requirements of Tucson Electric Power Company (TEP), and as approved by the Engineer.

**808-2.10 (A) Controller Security Cabinet** of the Standard Specifications is modified to add:

The controller security cabinet shall be fabricated from 3/16" steel plate. The enclosure shall be equipped with ventilated doors and pry resistant lock cover. The enclosure shall be equipped with two 24 valve terminal strips and a 110 volt convenience outlet. The enclosure shall be as manufactured by Le Meur, Model LE-A-CR, or approved equal. Color shall be "Desert Tan."

**808-2.12 Detectable Mainline Marking Tape:** add the following to the Standard Specifications:

The mainline marking tape shall be a five (5) mil thick, five-ply composition, polyethylene tape. The tape shall have a 20 gauge solid aluminum core that is fully encapsulated within the polyethylene material. The tape shall be three inches (3") wide and shall have the words "CAUTION - IRRIGATION LINE BELOW" printed at regular intervals. Tape color shall be green. The detectable marking tape shall be as manufactured by T. Christy Enterprises Inc., Model TA-DT-3"-G-I or TADT-3"-P-RW (reclaimed water) or approved equal.

**808-2.13 Valve Access Boxes** add the following to the Standard Specifications:

Valve access boxes for gate valves, ball valves, remote control valves, master valves, flow sensors, and flush caps shall be manufactured from a combination of polyolefin and fibrous inorganic components. All access boxes shall be equipped with a heavy-duty cover that is fully supported by access box. Covers shall be permanently marked with the word "IRRIGATION" and shall be capable of being bolted down for security purposes. Color shall be as noted on the plans. Access boxes shall be as manufactured by NDS, or approved equals. Box sizes and types shall be as follows:

Master Valve	Jumbo Rectangular with extensions as-needed
Flow Sensor	Jumbo Rectangular with extensions as-needed
Mainline Isolation Valves	Standard Rectangular with extensions as-needed
Drip Zone Remote Control Valves	Jumbo Rectangular with extensions as-needed
Temporary Spray Zone Remote Control Valves	Standard Rectangular with extensions as-needed
Emitter Line Flush Caps	Ten-Inch Round

**808-2.13 (A) Emitter Access Box:** add the following to the Standard Specifications:

The emitter access box shall be 6 inches (6") in diameter and constructed of heavy-duty, thermoplastic materials and shall be equipped with a snap-on, latching cover. The emitter access box shall be as manufactured by NDS or approved equal.

**808-2.14 Flow Sensors** add the following to the Standard Specifications:

The flow sensor shall be of the six-blade impeller type capable of determining flow rates between 0.5 and 30 feet per second with an accuracy of (+/-) 1%. The flow sensor shall have a heavy-duty PVC or brass body. The flow sensor shall be fully compatible with the controller and other control system components installed. Flow sensor for Controller A shall be Rain Master model FS-B100, or approved equal. Flow sensor for Controller B shall be Badger Meter, Inc. model 228PV size 1-inch

(1”), or approved equal.

### **808-3 CONSTRUCTION REQUIREMENTS**

**808-3.01(A) System Layout** of the Standard Specifications is modified to add:

Prior to the start of trench excavation, the Contractor shall lay out the irrigation system marking the locations of all meter(s), backflow preventers, controller(s), mainlines, isolation valves, master valves, flow sensors, remote control valves, sleeves, and related equipment. The layout shall be approved by the Engineer prior to the start of trenching and installation work. The Engineer shall have the authority to make changes to layout of the system if appropriate for field conditions.

**808-3.01 (B) Blue-Staking** of the Standard Specifications is modified to add:

The Contractor shall request that the project site be Blue-Staked prior to the start of any irrigation excavation or trenching work. Blue Staking shall be kept current during the course of the project. All utilities damaged by the Contractor shall be repaired or replaced by the Contractor, as required by the Owner or appropriate utility company, at the Contractor’s expense.

**808-3.01 (C) Abandonment or Removal of Existing Reclaimed Water Pipe and Appurtenances** of the Standard Specifications is modified to add:

Work required to reconfigure existing reclaimed irrigation mainlines on bridge and within River Park boundaries shall follow all requirements of Section 511-3.01 of the Standard Specifications.

**808-3.02 Trenching and Piping** of the Standard Specifications is modified to add:

Underground piping shall be installed within trenches as detailed on the project plans. Select bedding material shall be used within three inches (3”) of all pipe. Detectable marking tape shall be installed above all mainline piping as detailed on the project plans.

**808-3.02(A) Pipe Sleeves** of the Standard Specifications is modified to add:

Sleeves shall be provided in all locations where irrigation mainlines and/or laterals extend under roadways, drives, multi-use paths, sidewalks, or other paved surfaces or in locations where conflicts with ITS conduit cannot be avoided. Sleeve sizes shall be as noted on the drawings. If sleeve size is not noted, the sleeve size shall be two standard pipe sizes larger than the pipe enclosed but in no case shall sleeve be less than two inch (2”) size. The location of all sleeves under the roadway and multi-use path shall be clearly and accurately recorded on the as-built drawings. The Roadway Station where the sleeves are installed under the roadway shall be noted on the As-Built Drawings.

**808-3.10 Water Meter** of the Standard Specifications is modified to add:

Water Meter for Reclaimed Water Service: The water meter for reclaimed water service shall be installed by the Contractor and does not require coordination with the water utility. The Meter shall be disc type with a bronze body and thermoplastic purple colored lid. The meter shall be the size specified on the project plans. The water meter shall be installed per manufacturer’s specific instructions.

**Water Meter for Potable Water Service:** The water utility serving the site may be contacted prior to the bid date for information pertaining to the Metered Water Service Application. The Contractor shall present the project plans to appropriate Water Utility personnel. Water company personnel will provide specific information pertaining to the cost of the proposed metered water service.

Following the award of contract, the Contractor shall contact the Pima County Planning and Development Services Department / Address Issuing Agency, and shall obtain an "address" for each required meter service. After the required address has been obtained, an "Application for Metered Water Service", along with all applicable fees, may be filed with the Water Utility. The Water Utility will then schedule the installation of the required meters and services. The installation of service(s) and meter(s) will be performed by the water utility forces. All water obtained from the new irrigation water service / meter(s) and used for irrigation or other purposes during project construction and during the landscape establishment period shall be paid for by the Contractor. Upon completion of the landscape establishment period responsibility for payment of water charges will be transferred to Pima County as directed by the Engineer.

**808-3.11 Backflow Preventers** add the following to the Standard Specifications:

The backflow preventers shall be installed as detailed in the locations shown on the project plans. All backflow preventers shall be tested by an individual certified to perform such testing by the water utility. Certificates, signed by the tester and indicating that the devices are operating correctly, shall be filed with the Engineer and the water utility prior to the Contractor's use of water from the new water meter.

**808-3.11 (A) Backflow Preventer Security Enclosure:** add the following to the Standard Specifications:

A security enclosure shall be installed at each backflow preventer as detailed. The enclosure shall be positioned, relative to the backflow preventer, to allow for the opening and closing of the enclosure with out interference with the backflow preventer.

**808-3.12 Valves and Sensors** add the following to the Standard Specifications:

All sensors and valves (master valves, gate valves, ball valves, remote control valves, flow sensors, etc.) shall be installed in access boxes as detailed. Use teflon tape on male threads of all threaded connections. Install access boxes such that the top of the box is parallel to and flush with the surrounding grade, or as detailed. Provide gravel sumps and brick footings as detailed. In locations where more than one box is to be installed in a given location, group boxes together and keep boxes within a uniform alignment. Provide adequate clearance around enclosed valve to allow for valve operation and/or removal.

**808-3.13 Control System:** add the following to the Standard Specifications:

The controller and all related control system components shall be installed as detailed and in accordance with the control system manufacturer's written instructions. The work shall be under the supervision or direction of a factory authorized technician. The Contractor shall be responsible for all installation and testing work as required for the operation of the system in accordance with the manufacturer's specifications.

The controllers supplied by PCNRPR shall be installed in accordance with the control system manufacturer's written instructions and in coordination with a PCNRPR representative.

**808-3.13(A) Electrical Services to the Controllers** add the following to the Standard Specifications:

The Contractor shall be responsible for the installation of the electrical services to the new controllers as follows:

Controller A: Electrical service to Controller A shall be as shown on the project plans. Installation shall include the required connections at the service panel and controller. The conductors required shall be as noted on the project plans or as required by applicable code(s). All wiring shall be installed in one and one-half inch (1-1/2") size (or larger) Schedule 40 PVC conduit. Pull boxes shall be provided and installed along the conduit path at intervals not exceeding two hundred feet (200'). All work shall be in accordance with the Pima County/City of Tucson Standard Specifications for Public Improvements, the special provisions, and applicable codes. The contractor performing the electrical work shall be licensed by the State of Arizona Registrar of Contractors and shall hold a license appropriate for the work to be performed.

Controller B: In addition to installation requirements associated with connection of the service panel to the controller as described for Controller A, electrical service to Controller B requires the installation of a new metered electrical service at the location shown on the project plans. The work under this item shall consist of furnishing all labor, equipment and materials required for securing and installing electrical service at the location noted on the plans. The work shall include the securing of required permits related to the electric service and trenching/backfill between the service point and metered electric service pedestal for installation of cable in conduit by the utility company. The work to coordinate the service installation, meter enclosure installation, permit fee(s) documentation and coordination time and expenses borne by the contractor is intended to be covered by the irrigation lump sum bid item.

Controllers P (Controllers provided by PCNRPR): Electrical connection to the controllers to be provided by PCNRPR shall be made in coordination with the PCNRPR representative.

**808-3.14 Flush Cap Assembly:** add the following to the Standard Specifications:

Flush cap assembly shall be installed at the end of lateral lines as shown on the plans. Assembly shall be installed in a ten inch (10") diameter access box as detailed. Box color shall be as shown on plans.

**808-3.16 Irrigation System Guarantee:** add the following to the Standard Specifications:

The Contractor shall guarantee the irrigation system installed to be free from defects in materials and workmanship for a period of two-years starting on the date of Final Acceptance of the Work. All materials and equipment that are found to be defective during the guarantee period, for reasons other than vandalism, neglect, or improper operation by others, shall be repaired or replaced by the Contractor at no cost to Pima County. Repair or replacement work shall be completed within 10 calendar days of receipt of written notice. If work is not completed within this time period, Pima County may perform the work, or have others perform the work, and bill the Contractor for all direct expenses associated with the remedial work.

## **808-4 TESTING**

### **808-4.01 Operational Testing** add the following to the Standard Specifications:

Upon completion of the irrigation system installation, the Contractor shall perform an operational test of the irrigation system. The operational test shall be performed with the Engineer present. The test shall demonstrate that the controller, control valves, and all system applicators are operating correctly and providing adequate water to the landscape plantings. Irrigation system components found to be operating incorrectly shall be repaired or replaced prior to start of the Landscaping Establishment Period and at no cost to the Owner.

## **808-5 RECORD AND AS-BUILT DRAWINGS**

### **808-5.01 As-Built Drawings** add the following to the Standard Specifications:

The Contractor shall submit to the Owner's Representative, prior to Substantial Completion of the Work, as-built record drawings for the irrigation system installed. The drawings shall indicate the location of all; meters, backflow preventers, mainlines, master valves, isolation valves, and sleeves/pipelines under paved surfaces. Sleeves under the roadway shall be identified by roadway station number. The location of valves and other system appurtenances shall be identified by two or more dimensions from fixed objects such as curbs, or utility structures. As-built drawings shall be prepared with ink on-mylar. The preparation of the mylar drawings shall be the Contractor's responsibility and shall be at the Contractor's expense.

A set of as-built drawings shall be maintained on the project site at all times. The as-built drawings shall be updated daily, as the work is performed. If the as-built drawings are not updated in an accurate or timely manner, The Engineer shall have the authority to order a stop to the irrigation installation work. The stop shall remain in effect until such time as the as-built irrigation drawings are updated and/or corrected as specified.

### **808-6 METHOD OF MEASUREMENT** of the Standard Specifications is modified to add:

The completed landscape irrigation system will be measured on a lump sum basis.

No separate measurement will be made for the work required to modify existing irrigation systems.

### **808-7 BASIS OF PAYMENT** of the Standard Specifications is modified to add:

The accepted quantity of landscape irrigation system, measured as provided above, will be paid for at the contract lump sum price called for in the Bidding Schedule, which shall be full compensation for the work complete in place.

No separate payment will be made for the work required to modify existing irrigation systems.

## **ITEM NO. 8080011 MISCELLANEOUS LANDSCAPE WORK**

### **DESCRIPTION:**

The work under this item shall consist of miscellaneous landscape work not covered by other items included in the project, during the course of construction.

**MATERIALS:** (None Specified)

**CONSTRUCTION DETAILS:** (None Specified)

### **METHOD OF MEASUREMENT:**

The landscape work under this section shall be completed on a Force Account basis as specified in the provisions of Subsection 109-5.

### **BASIS OF PAYMENT:**

Payment for miscellaneous landscape work will be on a Force Account basis in accordance with the provisions of Subsection 109-5.

**(810EROS\_CON, 6/17/09)**

**SECTION 810 - EROSION CONTROL AND POLLUTION PREVENTION** of the Standard Specifications is revised to read:

### **810-1 DESCRIPTION**

**810-1.01 General.** On projects where an Arizona Pollutant Discharge Elimination System or equivalent National Pollutant Discharge Elimination System (AZPDES/NPDES) permit is required, the contractor shall implement the requirements of the permit for sediment and erosion control due to stormwater runoff during construction, as specified under the AZPDES/NPDES Construction General Permit AZG2008-001. The Agency and the contractor shall prepare and submit separate Notices of Intent (NOI) and Notices of Termination (NOT) forms for the project. The contractor shall copy their AZPDES NOI Application and NOI Certification to the owner of the Municipal Separate Storm Sewer System (MS4) (i.e. Pima County Department of Environmental Quality, City of Tucson Stormwater Management or Town of Marana Environmental Engineering). The contractor shall copy their AZPDES NOT Acknowledgement to the owner of the MS4 upon project stabilization. Copies of all NOI and NOT documentation shall be placed in to the SWPPP.

The Agency has prepared a Stormwater Pollution Prevention Plan (SWPPP), which includes a narrative description of the proposed measures to be implemented, sequence of construction activities, and a site-specific diagram indicating the proposed locations where erosion control devices or measures may be required during construction. This SWPPP is included in the Special Provisions. A list of subcontractors and key field personnel contact numbers shall be placed into the

SWPPP. Prior to the start of construction, each contractor and all subcontractors shall be asked to sign a certification that they understand all requirements of the AZPDES/NPDES permit. Signed certifications shall be placed into the SWPPP.

The work under this item shall include furnishing, installing, maintaining, removing and disposing of temporary sediment and erosion control measures such as silt fences, check dams, sediment basins, netting, sediment logs/wattles, and other erosion control devices or methods as shown in the SWPPP and in the Special Provisions.

Permanent erosion control will be constructed under the specific items found in the plans and listed in the Special Provisions and bid schedule.

**810-1.02 Erosion Control.** Erosion controls, both temporary and permanent, shall be installed in accordance with phasing provisions in the approved SWPPP and coordinated with the related construction. Erosion controls must be provided within 14 days of completion of land disturbance. This applies to each location within a project area.

Perimeter control is required before work begins for all down-slope and some side-slope boundaries, unless the project is designed with sediment basins.

Stockpiles must have sediment control, except when actively worked. Sediments controls are required during weekends and evenings. Stockpiles cannot be placed in washes, surface waters, curb and gutter, or streets leading to these conveyances.

All work specified in this subsection will be temporary for use during construction.

The contractor shall be responsible for maintaining all erosion and pollution control devices in proper functioning condition at all times.

When deficiencies in the erosion control devices or other elements of work listed herein are noted by inspection or other observation, specified corrections shall be made by the contractor by the end of the day or work shift, or as directed by the Engineer.

Work specified herein which is lost, destroyed, or deemed unacceptable by the Engineer as a result of the contractor's operations shall be replaced by the contractor at no additional cost to the Agency. Work specified herein which is lost or destroyed as a result of natural events, such as excessive rainfall, shall be replaced by the contractor and be paid for in accordance with the requirements of Subsection 109-3.

In cases of serious or willful disregard for the protection of the waters of the U.S. and/or natural surroundings by the contractor, the Engineer will immediately notify the contractor of such non-compliance. If the contractor fails to remedy the situation within 24 hours after receipt of such notice, the Engineer may immediately place the erosion and/or other pollution control elements in proper condition and deduct the cost thereof from moneys due the contract.

**810-1.03 Other Pollutant Controls.** The work shall include implementing controls to eliminate the discharge of pollutants, such as fuels, lubricants, bitumens, dust palliatives, raw sewage, wash water, silt laden water, and other harmful materials into storm and other off-site waters. The work shall include the implementation of spill prevention and material management

controls and practices to prevent the release of washoff of pollutants. These controls and practices shall be specified in the SWPPP and shall include delivery and storage procedures for chemicals and construction materials, material use, stockpile management, liquid and solid waste management, hazardous waste management, disposal and cleanup procedures, the contractor's plans for handling of potential pollutants, and other pollution prevention measures as required.

Handling procedures for potential pollutants shall also be included in the contractor's "good housekeeping" practices as specified herein. At the preconstruction conference, the contractor shall specify "good housekeeping" practices and requirements, on-site and off-site tracking control, protection of equipment storage and maintenance areas, sweeping schedule of highways and roadways related to hauling activities, a construction sequence of major activities, Spill Prevention and Response Plan, and a listing of potential pollutants in the SWPPP.

If concrete washout activities occur and there is an AZPDES Construction General Permit (402 Permit) for the site, ADEQ's Aquifer Protection Type 1.12 General Aquifer Protection Permit (APP) shall be followed. If there is no 402 permit and concrete washout activities occur, a separate APP permit shall be obtained by the contractor.

Vehicle/equipment washing is not an allowable discharge covered under the SWPPP. Contractor shall apply for and obtain a type 3.03 General APP if vehicle washing will be done on site. Contractor shall also provide copies of their Type 3.03 General APP Permit for vehicle/equipment wash down areas for placement into the SWPPP as well as any other permits required

Contractor must identify locations of the following on the SWPPP Site Map: Vehicle/equipment wash down area, concrete wash out areas, staging yard/area, chemical storage area, equipment maintenance and repair areas, stockpile areas and equipment and construction material storage areas.

**810-1.04 Staging/Storage Yard.** If the contractor has entered into a separate agreement with an owner or lessee of private property to obtain property for use as a storage or staging area, the contractor shall assume all responsibilities for compliance with the AZPDES/NPDES regulations for this property. Contractor shall ensure that activities at this location do not affect the AZPDES permit held by the Agency.

The Agency shall state in its SWPPP that this area is under the control of the contractor.

## **810-2 MATERIALS**

**810-2.01 Silt Fence.** Material requirements for silt fences, including posts, wire support fencing, and fasteners, shall be in accordance with Section 915. Geotextile fabric shall conform to the requirements of Subsections 1014-1 and 1014-8, except that the filter cloth shall be woven polypropylene, and the fabric Apparent Opening Size shall be between numbers 20 and 50 U.S. Standard sieve sizes when tested in accordance with ASTM D 4751.

**810-2.03 Riprap and Rock Mulch.** Riprap for culvert inlet and outlet protection and cut and fill transitions designated on the plans shall conform to the requirements of Section 913 and shall be in accordance with the following table, unless otherwise specified. Riprap shall conform to gradation A or B as designated on the project plans.

Sieve Size		Percent Passing
Gradation A	Gradation B	
6 inch	12 inch	90-100
4.5 inch	9 inch	70-85
3 inch	6 inch	30-50
2 inch	4 inch	5-15
1 inch	2 inch	0-5

Rock mulch for headwall and wingwall treatments and rock check dams shall conform to the requirements of Section 803 and shall be in accordance with gradation C below, unless otherwise specified. Section 803 requirements for use of pre-emergent herbicide and for post-placement watering of rock mulch shall not apply to rock mulch applied under Section 810.

Gradation C	
Sieve Size	Percent Passing
3 inch	100
2 inch	50-75
1 inch	10-20

**810-2.04 Sand Bags and Gravel Bags.** Sand and gravel bags, when filled shall measure approximately 18 inches long by 12 inches wide by 3 inches thick, and weight approximately 33 pounds. Bags shall be manufactured from polypropylene, polyethylene, or polyamide woven fabric with the following characteristics:

Unit Weight, Minimum, oz. Per sq. yd.	4
Mullen Burst Strength, Exceeding, psi.	300
Ultraviolet Stability, Exceeding, %	70

Material used to fill sand bags shall be clean sand or a clean sandy soil free of silt, as approved by the Engineer.

Gravel fill shall be between 0.4 and 0.8 inches in diameter, and shall be clean and free from clay balls, organic matter and other materials.

**810-2.05 Erosion Control Sediment Logs.** Erosion control sediment logs shall be composed of weed-free, 100 percent virgin aspen wood excelsior or rice straw in a tube of non-biodegradable polyester or high-density polyethylene netting. Netting at each end of the log shall be secured with metal clips or knotted ends to assure fiber containment. The nominal diameter of the logs shall be from 9 to 20 inches as specified on the plans. The length of the rolls shall be from 7 to 25 feet as specified on the plans.

**810-2.06 Sediment Wattles.** Sediment wattles shall be manufactured rolls composed of weed-free, 100-percent virgin aspen wood excelsior or rice straw, encased in a tube of long-term photodegradable plastic or biodegradable natural fiber netting with a maximum one-inch by one-inch grid. Netting at each end of the log shall be secured with metal clips or knotted ends to assure fiber containment. Sediment wattles shall have nominal diameters of 9, 12, or 18 inches, with lengths from 7 to 25 feet, as specified on the plans. Fibers shall be evenly distributed throughout the wattle.

**810-2.07 Curb Inlet Guard.** Curb drain inlet guards shall be manufactured systems composed of high density polyethylene (HDPE) support brackets, an HDPE outer jacket and an integrated particle filter. Segments shall be adjusted and overlapped to fit the drain opening.

### **810-3 CONSTRUCTION REQUIREMENTS**

Prior to the start of construction, the Engineer and contractor will jointly review the SWPPP, make any revisions needed, and approve and sign the SWPPP. The contractor shall use the signed SWPPP provided at the pre-construction meeting, and implement the SWPPP as required throughout the construction and establishment periods. The Engineer and contractor will perform a minimum of one routine inspection of disturbed areas that have not been stabilized at least once every 14 calendar days *and* within 24 hours of the end of a 0.5 inch rainfall. Reduced inspection frequency can occur when the site has been temporarily stabilized. The reduced inspection frequency is once every 28 days *and* before predicted rainfall events *and* after 0.5 inch rainfall events.

After each inspection, the contractor shall document the findings and revise the SWPPP as necessary. The Engineer and contractor shall jointly approve and sign each revision to the SWPPP before implementation. The contractor shall complete revisions to the SWPPP within 15 calendar days following notification if ADEQ determines the SWPPP is deficient. The contractor shall amend the SWPPP, as needed and record inspection results in the SWPPP within 15 business days after an inspection by local, state or federal officials. Changes to the SWPPP must be implemented in the field within 7 calendar days, or before the next rainfall event.

Maintenance of erosion and sediment control devices will follow the schedule outlined in Part IV, I. of the CGP #AZG2008-001. The contractor shall maintain all related erosion control elements in proper working order.

No condition of local grading ordinances or the SWPPP shall release the contractor from any responsibilities or requirements under other environmental statutes or regulations.

Erosion control and pollution prevention work specified in the contract which is to be accomplished under any of the various contract items will be paid for as specified under those items.

Final stabilization is met when all soil disturbing activities have been completed, temporary Best Management Practices have been removed and disposed of, and either a uniform perennial vegetative cover with a density of 70% of the native background has been established on all unpaved areas, or equivalent permanent stabilization measures are in place. Until final stabilization of the project, the contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part thereof by the action of the elements, or from the nonexecution of the work. The contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final stabilization. No reimbursement shall be made for work necessary due to the contractor's failure to comply with the requirements of the SWPPP. The original completed SWPPP shall be returned to the Agency.

Except as specifically provided under Subsection 108-4, in the case of suspension of work from any cause whatsoever the contractor shall be responsible for the project and shall take such precautions as may be necessary to prevent damage to the project, provide for normal drainage and shall erect any necessary temporary structures, signs, or other facilities. During such period of suspension of work, the contractor shall properly and continuously maintain, in an acceptable growing condition, all newly established plantings, seedlings and soddings, furnished under its contract and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

Erosion control features shall be temporary or permanent, as designated herein. All temporary erosion control features specified for removal shall become the property of the contractor, and shall be removed and disposed of by the contractor upon final stabilization. During removal, all sediment shall be disposed of, and the area restored to a finished condition as shown on the plans, or as directed by the Engineer.

**810-3.01 Silt Fences.** Installation and maintenance requirements for silt fences shall be accordance with Section 915, unless otherwise specified.

**810-3.03 Riprap and Rock Mulch.** Ripraps used in culvert inlet and outlet protection and cut and fill transitions; and rock mulch treatments for headwalls, wingwalls, and rock check dams; shall be installed in accordance with the project plans and details or as directed by the Engineer.

Rock shall be installed so as to conform to and completely cover the treatment area shown on the plans with a uniform, cohesive rock unit. The rock shall not impede flow into the treatment area and shall be feathered at the outflow.

Accumulated debris shall be removed and disposed of by the contractor after each rain storm, or as directed by the Engineer.

Pipe treatments, headwall and wingwall treatments, and cut and fill transitions are permanent project features, which shall remain in continuous service after installation and project completion.

Rock check dams shall remain in service until the seeding work commences or until they are no longer needed, as approved by the Engineer. When use of a rock check dam is discontinued, the materials shall be removed and wasted on site in a manner that will not impede designed drainage flows, as approved by the Engineer.

**810-3.04 Sand Bags and Gravel Bags.** The work shall include supplying bags and sand or gravel, preparing the filled bags, and installing filled bags where shown on the plans or as approved by the Engineer.

Gravel bags shall be used for drain inlets surrounded by asphaltic concrete or paved surfaces.

Bags in the vicinity of curbs and catch basins shall be installed to 2 inches below the height of the adjacent curb to allow drainage into the drainage structure. Flow during a severe storm shall not overtop the curb. When sediment depth behind the bags reaches one-third the height of the bag, the sediment shall be removed and disposed of in accordance with local, state, and federal laws and permit requirements.

**810-3.05 Erosion Control Sediment Logs.** Erosion control sediment logs shall be installed in channel bottoms, around catch basins, as check dams, or on slopes, in accordance with the project plans and details, or as directed by the Engineer in accordance with the manufacturer's instructions. Stakes shall be located every two feet to secure the logs. Each stake shall be intertwined with the netting on the downstream side of the log and driven approximately two feet into the ground. Soil shall be tamped against the upstream side of the roll to assure that storm water is forced to flow through the log rather than under it. There shall be no gaps between the log and soil.

The ends of adjacent logs shall be abutted tightly together so that water cannot undermine the logs. If the width of the ditch/channel is greater than the length of one log, the ends of adjacent logs shall be overlapped a minimum of 24 inches.

When allowed by the SWPPP, sediment logs installed in drainage channel bottoms shall be perpendicular to the flow of the water, and shall continue up the channel side slope two feet above the high water flow line. Spacing of the logs shall be as specified in the project plans.

When sediment logs are used to construct check dams, the logs placed on the ground shall be buried four to six inches deep as shown on the project plans.

**810-3.06 Sediment Wattles.** Sediment wattles shall be installed on slopes as shown on the project plans, and in accordance with the manufacturer's instructions, or as directed by the Engineer. Trench depth shall be one-third the width of the wattle. Excavated material shall be placed along the downhill side of the trench. The wattle shall be in continuous contact with the bottom and sides of the trench. Sediment wattles shall be secured with wooden stakes spaced 5 feet apart and a maximum of 1 foot from the ends of the wattle. Stakes shall extend a minimum depth of 12 inches into the soil and a maximum height of 3 inches above the wattle surface. The ends of adjacent wattles shall be abutted tightly together.

**810-3.07 Curb Inlet Guard.** Curb inlet guards shall be used at curb drain inlets as shown on the project plans and in accordance with manufacturer's instructions, or as directed by the Engineer. The guard shall be anchored using gravel bags.

When sediment in front of the guard reaches one-third the height, the sediment shall be removed and disposed of in accordance with local, state, and federal laws and permit requirements.

#### **810-4 METHOD OF MEASUREMENT**

Work required by the SWPPP as included in the bid package, and as may be approved prior to construction, and "good-housekeeping" practices and requirements will be measured on a lump sum basis under AZPDES/NPDES (Original).

No measurement or direct payment will be made to the contractor for time spent in reviewing or revising the SWPPP, or providing other required documentation, the cost being considered as included in the price for the Item AZPDES/NPDES (Original).

If circumstances require changes to the approved SWPPP and such changes are determined by the Engineer to be beyond the scope of AZPDES/NPDES (Original), force account work may be authorized under Item AZPDES/NPDES (Modified).

Permanent erosion control will be measured and paid under the specific items found in the plans and listed in the Special Provisions and bid schedule.

#### **810-5 BASIS OF PAYMENT**

Payment for AZPDES/NPDES (Original) will be made at the contract lump sum price which shall be full compensation for supplying and furnishing all materials, facilities, and services and performing all work involved as specified herein.

Partial payments under this item shall be made in accordance with the following provisions:

- (1) When work shown on the (approved) SWPPP is in place, 50 percent of the amount bid for AZPDES/NPDES (Original) will be paid.
- (2) 40 percent of the bid amount will be paid incrementally over the life of the contract to cover maintenance. In the event that deficiencies exist with regard to Materials or Construction Requirements, Agency will withhold payment until such time as contractor mitigates the deficiencies.
- (3) The remaining 10 percent will be paid upon final stabilization of the project.

No additional payments will be made for this item of work.

The work under this item shall include furnishing, installing, maintaining, removing and disposing of temporary erosion control measures such as silt fences, check dams, straw barriers, and other erosion control devices or methods as shown in the Storm Water Pollution Prevention Plan (SWPPP) and in the Special Provisions.

The work shall also include maintaining permanent erosion control measures such as culvert inlet and outlet protection, cut and fill slope transitions, headwall and wingwall treatments, and other permanent erosion control devices or methods as shown in the SWPPP. The cost of furnishing and installing these items will be paid under the specific items found in the plans and listed in the Special Provisions and bid schedule.

The work shall also include regular inspections by the contractor at the frequency described in Section 810-3 and the SWPPP.

When circumstances require changes to the approved SWPPP and such changes are determined by the Engineer to be beyond the scope of AZPDES/NPDES (Original), payment will be made in accordance with the requirements of Subsection 109-5, Force Account work. Payment will be made under Item AZPDES/NPDES (Modified)

## **ITEM 9050040 - GUARDRAIL FLARED END**

### **1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to construct FLEAT 350 flared guardrail terminals at the locations shown on the plans and in accordance with the details shown on the plans and the requirements of these specifications.

### **2. Materials:**

FLEAT 350 flared guardrail terminals shall be as manufactured by Road Systems Incorporated in Big Spring, Texas.

### **3. Construction Requirements:**

The flared guardrail terminals shall be installed in accordance with the requirements of Subsection 905-3.10 of the Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, 2008 Edition.

### **4. Method of Measurement:**

Flared guardrail terminals will be measured by the unit each, including all components and delineation required for a complete installation as shown on the plans and in the approved manufacturer's drawing and installation manual.

### **5. Basis of Payment:**

The accepted quantity of flared guardrail terminal, measured as provided above, will be paid for at the contract unit price each, which price shall be full compensation for the work, complete in place, including all components and delineation as required, excavation, backfill and disposal of surplus material.

**(908ADA DOMES, 6/05/09)**

## **SECTION 908 - CONCRETE CURBS, GUTTERS, SIDEWALKS AND DRIVEWAYS**

**908-1 Description of the Standard Specifications** is modified to add:

The work under this section shall also include the installation of Detectable Warning Strips at curb access ramp and median refuge area.

**908-2 Materials** of the Standard Specifications are modified to add:

### **908-2.05 Detectable Warning Strip:**

The detectable warning strip panel shall consist of prefabricated panels constructed of either vitrified polymer composite, polymer concrete composite or approved equal. The prefabricated panels shall have truncated domes aligned in the direction of travel in a square or radial grid pattern, compositely

imbedded on a flat substrate, and shall meet the requirements of ADAAG, Americans with Disabilities Act Accessibility Guidelines, and the details shown on the project plans.

Detectable warning strips shall contrast visually with the adjoining pedestrian access route, either light-on-dark or dark-on-light. The strip shall be "safety yellow" (Federal Color No. 33538) with an optional color being Terracotta or Colonial Red (Federal Color No. 20109). The color shall be an integral part of the material. Alternate colors may be authorized by the Engineer.

The detectable warning strip shall be a pre-fabricated panel. A dotted micro textured surface on top of and between the truncated domes for added slip resistance is preferred. On-site fabrication of the panels or truncated domes is prohibited. Detectable warning strips shall be non-flammable and shall not be subject to spalling, chipping, delamination, cracking, or separation throughout the warranty period. The warranty period shall be 10 years from the date of installation and be issued to the agency.

All access ramps within the project shall use the same detectable warning strip product, unless authorized by the Engineer.

The prefabricated detectable warning strip panels shall meet the following physical characteristics:

- A. Minimum compressive strength of 8,000 psi (ASTM C39) for concrete and 18,000 psi (ASTM D695) for polymers.
- B. Minimum tensile strength of 1,500 psi (ASTM C496) for concrete and 10,000 psi (ASTM D638) for polymers.
- C. Minimum flexural strength of 2,500 psi (ASTM C947 and C293) for concrete and 24,000 psi (ASTM D 790) for polymers.
- D. Minimum slip resistance of FA = 0.50 Dry and 0.6 Wet (ASTM C 1028) for concrete and polymers.
- E. Maximum abrasion volume loss of 0.92 inches<sup>3</sup>/7.75 inches<sup>2</sup> (when tested in accordance with ASTM C418) or a minimum abrasion resistance of 500 (when tested in accordance with ASTM C501).
- F. Maximum water absorption of 5.0 % (ASTM C140) for concrete and 1.0 % (ASTM D570) for polymers

**Test results from an independent Geotechnical Testing Laboratory indicating conformance with the applicable physical characteristics A thru F above shall be submitted to the Engineer for approval prior to placement of the detectable warning strips.**

**908-3 Construction Requirements** - the first sentence of the fifteenth paragraph of the Standard Specifications is revised to read:

Contraction joints (weakened-plane joints) in curbs, gutters and sidewalks shall be constructed at a maximum of 10 foot (3 meters) intervals, and shall coincide with contraction joints in adjacent concrete pavement or existing concrete curb and sidewalk.

**908-3 Construction Requirements** of the Standard Specifications is modified to add:

Detectable warning strip installation shall be in accordance with the manufacturer's instructions and current industry practices. In case of discrepancy, the manufacturer's instructions shall govern. Detectable warning surfaces shall be recessed into the access ramp so that the surface of the detectable warning strip, exclusive of the dome, is flush, to a tolerance of plus or minus one-sixteenth of an inch (1/16 inch) with the surface of the ramp. The detectable warning strip shall imbed a minimum of three-eighths of an inch (3/8 inch) into the surface of the access ramp or median refuge area, exclusive of the height of the truncated domes.

Prefabricated detectable warning strip panels shall be utilized for both new construction and retrofit installations. Surface applications dependent on an adhesive bonding agent(s) and anchored systems are not approved for use.

The manufacturer of the detectable warning strip panels shall have an active installation certification program. The installer must be certified by the manufacturer in accordance with manufacturer specifications and current industry practices. The installer must provide the certification to the Engineer prior to placement of the detectable warnings strips.

**908-4 Method of Measurement** of the Standard Specifications is modified to add:

Curb access ramp will be measured as a unit for each access ramp installed, complete in place. The measurement limits for curb access ramp will be shown on the project plans.

Median cross walk will be measured as a unit for each cross walk installed, complete in place. The measurement limits for the median cross walk will be shown on the project plans and the standard details.

Retrofitted detectable warning strips installed on existing curb access ramps and median cross walks will be measured by the square foot of detectable warning strip area installed, complete in place.

**908-5 Basis of Payment** of the Standard Specifications is modified to add:

The accepted quantities of curb access ramp and median cross walk, measured as provided above, will be paid for at the contract unit price each, which price shall be full compensation for the work, complete in place, including excavating, removal of unsuitable material, backfill, compaction, grading, forming, furnishing and installing concrete and finishing to the lines and grades shown on the project plans. No separate payment will be made for furnishing and installing the detectable warning strip, its cost being considered as included in the price of the related item.

The accepted quantities of detectable warning strips installed on existing curb ramps and median cross walks, measured as provided above, will be paid for at the contract unit price per square foot, which price shall be full compensation for the work, complete in place, including but not limited to the removal of concrete, excavation, backfill, compaction, forming, furnishing and placing concrete, detectable warning strip and incidentals necessary to complete the work.

### **ITEM 9100143 - CONCRETE MEDIAN BARRIER TRANSITION (TYPE F) (42")**

**(1) Description:**

The work under this item consists of furnishing all materials, equipment and labor to construct concrete median barrier transitions in accordance with Detail R34 shown in the plans.

**(2) Materials:**

All materials shall conform to the requirements of the Standard Specifications, ADOT Standard Drawings and as shown on the plans.

**(3) Construction Requirements:**

The barrier transition shall be constructed in accordance with the plans, these Special Provisions, Section 910 of the Standard Specifications and as directed by the Engineer.

The reinforcing steel shall be placed in accordance with the Detail R34 and the requirements of the Standard Specifications.

**(4) Method of Measurement:**

Concrete barrier transition will be measured as a unit each.

**(5) Basis of Payment:**

The accepted quantities of concrete barrier transition, measured as provided above, will be paid for at the contract unit price per each, which price shall be considered full compensation for the work, complete in place, including all concrete, reinforcing steel, excavation, backfill, and dowels as specified herein. Reinforcing steel embedded below the barrier or transition shall be included in the cost of the transition.

### **ITEM 9130008 - RIPRAP (HAND PLACED)**

**1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to construct hand placed riprap slope protection at the locations shown on the plans and in accordance with the details shown on the plans and the requirements of these specifications.

**2. Materials:**

Riprap stones shall be a durable, angular natural stone free from clay or shale seams, cracks or other structural defects, and to the gradation as shown on the plans. They shall have a minimum bulk specific gravity of 2.60 when tested in accordance with Test Method AASHTO T-85. The engineers

must approve the material in writing before any rock is delivered to the job site. The engineer shall be provided a sample and may check stockpiles two weeks before deliveries.

### **3. Construction Requirements:**

The slopes and other areas to be protected shall be dressed to the lines and grades shown on the plans.

Stone shall be selected as to size and shape in order to secure fairly large, flat-surfaced stone which may be laid with a true and even surface with a minimum of voids. Stones shall be placed with the flat surface uppermost and parallel to the surface. The largest stones shall be placed near the base of the slope. The spaces between the larger stones shall be filled with stones of a suitable size, leaving the surface smooth, reasonably tight and conforming to the slope required. Open joints shall be filled with spalls.

### **4. Method of Measurement:**

Riprap (hand placed) will be measured by the square yard of exposed surface area of material constructed to the specified thickness as shown on the plans

### **5. Basis of Payment:**

The accepted quantities of hand placed riprap bank protection, measured as provided above, will be paid for at the contract unit price per square yard, which price shall be full compensation for the work, complete in place, including excavating, backfilling, fine grading, preparing the ground area and furnishing and installing the rock.

## **ITEM 9130009 - RIPRAP (HAND PLACED) (GROUTED)**

### **1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to construct hand placed riprap in a concrete bed as a channel lining at the locations shown on the plans and in accordance with the details shown on the plans and the requirements of these specifications.

### **2. Materials:**

Riprap stones shall be a durable, natural stone free from clay or shale seams, cracks or other structural defects. They shall have a minimum bulk specific gravity of 2.60 when tested in accordance with Test Method AASHTO T-85. Stones shall be angular in shape and have at least one (1) broad flat surface. All stones shall vary in size from four to six inches. The Engineer must approve the material in writing before any rock is delivered to the job site.

Concrete shall be Class B,  $f'c = 2500$  psi and placed in accordance with Section 601 of the Standard Specifications. The Engineer must approve any retarding agents that may be used.

Welded wire fabric shall conform to the requirements of Section 914-2.02 (A) of the Standard Specifications.

### **3. Construction Requirements:**

The slopes and other areas to be protected shall be dressed to the lines and grades shown on the plans prior to the placing the concrete bed. After the concrete bed has been placed onto the surface, it shall be screeded to the approximate six-inch thickness.

A minimum lap of six (6) inches shall be used at all splices of the welded wire fabric. At the edge of the riprap, the wire fabric shall be not less than one (1) inch nor more than three (3) inches from the edge of the concrete and shall have no wires projecting beyond the face of the concrete bed. Wire reinforcement shall be adjusted during concrete placement to maintain its position approximately equidistant from the top and bottom surface of the slab. A rebar mat of number 4 rebars at 12 inches each way may be substituted for the weld wire fabric.

The stones shall be embedded in the concrete bed in a single layer with close joints. Stone shall be selected as to size and shape in order to secure fairly large, flat-surfaced stone which may be laid with a true and even surface with a minimum of voids. Stones shall be placed with the flat surface uppermost and parallel to the surface. The largest stones shall be placed near the base of the slope. The spaces between the larger stones shall be filled with stones of a suitable size, leaving the surface smooth, reasonably tight and conforming to the slope required. Open joints shall be filled with spalls.

### **4. Method of Measurement:**

Riprap (hand placed) (grouted) will be measured by the square yard of exposed surface area placed to the specified thickness as shown on the plans.

No measurement will be made of cut-off walls or toedowns which shall be considered included in the square yard unit cost of riprap.

### **5. Basis of Payment:**

The accepted quantities of riprap (hand placed) (grouted) channel lining, measured as provided above, will be paid for at the contract unit price per square yard, which price shall be full compensation for the work, complete in place, including excavating, backfilling, fine grading, preparing the ground area and furnishing and installing the rock, reinforcement, and concrete.

## **SECTION 915 - TEMPORARY SILT FENCE**

**915-4 METHOD OF MEASUREMENT.** of the Standard Specifications is revised to read:

There will be no separate measurement for this work. Work shall be incidental to work outlined in Section 810.

**915-5 BASIS OF PAYMENT.** of the Standard Specifications is revised to read:

There will be no separate payment for this work. Payment will be covered under the items AZPDES/NPDES (Original) or AZPDES/NPDES (Modified) as outlined in Section 810.

## **ITEM 9200401 - SOIL-CEMENT BANK PROTECTION**

### **1. Description:**

The work under this term consists of furnishing all equipment, labor and materials required to reconstruct soil-cement bank protection at the locations shown on the plans and in accordance with the details shown on the plans and the requirements of these specifications.

### **2. Materials:**

The contractor may use the soil-cement as specified in Section 920 of the Standard Specifications or may use a low slump concrete from a commercial source. If a commercial source is used then the concrete shall be Class S,  $f'c = 1000$  psi and in accordance with Section 601 of the Standard Specifications. A mix design shall be approved by the Engineer before construction. The maximum allowable aggregate size shall be two inches.

### **3. Construction Requirements:**

The soil-cement shall be constructed in accordance with the requirements of Sections 601 and 920 of the Standard Specifications.

All fine and coarse aggregates must be totally non-reactive (free from deleterious particles). The water content shall be the minimum practicable and the slump not to exceed four inches.

Concrete shall only be placed on solid compacted material in accordance with Section 601. The existing soil-cement or subgrade shall be thoroughly sprinkled with water in a manner satisfactory to the Engineer prior to the placement of concrete.

### **4. Method of Measurement:**

The soil-cement bank protection will be measured by the cubic yard, complete in place, to the dimensions shown on the plans.

### **5. Basis of Payment:**

The accepted quantities of soil-cement bank protection will be paid for at the contract unit price complete in place, including excavating, backfilling, fine grading, compacting, joint material, cement, dowels, and connections to new and existing channel lining. Only handrails and removal of existing soil-cement bank protection will be paid under other items.

## **ITEM 9300110 - MISCELLANEOUS WORK 1**

### **1. Description:**

The work under this item consists of furnishing all materials and installing new mail receptacles at the locations shown on the plans and in accordance with the requirements of these specifications.

**2. Materials:**

Mail receptacles shall conform to the requirements shown in Detail No. 102, sheet 1 of 2 of the PC/COT Standard Details for Public Improvements.

Concrete for post footings shall be utility concrete conforming to the requirements of Section 922.

**3. Construction Requirements:**

The contractor shall contact the U.S. Postal Service serving the area prior to any construction and ascertain the rules and regulations for mail delivery and private mail boxes and the rules for temporary relocation during construction.

At least 15 calendar days prior to the start of construction, the contractor shall notify the affected property owners and/or resident on whose property the private mail boxes are adjacent, so that adequate time may be afforded to those parties who so desire to remove and temporarily relocate the mail boxes during construction. If at the end of 15 days, the owner has not relocated or made arrangements to relocate the conflicting mailbox to a temporary location, the contractor shall remove and temporarily relocate the mailbox in accordance with Postal Service requirements.

As soon as possible after completion of construction in that area, the contractor shall install the new mail receptacles at the locations shown on the project plans in accordance with Detail No. 102 of the Standard Details.

**4. Method of Measurement:**

Mail receptacles will be measured as a unit for each receptacle.

**5. Basis of Payment:**

The accepted quantity of mail receptacles, measured as provided above, will be paid for at the contract unit price each, which price shall be full compensation for furnishing and installing all materials, excavation, backfill and performing all work involved as specified herein. No measurement or direct payment will be made for temporary relocation of mail boxes and coordination with the Post Office and with mail recipients, the cost being considered as included in the cost of this contract item.

**ITEM 9300111 – MISCELLANEOUS WORK 1**

**1. Description:**

The work under this item shall consist of furnishing all equipment, labor and materials required to install Tucson Electric Power (TEP) conduit for future use under the southbound bridge approach slabs and through openings provided in the abutment walls.

**2. Materials:**

The conduit shall be 6" Diameter HDPE. Additional material requirements will be provided by TEP.

**3. Construction Requirements:**

TEP will provide construction requirements to the contractor.

**4. Method of Measurement:**

The method of measurement for Item 9300111 – Miscellaneous Work 1 shall be by force account in accordance with Subsection 109-5 of the Standard Specifications.

**5. Basis of Payment:**

The accepted quantity of Item 9300111 - Miscellaneous Work 1, measured as provided above, will be paid for on a force account basis.

**ITEM 9300113 - MISCELLANEOUS WORK 3**

**1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to remove and salvage the existing Ruthrauff Z-A Zone Booster & PRV Station at the southwest corner of the Ruthrauff Road and La Cholla Boulevard intersection in accordance with the requirements of these specifications.

**2. Materials:**

Blind flange plates shall be manufactured from cast iron or ductile iron.

**3. Construction Requirements:**

The existing Ruthrauff Z-A Zone Booster & PRV Station shall remain in service until the new replacement station construction is complete, tested and fully operational. Tucson Water has committed to a date of August 1, 2010 for the new booster station being operational. The operational status of the new station shall be verified with Tucson Water (TW) before commencing with the following scope of work:

1. Coordinate closing of all three existing station below ground valves connected to the TW system under supervision of the TW Construction Inspector.
2. Disassemble all above ground station components including piping & appurtenances, electrical rack & footings, electrical & control panels, antenna, and fencing & footings.
3. Excavate and disassemble below ground piping to closed valves- see task #1 above.
4. Furnish and install blind flange plates at closed valves.
5. Disassemble valve stems, boxes & covers and abandon capped valves in place.

6. Per the TW Plant Design Representative's determination, salvage and deliver station components to TW Plant 1 salvage yard at 510 W 18th Street. The Plant Design Representative is Jim Meskan (837-2194).
7. All station components that are determined to be unsalvageable shall be hauled away and disposed of at an appropriate location.

**4. Method of Measurement:**

This item will be measured on a lump sum basis.

**5. Basis of Payment:**

Payment for this item will be made at the contract lump sum price which shall be full compensation for supplying and furnishing all materials, facilities, and services and performing all work involved as specified herein.

**ITEM 9300114 – MISCELLANEOUS WORK 4**

**1. Description:**

The work under this item consists of furnishing all equipment, labor and materials required to construct and install four painted steel signs with cutout lettering that are attached to the side of the bridge girders as shown in Details 3 and 4 on Sheet S38 of the Bridge Plans. It also includes salvaging four signs that are attached to the existing bridge and reinstalling them on the underside of the bridge deck overlooks as shown on Sheet S35 of the Bridge Plans. One of the four signs that is to be mounted to the underside of the bridge deck overlooks has been defaced and will need to be replaced by the Contractor to match the other 3 signs.

**2. Materials:**

Threaded inserts shall conform to the requirements on the bridge plans.

Structural steel shall conform to ASTM A36. Structural Tubing shall conform to ASTM A500, Grade B.

Structural steel to be galvanized shall conform to ASTM A123. Bolts, nuts & washers shall be galvanized in accordance with ASTM A153, unless specified to be painted.

Paint shall conform to Sections 1002 of these Special Provisions

**3. Construction Requirements:**

The signs and attachments shall be constructed as shown in the project plans

**4. Method of Measurement:**

The method of measurement shall be lump sum for the four signs (2 new and 2 salvaged) attached to the southbound bridge and lump sum for the four signs (2 new and 2 salvaged) attached to the northbound bridge.

**5. Basis of Payment:**

The accepted quantity of Miscellaneous Work 4 will be paid for at the contract lump sum price, measured as provided above, which price shall be full compensation for the work, complete in place, including fabrication of the signs, salvaging, replacing the defaced sign, painting, galvanizing, installing threaded inserts, unistrut hangers, cutting, and all other items associated with the signs.

**ITEM 9300119 - MISCELLANEOUS WORK 9**

**1. Description:**

The work under this item consists of furnishing all materials and installing new mail receptacles called Cluster Box Units (CBU) at the locations shown on the plans and in accordance with the requirements of these specifications. Cluster Box Unit is the manufacturer's designation for these items, however, on the plans they are designated as Neighborhood Delivery & Collection Box Unit (NDCBU).

**2. Materials:**

The Cluster Box Unit shall be a metal Type IV unit with thirteen standard compartments and one parcel compartment. It shall be a Vital 1570 "F" Series unit as manufactured by Auth Florence Manufacturing, 5935 Corporate Drive, Manhattan Kansas 66503. The materials for the concrete foundation shall conform to the requirements from the manufacturer.

**3. Construction Requirements:**

The contractor shall contact the U.S. Postal Service serving the area prior to any construction and ascertain the rules and regulations for installation of CBU's.

The CBU shall be located as shown on the plans. The Engineer may adjust the location in the field to ensure it is not in any sight visibility triangles. The CBU shall be installed in accordance with the manufacturers' recommendations and U.S. Postal Service requirements.

**4. Method of Measurement:**

Cluster Box Units will be measured as a unit for each box.

**5. Basis of Payment:**

The accepted quantity of Cluster Box Units, measured as provided above, will be paid for at the contract unit price each, which price shall be full compensation for coordinating with the post office and mail recipients, furnishing and installing the CBU, pedestal, constructing the concrete pad, grading, excavation, backfill and performing all work involved as specified herein.

## SECTION 931 - DECORATIVE CONCRETE PAVEMENT

**931-2.01 CONCRETE FOR DECORATIVE PAVEMENT:** of the Standard Specifications is modified to add:

The concrete for the median nose pavement shall be integrally colored. The color additives shall contain pure, concentrated mineral pigments specially processed for mixing into concrete and complying with ASTM C979. The colors shall be as manufactured by Davis Colors, Color Canyon 160, or approved equal.

**931-3 CONSTRUCTION DETAILS** of the Standard Specifications is modified to add:

Decorative concrete pavement (median nose pavement) shall be finished with a medium broom finish.

**931-4 METHOD OF MEASUREMENT** of the Standard Specifications is modified to add:

Decorative concrete pavement (median nose pavement) will be measured by the square yard of decorative concrete pavement.

**931-5 BASIS OF PAYMENT** of the Standard Specifications is modified to add:

The accepted quantities of decorative pavement, measured as provided for above, will be paid for at the contract unit price per square yard, complete in place.

## SECTION 933 - BARRICADE RAILING

**933-2.03 Paint:** of the Standard Specifications is modified to add:

For the standard barricade railing built per PC/COT Standard Detail No. 105, the paint shall be Frazee Paint, Mira-Glide, "Hollyhock" No. 8135D or approved equal. The paint for the barricade railing on top of retaining walls RW-1 and the metal railing on top of RW-2 (Details R21 and R22) and the barricade railing approaching the four corners of the bridge shall be the same paint used for the metal pedestrian railing on the bridge.

**933-3.03 Painting:** the fourth paragraph shall be revised to read:

For the standard barricade railing built per PC/COT Standard Detail No. 105, the finished coat shall consist of 2 coats of Frazee Paint No. 8135D or approved equal. The paint shall be approved by the Engineer prior to use. For the barricade railing on top of retaining walls RW-1 and the metal railing on top of RW-2 (Details R21 and R22) and the barricade railing approaching the four corners of the bridge the finished coat shall be as specified for the metal pedestrian railing on the bridge.

**933-5 Basis of Payment:** of the Standard Specifications is modified to add:

For the standard barricade railing built per PC/COT Standard Detail No. 105, or for any other metal railing on the project, no separate payment shall be made for the base plates, anchors, sleeves and all other items required to install the railings to new or existing headwalls or wingwalls as shown in Detail DC or other railing connection details.

### **ITEM 9330002 – BARRICADE RAILING (SPECIAL)**

#### **1. Description:**

The work under this item shall consist of furnishing all material, tools, equipment and labor and painting and installing a metal railing on top of retaining wall RW-2 as shown in Detail R22. The work includes steel posts, rails, decorative panels, metal mesh, fittings, embedded plates, and anchorages. Railing shall be fabricated and installed in accordance with the details shown on the plans and these special provisions.

#### **2. Materials:**

Steel pipe members shall conform to the requirements of ASTM A-53, Grade B. Structural steel plates and shapes shall conform to ASTM A-36.

All structural steel shall be primed and painted in accordance with Sections 610 and 1002 of these Special Provisions. Finish coat shall be SW 7742 Agate Green or approved equal.

#### **3. Construction Requirements:**

Railing shall conform to Section 604 of the Standard Specifications. All welding shall conform to the requirements of the American Welding Society, ANSI/AWS D1.5-02 Structural Welding Code. All butt welds on exposed surfaces shall be ground flush with adjacent surfaces. Field welds and any damaged or marred surfaces shall be touch-up painted.

Railing shall be straight and true to dimensions. Posts shall be constructed vertical.

For structures on curves, either horizontal or vertical, the railing shall conform to the curvature of the structure.

Contractor shall submit shop drawings to the Engineer for review and approval prior to fabrication of the railing. The shop drawings shall contain complete information for construction of the railing; including sizes of material, type of material, post layout plans, fabrication details, welds, and dimensions.

#### **4. Method of Measurement:**

Barricade Railing (Special) will be measured to the nearest linear foot along the centerline of the railing between the centerline of the first post to the centerline of the last post.

#### **5. Basis of Payment:**

The accepted quantities of Item 9330002 Barricade Railing (Special) measured as provided above, will be paid for at the contract unit price per linear foot, which shall be considered full compensation for the work, complete in place, as shown on the project plans and as defined and described herein. The unit

price shall include all fasteners, post anchors, painting, shop drawings and other work necessary to deliver the railing complete in place.

### **ITEM 9330006 – BRIDGE RAILING (SPECIAL)**

#### **1. Description:**

The work under this item shall consist of furnishing all material, tools, equipment and labor and painting and installing a metal mesh pedestrian bridge railing with artistic treatment in span 2 of the southbound and northbound bridges. The work includes steel posts, rails, decorative panels, metal mesh, fittings, embedded plates, and anchorages. The work also includes mock-up panels. Railing shall be fabricated and installed in accordance with the details shown on the plans and these special provisions.

#### **2. Materials:**

Structural steel tubing shall conform to ASTM A500, Grade B. Steel pipe members shall conform to the requirements of ASTM A-53, Grade B. Structural steel plates and shapes shall conform to ASTM A-36.

All structural steel shall be primed and painted in accordance with Sections 610 and 1002 of these Special Provisions. Finish coat shall be SW 7742 Agate Green or approved equal.

The metal mesh shall be galvanized in accordance with the requirements of ASTM A123.

#### **3. Construction Requirements:**

Railing shall conform to Section 604 of the Standard Specifications. All welding shall conform to the requirements of the American Welding Society, ANSI/AWS D1.5-2008 Structural Welding Code. All butt welds on exposed surfaces shall be ground flush with adjacent surfaces. Field welds and any damaged or marred surfaces shall be touch-up painted.

Railing panels shall be straight and true to dimensions. Posts shall be constructed vertical.

For structures on curves, either horizontal or vertical, the railing shall conform to the curvature of the structure.

Contractor shall submit shop drawings to the Engineer for review and approval prior to fabrication of the railing. The shop drawings shall contain complete information for construction of the railing; including sizes of material, type of material, post layout plans, fabrication details, welds, and dimensions.

A mock-up panel shall be constructed as shown on the architectural treatment details in the bridge plans. The mock-up panel must be approved by the Engineer prior to fabrication of the remaining panels. The contractor may be required to construct more than one mock-up in order to refine the work and to obtain a high quality panel that is acceptable for use. If requested by the Contractor, and approved by the Engineer, the approved mock-up panel may be used as part of the finished product.

#### **4. Method of Measurement:**

Bridge Railing (Special) will be measured to the nearest linear foot along the centerline of the railing between the centerline of the first post to the centerline of the last post.

## **5. Basis of Payment:**

The accepted quantities of Bridge Railing (Special) measured as provided above, will be paid for at the contract unit price per linear foot, which shall be considered full compensation for the work, complete in place, as shown on the project plans and as defined and described herein. The unit price shall include all fasteners, embed plates, post anchors, painting, shop drawings and other work necessary to deliver the railing complete in place. No payment will be made for mock-up panels, the price being considered incidental to the cost of the railing.

### **ITEM 9330007 - RAILING (SPECIAL)**

#### **1. Description:**

The work under this item shall consist of furnishing all material, tools, equipment and labor and installing a metal overlook pedestrian bridge railing on the deck overlooks of the southbound and northbound bridges. The work includes railings, posts, metal mesh, fittings, embedded plates and anchorages. The railing shall be fabricated and installed in accordance with the details shown on the plans and these special provisions.

#### **2. Materials:**

Structural steel tubing shall conform to ASTM A500, Grade B. Steel pipe members shall conform to the requirements of ASTM A-53, Grade B. Structural steel plates and shapes shall conform to ASTM A-36. The forged steel balls shall be 3 15/16" diameter solid steel with rough texture as manufactured by King Architectural Metals, Item No. 13-113-11 or approved equivalent.

All structural steel shall be primed and painted in accordance with Sections 610 and 1002 of these Special Provisions. Finish coat shall be SW 7742 Agate Green or approved equal.

Metal mesh shall be galvanized in accordance with the requirements of ASTM A123.

#### **3. Construction Requirements:**

Railing shall conform to Section 604 of the Standard Specifications. All welding shall conform to the requirements of the American Welding Society, ANSI/AWS D1.5-2008 Structural Welding Code. All butt welds on exposed surfaces shall be ground flush with adjacent surfaces. Field welds and any damaged or marred surfaces shall be touch-up painted.

Railing panels shall be straight and true to dimensions. Posts shall be installed vertical.

For structures on curves, either horizontal or vertical, the railing shall conform to the curvature of the structure.

Contractor shall submit shop drawings to the Engineer for review and approval prior to fabrication of the railing. The shop drawings shall contain complete information for construction of the railing;

including sizes of material, type of material, post layout plans, fabrication details, welds, and dimensions.

A mock-up panel shall be constructed as shown on the architectural treatment details in the bridge plans. The mock-up panel must be approved by the Engineer prior to fabrication of the remaining panels. The contractor may be required to construct more than one mock-up in order to refine the work and to obtain a high quality panel that is acceptable for use. If requested by the Contractor, and approved by the Engineer, the approved mock-up panel may be used as part of the finished product.

#### **4. Method of Measurement:**

Railing (Special) will be measured to the nearest linear foot from centerline post to centerline post along the centerline of the railing.

#### **5. Basis of Payment:**

The accepted quantities of Railing (Special) measured as provided above, will be paid for at the contract unit price per linear foot, which shall be considered full compensation for the work, complete in place, as shown on the project plans and as defined and described herein. The unit price shall include all fasteners, post anchors, embedded plates, painting, galvanizing, shop drawings and other work necessary to deliver the railing complete in place. No payment will be made for mock-up panels, the price being considered incidental to the cost of the railing.

### **SECTION 975 - TELECOMMUNICATIONS INFRASTRUCTURE**

#### **975-1 DESCRIPTION**

The work covered under this section shall consist of a Complete-in-Place installation, furnishing all material, labor and equipment, and installing conduit, pull boxes, vaults, and tracer wires for an underground fiber optic conduit system, including excavation, backfilling, compacting, jacking, and boring in accordance with the details.

#### **975-2 MATERIALS**

**975-2.01 Polyvinyl Chloride (PVC) Conduit.** All conduit shall be listed by Underwriters Laboratory (UL) and conform to NEC standards. Unless otherwise specified, all conduits to be installed underground or installed in concrete structures shall be 4-inch diameter, rigid Polyvinyl Chloride (PVC) Non-Metallic Conduit. The PVC conduit shall be schedule 40, heavy wall, sunlight resistant, manufactured from high impact material and shall be rated for use at 90 degrees centigrade. The conduit shall meet the specifications of UL 651 and NEMA TC-2, and furnished with interface fit bell ends. Fittings shall be schedule 40 PVC, meeting the specifications of NEMA TC-3 and UL 514. PVC bends of 30 degrees or greater may be used when necessary. Field bends should not have a radius of less than 50 feet. Factory bends shall have a radius of not less than 12 times the nominal diameter of the conduit.

**975-2.02 Conduit with Integral Innerduct.** Conduit with Integral Innerduct shall be of schedule 40 PVC in modular, slip fit lengths. Shall have pre-lubricated innerducts with internal spacers and which expand and contract at the same rate as the outerduct. Conduits shall have anti-

reversing gaskets and an o-ring gasket at bell base. Shall have inward tapering holes on coupling body for easy assignment, printed indication such as “Install Print Side Up” to keep system straight during installation, and marked innerduct and marked hole on coupling body to insure proper innerduct alignment and allow crews to work from opposite directions. Bends shall be flexible and engineered to be cutthrough resistant. Innerducts shall be Carlon Telecom Systems Multi-Gard brand or equivalent. All integral innerducts shall have a continuous non-spliced, unknotted detectable 1250 pound test mule tape installed.

**975-2.03 Solvent Cement for Polyvinyl Chloride (PVC) Conduit and Couplings.**

All solvent cement shall meet the requirements of ASTM D 2564. The cement shall be of medium or heavy bodied cement capable of making watertight joints. The cement and primer shall be of a type recommended by the manufacturer of the conduit.

**975-2.04 Rigid Steel Conduit Bends.** Conduit bends shall be listed by UL and conform to NEC standards. The bends shall be steel, hot dipped zinc coated, meeting the requirements of UL 6 and ANSI C80.1, and shall carry the UL label. Non-thread couplings shall not be used. Bends shall have a minimum radius of 12 times the nominal diameter of the conduit. Steel conduit bends shall have a factory applied 40 mil PVC coating or be doubled (half overlap) wrapped with a 10 mil PVC plastic tape specifically manufactured for corrosion protection of metallic conduits installed below grade. For PVC conduit bends see section 975-2.01.

**975-2.05 Flexible Conduit.** When specifically indicated on the plans and where approved by the engineer, flexible solid wall direct bury conduit may be used. The conduit shall be manufactured of Polyvinyl Chloride (PVC), or Polyethylene (PE) plastic. The conduit shall be specifically manufactured for direct buried fiber optic raceway systems and shall be Carlon “Optic-Gard PE” conduit, or approved equal. Flexible conduit shall not be utilized for making bends in conduit system. Connection between the flexible conduit and conduits of other materials shall be made with a watertight transition coupling manufactured for the specific type of material.

**975-2.06 Plastic Conduit Spacers.** Spacers shall be constructed of Polyvinyl Chloride (PVC) or other non-metallic material. The spacers shall be vertical and horizontal interlocking and provide a minimum of 3-inch clearance between conduits. Base spacers shall be provided with a wide base plate to provide solid support on the bottom of the trench. The base spacers shall provide for a minimum clearance of 3 inches between the bottom of the trench and the conduit.

**975-2.07 Aggregate Bedding Material.** Aggregate material for bedding material shall meet the gradation indicated in the specifications and on the drawings for the subject project. The plasticity index shall also conform to the specifications under which the subject project is designed and constructed.

**975-2.08 Not Used**

**975-2.09 Detectable Warning Tape.** On open trenching an electronically detectable 6” Fiber Warning tape shall be installed 18” above the conduit. Tape shall be acid and alkali-resistant polyethylene film, with a minimum thickness of 0.004 inch. The tape shall have a minimum strength of 7500 PSI lengthwise and 1,500 PSI crosswise. The tape shall be manufactured with integral wires, foil backing, or other means to enable its detection by a metal detector when the tape is buried up to a depth of 3 feet deep. The tape shall be orange in color and have the following continuous inscription, “CAUTION -FIBER OPTIC CABLE BURIED BELOW”. The inscription shall be 2

inch black letters.

**975-2.10 Backfill Material.** The backfill material shall be designed and constructed using the plans and specifications of the subject project.

**975-2.11 Tracer Conductor.** The cable and conductor shall be listed by UL and conform to NEC standards. The conductor shall be a continuous unspliced stranded CU 6AWG, rated for 600 volts, and shall have THW or XHHW insulation. The color of the insulation shall be green. The conductors shall be of the required length to eliminate all splices within the conduit.

**975-2.12 Pull Boxes.** Communications pull boxes shall be UL listed. All pull boxes shall have an etched polyethylene face, anchored in concrete, with an ultraviolet inhibitor and be of a neutral color. Unless specified otherwise, pull box lids shall be of 'fiberlight' material, polyester pre-mix with Calcium Carbonate, and shall be equipped with a bolt-down cover secured by a minimum of two (2) recessed penta-head bolts. The pull box cover shall have the word "COMMUNICATIONS" in permanent raised or stamped letters. Pull boxes shall be open base. The pull box cover shall have two (2) ½" x 4" pull slots. The pull box base shall have two (2) 4 ½" x 4 1/2" mouse holes, one at each end. Pull boxes may be extended by means of an extension". The extension shall have eight (8) 4 1/2" x 4 1/2" knockouts, two on each side. Contractor shall provide all necessary collars, extensions, hardware, sealant, and conduit caps. All conduit entrances shall be sealed. The assigned pull box number shall be painted on the box at the time of installation. Chipped, cracked, or otherwise damaged boxes and covers will not be accepted.

**975-2.13 Vaults.** (Also known as ADOT No. 9 Pull Box) Communications vaults shall be UL listed. Vault base shall be pre-cast concrete with a minimum thickness of 6". Vault cover shall be fabricated steel, 36" diameter, secured by a minimum of one (1) recessed penta-head bolt. The cover lid shall have "COMMUNICATIONS" written on it in permanent raised, stamped or welded lettering. The vault base and vault cover shall be gasketed and weather proof. Vaults shall have a minimum outside dimension of 48" long by 48" wide by 50" high with a minimum thickness of 4". The base shall have one (1) 8" diameter by 4" deep sump hole knockout in the floor. The base interior shall have a minimum of one (1) 2 ½" diameter ground rod knockout in the floor, at a corner; the base interior shall have four (4) 7/8" diameter pulling irons, one centered on each side. The base exterior walls shall have four (4) 36" "C" channels precast in the sides, one on each side; the base exterior shall have four (4) 18" x 18" knockouts, one on each side; and, the base exterior shall have sixteen (16) 4 1/2" diameter knockouts for 4" conduit entrances, four on each side. The contractor shall provide all necessary collars, extensions, hardware, sealant, and conduit caps. All conduit entrances shall be sealed. The assigned box number shall be painted on the box at the time of installation. Chipped, cracked, or otherwise damaged boxes and covers will not be accepted.

**975-2.14 Portland Cement Concrete.** Concrete shall be Class B meeting the requirements of Section 1006 of the Pima County/City of Tucson Standard Specifications for Public Improvements.

**975-2.15 Innerduct.** Innerduct shall be 1" PVC constructed of a smooth walled exterior and a longitudinally ribbed interior with a continuous unknotted 1250 lbs test mule tape installed. No corrugated innerduct will be accepted. Each innerduct within a single conduit shall be of a different color (orange, brown, blue and black).

**975-2.16 Watertight Alibi.** Watertight Alibi shall consist of a Quadraplex Duct Plug designed to seal around, organize, and support innerduct where it emerges at the top of the riser. Fasteners

shall be stainless steel. Plug shall support a minimum of 400 lbs of cable, and shall be removable. Jackmoon or equivalent. No chemical seals will be accepted.

**975-2.17 Blank Duct Plugs.** Blank Duct Plugs shall be installed in each individual innerduct where it emerges at the top of the riser. Duct plugs shall be all plastic construction, corrosion proof, water and air tight to 30 psi. Jackmoon or equivalent.

### **975-3 CONSTRUCTION DETAILS**

#### **975-3.01 Conduit.**

**(A) Handling and Storage.** All conduit shall be transported in modules or bundled in a straight and level position. The straps securing the conduit to the vehicle shall be a minimum of 4 inches in width and shall not deform or damage the conduit in any manner. Conduits shall be unloaded in accordance with the manufacturer's recommendations and shall not be dropped to the ground. Conduits shall be stored in a straight and level position in stacks not exceeding 8 feet in height. Materials shall be stored in an approved manner and covered to prevent ultraviolet deterioration due to the exposure to sunlight. When stored, conduit ends shall not be capped nor shall conduit be subject to temperatures in excess of 140° F.

**(B) Cleaning.** The interior of the conduit shall be kept clean and free of debris. Prior to installation, all foreign materials shall be removed from the interior of the conduit with compressed air and a swab.

**(C) Size.** Unless otherwise indicated on the plans or special provisions, all conduit shall be 4-inch diameter.

**(D) Cuts and Connections.** The conduit shall be cut square, de-burred, and trimmed to remove all rough edges. PVC conduit connections shall be of the solvent weld type. Wipe conduit dry and clean before joining. Apply a full coat of primer to the pipe and coupling per the manufacturer's recommendations. Apply a full and even coat of solvent cement to the entire area inserted into the fitting. Prevent excess cement from accumulating in the interior of the conduit. Allow joint to cure a minimum of 20 minutes. The complete joint shall be water tight. Where a connection is made to a steel bend, the coupling used shall be a PVC female adapter. Expansion fittings shall not be installed in PVC conduit runs unless otherwise specified. Expansion fittings shall be installed in conduit runs where both ends are fixed in-place, such as between two foundations, and within concrete structures. Expansion fittings shall allow for a minimum linear expansion of 6 inches.

**(E) Bends.** Bends shall be installed only when absolutely necessary. All bends shall be manufactured out of PVC or rigid steel conduit. Bend shall be factory bent or field bent. Field bends should not have a radius of less than 50 feet. Factory bends shall have a radius of not less than 12 times the nominal diameter of the conduit. Conduit shall be bent without crimping or flattening, using the longest radius practicable. The sum of the deflection angles of all bends in any conduit run shall not exceed 270 degrees between termination and/or junction points. For the purpose of calculating the sum of the deflection angles, bends with a radius of 500 feet or greater may be excluded from these criteria.

**(F) End Treatment.** Conduit ends shall be capped with conduit end caps at all times when work is not in progress. Rigid steel bends terminating in pull boxes shall terminate with an approved plastic bushing.

**(G) Placement.** Conduit runs shown on the plans shall be changed only to avoid underground obstructions and only as directed by the Pima County DOT/TED Project Manager. Unless otherwise specified, conduits shall be placed with a minimum cover of 36 inches to the top of the conduit below the finished grade; the minimum requirement for transportation projects is 30" due to the depth of electrical conduit placement. When conduit runs, or any part thereof, cannot be installed at the minimum depth, the run, or part thereof, shall be encased in concrete. Conduits shall be installed along the straightest horizontal and vertical alignment practicable, and with a uniform depth of cover. Variations in the alignment shall be accomplished with smooth transitions maximizing the radius of the bends. In cases where it is impossible to maintain the alignment of the conduit, the grade of the conduit shall be transitioned using the minimum number and the longest radius bends. Should discovered field conditions necessitate additional bends in the conduit run, the location and number of pull boxes shall be adjusted as directed by the Pima County DOT/TED Project Manager. Conduits to be encased within concrete shall be installed on plastic conduit spacers. The spacers shall be placed at suitable locations to prevent sagging of the conduit between spacers or at 10 foot maximum centers. Prior to the placement of the concrete, the conduits shall be tied down to prevent them from floating.

Conduit penetrations into pull boxes shall be made using the knockouts or shall be cored in the structure. Conduits entering through the side wall of pull boxes shall be located 3 inches above the floor and 3 inches away from the end wall of the box. Conduit entering the bottom of pull boxes shall be located in the near side corner of the box, approximately 3 inches away from the side and end walls. The conduit shall be sloped towards the top center of the box to facilitate pulling of the cables and innerduct. Conduits terminating in pull boxes shall terminate a minimum of 3 inches inside the box wall. The void between the conduit and the box shall be completely filled with mastic to form a watertight seal. Conduits entering vaults shall enter through single duct knockouts. The location of the knockout shall be as indicated on the plans, or directed by the engineer. The joint between the knockout and the conduit shall be filled to form a watertight seal. At all locations where the conduits cross under a new curb, the letters "FO" shall be cut into the top of the curb directly over the conduit run. The letters shall be 3 inches tall and shall be clearly defined.

**975-3.02 Trenching.** Unless otherwise specified, all conduit runs shall be installed by trenching methods. Trenching shall include the removal of all material to the design grade no matter what type of material is encountered. The alignment of the conduit shall be staked in the field per the Pima County standard procedures. When trenching in excess of 5 feet is required, the contractor shall submit, in writing to the Pima County DOT/TED Project Manager, a detailed description of their proposed trenching operations, including shoring methods, prior to the commencement of construction.

All conduit shall be covered with bedding material or concrete at the completion of each day's work to prevent shrinkage and thermal expansion that could influence the alignment of the conduit. Concrete encasement shall be a minimum of Class B (2,500 PSI) in accordance with Pima County/City of Tucson Standard Specifications and provide a minimum cover of 3 inches on all sides of the conduit. Otherwise, bedding and shading of the conduit shall be in accordance with the plans and specifications of the subject project. When installed adjacent to water mains, the conduit shall be encased in concrete.

**(A) Bedding and Shading.** Bedding and shading of the conduit shall be in accordance with the following: Conduits installed in conjunction with Tucson Water projects shall be designed and installed using the plans and specifications of the subject project. Conduits installed with traffic signal or street lighting conduits shall be designed and installed using the plans and specifications of the subject project. Conduits with a depth of cover less than cited above, and where indicated on the plans, shall be encased in concrete. The concrete shall be placed to provide a minimum of 3 inches of encasement on all sides of the conduit.

**(B) Backfill.** Upon completion of the conduit and bedding installation, the trench shall be backfilled and compacted. The backfill shall be designed and constructed using the plans and specifications of the subject project. Place the detectable warning tape in the backfill, 18 inches below finished grade and directly above the conduit.

**975-3.03 Boring and Jacking.** Conduit runs shall be installed by boring and jacking methods when required by the plans or directed by the Pima County DOT/TED Project Manager. The boring and jacking method shall be approved by the Pima County DOT/TED Project Manager prior to the commencement of work. Where a conduit run is required by the plans to be installed by boring or jacking, the trenching method shall not be utilized except with prior written approval of the Pima County DOT/TED Project Manager. When casing is used, the casing shall be schedule 40 “standard wall” steel pipe. The casing shall not deviate more than 0.20 feet from the design grade. The joints in the casing shall be fully welded in accordance with A.S.M.E. Section 9. Concrete end seals shall be provided at each end. The intervening annular space shall be filled with sand material approved by the Pima County DOT/TED Project Manager. Conduits installed within the casing used for water mains shall consist of either four each one (1) inch, four each one and one-half (1 1/2) inch, or two, or more, two (2) inch diameter flexible conduits. The largest practical size shall be used. The conduits shall be strapped to the glass reinforced skids installed on the water line, pulled into the casing after the water main is installed, or installed on a hanger welded to the casing. The alignment of the conduits shall be maintained as straight as possible. The placement of sand within the annular space of the casing shall be controlled to a rate that does not displace the conduit. Boring and jacking pits shall be located a minimum of 2 feet outside the pavement edge. The diameter of the bore shall be as close to the outside diameter of the conduit such that it will enable the conduit to be installed. At all locations where the diameter of the bore is 2 inches, or greater, than the outside diameter of the conduit, the interstitial space between the conduit and the bore shall be filled with slurry. All boring and jacking methods used shall neither damage nor deform the conduit. The installed conduit shall conform to the alignment and grade shown on the plans.

**975-3.04 Concrete Structures.** Conduit embedded in concrete structures shall be securely attached to the reinforcing steel at locations and intervals detailed on the plans. Expansion fittings shall be installed at all locations where the conduit crosses expansion joints in the structure. Expansion joints shall also be installed at the point where the conduit enters and exits the concrete structure. Where it is not possible to install expansion joints, the conduit shall be installed in a conduit sleeve of sufficient size to provide a minimum of 1/2-inch clearance between the outside diameter of the conduit and the inside wall of the sleeve. Sleeves shall be discontinuous across the expansion joints in the structure.

**975-3.05 Pull Boxes and Vaults.** Prior to setting the pull box or vault, verify that the excavation is to the design elevation and alignment. Pull boxes and vaults shall be placed such that the crushed stone does not wash away or into the conduit. Vaults and pull boxes shall NOT be

placed in a location of water drainage or standing water. Set boxes and vaults true and plumb. The top plane of the cover shall be a minimum of 1 inch above finished grade and 6 inches above possible standing water level for the location. Backfill and compact around the structure avoiding damage to the structure. The backfill shall be compacted to a minimum of 95 percent of the maximum density as determined by ASTM D698. Pull boxes are to be placed on a minimum of 5 cubic feet of clean 1 inch (size 57) rock and vaults are to be placed on a minimum of 16 cubic feet of clean 1 inch (size 57) rock. Pull boxes shall be encased in a concrete ring a minimum 10 inches wide and a minimum of 12 inches deep on compacted soil. Each pull box/vault shall be provided with a 5/8 inch by 8 foot ground rod and acorn, driven vertically in the corner with 6 inches of rod exposed above the top of the rainage rock. Install the precast sections in accordance with ASTM C891. Joints between the precast sections shall be sealed with a flexible butyl sealant meeting the requirements of AASHTO M-198. Install precast adjustment rings and the frame and cover to finished grade. Pull boxes shall be encased in a concrete ring a minimum 10 inches wide and a minimum of 12 inches deep on compacted soil. Cables passing through pull boxes require a minimum 50 feet service loop where attainable without exceeding manufacturer's minimum bend radius. Cables pulled through vaults require not less than 150 feet before exiting.

**975-3.06 Innerducts.** All 4 inch conduits shall have a minimum of four 1 inch smooth wall exterior, longitudinally ribbed interior innerducts with 1250 lbs test rated pull strength mule tape installed. Each innerduct within a single conduit shall be of a different color (orange, brown, blue and black).

**975-3.07 Tracer Wire, Electronic Marker, Mule Tape.** A continuous, separate #6 AWG THW/XHHW CU insulated tracer wire shall be installed in each conduit run, external to the innerducts. All lubricants used in the pulling of the tracer wire shall be water soluble. No splicing of the tracer wire shall be permitted in the conduit runs. The ends of the wire shall extend into each pull box, or vault, a minimum of 5 feet, coiled and secured. Connect the ends of all tracer wires within a pull box, or vault, together to a common lug. An electronic marker, 3M model 1255 mini-marker shall be placed by the Contractor at the location of any capped conduit not in a building or pull box/vault. All unoccupied or capped conduits shall have a continuous unspliced unknotted detectable 2500 lbs test rated pull strength mule tape installed, secured at each end and shall be labeled with location of opposite end.

**975-3.08 Testing and Cleaning.** The completed conduit runs shall be cleaned and tested prior to final acceptance. Cleaning shall consist of pulling a swab through the conduit and removing all foreign material from within the conduit. If water is allowed to enter the conduit during construction, it shall be blown out or removed by other satisfactory means prior to the acceptance of the system. Vaults and pull boxes shall be cleaned of all debris. Upon completion of the cleaning operations, the ends of the conduit shall be capped. RGS sweeps terminating in pull boxes shall be plugged. All conduit runs shall be clearance tested after the completion of all backfilling and subgrade preparation operations. This test shall consist of pulling a mandrel through the conduit run. The mandrel shall be segmented with an outer diameter of 1/4 inch less than the inside diameter of the conduit, and shall be 10 inches in length. The test shall be considered acceptable when the mandrel can be passed through the entire conduit run with a pulling force of 300 lbs or less. Each conduit run shall be verified for continuity along its entire length, as noted on the plans, and by means of an underground line locator. The installed conduit system shall be marked on the ground using standard bluestake color code and markings procedures. All testing of the system shall be scheduled with, and conducted in the presence of the Pima County DOT/TED Project Manager. All portions of the

system that do not pass the specified testing shall be repaired by the contractor, and retested, at no additional cost.

#### **975-4 METHOD OF MEASUREMENT**

**975-4.01 Conduits.** Conduits will be measured by the linear foot for each diameter size of conduit. The measurement will be from center to center of pull box or vault. No measurement or direct payment will be made for the trenching, bedding, encasement, tracer wire, marking tape, mule tape, backfill and testing, the cost being considered as included in the contract price for the conduit.

**975-4.02 Pull Boxes.** Pull boxes will be measured as a unit for each pull box installed complete with cover and accessories.

**975-4.03 Vaults.** Vaults will be measured as a unit for each vault complete with frame and cover and accessories.

#### **975-5 BASIS OF PAYMENT**

**975-5.01 Conduit.** Acceptable quantities of conduit, measured as provided above, will be paid for at the contract unit price per linear foot, which price shall be full compensation for the work, complete in place, including any excavation, removals of obstruction, bedding, encasement, backfill, and any incidentals necessary to complete the work.

**975-5.02 Pull Boxes.** Acceptable quantities of pull boxes, measured as provided above, will be paid for at the contract unit price each, which price shall be full compensation for the work, complete in place, including any excavation, removals of obstruction, bedding, coring, knockouts, backfill, and any incidentals necessary to complete the work. Pull Boxes will be paid under Items 7320420 and/or 7320421.

**975-5.03 Vaults.** Acceptable quantities of vaults, measured as provided above, will be paid for at the contract unit price each, which price shall be full compensation for the work, complete in place, including any excavation, removals of obstruction, coring, knockouts, support channels, bedding, backfill, risers, frames and covers, accessories, and any incidentals necessary to complete the work.

## SECTION 1002 – PAINT

**1002-2.01 Three-Paint Coating System** of the Standard Specifications is modified to add:

The following modifications apply to the Metal Mesh Pedestrian Railing, Metal Overlook Pedestrian Railing, Steel Barrier on top of the 32” Concrete Barrier, Steel Barricade Railing on top of the retaining wall at the northeast corner of the northbound bridge (Detail R21), Steel Barricade Railing approaching the southbound and northbound bridges that terminates at the bridge wingwalls, the railing on top of the retaining/entry wall along the bike path near the northeast corner of the northbound bridge (Detail R22), and the steel signs attached to the side of the bridge girders:

Painting New Steel Structures: The items noted above shall be painted with a shop applied, Low VOC zinc-rich aromatic urethane primer, followed by a shop applied two coat paint system prior to field erection. Touch up in the field will be permitted after cleaning, and spot priming have been completed. All steel surfaces shall be painted with three coats of paint.

Paint Colors & Submittals:

Colors shall match the following hues (SW = Sherwin Williams Color Chart)

SW 7742 Agate Green or equal: Agate Green:

For each color specified the Contractor will submit a factory finished color sample, 12”x12” minimum size on the material specified for the work. The Contractor may need to submit up to three variations for each color specified until the correct color balance is achieved. All color samples must be submitted during the same review period, as all colors will be reviewed and approved collectively.

The painting system shall consist of three coats as follows:

- Primer Coat: Low VOC zinc-rich aromatic urethane, Tnemec Series 94-H20 Tnemec Zinc or equal
- 2nd Coat: Low VOC hybrid waterborne epoxy polyamide primer, Tnemec Series 27WB-33GR Grey low VOC HB Epoxoline II or equal
- 3rd Coat: Low VOC aliphatic acrylic polyurethane enamel finish, Tnemec Series 750 Endura-Shield or equal: for pedestrian railing and fencing. Match specified colors for each component.

Paint materials shall comply with following:

1. Zinc-Rich Urethane Primer: Zinc-rich urethane primer with a minimum of 62.0 percent solids by volume plus or minus 2 percent (mixed). VOCs shall be no more than 96 grams per Litre (maximum thinning). Spreading rate shall be a minimum of 331 square feet per gallon (theoretical) at 3.0 dry mils.
  - a. Adhesion: Not less than 1,713 psi pull, average of three trials ( ASTM D 4541). No less than a rating of 5, average of three trials (ASTM D 3359, Method B).
  - b. Salt Spray (Fog): No blistering, cracking, spot rusting or delamination of film. No more than 1/16 inch rust creepage at scribe and no rusting at edges after 10,000 hours exposure (ASTM B 117).
  - c. Immersion: No blistering, cracking, rusting or delamination of film after two years exposure (ASTM D 870).

- d. Prohesion: No blistering, cracking, rusting or delamination of film. No more than 1/8 inch creepage at scribe after 10,000 hours exposure (ASTM G 85).
  - e. Percent Zinc Dust in Dried Film: Minimum 83 percent by weight in dried film.
  - f. Zinc Purity: Meets the requirements of ASTM D 520, Type III.
  - g. Solids by Volume: 62.0 percent plus or minus 2 percent (mixed).
2. Low VOC Hybrid Waterborne Epoxy Polyamide Primer: Satin two-component epoxy coating with a minimum of 100 percent solids by volume plus or minus 2 percent (mixed). VOCs shall be no more than 11 grams/Litre (maximum thinning). Spreading rate shall be a minimum of 301 square feet per gallon (theoretical) at 4.0 mils.
- a. Abrasion: No more than 181 mg loss after 1,000 cycles (ASTM D 4060, CS17 Wheel, 1,000 grams load).
  - b. Adhesion: Not less than 1,140 psi pull, average of three trials (ASTM D 4541). No less than a rating of 5, average of three trials (ASTM D 3359, Method B).
  - c. Cyclic Weathering: No blistering, cracking, rusting or delamination of film after 3,000 hours continuous exposure (ASTM D 5894).
  - d. Deionized Water: No blistering, cracking, rusting or delamination of film after 5,000 hours continuous immersion in deionized water at 140 F (60 C), average of two tests.
  - e. Salt Spray (Fog): No blistering, cracking, rusting or delamination of film. No more than 3/16 inch rust creepage at scribe after 6,200 hours exposure (ASTM B 117).
  - f. Solids by Volume: 100.0 percent plus or minus 2 percent (mixed)
3. Low VOC Hybrid Acrylic Polyurethane Enamel Finish: Semi-gloss pure polyurethane coating with a minimum of 72 percent solids by volume plus or minus 2 percent (mixed). VOCs shall be no more than 99 grams per Litre (maximum thinning). Spreading rate shall be a minimum of 385 square feet per gallon (theoretical) at 3.0 mils.
- a. Abrasion: No more than 19 mg. loss after 1,000 cycles (ASTM D 4060, CS-17 Wheel, 1,000 gram load).
  - b. Adhesion: No less than a rating of 5, average of three tests (ASTM D 3359, Method B, Crosshatch Adhesion). No less than 1,633 psi pull, average of three tests (ASTM D 4541).
  - c. Humidity: No blistering, cracking or delamination of film after 1,500 hours exposure (ASTM D 4585 Condensing Humidity).
  - d. Salt Spray (Fog): No blistering, cracking, rusting or delamination of film after 1,500 hours exposure (ASTM B 117).
  - e. QUV Exposure: No blistering, cracking or chalking. No gloss loss and no more than 0.67 DE00 color change after 4,000 hours exposure (ASTM G 53).
  - f. Solids by Volume: 72 percent plus or minus 2 percent (mixed).

The color for the second coat shall be a contrasting yet complementary color to the third coat.

## SECTION 1005 - BITUMINOUS MATERIALS FOR SURFACING

### 1005-3 BITUMINOUS MATERIAL REQUIREMENTS

**1005-3.01 Asphalt Cement:** the first sentence of the Standard Specifications is revised to read:

Asphalt cement shall be a performance grade (PG 70-10) asphalt binder conforming to the requirements of AASHTO Provisional Standard MP1, and the pressure aging temperature shall be 100 °F.

## SECTION 1006 – PORTLAND CEMENT CONCRETE

### 1006-2 MATERIALS

#### 1006-2.03 Aggregates

**(B) Fine Aggregate, second paragraph, and (C) Coarse Aggregate, second paragraph:** replace the individual Fine and Coarse Aggregate grading requirements with the following for Class X Concrete:

Aggregates shall be combined to meet the trapezoid target area on the Combined Aggregates Relationship Chart as determined by the “Shilstone” procedure for performance based on concrete mixtures. See Chart #1.

Aggregate grading shall follow the trend on the 0.45 Power Curve without major deviations.

Nominal maximum aggregate size shall be 1 inch.

The following is an *Example* of a gradation that satisfies the Shilstone Combined Aggregates criteria for 564 lb/cy cementitious materials:

Sieve Size:	Percent Passing:
1½”	100
1”	96
¾”	84
½”	71
⅜”	60
¼”	-
#4	42
#8	33
#16	25
#30	17
#50	8
#100	2
#200	0.5

A copy of the design procedure and design form is included.

Quality Control – The concrete producer shall maintain a continuing quality control program, including aggregate testing, and making adjustments in proportions where required to meet the Mixture Design requirements.

If the concrete producer has any questions concerning this Special Provision, please contact the Pima County Department of Transportation Materials Lab, located in the Field Engineering Division, 1313 South Mission Road, Tucson, AZ 85713 at (520) 740-2637.

### **1006-3 Design of Mixtures**

**1006-3.01 Design Criteria** of the Standard Specifications is revised to add for Class X Concrete:

Slump shall be 3.5” ± 1 inch.

A maximum of 10% of the required weight of Portland cement may be replaced with a fly ash admixture.

Maximum water/cementitious ratio shall be 0.50.

**1006-3.02 Design Procedures** of the Standard Specifications is modified to add:

At least six weeks prior to the placement of the bridge deck(s), the Contractor shall furnish a mix design for the 4500 psi bridge deck Class X concrete for review and approval. The design should include the following additional information: composite and individual grading, Combined Aggregates Relationship Chart, 0.45 Power Grading Chart, and the Percent Aggregate Retained Chart.

The Engineer shall be solely responsible for determining if the proposed mix is acceptable for the intended purpose.

## CONCRETE MIXTURE DESIGN

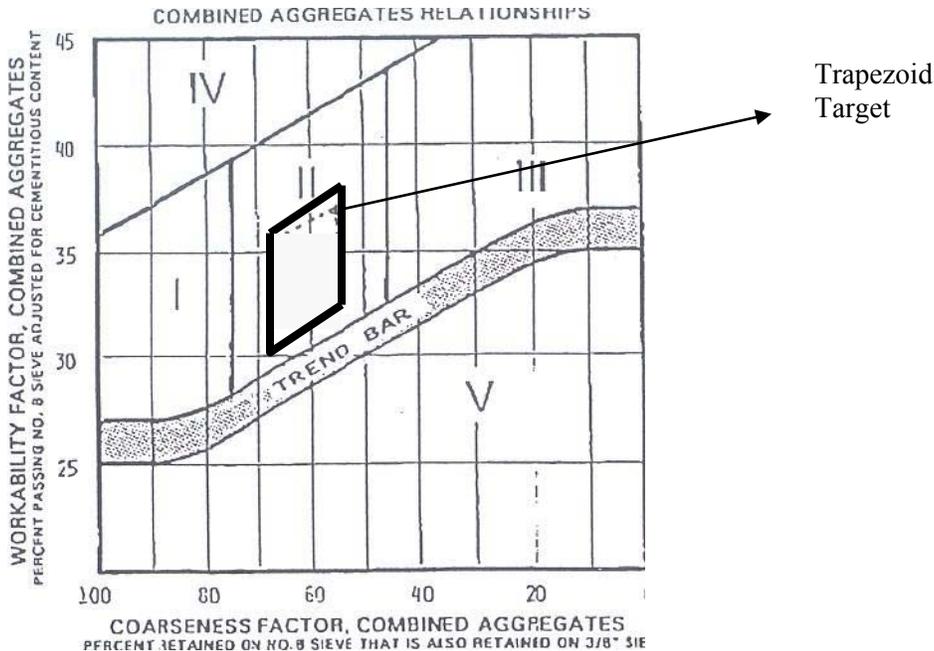


CHART No. 1

## CONCRETE MIX ANALYSIS

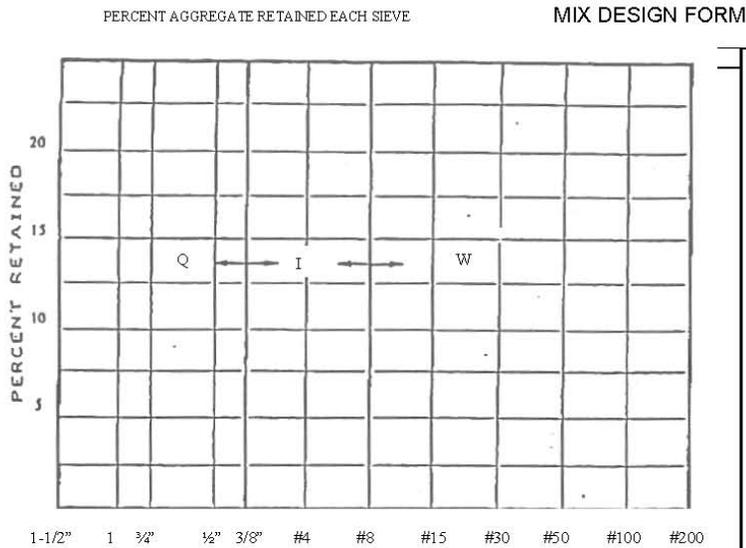
### Worksheet

These charts help evaluate concrete mixture proportions. Instead of using the traditional division of “coarse” and “fine” aggregate at the No. 4 sieve, aggregates are classified in three sizes. The coarse particles (“Q”) are those retained on the 3/8” sieve. The “intermediate” particles (“I”) pass the 3/8” sieve but are retained on the No. 8 sieve. The fine aggregate (“W”) passes the No. 8 sieve.

The Percent Aggregate Retained Chart shows the particle distribution by sieve. Cubically crushed and gravel particles should be well distributed with a high incidence in the intermediate range. They reduce water demand and improve mobility. Avoid peaks (in “Q” & “W”) and valleys (in “I”) unless the intermediate particles are slivered. If slivered, the “I” becomes “Interference” and leads to mobility problems.

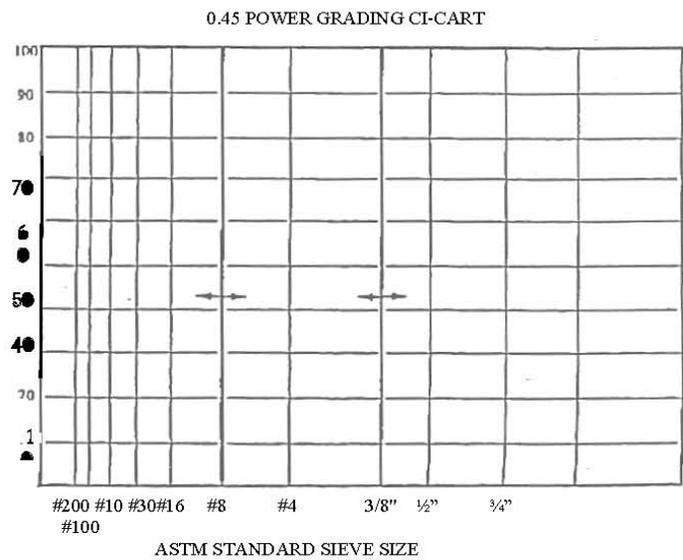
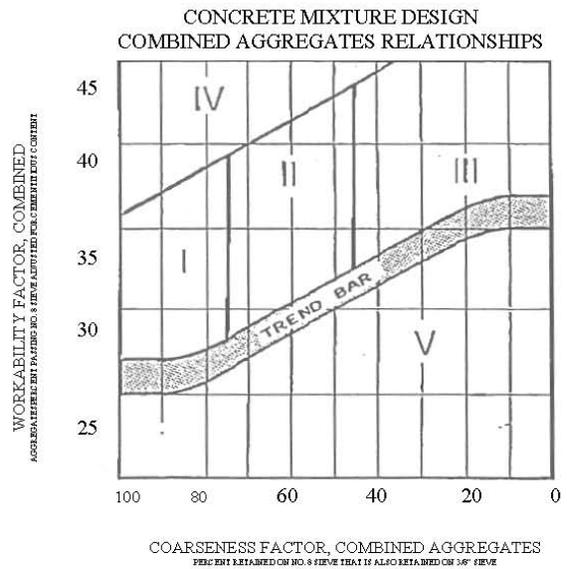
The Optimum Aggregate Chart shows the relationship between the two coarser fractions and the fine fraction. The Coarseness Factor is the percent of all aggregate retained on the No. 8 sieve (“Q” & “I”) that is also retained on the 3/8” sieve (“Q”). The Workability Factor is the percent of all aggregate passing the No. 8 sieve (“W”). It should be adjusted for cementitious materials at the rate of 2.5% per US bag (94 Lbs.) more or less than 6 US bags of cement. Mixes plotted at the top of the trend bar are generally excellent for paving and those placed by chute or bottom-drop bucket in an open space. General use concrete should be 3 to 5 points above trend bar. Mixtures in the “Sandy” area generally have wide strength variations, are difficult to finish, and exhibit a high incidence of crazing and cracking.

The 0.45 Power Chart is an asphalt industry standard but an excellent tool to analyze the combined aggregate in concrete. An optimum asphalt grading should follow the line drawn from the first sieve on which aggregate is retained to “O”. Concrete aggregate gradation should drop below the optimum line bar at the No. 8 sieve. Wide swings across the “optimum” line can indicate potential problems.



MIXTURE ID \_\_\_\_\_

Compressive Strength,	Min PSI	_____
Cementitious Materials:		
Portland Cement, ASTM C150,	Lbs	_____
Fly Ash	Lbs	_____
Total Water,	Lbs/Gal	_____
W/(C/P) Ratio	Max	_____
Aggregate:		
_____ ASTM C33, Size _____,	Lbs - SSD	_____
_____ ASTM C33, Size _____,	Lbs - SSD	_____
_____ ASTM C33, Sand _____,	Lbs - SSD	_____
_____ ASTM C33, Sand _____,	Lbs - SSD	_____
Admixtures/Air Entrainment:		
_____	ozs / cuyd	_____
_____	ozs / cuyd	_____
_____	ozs / cuyd	_____
Slump:		
Without/With HRWR,	Inches	_____



**SECTION 1007 - RETROREFLECTIVE SHEETING**  
of the Standard Specifications is revised to read:

**1007-1 General Requirements**

Retroreflective sheeting shall consist of a retroreflective system having a smooth outer surface. The sheeting shall have a pre-coated adhesive on the back side protected by an easily removable liner. The sheeting shall conform to all criteria in the most current version of AASHTO M 268 for the applicable type and class or as modified herein. Retroreflective sheeting of the same color placed on the same sign panel or adjacent sign panels shall be color matched and be from the same manufacturing lot and run.

Only those sign sheeting products currently shown in the ADOT's Approved Products List (APL) shall be utilized in the performance of this work. Copies of the most recent version of the APL are available on the internet at: <http://www.dot.state.az.us/ABOUT/atrc/apl.htm>.

Manufacturer's identification marks shall be fabricated in, or on, the face of the various types of sheeting utilized. The markings shall be visible from a distance not greater than three feet, and the identification codes shall be furnished to the Engineer.

A Certificate of Compliance, conforming to the requirements of Subsection 106.05, shall be submitted.

**1007-2 Reflective Materials Types**

Retroreflective sheeting shall meet the requirements of AASHTO M 268 for the types of sheeting called for in the project plans. The minimum criteria to be met are those established for Type II sheeting. Only those products which meet or exceed these requirements and which are listed in the Department's Approved Products list shall be used. The specific type of sheeting for each application shall be called for in the project plans. If no sheeting type is designated, the contractor shall furnish Type II sheeting.

**1007-3 Color Requirements**

The color shall be as specified in the ADOT Manual of Approved Signs or on the project plans.

The Engineer may accept colors by certification or may require the contractor to furnish laboratory test results.

**1007-4 Specific Intensity Per Unit Area (SIA)**

The Specific Intensity per Unit Area (SIA) shall meet the minimum requirements of AASHTO M 268 for the type of sheeting called for in the Manual of Approved Signs or the project plans.

**1007-5 Color Processing**

Color processing shall meet all requirements specified in AASHTO M 268. Opaque or transparent colors, inks and paints used in sign fabrication shall be of the type and quality as recommended by the manufacturer of the reflective sheeting. Only those products listed in the approved Products List

shall be used. Application will be by a screen process which results in uniform color and tone, possessing sharply defined edges of legend and border. Screen Mesh P.E. 157, using a fill pass, shall be used for applying transparent colors. After the ink is applied, the inked colors shall meet the minimum SIA requirements for the basic color and the type of sheeting being used.

**1007-6 Adhesive**

The reflective sheeting shall include either Class 1 or Class 2 adhesive backing as specified in AASHTO M 268.

**SECTION 1009 - ASPHALT-RUBBER MATERIAL**  
of the Standard Specifications is revised to read:

**1009-1 DESCRIPTION**

The work under this section shall consist of furnishing, proportioning and mixing all the ingredients necessary to produce an asphalt-rubber material.

**1009-2 MATERIALS**

**1009-2.01 Asphalt-Rubber.**

(A) **Asphalt Cement.** Asphalt cement shall be a performance grade (PG) asphalt binder conforming to the requirements of Section 1005.

(B) **Rubber.** Rubber shall meet the following gradation requirements when tested in accordance with Arizona Test Method 714.

Sieve Size	Percent Passing	
	Type A	Type B
No. 8	100	
No. 10	95 - 100	100
No. 16	0 - 10	65 - 100
No. 30		20 - 100
No. 50		0 - 45
No. 200		0 - 5

The rubber shall have a specific gravity of  $1.15 \pm 0.05$  and shall be free of wire or other contaminating materials, except that Type A rubber shall contain not more than 0.1 percent fabric and Type B shall contain not more than 0.5 percent fabric. Calcium carbonate, up to four percent by weight of the granulated rubber, may be added to prevent the particles from sticking together.

Certificates of Compliance conforming to Subsection 106.05 shall be submitted. In addition, the certificates shall confirm that the rubber is a crumb rubber, derived from processing whole scrap tires or shredded tire materials; and the tires from which the crumb rubber is produced are taken from automobiles, trucks, or other equipment owned and operated in the United States. The

certificates shall also verify that the processing does not produce, as a waste product, casings or other round tire material that can hold water when stored or disposed of above ground.

**1009-2.02 Asphalt-Rubber Proportions.** The asphalt-rubber shall contain a minimum of 20 percent ground rubber by the weight of the asphalt cement.

**1009-2.03 Asphalt-Rubber Properties.** Asphalt-rubber shall conform to the following:

Property	Requirement		
	Type 1	Type 2	Type 3
Grade of base asphalt cement	PG 64-16	PG 58-22	PG 52-28
Rotational Viscosity *; 350 °F; Pascal seconds	1.5 – 4.0	1.5 - 4.0	1.5 - 4.0
Penetration; 39.2 °F, 200 g, 60 sec. (ASTM D 5); minimum	10	15	25
Softening Point; (ASTM D 36); °F, minimum	135	130	125
Resilience; 77 °F (ASTM D 5329); %, minimum	30	25	15
* The viscotester used must be correlated to a Rion (formerly Haake) Model VT-04 viscotester using the No. 1 Rotor . The Rion viscotester rotor, while in the off position, shall be completely immersed in the binder at a temperature from 350 to 355 degrees F for a minimum heat equilibrium period of 60 seconds, and the average viscosity determined from three separate constant readings ( $\pm 0.5$ pascal seconds) taken within a 30 second time frame with the viscotester level during testing and turned off between readings. Continuous rotation of the rotor may cause thinning of the material immediately in contact with the rotor, resulting in erroneous results.			

**1009-2.04 Asphalt-Rubber Design.** At least two weeks prior to the use of asphalt-rubber, the Contractor shall submit an asphalt-rubber design prepared by an approved laboratory. Such design shall meet the requirements specified herein. The design shall show the values obtained from the required tests, along with the following information: percent, grade and source of the asphalt cement used; and percent, gradation and source(s) of rubber used.

**1009-3 CONSTRUCTION DETAILS**

During production of asphalt-rubber, the Contractor shall combine materials in conformance with the asphalt-rubber design unless otherwise approved by the Engineer.

**1009-3.01 Mixing of Asphalt-Rubber.** The temperature of the asphalt cement shall be between 350 and 400° F at the time of addition of the ground rubber. No agglomerations of rubber particles in excess of two inches in the least dimension shall be allowed in the mixing chamber. The ground rubber and asphalt-cement shall be accurately proportioned in accordance with the design and thoroughly mixed prior to the beginning of the one-hour reaction period. The Contractor shall document that the proportions are accurate and that the rubber has been uniformly incorporated into

the mixture. Additionally the Contractor shall demonstrate that the rubber particles have been thoroughly mixed such that they have been "wetted." The occurrence of rubber floating on the surface or agglomerations of rubber particles shall be evidence of insufficient mixing. The temperature of the asphalt-rubber immediately after mixing shall be between 325 and 375° F. The asphalt-rubber shall be maintained at such temperature for one hour before being used.

Prior to use, the viscosity of the asphalt-rubber shall be tested by the use of a rotational viscotester, which is to be furnished by the Contractor or supplier.

**1009-3.02 Handling of Asphalt-Rubber.** Once the asphalt-rubber has been mixed, it shall be kept thoroughly agitated during periods of use to prevent settling of the rubber particles. During the production of asphaltic concrete the temperature of the asphalt-rubber shall be maintained between 325 and 375° F. However, in no case shall the asphalt-rubber be held at a temperature of 325° F or above for more than 10 hours. Asphalt-rubber held for more than 10 hours shall be allowed to cool and gradually reheated to a temperature between 325 and 375° F before use. The cooling and reheating shall not be allowed more than one time. Asphalt-rubber shall not be held at temperatures above 250° F for more than four days.

For each load or batch of asphalt-rubber, the Contractor shall provide the Engineer with the following documentation:

- (1) The source, grade, amount and temperature of the asphalt cement prior to the addition of rubber.
- (2) The source and amount of rubber added and the rubber content expressed as percent by the weight of the asphalt cement.
- (3) Times and dates of the rubber additions and resultant viscosity test.
- (4) A record of the temperature, with time and date reference for each load or batch. The record shall begin at the time of the addition of rubber and continue until the load or batch is completely used. Readings and recordings shall be made at every temperature change in excess of 20 degrees F, and as needed to document other events which are significant to batch use and quality.

## **SECTION 1010 - PIPE MATERIALS**

**1010-2.09 Corrugated High Density Polyethylene Pipe.** of the Standard Specifications is modified to add:

For pipe sizes above 24 inches (*610 millimeters*) in diameter, materials must meet with the approval of the Engineer.

Water resistant joints shall be watertight according to the requirements of ASTM D 3212, except that the internal water pressure test shall be conducted at 2 psi (*14 kPa*), during which the joint leakage shall not exceed 200 gallons per inch of diameter per mile of pipe per day (*19 liters per millimeter of diameter per kilometer of pipe per day*).

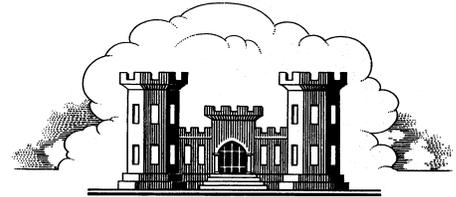
# **Appendix A**

Nationwide Permit Number 14

and

State of Arizona 401 Water Quality Conditions

# NATIONWIDE PERMIT NUMBER 14



## LINEAR TRANSPORTATION PROJECTS

**US Army Corps of Engineers  
Los Angeles District  
Regulatory Division/Arizona Branch**

Pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344) and/or Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 401 et seq) the U.S. Army Corps of Engineers published the "Reissuance of Nationwide Permits" in the Federal Register (72 FR 11092) on March 12, 2007. This Nationwide Permit is effective from March 19, 2007 to March 18, 2012 unless modified, reissued or revoked before that time. It is incumbent upon the permittee to remain informed of changes to the nationwide permits.

**14. Linear Transportation Projects.** Activities required for the construction, expansion, modification, or improvement of linear transportation projects (e.g., roads, highways, railways, trails, airport runways, and taxiways) in waters of the United States. For linear transportation projects in non-tidal waters, the discharge cannot cause the loss of greater than ½ acre of waters of the United States. For linear transportation projects in tidal waters, the discharge cannot cause the loss of greater than 1/3 acre of waters of the United States. Any stream channel modification, including bank stabilization, is limited to the minimum necessary to construct or protect the linear transportation project; such modifications must be in the immediate vicinity of the project.

This NWP also authorizes temporary structures, fills, and work necessary to construct the linear transportation project. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

This NWP cannot be used to authorize non-linear features commonly associated with transportation projects, such as vehicle maintenance or storage buildings, parking lots, train stations, or aircraft hangars.

*Notification:* The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity if: (1) The loss of waters of the United States exceeds 1/10 acre; or (2) there is a discharge in a special aquatic site, including wetlands. (See general condition 27.) (Sections 10 and 404)

*Note:* Some discharges for the construction of farm roads or forest roads, or temporary roads for moving mining equipment, may qualify for an exemption under Section 404(f) of the Clean Water Act (see 33 CFR 323.4).

### 401 Certification

**303[d]-impaired waters (see Water Quality Definitions):** For projects on a waterbody with an impaired reach, if the project impacts the listed waterbody within 800 meters (or ½ mile) downstream of an impaired reach to within 1600 meters (or 1 mile) upstream of an impaired reach: Individual 401 Certification.

**Tributaries to 303[d]-impaired waters:** For projects on a tributary to a waterbody listed as impaired, if the tributary mouth is on an impaired reach and the project impacts the tributary within 1600 meters (or 1 mile) of its mouth: Individual 401 Certification.

**Outstanding Arizona Waters (a.k.a. "unique Waters") (see Water Quality Definitions):** For projects on a designated Outstanding Arizona Water, if the project impacts the designated waterbody within 800 meters (or ½ mile) downstream of a designated reach to within 1600 meters (or 1 mile) upstream of a designated reach: Individual 401 Certification.

**Tributaries to Outstanding Arizona Waters:** For projects on a tributary to a designated Outstanding Arizona Water, if the tributary mouth is on a designated reach and the project impacts the tributary within 1600 meters (or 1 mile) of its mouth: Individual 401 Certification.

**Lake (see Water Quality Definitions):** Individual 401 Certification required.

**Other waters:** Conditionally certified (all applicable general 401 conditions, below). *Note: Conditional certification only applies when none of the other 401 certification categories apply.*

**Tribal Waters:** Hualapai Tribe – Individual Certification required

### State of Arizona 401 Water Quality Conditions

Except as noted, the following 401 General Conditions apply to all waters of the U.S. (WUS) and all applicable NWP:

1. Any discharge (including runoff or seepage) occurring as a result of activities certified for the subject project shall not cause a violation of surface water quality standards for any WUS. Applicability of this condition is as defined in A.A.C. R18-11-102.
2. This certification does not authorize the discharge of process water, material processing residues, wastewater or other residual material to any WUS.
3. Activities herein certified shall be performed during periods of low flow (baseflow or less) in any watercourse or other WUS, or no flow in the case of ephemeral and intermittent waterbodies.
4. If activities are likely to create an erosion or sedimentation problem, operations shall cease until the problem is resolved or until reasonable control measures have been undertaken.
5. Erosion control, sediment control and/or bank protection measures shall be installed before construction and pre-operation activities, and shall be maintained as necessary during construction and post-construction periods to minimize channel or bank erosion, soil loss and sedimentation. Control measures shall not be constructed of uncemented or unconfined soil, or other easily transportable (by flow) materials.
6. The applicant is responsible for ensuring construction material and/or fill including, but not limited to: rock, gabion fill or other uncemented channel-lining materials, placed within the Ordinary High Water Mark (OHWM) of any WUS, shall not include materials that can cause or contribute to an exceedence of Arizona Water Quality Standards for Surface Waters (18, A.A.C., 11, Article 1). Any fill material washing must occur outside of the floodplain of any WUS prior to placement and the rinseate from such washing shall be contained and settled or otherwise prevented from contributing sediment or causing erosion to any WUS. Fill placed in locations subject to scour shall contain not more than ten percent (10%) on a dry weight basis of particles finer than 0.25 mm diameter (passing a No. 60 sieve).
7. Any dredged material is to be placed and retained in areas outside the OHWM of any WUS. Runoff from materials deposited outside the OHWM is to be settled, filtered or otherwise treated to prevent escape of pollutants (including sediment) to any WUS.
8. Except as otherwise allowed herein, upon completion of construction the applicant shall ensure no adverse change due to the subject project has occurred in the stability (with respect to stream geometry, erosion and sedimentation) of any WUS, including upstream and downstream from the project. If such change has occurred, the applicant shall take steps to restore the pre-project stability of any impacted segments.
9. Except where the activities certified herein are intended to permanently alter any WUS, all disturbed areas between the OHWM shall be restored to preconstruction conditions. Denuded areas shall be revegetated as soon as possible with native and/or salvaged plants and seed. Vegetation should be maintained on unarmored banks and slopes to stabilize soil and prevent erosion.
10. Where needed to prevent erosion/sedimentation, flows unimpacted by the subject project shall be diverted around work operations, and material and equipment storage areas. Permanent and temporary access roadways, staging areas and material stockpiles shall be designed or located to allow storm flows to pass unimpeded. Except as otherwise allowed herein, when flow is present in any wash or other WUS within the project area, the applicant and any contractor will not impede, restrict, or stop the flow by any means.
11. Permanent and temporary pipes and culverted crossings and pads shall be adequately sized to handle expected flow and properly set with end section, splash pads, or headwalls that dissipate water energy to control erosion. Culverted and unculverted crossings and pads shall be constructed so as to accommodate the overtopping of the fill by streamflow and armored to prevent erosion of the fill.
12. Acceptable construction materials that will or may contact water in any WUS are: crushed stone, native fill (meeting the requirements in 401 General Condition 6) concrete, steel, plastic, or aluminum and other materials specifically approved in writing by ADEQ.
13. Silt laden or turbid water resulting from project activity shall be settled, filtered or otherwise treated prior to discharge to ensure no violation of Arizona Surface Water Quality Standards in any WUS.
14. When flow greater than described in 401 General Condition 3 above is present within the project area, all activities certified herein shall cease and construction equipment and materials easily transported by flow will be moved outside the flow area and the OHWM of any WUS. If such movement cannot be accomplished rapidly enough to prevent pollution of a WUS, measures shall be taken to prevent transport of sediment or other pollutants out of the construction area or into any WUS.

15. Work shall be conducted and monitored to ensure that pollution from the activities certified herein including, but not limited to: earthwork, concrete mixing and placement, detention ponds, and equipment maintenance and washing does not drain into any WUS.
16. If water is used for dust suppression, it shall not contain contaminants that could violate Arizona Surface Water Quality Standards of any WUS.
17. The applicant will erect any barriers, covers, shields and other protective devices as necessary to prevent any construction materials, equipment or contaminants/pollutants from falling, being thrown or otherwise entering any flowing WUS.
18. Upon completion of the activities certified herein, areas within the OHWM of all WUS at the project site shall be promptly cleared of all false work, piling, construction residues, equipment, debris or other obstructions. Any debris including, but not limited to: soil, silt, sand, rubbish, cement, bituminous material, oil or petroleum products, organic materials, tires or batteries, derived from the activities certified herein shall not be stored at any site where it may be washed into a WUS and shall be properly disposed of after completion of the work.
19. The applicant must designate area(s) for equipment staging and storage located where runoff from these activities cannot enter any WUS. Any equipment maintenance, washing or fueling that cannot be done offsite will be done here. Material specifically manufactured and sold as spill adsorbent/absorbent will be on hand to control small spills. All equipment and workboats shall be inspected for leaks daily and prior to use. All leaks shall be repaired immediately. All equipment and workboats will be steam cleaned prior to use in any WUS with flow.
20. The applicant shall have a spill containment plan onsite to ensure that pollutants are contained, removed and properly disposed of. In addition, the applicant must designate areas, located where runoff from these activities cannot enter any WUS, for chemical and petroleum storage, and solid waste containment. All materials stored onsite will be stored in appropriate containers or packaging. Any pollutant produced by activities certified herein shall be properly disposed of in accordance with applicable regulations. A spill response kit will be maintained in this (these) area(s) to mitigate a potential spill. The kit will include material specifically manufactured and sold as spill adsorbent/absorbent including booms. The applicant will ensure that whenever there is activity on the site, that there are personnel on site trained in the proper response to spills and the use of spill response equipment.
21. If fully, partially or occasionally submerged structures are constructed of cast-in-place concrete instead of pre-cast concrete planks or slabs, applicant will take steps; e.g., sheet piling or temporary dams (except for NWP 33 & 15, filled cofferdams are not allowed), to prevent contact between water (instream and runoff) and the concrete until it cures and until any curing agents have evaporated or otherwise cease to be available; i.e., are no longer a pollutant threat. Where possible, construction work will be during extreme low water conditions or at a time and season that ensures all work is done in the dry.
22. For portions of the project utilizing potable water or groundwater for irrigation, direct runoff of irrigation water and overflows from runoff detention and/or retention areas into washes shall be limited to the extent practicable and shall not cause downstream erosion or flooding.
23. For portions of the project utilizing reclaimed wastewater for irrigation, direct runoff of irrigation water and overflow from retention/detention structures or storage impoundments into WUS is prohibited without the proper permits including, but not limited to, Arizona's Reclaimed Wastewater Permit and, if within the wetted area of a 25-year flood event (or within the floodplain in some cases), a AZPDES permit.
24. Fertilizer, herbicide and insecticide chemicals used for development of vegetated areas shall be selected based on minimum environmental impacts and approved for the intended use. Application rates printed on the product labels shall be strictly followed. Excess chemicals shall not be applied on recently treated areas and must either be stored, used elsewhere or disposed of (in any case, in accordance with all applicable regulations).

### **Water Quality Definitions**

**303[d]-listed Impaired Waters:** These are waterbodies that as a result of the CWA 305[b] process are listed under CWA 303[d] as impaired; i.e., consistently not meeting water quality standards, and as a result merit special attention. The complete current 303[d] list of Impaired Waters is available on ADEQ's website:

<http://www.azdeq.gov/environ/water/assessment/assess.html>

(401 conditions herein are meant to apply to waterbodies on the current, not draft, list)

**Lake:** The following are lakes which require an individual 401 certification for activities undertaken via a NWP:

**Apache County**

- |                |                     |                       |
|----------------|---------------------|-----------------------|
| • Becker Lake  | Lat.: 34° 9' 14.4"  | Long.: 109° 18' 18.0" |
| • Carnero Lake | Lat.: 34° 6' 57.6"  | Long.: 109° 31' 40.8" |
| • Lyman Lake   | Lat.: 34° 21' 28.8" | Long.: 109° 21' 28.8" |

**Cochise County**

- Parker Canyon Lake Lat.: 31° 25' 33.6" Long.: 110° 27' 14.4"

**Coconino County**

- Ashurst Lake Lat.: 35° 1' 08.4" Long.: 111° 24' 10.8"
- Bear Canyon Lake Lat.: 34° 24' 10.8" Long.: 111° 0' 10.8"
- Blue Ridge Reservoir Lat.: 34° 33' 14.4" Long.: 111° 11' 02.4"
- Boot Lake Lat.: 34° 58' 51.6" Long.: 111° 19' 58.8"
- Chevelon Canyon Lake Lat.: 34° 30' 39.6" Long.: 110° 49' 26.4"
- Kinnikinick Lake Lat.: 34° 53' 52.8" Long.: 111° 18' 21.6"
- Lake Mary, Lower Lat.: 35° 6' 21.6" Long.: 111° 34' 19.2"
- Lake Mary, Upper Lat.: 35° 4' 44.4" Long.: 111° 31' 55.2"
- Long Lake Lat.: 34° 46' 44.4" Long.: 111° 12' 0.0"
- Long Lake Lat.: 35° 0' 0.0" Long.: 111° 20' 60.0"
- Mormon Lake Lat.: 34° 56' 38.4" Long.: 111° 27' 10.8"
- Odell Lake Lat.: 34° 56' 02.4" Long.: 111° 37' 51.6"
- Soldier Annex Lake Lat.: 34° 47' 13.2" Long.: 111° 13' 48.0"
- Soldier Lake Lat.: 34° 47' 13.96" Long.: 111° 13' 48.0"
- Steel Dam Lake Lat.: 35° 13' 37.2" Long.: 112° 24' 50.4"
- Stone Dam Lake Lat.: 35° 13' 37.2" Long.: 112° 24' 14.4"
- Stoneman Lake Lat.: 34° 46' 44.4" Long.: 111° 31' 04.8"
- Whitehorse Lake Lat.: 35° 7' 01.2" Long.: 112° 0' 46.8"
- Woods Canyon Lake Lat.: 34° 20' 06.0" Long.: 110° 56' 34.8"

**Gila County**

- Roosevelt Lake Lat.: 33° 40' 44.4" Long.: 111° 9' 14.4"

**La Paz County**

- Alamo Lake Lat.: 34° 14' 45.6" Long.: 113° 34' 58.8"

**Maricopa County**

- Apache Lake Lat.: 33° 35' 31.2" Long.: 111° 20' 31.2"
- Bartlett Lake Lat.: 33° 49' 01.2" Long.: 111° 37' 44.4"
- Canyon Lake Lat.: 33° 32' 38.2" Long.: 111° 26' 06.1"
- Lake Pleasant Lat.: 33° 51' 14.4" Long.: 112° 16' 15.6"
- Painted Rock Borrow Pit Lat.: 33° 4' 58.8" Long.: 113° 1' 19.2"
- Painted Rock Reservoir Lat.: 33° 4' 15.6" Long.: 113° 0' 28.8"
- Roosevelt Lake Lat.: 33° 40' 44.4" Long.: 111° 9' 14.4"
- Saguaro Lake Lat.: 33° 34' 01.2" Long.: 111° 32' 06.0"

**Mojave County**

- Alamo Lake Lat.: 34° 14' 45.6" Long.: 113° 34' 58.8"

**Navajo County**

- Rainbow Lake Lat.: 34° 9' 03.6" Long.: 109° 59' 02.4"
- Show Low Lake Lat.: 34° 11' 24.0" Long.: 109° 59' 56.4"

**Pima County**

- Arivaca Lake Lat.: 31° 31' 51.6" Long.: 111° 15' 03.6"

**Santa Cruz County**

- Arivaca Lake Lat.: 31° 31' 51.6" Long.: 111° 15' 03.6"
- Patagonia Lake Lat.: 31° 29' 31.2" Long.: 110° 52' 01.2"
- Peña Blanca Lake Lat.: 31° 24' 10.8" Long.: 111° 5' 02.4"

**Yavapai County**

- Granite Basin Lake Lat.: 34° 37' 02.1" Long.: 112° 32' 56.5"
- Horseshoe Reservoir Lat.: 33° 58' 58.8" Long.: 111° 42' 28.8"

• Horsethief Lake	Lat.: 34° 9' 43.2"	Long.: 112° 17' 56.4"
• Lake Pleasant	Lat.: 33° 51' 14.4"	Long.: 112° 16' 15.6"
• Lynx Lake	Lat.: 34° 31' 08.4"	Long.: 112° 23' 06.0"
• Peck's Lake	Lat.: 34° 47' 06.0"	Long.: 112° 2' 31.2"
• Watson Lake	Lat.: 34° 35' 16.8"	Long.: 112° 25' 04.8"

**Other Waters:** Any waters of the United States, occurring on non-tribal land, that does not fall within one of the other definitions listed here.

**Outstanding Arizona Waters:** ADEQ is in the process of the triennial review of surface water quality standards (18 Arizona Administrative Code 11, Art 1) and among other things, this entails an updating of the Unique Waters of the state. A definite change is the name: instead of "Unique Waters", these bodies of water shall be referred to as "Outstanding Arizona Waters". Current Water Quality Standards For Surface Waters are available on the Arizona Secretary of State website ([http://azsos.gov/public\\_services/Title\\_18/18-11.pdf](http://azsos.gov/public_services/Title_18/18-11.pdf)).

The following are currently classified as Unique Waters (from R18-11-112(E), Arizona Administrative Code):

#### **Apache County**

- The West Fork of the Little Colorado River, from its headwaters to Government Springs at Latitude 33° 59' 33" / Longitude 109° 27' 54".
- Lee Valley Creek, from its headwaters to confluence with Lee Valley Reservoir.
- Hay Creek, from its headwaters to its confluence with the West Fork of the Black River.
- Stinky Creek, from the White Mountain Apache Indian Reservation boundary to its confluence with the West Fork of the Black River.

#### **Cochise County**

- Cave Creek from the headwaters to the Coronado National Forest boundary.
- South Fork of Cave Creek from its headwaters to its confluence with Cave Creek.

#### **Coconino County**

- Oak Creek from its headwaters to confluence with the Verde River.
- West Fork of Oak Creek from its headwaters to confluence with Oak Creek.

#### **Gila County**

- (Proposed ) Fossil Creek, from its headwaters at the confluence of Sandrock and Calf Pen Canyons above Fossil Springs to its confluence with the Verde River.

#### **Graham County**

- Bonita Creek, from the boundary of the San Carlos Indian Reservation to its confluence with the Gila River.
- Aravaipa Creek, from its confluence with Stowe Gulch at Latitude 32° 52' 10" / Longitude 110° 22' 03" to the downstream boundary of Aravaipa Canyon Wilderness Area at Latitude 32° 54' 23" / Longitude 110° 33' 42".

#### **Greenlee County**

- Bear Wallow Creek, from its headwaters to the boundary of the San Carlos Indian Reservation.
- North Fork of Bear Wallow Creek, from its headwaters to confluence with Bear Wallow Creek.
- South Fork of Bear Wallow Creek, from its headwaters to confluence with Bear Wallow Creek.
- Snake Creek, from its headwaters to its confluence with the Black River.
- KP Creek, from its headwaters to its confluence with the Blue River.

#### **Mohave County**

- Francis Creek, from its headwaters to its confluence with Burro Creek.

#### **Pima County**

- Cienega Creek, from confluence with Gardner Canyon and Spring Water Canyon to USGS gaging station at Latitude 32° 02' 09" / Longitude 110° 40' 36".
- Buehman Canyon Creek, from its headwaters to confluence with unnamed tributary at Latitude 32° 24' 31.5" / Longitude 110° 32' 08".
- Aravaipa Creek, from its confluence with Stowe Gulch at Latitude 32° 52' 10" / Longitude 110° 22' 03" to the downstream boundary of Aravaipa Canyon Wilderness Area at Latitude 32° 54' 23" / Longitude 110° 33' 42".

## **Yavapai County**

- Oak Creek from its headwaters to confluence with the Verde River.
- Peoples Canyon Creek from its headwaters to confluence with the Santa Maria River.
- Burro Creek, from its headwaters to confluence with Boulder Creek.
- Francis Creek, from its headwaters to its confluence with Burro Creek.

**Tribal Waters:** All waters of the United States occurring on tribal lands.

**Unique Waters:** Now known as “Outstanding Arizona Waters”

### **Regional Conditions**

Of the ten regional conditions effective within the Los Angeles District of the Corps of Engineers, three apply to projects within Arizona (2, 3, and 4). The remaining conditions apply to specific geographic areas, resources or species in California.

The following regional conditions must be followed in order for any authorization by an NWP to be valid in the State of Arizona:

**Regional Condition 2:** For the State of Arizona and the Mojave and Sonoran (Colorado) desert regions of California in Los Angeles District (generally north and east of the San Gabriel, San Bernardino, San Jacinto, and Santa Rosa mountain ranges, and south of Little Lake, Inyo County), no nationwide permit, except Nationwide Permits 1 (Aids to Navigation), 2 (Structures in Artificial Canals), 3 (Maintenance), 4 (Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities), 5 (Scientific Measurement Devices), 6 (Survey Activities), 9 (Structures in Fleeting and Anchorage Areas), 10 (Mooring Buoys), 11 (Temporary Recreational Structures), 20 (Oil Spill Cleanup), 22 (Removal of Vessels), 27 (Stream and Wetland Restoration Activities), 30 (Moist Soil Management for Wildlife), 31 (Maintenance of Existing Flood Control Projects), 32 (Completed Enforcement Actions), 35 (Maintenance Dredging of Existing Basins), 37 (Emergency Watershed Protection and Rehabilitation), and 38 (Cleanup of Hazardous and Toxic Waste), or other nationwide or regional general permits that specifically authorize maintenance of previously authorized structures or fill, can be used to authorize the discharge of dredged or fill material into a jurisdictional special aquatic site as defined at 40 CFR Part 230.40-45 (sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle-and-pool complexes).

**Regional Condition 3:** For all projects proposed for authorization by nationwide or regional general permits where prior notification to the District Engineer is required, applicants must provide color photographs or color photocopies of the project area taken from representative points documented on a site map. Pre-project photographs and the site map would be provided with the permit application. Photographs should represent conditions typical or indicative of the resources before impacts.

**Regional Condition 4:** Notification pursuant to general condition 13 shall be required for projects in all special aquatic sites as defined at 40 CFR Part 230.40-45 (sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle-and-pool complexes), and in all perennial watercourses or waterbodies in the State of Arizona and the Mojave and Sonoran (Colorado) desert regions of California in Los Angeles District (generally north and east of the San Gabriel, San Bernardino, San Jacinto, and Santa Rosa mountain ranges, and south of Little Lake, Inyo County), excluding the Colorado River from Davis Dam downstream to the north end of Topock and downstream of Imperial Dam.

### **General Conditions**

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as appropriate, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/ or Coastal Zone Management Act consistency for an NWP.

#### **1. Navigation**

- (a) No activity may cause more than a minimal adverse effect on navigation.
- (b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.
- (c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

#### **2. Aquatic Life Movements**

No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. Culverts placed in streams must be installed to maintain low flow conditions.

#### **3. Spawning Areas**

Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

#### **4. Migratory Bird Breeding Areas**

Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

**5. Shellfish Beds**

No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWP 4 and 48.

**6. Suitable Material**

No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

**7. Water Supply Intakes.**

No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

**8. Adverse Effects From Impoundments.**

If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

**9. Management of Water Flows**

To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization and storm water management activities, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

**10. Fills Within 100-Year Floodplains.**

The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

**11. Equipment**

Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

**12. Soil Erosion and Sediment Controls**

Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow.

**13. Removal of Temporary Fills**

Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

**14. Proper Maintenance**

Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety.

**15. Wild and Scenic Rivers**

No activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status. Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency in the area (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service).

**16. Tribal Rights**

No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

**17. Endangered Species**

(a) No activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless Section 7 consultation addressing the effects of the proposed activity has been completed.

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements.

(c) Non-federal permittees shall notify the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that may be affected by the proposed work or that utilize the designated critical habitat that may be affected by the proposed work. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the project, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification the proposed activities will have "no effect" on listed species or critical habitat, or until Section 7 consultation has been completed.

(d) As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species-specific regional endangered species conditions to the NWPs.

(e) Authorization of an activity by a NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the U.S. FWS or the NMFS, both lethal and non-lethal "takes" of protected species are in violation of the ESA. Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the U.S. FWS and NMFS or their world wide Web pages at <http://www.fws.gov/> and <http://www.noaa.gov/fisheries.html> respectively.

## 18. Historic Properties

(a) In cases where the district engineer determines that the activity may affect properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of Section 106 of the National Historic Preservation Act. Federal permittees must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the authorized activity may have the potential to cause effects to any historic properties listed, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties may be affected by the proposed work or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of or potential for the presence of historic resources can be sought from the State Historic Preservation Officer or Tribal Historic Preservation Officer, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted and these efforts, the district engineer shall determine whether the proposed activity has the potential to cause an effect on the historic properties. Where the non-Federal applicant has identified historic properties which the activity may have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects or that consultation under Section 106 of the NHPA has been completed.

(d) The district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA Section 106 consultation is required. Section 106 consultation is not required when the Corps determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). If NHPA section 106 consultation is required and will occur, the district engineer will notify the non-Federal applicant that he or she cannot begin work until Section 106 consultation is completed.

(e) Prospective permittees should be aware that section 110k of the NHPA (16 U.S.C. 470h-2(k)) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, explaining the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

## 19. Designated Critical Resource Waters

Critical resource waters include, NOAA-designated marine sanctuaries, National Estuarine Research Reserves, state natural heritage sites, and outstanding national resource waters or other waters officially designated by a state as having particular environmental or ecological significance and identified by the district engineer after notice and opportunity for public comment. The district engineer may also designate additional critical resource waters after notice and opportunity for comment.

(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, and 50 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, and 38, notification is required in accordance with general condition 27, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

## 20. Mitigation

The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that adverse effects on the aquatic environment are minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating) will be required to the extent necessary to ensure that the adverse effects to the aquatic environment are minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10 acre and require pre-construction notification, unless the district engineer determines in writing that some other form of mitigation would be more environmentally appropriate and provides a project-specific waiver of this requirement. For wetland losses of 1/10 acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in minimal adverse effects on the aquatic environment. Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, wetland restoration should be the first compensatory mitigation option considered.

(d) For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation, such as stream restoration, to ensure that the activity results in minimal adverse effects on the aquatic environment.

(e) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of ½ acre, it cannot be used to authorize any project resulting in the loss of greater than ½ acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that a project already meeting the established acreage limits also satisfies the minimal impact requirement associated with the NWPs.

(f) Compensatory mitigation plans for projects in or near streams or other open waters will normally include a requirement for the establishment, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, riparian areas may be the only compensatory mitigation required. Riparian areas should consist of native species. The width of the required riparian

area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(g) Permittees may propose the use of mitigation banks, in-lieu fee arrangements or separate activity-specific compensatory mitigation. In all cases, the mitigation provisions will specify the party responsible for accomplishing and/or complying with the mitigation plan.

(h) Where certain functions and services of waters of the United States are permanently adversely affected, such as the conversion of a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse effects of the project to the minimal level.

### **21. Water Quality**

Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA Section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

### **22. Coastal Zone Management**

In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

### **23. Regional and Case-By-Case Conditions**

The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

### **24. Use of Multiple Nationwide Permits**

The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

### **25. Transfer of Nationwide Permit Verifications**

If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

“When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.”

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(Transferee)

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(Date)

### **26. Compliance Certification**

Each permittee who received an NWP verification from the Corps must submit a signed certification regarding the completed work and any required mitigation. The certification form must be forwarded by the Corps with the NWP verification letter and will include:

- (a) A statement that the authorized work was done in accordance with the NWP authorization, including any general or specific conditions;
- (b) A statement that any required mitigation was completed in accordance with the permit conditions; and
- (c) The signature of the permittee certifying the completion of the work and mitigation.

### **27. Pre-Construction Notification**

(a) *Timing.* Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, as a general rule, will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) Forty-five calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 17 that listed species or critical habitat might be affected or in the vicinity of the project, or to notify the Corps pursuant to general condition 18 that the activity may have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that is “no effect” on listed species or “no potential to cause effects” on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or Section 106 of the National Historic Preservation (see 33 CFR 330.4(g)) is completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee cannot begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity

until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) *Contents of Pre-Construction Notification:* The PCN must be in writing and include the following information:

- (1) Name, address and telephone numbers of the prospective permittee;
- (2) Location of the proposed project;
- (3) A description of the proposed project; the project's purpose; direct and indirect adverse environmental effects the project would cause; any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity. The description should be sufficiently detailed to allow the district engineer to determine that the adverse effects of the project will be minimal and to determine the need for compensatory mitigation. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the project and when provided result in a quicker decision.);
- (4) The PCN must include a delineation of special aquatic sites and other waters of the United States on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters of the United States, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many waters of the United States. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, where appropriate;
- (5) If the proposed activity will result in the loss of greater than 1/10 acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.
- (6) If any listed species or designated critical habitat might be affected or is in the vicinity of the project, or if the project is located in designated critical habitat, for non-Federal applicants the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed work or utilize the designated critical habitat that may be affected by the proposed work. Federal applicants must provide documentation demonstrating compliance with the Endangered Species Act; and
- (7) For an activity that may affect a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, for non-Federal applicants the PCN must state which historic property may be affected by the proposed work or include a vicinity map indicating the location of the historic property. Federal applicants must provide documentation demonstrating compliance with Section 106 of the National Historic Preservation Act.

(c) *Form of Pre-Construction Notification:* The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is a PCN and must include all of the information required in paragraphs (b)(1) through (7) of this general condition. A letter containing the required information may also be used.

(d) *Agency Coordination:* (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the project's adverse environmental effects to a minimal level.

(2) For all NWP 48 activities requiring pre-construction notification and for other NWP activities requiring pre-construction notification to the district engineer that result in the loss of greater than ½-acre of waters of the United States, the district engineer will immediately provide (e.g., via facsimile transmission, overnight mail, or other expeditious manner) a copy of the PCN to the appropriate Federal or state offices (U.S. FWS, state natural resource or water quality agency, EPA, State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Office (THPO), and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will then have 10 calendar days from the date the material is transmitted to telephone or fax the district engineer notice that they intend to provide substantive, site-specific comments. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame, but will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(3) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by Section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(4) Applicants are encouraged to provide the Corps multiple copies of pre-construction notifications to expedite agency coordination.

(5) For NWP 48 activities that require reporting, the district engineer will provide a copy of each report within 10 calendar days of receipt to the appropriate regional office of the NMFS.

(e) *District Engineer's Decision:* In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. If the proposed activity requires a PCN and will result in a loss of greater than 1/10 acre of wetlands, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for projects with smaller impacts. The district engineer will consider any proposed compensatory mitigation the applicant has included in the proposal in determining whether the net adverse environmental effects to the aquatic environment of the proposed work are minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse effects on the aquatic environment are minimal, after considering mitigation, the district engineer will notify the permittee and include any conditions the district engineer deems necessary. The district engineer must approve any compensatory mitigation proposal before the permittee commences work. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure no more than minimal adverse effects on the aquatic environment. If the net adverse effects of the project on the aquatic environment (after consideration of the compensatory mitigation proposal) are determined by the district engineer to be minimal, the district engineer will provide a timely written response to the applicant. The response will state that the project can proceed under the terms and conditions of the NWP.

If the district engineer determines that the adverse effects of the proposed work are more than minimal, then the district engineer will notify the applicant either:

(1) That the project does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; (2) that the project is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level; or (3) that the project is authorized under the NWP with specific modifications or conditions. Where the district engineer determines that mitigation is required to ensure no more than minimal adverse effects occur to the aquatic environment, the activity will be authorized within the 45-day PCN period. The authorization will include the necessary conceptual or specific mitigation or a requirement that the applicant submit a mitigation plan that would reduce the adverse effects on the aquatic environment to the minimal level. When mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan.

### **28. Single and Complete Project**

The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

### **Further Information**

1. District Engineers have authority to determine if an activity complies with the terms and conditions of an NWP.
2. NWPs do not obviate the need to obtain other federal, state, or local permits, approvals, or authorizations required by law.
3. NWPs do not grant any property rights or exclusive privileges.
4. NWPs do not authorize any injury to the property or rights of others.
5. NWPs do not authorize interference with any existing or proposed Federal project.

### **Definitions**

**Best management practices (BMPs):** Policies, practices, procedures, or structures implemented to mitigate the adverse environmental effects on surface water quality resulting from development. BMPs are categorized as structural or non-structural.

**Compensatory mitigation:** The restoration, establishment (creation), enhancement, or preservation of aquatic resources for the purpose of compensating for unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved.

**Currently serviceable:** Useable as is or with some maintenance, but not so degraded as to essentially require reconstruction.

**Discharge:** The term "discharge" means any discharge of dredged or fill material.

**Enhancement:** The manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s), but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area.

**Ephemeral stream:** An ephemeral stream has flowing water only during, and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.

**Establishment (creation):** The manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area.

**Historic Property:** Any prehistoric or historic district, site (including archaeological site), building, structure, or other object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria (36 CFR part 60).

**Independent utility:** A test to determine what constitutes a single and complete project in the Corps regulatory program. A project is considered to have independent utility if it would be constructed absent the construction of other projects in the project area. Portions of a multi-phase project that depend upon other phases of the project do not have independent utility. Phases of a project that would be constructed even if the other phases were not built can be considered as separate single and complete projects with independent utility.

**Intermittent stream:** An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.

**Loss of waters of the United States:** Waters of the United States that are permanently adversely affected by filling, flooding, excavation, or drainage because of the regulated activity. Permanent adverse effects include permanent discharges of dredged or fill material that change an aquatic area to dry land, increase the bottom elevation of a waterbody, or change the use of a waterbody. The acreage of loss of waters of the United States is a threshold measurement of the impact to jurisdictional waters for determining whether a project may qualify for an NWP; it is not a net threshold that is calculated after considering compensatory mitigation that may be used to offset losses of aquatic functions and services. The loss of stream bed includes the linear feet of stream bed that is filled or excavated. Waters of the United States temporarily filled, flooded, excavated, or drained, but restored to pre-construction contours and elevations after construction, are not included in the measurement of loss of waters of the United States. Impacts resulting from activities eligible for exemptions under Section 404(f) of the Clean Water Act are not considered when calculating the loss of waters of the United States.

**Non-tidal wetland:** A non-tidal wetland is a wetland that is not subject to the ebb and flow of tidal waters. The definition of a wetland can be found at 33 CFR 328.3(b). Non-tidal wetlands contiguous to tidal waters are located landward of the high tide line (i.e., spring high tide line).

**Open water:** For purposes of the NWPs, an open water is any area that in a year with normal patterns of precipitation has water flowing or standing above ground to the extent that an ordinary high water mark can be determined. Aquatic vegetation within the area of standing or flowing water is either non-emergent, sparse, or absent. Vegetated shallows are considered to be open waters. Examples of "open waters" include rivers, streams, lakes, and ponds.

**Ordinary High Water Mark:** An ordinary high water mark is a line on the shore established by the fluctuations of water and indicated by physical characteristics, or by other appropriate means that consider the characteristics of the surrounding areas (see 33 CFR 328.3(e)).

**Perennial stream:** A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for

stream flow.

**Practicable:** Available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

**Pre-construction notification:** A request submitted by the project proponent to the Corps for confirmation that a particular activity is authorized by nationwide permit. The request may be a permit application, letter, or similar document that includes information about the proposed work and its anticipated environmental effects. Pre-construction notification may be required by the terms and conditions of a nationwide permit, or by regional conditions. A pre-construction notification may be voluntarily submitted in cases where pre-construction notification is not required and the project proponent wants confirmation that the activity is authorized by nationwide permit.

**Preservation:** The removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms. Preservation does not result in a gain of aquatic resource area or functions.

**Re-establishment:** The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area.

**Rehabilitation:** The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions to a degraded aquatic resource. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource area.

**Restoration:** The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: Re-establishment and rehabilitation.

**Riffle and pool complex:** Riffle and pool complexes are special aquatic sites under the 404(b)(1) Guidelines. Riffle and pool complexes sometimes characterize steep gradient sections of streams. Such stream sections are recognizable by their hydraulic characteristics. The rapid movement of water over a coarse substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. Pools are deeper areas associated with riffles. A slower stream velocity, a streaming flow, a smooth surface, and a finer substrate characterize pools.

**Riparian areas:** Riparian areas are lands adjacent to streams, lakes, and estuarine-marine shorelines. Riparian areas are transitional between terrestrial and aquatic ecosystems, through which surface and subsurface hydrology connects waterbodies with their adjacent uplands. Riparian areas provide a variety of ecological functions and services and help improve or maintain local water quality. (See general condition 20.)

**Shellfish seeding:** The placement of shellfish seed and/or suitable substrate to increase shellfish production. Shellfish seed consists of immature individual shellfish or individual shellfish attached to shells or shell fragments (i.e., spat on shell). Suitable substrate may consist of shellfish shells, shell fragments, or other appropriate materials placed into waters for shellfish habitat.

**Single and complete project:** The term “single and complete project” is defined at 33 CFR 330.2(i) as the total project proposed or accomplished by one owner/developer or partnership or other association of owners/developers. A single and complete project must have independent utility (see definition). For linear projects, a “single and complete project” is all crossings of a single water of the United States (i.e., a single waterbody) at a specific location. For linear projects crossing a single waterbody several times at separate and distant locations, each crossing is considered a single and complete project. However, individual channels in a braided stream or river, or individual arms of a large, irregularly shaped wetland or lake, etc., are not separate waterbodies, and crossings of such features cannot be considered separately.

**Stormwater management:** Stormwater management is the mechanism for controlling stormwater runoff for the purposes of reducing downstream erosion, water quality degradation, and flooding and mitigating the adverse effects of changes in land use on the aquatic environment.

**Stormwater management facilities:** Stormwater management facilities are those facilities, including but not limited to, stormwater retention and detention ponds and best management practices, which retain water for a period of time to control runoff and/or improve the quality (i.e., by reducing the concentration of nutrients, sediments, hazardous substances and other pollutants) of stormwater runoff.

**Stream bed:** The substrate of the stream channel between the ordinary high water marks. The substrate may be bedrock or inorganic particles that range in size from clay to boulders. Wetlands contiguous to the stream bed, but outside of the ordinary high water marks, are not considered part of the stream bed.

**Stream channelization:** The manipulation of a stream’s course, condition, capacity, or location that causes more than minimal interruption of normal stream processes. A channelized stream remains a water of the United States.

**Structure:** An object that is arranged in a definite pattern of organization. Examples of structures include, without limitation, any pier, boat dock, boat ramp, wharf, dolphin, weir, boom, breakwater, bulkhead, revetment, riprap, jetty, artificial island, artificial reef, permanent mooring structure, power transmission line, permanently moored floating vessel, piling, aid to navigation, or any other manmade obstacle or obstruction.

**Tidal wetland:** A tidal wetland is a wetland (i.e., water of the United States) that is inundated by tidal waters. The definitions of a wetland and tidal waters can be found at 33 CFR 328.3(b) and 33 CFR 328.3(f), respectively. Tidal waters rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by other waters, wind, or other effects. Tidal wetlands are located channelward of the high tide line, which is defined at 33 CFR 328.3(d).

**Vegetated shallows:** Vegetated shallows are special aquatic sites under the 404(b)(1) Guidelines. They are areas that are permanently inundated and under normal circumstances have rooted aquatic vegetation, such as seagrasses in marine and estuarine systems and a variety of vascular rooted plants in freshwater systems.

**Waterbody:** For purposes of the NWP, a waterbody is a jurisdictional water of the United States that, during a year with normal patterns of precipitation, has water flowing or standing above ground to the extent that an ordinary high water mark (OHWM) or other indicators of jurisdiction can be determined, as well as any wetland area (see 33 CFR 328.3(b)). If a jurisdictional wetland is adjacent—meaning bordering, contiguous, or neighboring—to a jurisdictional waterbody displaying an OHWM or other indicators of jurisdiction, that waterbody and its adjacent wetlands are considered together as a single aquatic unit (see 33 CFR 328.4(c)(2)). Examples of “waterbodies” include streams, rivers, lakes, ponds, and wetlands.

## **Appendix B**

### Pima County Noise Ordinance

Title 9 PUBLIC PEACE, MORALS AND WELFARE

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**Chapter 9.30 REGULATION OF EXCESSIVE, UNNECESSARY AND ANNOYING NOISES**

9.30.010 Applicability.

9.30.020 Purpose.

9.30.030 Definitions.

9.30.040 Impermissible sound levels.

9.30.050 Loud radios, sound sets, etc.

9.30.060 Vehicular noise.

9.30.070 Construction of buildings and other projects.

9.30.080 Exemptions.

9.30.090 Penalty.

9.30.100 Severability.

9.30.110 Effective date.

**9.30.010 Applicability.**

This chapter shall not apply to any incorporated city, town or Indian reservation. It shall apply only within the unincorporated areas of the county.

**9.30.020 Purpose.**

It is hereby declared to be the policy of Pima County to prohibit excessive, unnecessary and annoying noises from all sources. At and above certain level, noises are detrimental to the health and welfare of the citizens of the county, and it is in the best interest of the citizens of Pima County that such noises be systematically eliminated. (Ord. 1999-61 § 1 (part), 1999)

**9.30.030 Definitions.**

The following definitions shall apply throughout this chapter unless a different meaning is clearly indicated by the context:

A. Commercial property means any property occupied by business which sell, rent, trade or store goods, or which provide a service.

B. Industrial property means any property occupied by land uses whose primary operation involves manufacturing, assembling, processing or otherwise treating raw materials, semi-finished products, or finished products for packaging and distribution to either wholesale or retail markets.

C. Property line means the line which represents the legal limits of property (including an

apartment, condominium, room or other dwelling unit) owned, leased or otherwise occupied by a person, business, corporation or institution. In cases involving sound from an activity on a public street or other public right-of-way, the property line shall be the nearest boundary of the public right-of-way.

D. Residential property means any property, the dominant use of which is nontransient occupancy of residential dwelling units.

E. Motor vehicle means any self-propelled vehicle operated within the county, including but not limited to licensed or unlicensed vehicles, automobiles, minibikes, go-carts, all terrain vehicles, and motorcycles.

F. Emergency work means any work performed to prevent or alleviate physical trauma or property damage threatened or caused by an emergency which has or may result in a disruption of service and which is necessary to protect the health, safety and welfare of persons or property.

G. Emergency vehicle means vehicles of the fire, police and public service departments and legally authorized ambulances and emergency vehicles of state departments or any political subdivisions thereof and vehicles of public service corporations.

H. Person means a human being and, as the context requires, an enterprise, a public or private corporation, an unincorporated association, a partnership, a firm, a society, a government, a governmental authority or an individual or entity capable of holding a legal or beneficial interest in property. (Ord. 2001-127 § 1 (part), 2001; Ord. 1999-61 § 1 (part), 1999)

#### **9.30.040 Impermissible sound levels.**

In addition to the prohibited noises described in 9.30.050, 9.30.060 and 9.30.070, it shall be unlawful for any person to make or continue, or cause or permit to be made or continued, any excessive, unnecessary or offensive noise which disturbs the peace or quiet of any neighborhood or which causes discomfort or annoyance to any reasonable person of normal sensitivity residing in the area. (Ord. 2001-127 § 1 (part), 2001; Ord. 1999-61 § 1 (part), 1999)

#### **9.30.050 Loud radios, sound sets, etc.**

A. It shall be unlawful for any person, including the owner or manager of a restaurant, bar, inn, or resort of any kind, to operate or permit to be operated any radio receiving set, phonograph, musical instrument, or sound producing or sound reproducing mechanism, at any time in such a manner as to permit the same to be heard at a distance of more than one hundred twenty-five (125) feet from the property line or motor vehicle where such radio receiving set, phonograph, or sound producing or sound reproducing mechanism is located, when the sound of such radio receiving set, phonograph, musical instrument, or sound producing or sound reproducing mechanism is operated in such a manner as to create an excessive, unnecessary or offensive noise that a reasonable person of normal sensitivity residing in the area is caused discomfort or annoyance.

B. It shall be unlawful for any person, including the owner or manager of a restaurant, bar, inn, or resort of any kind, to operate or permit to be operated any radio receiving set, phonograph, musical instrument, or sound producing or sound reproducing mechanism, between the hours of 10:00 P.M. and 7:00 A.M. in such a manner that the sound from such radio set, phonograph, musical instrument, sound producing or sound reproducing mechanism may be heard beyond the property line from which it is operated or outside the motor vehicle in which it is operated in such a manner as to create an excessive, unnecessary or offensive noise that a reasonable person of normal sensitivity residing in the area is caused discomfort or annoyance. (Ord. 2001-127 § 1 (part), 2001; Ord. 1999-61 § 1 (part), 1999)

#### **9.30.060 Vehicular noise.**

A. It shall be unlawful for any person within any residential area of this county to repair, rebuild or test any motor vehicle between the hours of 10:00 p.m. of one day and 7:00 a.m. of the next day in such a manner as to create an excessive, unnecessary or offensive noise that a reasonable person of normal sensitivity residing in the area is caused discomfort or annoyance.

B. No person shall operate or cause to operate any motor vehicle unless the exhaust system of such vehicle:

1. Is free from defects which may cause sound level magnification,
  2. Is equipped with a muffler,
  3. Has not been modified in such a manner which will amplify or increase the sound level emitted by the motor of such vehicle above that emitted by a muffler originally installed on the vehicle as manufactured for initial sale.
- C. No person shall operate a motor vehicle in such a manner which creates the squealing of tires in the roadway. (Ord. 1999-61 § 1 (part), 1999)

### **9.30.070 Construction of buildings and other projects.**

A. Noise limitations: Subject to the provisions of section 9.30.040, it shall be unlawful for any person to operate equipment or perform any outside construction or repair work on buildings, structures or projects, or to operate any pile driver, power shovel, pneumatic hammer, derrick, power hoist or any other construction type device except within the time periods specified below unless an appropriate permit has been obtained beforehand from the county.

B. Construction start/stop times:

1. Concrete work: From April fifteenth to October fifteenth, inclusive, concrete may be poured each day between the hours of 5:00 a.m. and 7:00 p.m. or at such other times as authorized by permit. From October sixteenth to April Fourteenth, inclusive, concrete may be poured each day between the hours of 6:00 a.m. to 7:00 p.m. or at such times as authorized by permit.
2. Other type construction (residential zones): From April fifteenth to October fifteenth, inclusive, all other construction or repair work shall not begin prior to 6:00 a.m. and must stop by 7:00 p.m. each day in, or within five hundred (500) feet of, a residential zone or at such other times as authorized by permit. From October sixteenth to April fourteenth, inclusive, all other construction or repair work shall not begin prior to 7:00 a.m. and must be stopped by 7:00 p.m. each day in, or within five hundred (500) feet of, a residential property or at such other times as authorized by permit.
3. Other type construction (commercial and industrial zones): Construction and repair work in commercial and industrial zones, not within five hundred (500) feet of a residential property, shall not begin prior to 5:00 a.m. and must stop by 7:00 p.m. or at such other times as authorized by permit.
4. Weekends and holidays excluded: Notwithstanding anything to the contrary herein, construction or repair work shall not begin prior to 7:00 a.m. and must stop by 7:00 p.m., and concrete pouring should not begin prior to 6:00 a.m. and must stop by 7:00 p.m. on any Saturday, Sunday or state or federal holiday, unless such other times are authorized by permit.

C. Permits: Construction and repair work may be conducted at different times and at higher noise levels than otherwise permitted, if upon written application, a permit is obtained beforehand from the county administrator or his designee. The permit shall be kept on the work site and shown to county officials on request. In granting such permit, the county administrator or his designee shall consider if construction noise in the vicinity of the proposed work site would be less objectionable at night than during the daytime because of different population levels or different neighboring activities; if obstruction and interference with traffic, particularly on streets of major importance, would be less objectionable at night than during the daytime; if the kind of work to be performed emits noises at such a low level as to not cause significant disturbance in the vicinity of the work site; if the neighborhood of the proposed work site is of such a character wherein sleep could be disturbed; if great economic hardship would occur if the work was spread over a longer time; if the work will abate or prevent hazards to life or property; if proposed early morning or night work is in the general public interest; and, he shall prescribe such conditions, working times, types of construction equipment to be used, and permissible noise emissions as he deems to be required in the public interest. No permit shall be required to perform emergency work as defined in section 9.30.030.

D. Revocation of permits: The county administrator or his designee may revoke any permit granted hereunder upon complaint based upon substantial evidence that the construction activity caused significant disturbance in the vicinity of the work site. (Ord. 1999-61 § 1 (part), 1999)

### **9.30.080 Exemptions.**

The following uses and activities shall be exempt from the provisions contained in this article:

- A. Heating and cooling equipment when it is functioning in accordance with manufacturer's

specifications and is in proper operating condition provided that no unit may create an excessive, unnecessary or offensive noise causing annoyance or discomfort to a reasonable person of normal sensitivity within any sleeping or living area inside any dwelling unit;

B. Landscape maintenance equipment when it is functioning in accordance with the manufacturer's specifications and with all mufflers and noise-reducing equipment in use and in proper operating condition;

C. Nonamplified crowd noises resulting from activities such as those planned by school, governmental or community groups, or organized sports except for such noises generated at restaurants, bars, inns, or resorts of any kind;

D. Noises of safety signals, warning devices and emergency pressure relief valves;

E. Noises resulting from any authorized emergency vehicle when responding to an emergency call or acting in time of emergency;

F. Noises resulting from emergency work as defined in section 9.30.030;

G. Noises from the normal operation of railroad trains;

H. Noises from church chimes;

I. Power plant equipment during normal operation;

J. Noise created by any county vehicle, equipment or facility while being operated for official use;

K. Operation of agricultural equipment in connection with farming operations;

L. Any aircraft operated in conformity with, or pursuant to, federal law, federal air regulations or air traffic control instructions issued pursuant to or within duly adopted federal air regulations, together with any noise created by aircraft operated under, or pursuant to, declaration of an emergency under federal air regulations. (Ord. 2001-127 § 1 (part), 2001; Ord. 1999-61 § 1 (part), 1999)

#### **9.30.090 Penalty.**

A violation of any provision of this article shall be deemed and is declared to be a public nuisance and any person who violates any of the provisions of this article shall be guilty of a class 1 misdemeanor. Each day a violation continues or exists shall be a separate offense subject to punishment as a separate class 1 misdemeanor. (Ord. 1999-61 § 1 (part), 1999)

#### **9.30.100 Severability.**

If any provisions of this ordinance, or the application thereof to any person or circumstance, is invalid, that invalidity shall not effect other provisions or applications of this ordinance which can be given effect without the invalid provisions or applications, and to this end the provisions of this ordinance are severable. (Ord. 1999-61 § 1 (part), 1999)

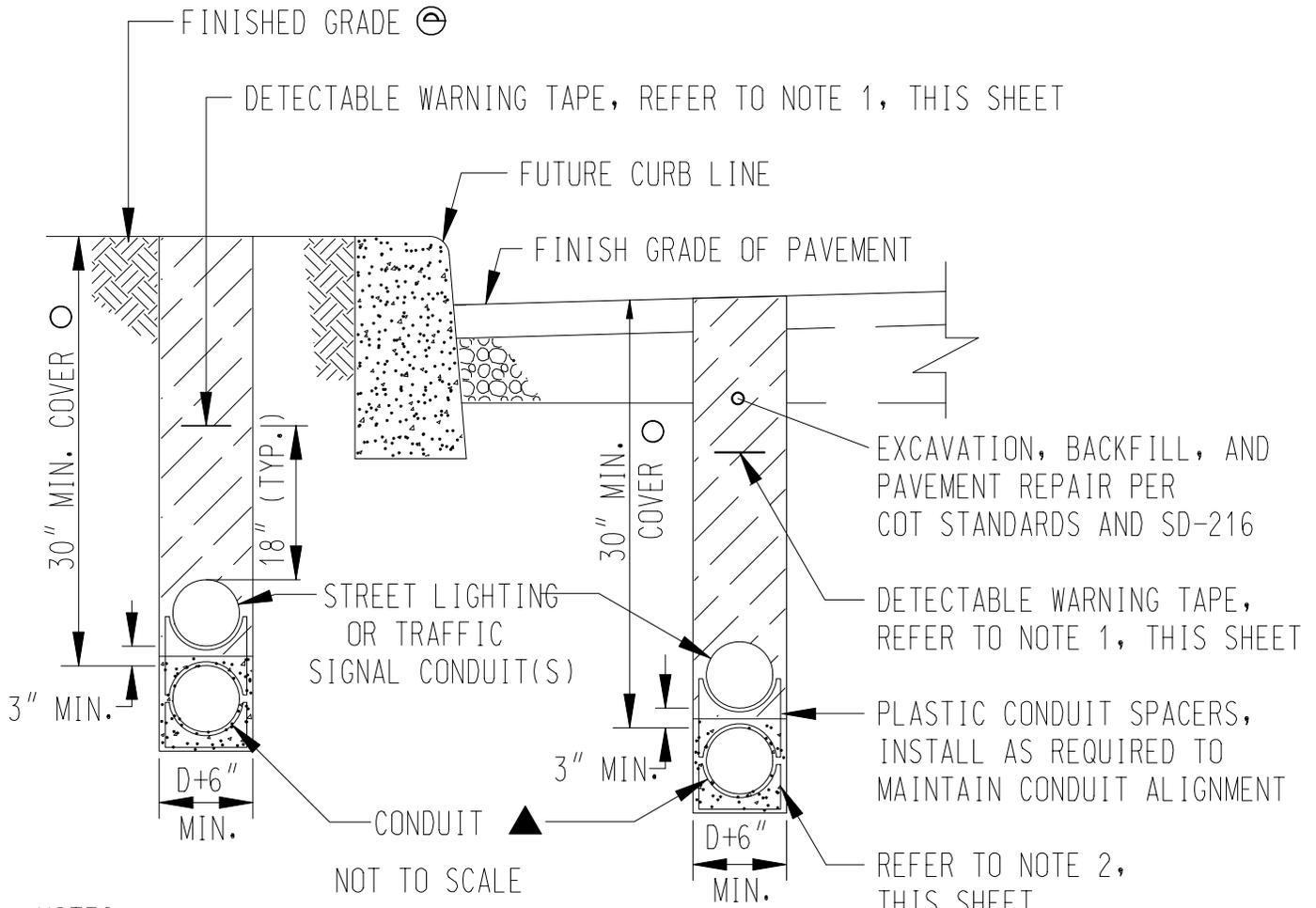
#### **9.30.110 Effective date.**

This ordinance will be in full force and effective after thirty days from the date of enactment. (Ord. 1999-61 § 1 (part), 1999)

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## **Appendix C**

### Conduit Installation Standard Drawings



NOTES:

1. INSTALL WARNING TAPE FOR THE FIBER OPTIC SYSTEM AND THE STREET LIGHTING / TRAFFIC SIGNAL CONDUITS, SIDE BY SIDE AT THE SPECIFIED DEPTH.
2. AT STREET CROSSINGS, WHERE THE STREET LIGHTING / TRAFFIC SIGNAL CONDUIT IS ENCASED IN CONCRETE, ENCASE FO CONDUIT IN CLASS B CONCRETE.
3. EXCAVATION, BEDDING, SHADING, BACKFILL, AND COMPACTION OF THE STREET LIGHTING AND TRAFFIC SIGNAL CONDUITS SHALL BE IN ACCORDANCE WITH THE PIMA COUNTY/CITY OF TUCSON STANDARD SPECIFICATIONS AND DETAILS FOR PUBLIC IMPROVEMENT.

TYPE 5: FO CONDUIT INSTALLED WITH STREET LIGHTING OR TRAFFIC SIGNAL CONDUIT

REFER TO SHEET 6 OF 6 FOR GENERAL NOTES AND SYMBOLS.

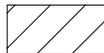
NOTE: CONCRETE ENCASEMENT REQUIREMENT FOUND IN SECTION 975-3.01(G)

<p>ISSUED August 2003</p>		<p><b>PCDOT Traffic Engineering Division</b> <b>Street Lighting &amp; ITS Conduit Design Manual</b></p>	<p><b>SHEET NO.</b> <b>7-02</b> 5 of 6</p>
<p>REVISED</p>			

GENERAL NOTES:

1. FOR CONDUIT IN THE ROADWAY RIGHT-OF-WAY WHERE REQUIRED BY THE CITY OF TUCSON/PIMA COUNTY SPECIFICATIONS AND DETAILS, AND WHERE SPECIFICALLY CALLED OUT ON THE DRAWINGS, CONDUIT SHALL BE ENCASED IN CLASS B PORTLAND CEMENT CONCRETE.
2. CONSTRUCTION STAKING SHALL BE IN ACCORDANCE WITH PROJECT REQUIREMENTS.
3. SHORING AND / OR BRACING SHALL CONFORM TO OSHA REQUIREMENTS.
4. REFER TO SPECIFICATIONS FOR THE REQUIREMENTS FOR THE DETECTABLE WARNING TAPE.

LEGEND:

- D            OUTSIDE DIAMETER OF CONDUIT.
- ▲            CONDUIT SHALL BE 4" IN DIAMETER UNLESS OTHERWISE NOTED ON THE PLANS.
- ⊕            THE LOWER OF EXISTING OR FUTURE FINISHED GRADE.
- PAVEMENT PATCHING SHALL CONFORM WITH THE REQUIREMENTS OF PIMA COUNTY / CITY OF TUCSON STANDARD DETAIL FOR PUBLIC IMPROVEMENTS, STANDARD DETAIL No. 216, AND THE CONSTRUCTION DOCUMENTS.
- 36" MINIMUM COVER, AND A MINIMUM OF 24" BELOW THE LIMITS OF SUBGRADE SCARIFICATION.
-             NATIVE UNDISTURBED SOIL.
-             BACKFILL MATERIAL AND COMPACTION SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE AUTHORITY THAT HAS JURISDICTION OVER THE RIGHT-OF-WAY, AND PROJECT SPECIFICATIONS.
-             AGGREGATE BEDDING MATERIAL OR CLASS B PORTLAND CONCRETE CEMENT AS REQUIRED IN SECTIONS 975-3.01 AND 975-3.02.
-             BACKFILL, BEDDING AND SHADING MATERIAL OF A JOINT TRENCH TO BE CONTROLLED BY THE SPECIFICATIONS AND DETAILS OF THE AGENCY RESPONSIBLE FOR THE UTILITY.

ISSUED  
August 2003

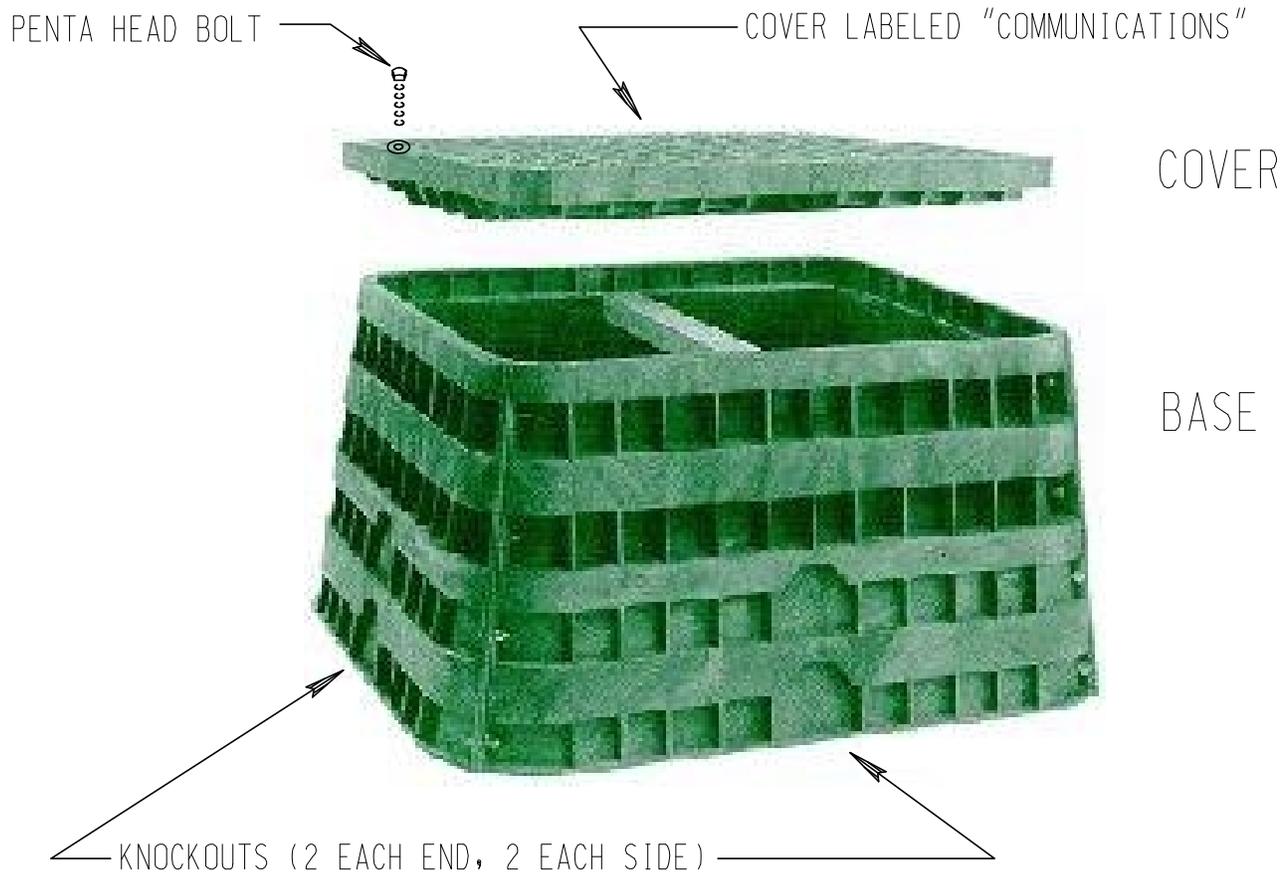


**PCDOT Traffic Engineering Division**  
**Street Lighting & ITS Conduit Design Manual**

**Detail No.: FO-100**  
**Conduit Installation**

**SHEET NO.**  
**7-02**  
**6 of 6**

REVISED



GENERAL NOTES:

1. BASE AND COVER SHALL BE IN A NEUTRAL COLOR.
2. BASE SHALL BE MOLDED HIGH DENSITY POLYETHYLENE.
3. PULL BOX SHALL BE OF THE DIMENSIONS 30" WIDTH BY 48" LENGTH BY 24" DEPTH.
4. COVER SHALL BE A POLYESTER PRE-MIX WITH CALCIUM CARBONATE.
5. COVER SHALL BE FACTORY EMBOSSED WITH "COMMUNICATIONS".
6. COVER SHALL BE SECURED BY 3/8-16 PENTA HEAD BOLTS.
7. PULLBOX MAY BE EXTENDED BY MEANS OF EXTENSION.

ISSUED  
August 2003

REVISED



**PCDOT Traffic Engineering Division**  
**Street Lighting & ITS Conduit Design Manual**

Detail No.: FO-300  
**Typical Fiber Optic Pull Box**

**SHEET NO.**  
**7-03**  
 1 of 1

## **Appendix D**

Stormwater Pollution Prevention Plan  
La Cholla Boulevard – Ruthrauff Road to River Road  
(BOUND SEPARATELY)