CITY OF PHOENIX SUPPLEMENT

TO

MARICOPA ASSOCIATION OF GOVERNMENTS

UNIFORM STANDARD SPECIFICATIONS

City of Phoenix

2009

2009 CITY OF PHOENIX SUPPLEMENT TO THE MAG UNIFORM STANDARD, SPECIFICATIONS AND DETAILS

The ***2009 edition*** of the City of Phoenix Supplements to the Maricopa Association of Governments (MAG) Uniform Standard Specifications and Details will become effective ***January 1, 2009***. The 2009 edition will supersede ***all previous*** editions.

All construction contracts advertised and all permits issued on or after ***January 1, 2009*** will be governed by these ***2009*** Supplements.

For more information, or a copy of this publication in an alternate format, contact Street Transportation Department at 602-262-6284 (Voice) and 602-256-4286 (TTY).

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PART 100

GENERAL CONDITIONS

SECTION 102

BIDDING REQUIREMENTS AND CONDITIONS

102.10 WITHDRAWAL OR REVISION OF PROPOSAL: is modified to add:

Pursuant to the provisions of Section 2-188 of the City Code, the low bidder may file a request to withdraw his or her bid with the City Clerk.

SECTION 106

CONTROL OF MATERIALS

106.2 SAMPLES AND TESTS OF MATERIALS: is changed to read:

The procedures and methods used to sample and test materials will be determined by the Engineer. Unless otherwise specified, samples and tests will be made in accordance with the following: The City of Phoenix Minimum Sampling Frequency Guide, The City of Phoenix Materials Testing Manual, and the standard methods of AASHTO or ASTM, which were in effect and published at the time of advertising for bids.

106.5 STORAGE OF MATERIALS: is modified to add:

No placement or storage of construction materials or storage bins, trash bins or trash receptacles on final surface pavement of Arterial and Collector streets.

106.7 UNACCEPTABLE MATERIALS: is modified to add:

106.7.1 Materials containing asbestos and/or lead in any form are unacceptable to incorporate into the project unless formally accepted in writing by the City of Phoenix. This written approval shall take place prior to the material being incorporated into the project and/or brought to the site.

Repair kits or touch-up materials, materials that include asbestos and/or lead introduced into the product at the factory or applied at the assembly plant are all unacceptable. Any and all field-applied products that are comprised of asbestos and/or lead containing materials are also unacceptable.

If asbestos and/or lead are installed without written approval by the City of Phoenix, the contractor will remove these materials at his expense and dispose of these materials in accordance with all state and federal laws and pay for the supervision and reporting costs in addition to the cost to properly remove them.

SECTION 107

LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

Subsection 107.5 SAFETY, HEALTH AND SANITATION PROVISIONS: is modified to add:

107.5.3 Hoist Certification: Prior to the final acceptance (MAG Section 105), the Contractor shall schedule a hoist, crane acceptance inspection through the Engineer. This inspection and load test will be performed by an agency approved by the Engineer. This inspection and acceptance will not relieve the Contractor from his contractual responsibility nor from his warranty for this installation.

107.6 PUBLIC CONVENIENCE AND SAFETY: is modified to add:

107.6.1 Contractor's Marshaling Yard: Contractors shall obtain approval of the City Engineer when using vacant property to park and service equipment and store material for use on City construction contracts.

(A) The Contractor shall notify adjacent property owners/residents of this proposed use.

(B) Any use of vacant property adjacent to or near the project for parking or servicing equipment and/or storing of material will require the Contractor to obtain written approval from the property owner. This approval shall contain any requirements which are a condition of this approval.

(C) A copy of the property owner's approval shall be submitted along with the Contractor's request to the City Engineer for approval for the use of the marshaling yard in connection with the project. An appropriate distance from adjacent property will be set by the City Engineer on a case by case basis on the size and type of equipment to be used on the project.

(D) The yard shall be fenced and adequately dust-proofed in a manner such as to preclude tracking of mud onto paved City streets.

(E) Work in the yard shall be scheduled so as to comply with the City Noise Ordinance.

(F) Equipment, materials, etc., shall be located so as to minimize impact on adjacent properties. A sound barrier may be required if deemed necessary by the City Engineer.

(G) The Contractor shall clean up property promptly upon completion of use.

107.6.2 City Code Section 23-14 (h): The Contractor shall comply with the City Code concerning work hours and noise level during construction.

SECTION 110

NOTIFICATION OF CHANGED CONDITIONS AND DISPUTE RESOLUTION

Section 110.3.3 (B) DISPUTE REVIEW BOARD/ARBITRATION is changed to read:

(B) Dispute Review Board: The decision of the Level III Representative in relation to the claim shall be final. The Contractor reserves the right to initiate litigation pursuant to Section 12-821 et. seg. of the Arizona Revised Statues, or if mutually agreed upon, the parties may choose to resolve the controversy utilizing the Dispute Review Board as prescribed in Subsection 110.5.

Section 110.3.4 AMOUNT OF DISPUTE: is struck

Section 110.4 ARBITRATION: is struck

Section 110.5 DISPUTE REVIEW BOARD: is changed to read:

If the Dispute Review Board is utilized as prescribed in Subsection 110.3.3(B), the Engineer shall be notified within thirty days after the Level III Representative decision. The Dispute Review Board is a three member board independent of the parties involved in the issue. The Agency and Contractor shall each select a member for this board. The third member shall be mutually agreed upon independent member. This Review Board must be selected within fourteen calendar days after notice to the Level III Representative. Each member shall agree to impartially serve the Agency and the Contractor. The Dispute Review Board shall meet within thirty days of the selection of the board, unless, by mutual agreement, another date is selected. The scope of the Dispute Review Board shall be restricted and limited to the matters originally presented to the Level III Representative for decision or determination and shall include no other matters. The Board shall consider and evaluate the dispute and render a written decision that assigns responsibilities and allocates adjustments in the contract time, if applicable, within seven calendar days after the meeting.

PART 200

EARTHWORK

NO CHANGES

PART 300

STREETS AND RELATED WORK

SECTION 301

SUBGRADE PREPARATION

Subsection 301.2 PREPARATION OF SUBGRADE: is modified to add:

The Contractor's grading operations will proceed in an orderly sequence and shall be followed directly with the placement of base course. At no time shall the Contractor's total grading operations precede the placement of base course by more than 1200 feet without specific written approval of the Engineer. At the end of each day's operation, the first lift of base course shall have been placed to within a maximum distance of 300 feet behind the finished subgrade area. Drop-offs on opposite sides of the pavement at the same time will not be allowed.

Existing pavement under proposed median islands shall be removed. Payment for this work shall be considered incidental to the project.

When excavating for concrete work, such as curb and gutter and sidewalk, the Contractor shall place the excavated material in uniform windrows. The windrows shall not interfere with property access or traffic flow on the streets.

Subsection 301.3 RELATIVE COMPACTION: is changed to read:

Unless otherwise provided in the plans and/or special provisions, the subgrade shall be thoroughly compacted to not less than the following densities when tested and determined by AASHTO T-99 and T-191 or ASTM 0-2922 and 0-3017. When AASHTO T-99, method A or B, and T-191 are used for density determination, MAG Detail 190 will be used for rock correction.

(A) Street Section
- (1) Asphalt pavement 95%
- (2) ABC 100%
- (3) Top 6” Subgrade .....95% (100% for arterial streets)

(B) Curbs, gutters, and sidewalk 90%

SECTION 312

CEMENT TREATED BASE

Subsection 312.5 INVERTED SECTION: is changed to read:

Where the cement treated base is to be covered with an aggregate base material, the minimum thickness of the aggregate base shall be 5 inches, unless otherwise specified in the special provision. In order to provide for free internal drainage of the aggregate base course overlaying the cement treated material, it shall be ABC, reference MAG 725. The cement treatment shall be held back approximately 1 foot from each curb line.

Subsection 312.6 CURING: is modified to add:

The bituminous curing seal specified in the first two paragraphs will not be used. Only the water curing and overlaying with the aggregate base course will be allowed.

SECTION 321

ASPHALT CONCRETE PAVEMENT

Subsection 321.3 WEATHER AND MOISTURE CONDITIONS: is changed to read:

For base paving two inches thick or greater, atmospheric temperature shall be 40 degrees Fahrenheit and rising.

For all surface paving or any pavement lift less than two inches thick, the surface temperature shall be 50 degrees Fahrenheit or greater.

Subsection 321.5.2 (A) SPREADING AND FINISHING EQUIPMENT: Last Paragraph is changed to read:

"Ski-type device or string line as described in A or B above (MAG 321.5.2, paragraph 5) shall be used as directed by the Engineer."

In conditions where the curb and/or gutter is not even and true to grade, the Engineer may require the Contractor to use a ski-type device or string line as described in C above (MAG 321.5.2, paragraph 5) to establish the grade of the asphalt concrete surface adjacent to the curb or gutter.

SECTION 336

PAVEMENT MATCHING AND SURFACING REPLACEMENT

Subsection 336.2.3 TEMPORARY PAVEMENT REPLACEMENT: is changed to read:

336.2.3 Temporary Pavement Replacement: Temporary pavement replacement as required in Section 601 may be made using cold mix asphalt concrete. The cold mix shall be MC-70 or MC-250 liquid asphalt (6.0 +/- 0.4 percent) combined with the aggregate gradation shown below. Paving asphalt AC 2.5 (5.5 percent) may be substituted for the liquid asphalt. AC 2.5 must be heated for mixing.

TABLE 336-1

SIEVE SIZE	% PASSING	TOLERANCE
3/4"	97-100	+/- 7%
1/2"	88	+/- 7%
3/8"	78	+/- 7%
#4	60	+/- 7%
#8	47	+/- 5%
#30	25	+/- 5%
#200	.5	+/- 2%

Temporary pavement shall be used in lieu of immediate placement of single course permanent replacement or the first course of two course pavement replacement only on transverse lines such as spur connections to inlets, driveways, road crossings, etc., when required by the Engineer, by utilities or others who subcontract their permanent pavement replacement, under special prior arrangement; or for emergency conditions where it may be required by the Engineer. Temporary pavement replacement shall be placed during the same shift in which the backfill to be covered is completed.

The cold mix shall be placed in two inch increments and compacted with a roller that has not less than 60 psi. contact pressure. Each layer shall be compacted to 96 percent of the laboratory compacted density for like materials. On small areas where the use of the equipment specified above is impractical, the Engineer will approve the use of small vibrating rollers or vibrating plate type compactors provided comparable compaction is obtained. The surface of the temporary pavement shall be flush with the adjacent pavement.

Subsection 336.2.4.1 PERMANENT PAVEMENT REPLACEMENT: Delete the second paragraph of this Subsection in its entirety.

The Contractor shall do the required seal coating using an asphalt overlay, slurry seal, microsurfacing, or a modified asphalt emulsion, as directed by the Engineer. Slurry seals are not permitted on major and collector streets.

The Contractor shall be responsible for adjusting to grade all new and existing manholes, valves, survey monuments, clean outs, etc., as directed by the Engineer. The Contractor shall remove all asphalt material and aggregate from this or prior work from all metal lids and covers encountered using a method approved by the Engineer. Debris will not be allowed to enter sanitary or storm sewers. All loose material shall be removed from the excavation site and the interiors of structures prior to resetting the frames.

The Contractor shall coordinate with the various utility companies regarding the adjustment and inspection of their facilities. Each utility company's specifications shall be adhered to during the adjustment. The Contractor shall be responsible for meeting any additional requirements of the utility companies.

Manhole frames shall be adjusted according to the MAG Standard Detail 422, except that the concrete collar shall extend up to the finished grade. Water valve, survey monument, and sewer clean out frames shall be adjusted in accordance with the City of Phoenix Supplement Standard Details P1270 and P1391.

Subsection 336.3 TYPES AND LOCATIONS OF PAVEMENT AND SURFACING REPLACEMENT: is changed to read:

336.3 TYPES AND LOCATION OF BACKFILL AND SURFACING REPLACEMENT:

Normally, the type of pavement replacement and backfill required for the trench excavation will be noted on the plans or specified in the special provisions and construction will be in accordance with City of Phoenix Supplement to MAG Detail P-1200.

(A) Unless otherwise specified, the "T" top as shown in City of Phoenix Supplement to MAG Specs Detail P-1200 will not be required within the City of Phoenix. If the project extends into another municipality/county the "T" top may be required for that portion of the project.

(B) When the trench excavation is not being accomplished in conjunction with a paving project, the following backfill and pavement replacement requirements apply:

(1) When the trench is transverse (45 to 90 degrees to street centerline) the backfill material required by Detail P-1200 for Type B shall be used. Permanent trench pavement replacement is required.

(2) When the trench is parallel or less than 45 degrees to the street centerline, the backfill material required by Detail P-1200 for Type A shall be used. Permanent trench pavement replacement is required.

(3) When the trench crosses a major street, collector street, or any other signalized intersection, the backfill materials required by Detail P-1200 for Type B shall be used. Permanent trench pavement replacement is required.

(C) When the trench excavation is being accomplished in conjunction with a paving project the following backfill and pavement replacement requirements apply:

(1) When the trench is transverse (45 to 90 degrees to street centerline) the backfill material required by Detail P-1200 for Type B will be used. Permanent pavement replacement is not required.

(2) When the trench is parallel or less than 45 degrees to the street centerline, the backfill material required by Detail P-1200 for Type A shall be used. Permanent trench pavement replacement is not required.

(3) When the trench crosses a major street, collector street, or any other signalized intersection, the backfill material required by Detail P-1200 for Type B shall be used. Permanent trench pavement replacement is not required.

(4) Temporary pavement replacement (MAG 336.2.3) will be required at intersections for traffic control and at existing partial paved areas when the total pavement is not scheduled for immediate removal and replacement. In addition to the above, the Engineer may require temporary pavement at any area where public safety and welfare warrants. This will be a non-pay item considered incidental to the project.

(5) If the excavation extends beyond the limits of the paving project, the Contractor shall provide permanent trench pavement replacement in accordance with paragraph (B) for this extension.

(D) When the trench excavation is made in Portland cement concrete pavement, Detail P-1200 Type C backfill and pavement replacement applies.

(E) When the condition of the existing pavement does not justify the use of Detail P-1200, Type A or Type B backfill, Type D backfill and pavement replacement shall apply. Written approval from the Engineer shall be required.

(F) When the trench excavation is made in ABC or decomposed granite pavement, Detail P-1200 Type E backfill and pavement replacement shall apply.

(G) When the trench excavation is made in asphalt concrete pavement which has a soil cement base course, concrete treated base course or bituminous treated base course, the Contractor has the option of matching the existing pavement structure, including all courses, or replacing the pavement structure with equivalent full depth asphalt concrete pavement. For computing the equivalent asphalt concrete pavement required, 1 inch of asphalt concrete is equivalent to 3.25 inches of ABC or 1.4 inches of soil cement, cement treated base or bituminous treated base. After computations are completed, the equivalent depth will be rounded off to the next higher 1/2 inch, i.e., 6.15 inches computed would be rounded to 6.5 inches.

Subsection 336.4 MEASUREMENT: change first paragraph to read:

Measurement and payment for permanent pavement replacement will be by the square yard, for the thickness specified. In computing the pay quantity, the field measurement along the centerline of the trench and the trench pay width as listed in COP Supplement 601 shall be used. When the longitudinal trench is only partially in the pavement, adjustments in the pay width will be made by the Engineer.

There will be no separate measurement and payment for trench backfill. The cost of the backfill shall be considered incidental to the cost of the pipe.

SECTION 340

CONCRETE CURB, GUTTER, SIDEWALK, DRIVEWAY AND ALLEY ENTRANCE

Subsection 340.3 CONSTRUCTION METHODS: change the 3rd, 4th, and 5th paragraphs to read:

Expansion joints, unless otherwise specified, shall be constructed in accordance with the City of Phoenix Detail P1230. They shall be in a straight line and vertical plane perpendicular to the longitudinal line of the sidewalk or curb and gutter, except in case of a curved alignment when they will be constructed along the radial lines of the curve. The expansion joints shall be constructed to the full depth and width of the concrete and shall match the joints in the adjacent pavement, sidewalk or curb and gutter. The expansion joint material shall extend fully through the concrete from the surface to one inch into the subgrade. Joints shall be constructed at all radius points, driveways, alley entrances and at adjoining structures with a maximum interval of 50 feet between joints.

Contraction joints, unless otherwise specified, shall be constructed in accordance with City of Phoenix Detail P1230 and in a straight line and vertical plane perpendicular to the longitudinal line of the sidewalk or curb and gutter, except in case of a curved alignment when they will be constructed along the radial lines of the curb. They shall be constructed to a depth of 1-1/2" at 10' intervals on all sidewalks regardless of the width. Unless an expansion joint is required, a contraction joint will coincide with each form joint. Sidewalk score marks, at least 1/2 inch deep are required at the mid-point of the contraction joint.

SECTION 342

DECORATIVE PAVEMENT CONCRETE PAVING STONE OR BRICK

Subsection 342.3.2 AGGREGATE BASE COURSE: delete in its entirety and substitute the following:

The base course for decorative pavement shall consist of cement-enriched aggregate base slurry consisting of one sack of Type II Portland cement per cubic yard of aggregate base course material. Aggregate base slurry shall be installed over subgrade soil compacted to a minimum of 95% density. The surface elevation of the aggregate base slurry shall be set to bring the 1-inch sand laying course, plus the thickness of the paving stones or bricks to the desired finished elevation of decorative pavement. The surface of the aggregate base slurry shall not vary more than +1/8 inch in 10 feet.

Subsection 342.4 MEASUREMENT AND PAYMENT: delete in its entirety and substitute the following:

Measurement for deco pavement shall be by the square foot. Payment for deco pavement shall be made at the unit bid price per square foot including subgrade preparation, cement-enriched aggregate base slurry, and sand base. This payment shall be full compensation for all labor, materials, tools and equipment required to complete the work.

SECTION 350

REMOVAL OF EXISTING IMPROVEMENTS

Subsection 350.3 MISCELLANEOUS REMOVAL AND OTHER WORK: delete the first sentence and substitute the following:

The work shall include all items as stated in MAG Subsection 350.3 and City of Phoenix Supplement. Any other miscellaneous removal not listed or not shown on the plans will be considered incidental and no additional payment will be made.

Subsection 350.3 MISCELLANEOUS REMOVAL AND OTHER WORK: is modified to add:

(I) Landscape Irrigation System Removal and Restoration: The Contractor shall remove the conflicting portion of all underground landscape irrigation systems that are within the right of way and/or easements that conflict with new work or any portion which may remain under proposed curb, gutter or sidewalk regardless of whether shown or not shown on the plans.

The Contractor shall restore all affected landscape irrigation systems to an operational condition at least as good as existed prior to removal. Bubbler and/or sprinkler heads shall be installed behind the new sidewalk in areas where watering was accomplished by landscape irrigation heads which were removed. Specifically, all areas behind the new sidewalk which were watered by the existing irrigation system before relocation shall be watered after relocation without any accumulation of water on the sidewalk or pavement.

The Contractor shall have the option of either providing all new materials or salvaging and reusing existing materials. Either new or salvaged irrigation heads shall be installed in a new location, as close as practical to the existing location. Either new or salvaged pipe shall be installed and all the necessary connections made to put the system back into operation.

In the event it is not feasible to reinstall removed irrigation heads, the Contractor shall then make all the necessary connections to make the remaining portion of the system operational. Irrigation heads and pipe not reinstalled shall be given to the owner.

The Contractor shall furnish all new irrigation heads, new pipe and fittings, and pipe compound necessary to supplement salvaged materials.

The Contractor shall notify the affected property owners, at least fourteen days prior to removing and replacing underground landscape irrigation systems because some of the owners may desire to do this work themselves.

(J) Lawn Restoration: When any construction by the Contractor encroaches into an improved yard, in or outside the right-of-way, the Contractor shall level any disturbed ground, resod all grass covered areas, and restore rock-covered areas with material to match existing in type and quality.

(K) Precast Safety Curbs Inside Right-of-Way: Existing precast concrete safety curbs inside the right-of-way and approximately parallel to the new curb line shall be reset by the Contractor directly opposite their existing location, with the back edge on the right-of-way line.

All other precast concrete safety cubs inside the right-of-way shall be salvaged and stockpiled by the Contractor at a location on the adjacent property agreeable to the property owner.

(L) Encroachments Inside the Right-of-Way: The Contractor shall notify property owners, who have encroaching walls, fences, planters, plants, bushes, small diameter trees, and other improvements in the right-of-way that interfere with construction, at least fourteen days before clearing is necessary.

Any encroaching items, not timely removed by the owner, shall be removed and disposed of by the Contractor in accordance with the Contract Documents.

(M) Restoration of Temporary Construction Easements: The Contractor shall leave the easements in as good a condition or better after work is completed. Special care must be taken to replace any asphalt, trees, sprinklers, lights, walls, fences, etc., which were disturbed as a result of construction. Where grass is located within the easement such as a lawn, the Contractor shall remove the sod which would be in the path of any construction, store it, keep it moist, an replace it immediately after construction is complete.

(N) Any removals called for on the Traffic Signal Plans.

(O) Any and all items not specifically set forth as a separate pay item.

Subsection 350.4 PAYMENT: change to read:

Measurement will be on a lump sum basis for the work done as described above and as included in MAG Section 350. Payment will be made on a lump sum price for proposal item - MISCELLANEOUS REMOVAL AND OTHER WORK which shall be full compensation for all work complete and to the satisfaction of the Engineer.

SECTION 361

MICROSEAL SPECIFICATIONS
Adding in entirety

361.1 SCOPE

The intent of this guideline is to specify the design, testing methods, and quality control procedures for the application of a "quick traffic solid/polymer microsurface."

361.2 DESCRIPTION

This specification covers the materials, equipment and construction procedures for rut filling and/or resurfacing of existing paved surfaces. The microsurface shall be a mixture of cationic polymer modified asphalt emulsion, mineral aggregates, mineral filler, water and other additives properly proportioned, mixed and spread on the pavement surface in accordance with this guideline and as directed by the Engineer.

361.3 SUPPLY OF MATERIALS

The Contractor shall supply all materials necessary for the performance of the work in accordance with the specifications.

The Contractor shall be responsible for the safety of all materials of which he has taken delivery, until they are in place on the road and shall take all necessary precaution to avoid loss by fire or theft or damage by water and shall bear the cost of replacing any such material that is lost, split, destroyed or damaged after delivery is effected.

361.4 MATERIALS

Materials shall be approved by the Engineer prior to the start of construction. Certificates of Compliance will accompany each delivery of emulsion.

361.4.1 ASPHALT EMULSION OF MICROSEAL

The polymerized Cationic Emulsion is herein classified as CSS-1H, quick-setting, cationic type emulsion for mixing applications and seal coat. A minimum of 4% of saturated polymer shall be high sheared into the asphalt prior to the emulsification process. The Agency may choose to sample the polymerized asphalt for testing. The amount of polymer will be based on weight of polymer and asphalt (total wt.) and be certified by supplier. The polymerized emulsion will meet the following specifications listed in Table 361-1.

TABLE 361-1

TEST	AASHTO METHOD	SPECIFICATION LIMITS
Tests on Emulsion*		
Viscosity, SSF @ 77°F. sec.	T-59	15-100
Sieve Test, %	T-59	0.10 Max
Particle Charge	T-59	Positive
Storage Stability Test. 24 h. %	T-59	0.1 Max
Evaporation Residue %	Ariz 512	60 Min.
Tests on Evaporation Residue	Ariz 504	
Kinematic Viscosity 275°F. cst	T-201	650 Min.
Penetration, 77°F 100 g.@ 5 sec.	T-49	40-90
Softening Point degrees F	T-53	140 Min.
Ductibility, 77% 5 cm/Min	T-51	60 Min.
Tests on Evaporation Residue after RFTO		
Kinematic Viscosity 275°F. aging ratio, cst	T-201	2.5 Max.
Softening Point degrees F.	T-53	140 Min.

* The emulsion upon standing undisturbed for a period of twenty-four (24) hours, shall show no white or milky colored substance on its surface, and shall be a homogeneous brown color throughout.

361.4.2 MODIFIER TYPE AND CONTENT

The modifier shall be saturated. The asphalt cement shall contain a minimum of 4% solid polymer by weight of asphalt residue, sheared into the asphalt prior to emulsification.

361.4.3 AGGREGATE

The mineral aggregate shall consist of sound, durable crushed stone or crushed gravel and approved material filler. The material shall be free from vegetable matter and other deleterious substances. Aggregates shall be 100% crushed with no rounded particles. No natural sand will be allowed.

The percentage of composition by weight of the aggregate shall conform to the nominated gradation selected from the following:

TABLE 361-2
PERCENT PASSING

SIEVE SIZE	RUT FILLING	TYPE III	TYPE II
1/2	100	100	100
3/8	85-95	100	100
No.4	55-75	70-90	85-100
No.8	45-55	45-70	65-90
No.16	25-10	28-50	45-70
No.30	19-34	19-34	30-50
No.50	10-20	12-25	18-30
No.100	7-18	7-18	10-21
No.200	5-15	5-15	5-15
Application Rate			
Pounds per Square Yard	30-35	24-35	18-24

The mineral aggregate and mineral filler shall have a sand equivalency value not less than 50 (ASTM D 2419) and be non-plastic.

If more than one kind of aggregate is used, the correct amount of each kind of aggregate to produce the required grading shall be proportioned separately in a manner that will result in a uniform and homogeneous blend. The final blended aggregate shall meet requirements for grading, sand equivalency and plasticity per above.

361.4.4 MINERAL FILLER

Mineral filler, required by the mix design, shall be any recognized brand of non-airentrained Type I normal Portland cement that is free of lumps and clods, with a minimum of 85% passing the #200 sieve added by weight of aggregate as specified by the mix design.

361.4.5 WATER

The water is to be potable water free from any injurious impurities. The Contractor shall state the source of water at the time of tendering.

361.4.6 ADDITIVES

Additives may be used to accelerate or retard the breaking point and set times of the microsurface mix, or improve the resulting finished surface.

The use of additives in the microsurface mix shall be supplied to quantities predetermined by the laboratory mix design.

361.4.7 PROPORTIONING

The microsurface shall be proportioned in accordance with the mix design. Calibrated sign flowmeters shall be provided to measure both the addition of water and additives to the pugmill. Emulsion and cement flow shall be tied directly to aggregate flow. All additive flows shall be calibrated.

361.4.7.1 The microsurface mixture shall be proportioned per the mix design to ensure:

(A) Trafficability - with a relative humidity at not more than 50% and ambient air temperature of at lease 77 degrees F, the material will permit controlled traffic without damage to the surface within thirty (30) minutes and uncontrolled traffic without damage within sixty (60) minutes.

(B) Prevent development of bleeding, raveling, separation or other distress for seven (7) days after placing the microsurface.

(C) The finished mixture will be warranted against material defects for one year; existing conditions excluded.

361.5 MIX DESIGN

361.5.1 The Contractor shall provide a job mix formula from an approved laboratory and present certified test results for the Engineer's approval. Compatibility of the aggregate and polymer modified emulsion shall be certified by the emulsion manufacturer. All the materials used in the job mix formula shall be representative of the materials proposed by the Contractor for use in the project.

361.5.2 All the products used in the construction shall have certifications from the suppliers and shall be given to the Engineer upon delivery of the project.

361.5.3 Mix design and proportioning will be approved by the Engineer prior to the start of the project.

361.5.4 SPECIFICATIONS

361.5.4.1 The Engineer shall approve the mix design prior to use. The specification limits are as follows:

TABLE 361-3

SPECIFICATION	LIMITS
Residual Asphalt	6%- 11.5% by dry weight of agg.
Mineral Filler	1% - 1% by dry weight of agg.
Polymer Content/Type	4% min. (see COP Supplement Section 4.2)
Additive	As required for mix properties
Water	As required for mix properties
Aggregate Grading	Type as specified meeting COP Supp. Sec. 4.3
Consistency	2.5 to 3.0 cm
Traffic Time	See COP Supplement Section 5.2.2
Abrasion Loss	75 g/sf max.
Adhesion	90% minimum
Loaded Wheel Sand Adhesion	See COP Supplement Section 5.4.3

361.5.4.2 MODIFIED COHESION TEST

Furnish laboratory test data showing the mix design to be trafficable thirty (30) minutes after application at 77°F conforming to the following criteria in accordance with test methods described in the applicable specifications.

Set Time Test: 15 minutes 12 kg - cm minimum.
Early Rolling Traffic Time: 60 minutes 20 kg - cm minimum.

361.5.4.3 LOADED WHEEL SAND ADHESION TEST

Furnish laboratory test data showing the mix design conforming to the following criteria in accordance with test methods described in the appropriate specifications.

TABLE 361-4

VEHICLES/DAY	MINIMUM SAND ADHESION
0-30	70 g/ft
250-1500	60 g/ft
1500-3000	55 g/ft
Greater than 3000	50 g/ft

361.5.5 The laboratory shall further report the quantitative effects of moisture content in the unit weight of the aggregate (bulking effect). The report must clearly show the theoretical recommended proportion of aggregate, mineral filler (Min. & Max.), water (Min. & Max.), additive(s), and asphalt and how the proportions are based (dry aggregate weight, total mix, etc.).

361.6 TESTING THE MICROSURFACE

Samples will be taken throughout the project for testing by the approved laboratory per ISSA TB101. Testing for asphalt content shall be at the expense of the Agency.

361.7 EQUIPMENT

361.7.1 GENERAL

All equipment, tools and machines used in the performance of this work shall be maintained in satisfactory working condition at all times to ensure a high quality product.

361.7.2 MIXING EQUIPMENT

The mixing machine shall be a self-propelled or truck-mounted mixing machine which shall be able to accurately deliver and proportion the aggregate, mineral filler, water, additive, and polymer-modified asphalt emulsion to a revolving multi-blade mixer capable of minimum speeds of 200 RPM and discharge the product on a continual flow basis. The machine shall have sufficient storage capacity for aggregate, polymer modified asphalt emulsion, mineral filler, water, and additive to maintain an adequate supply to the proportioning controls.

361.7.3 MATERIAL CONTROL

361.7.3.1 CALIBRATION

Each mixing unit to be used in the performance of the work shall be calibrated prior to construction. Calibration data, if done within the calendar year, using the same material, may be used, providing a verification of the aggregate feed agrees.

361.7.3.2 Individual volume or weight controls for proportioning each material to be added to the mix shall be provided, and shall be accesible to the Engineer. Each material control device shall be calibrated prior to work and documented for inspection by the Engineer.

361.7.3.3 AGGREGATE FEED

The aggregate feed to the mixer shall be equipped with a revolution counter or similar device so the amount of aggregate used may be determined at any time.

361.7.3.4 EMULSION PUMP

The emulsion pump shall be the positive displacement type with a jacketed housing for uniform heating. A revolution counter or similar device shall be fitted so that the amount of emulsion used may be determined at any time.

361.7.3.5 FINES FEEDER

An approved fines feeder is required that will provide a uniform, positive, accurately metered range of 0 - 1 percent by dry aggregate weight. The fines feeder shall have a counter so the amount of mineral filler can be filler determined at any time.

361.7.3.6 LIQUID ADDITIVE

The mixing machine shall be equipped with a liquid additive system that provides a pre-determined amount of additive to the mixing chamber. This additive system must be equipped with a counter that can determine the amount used at any time.

361.7.3.7 WATER SYSTEM

The mixing machine shall be equipped with a water system that provides a pre-determined amount of water to the mixing chamber. This water system must be equipped with a counter that can determine the amount used at any time.

361.7.4 OPERATOR CONTROLS

361.7.4.1 Controls will allow the operator to sequence and proportion the material per the mix design.

361.7.5 SPRAY BARS

The mixing machine shall be equipped with a water pressure system that provides a water spray immediately ahead of and outside the spreader box.

361.7.6 SPREAD EQUIPMENT

361.7.6.1 The paving mixture shall be spread uniformly by means of mechanical type laydown box attached to the mixer, equipped with agitation, to spread the materials throughout the box without any dead zones. The paddles shall be designed and operated so all the fresh mix will be agitated. Flexible seals, front and rear, shall be in contact with the road surface to prevent loss of mixture from the box. The spreader box shall be equipped with hydraulic cylinders for controlling the thickness of the spread mixture.

361.7.6.2 The rut filling spreader box shall have 6 to 8 skids to provide for leveling and filing uneven depressed areas. The rut filling spreader box will require two adjustable steel strike-off plates. The rear flexible seal shall act a final strike-off and shall be adjustable. The steel strike-offs shall be controlled by hydraulic cylinders placed at the rear of the spreader box.

361.7.6.3 The spreading equipment shall be maintained free from build-up of the mixture on the paddles or side walls. Skips, lumps, or tears will not be allowed in the finished product.

361.8 APPLICATION

361.8.1 GENERAL

The microsurface shall be of the desired consistency when deposited in the spreading box and nothing more shall be added to it. The mixing time shall be sufficient to produce a complete and uniform coating of the aggregate and the mixture shall be chuted into the moving spreader box at a sufficient rate to maintain ample supply across the full width of the strike-off squeegee at all times.

361.8.2 WEATHER

The microsurfacing shall be placed when the temperature is at least 45 degrees F and rising, and it is not raining. The surface temperature shall be 50 degrees F or higher when the mixture is applied.

361.8.3 PROTECTION OF EXISTING SERVICES

The Contractor shall take all necessary precautions to prevent microsurface or other material used from entering or adhering to gratings, hydrants, valve boxes, manhole covers, bridge or culvert decks, and other road fixtures. Immediately after resurfacing, the Contractor shall clean off any such material and leave any grating, manholes, etc. in a satisfactory condition.

361.8.4 FOGGING PAVEMENT

The surface should be pre-wetted by fogging ahead of the spreader box. The rate should be adjusted as dictated by the pavement temperatures, surface texture, humidity, and dryness of existing pavement.

361.8.5 MIX STABILITY

The modified mix shall possess sufficient stability so that premature breaking of material in the spreader box does not occur. The mixture shall be homogeneous during mixing and spreading; it shall be free of excess water or emulsion, and free of segregation of the emulsion and aggregate fines from the coarser aggregate.

361.8.6 APPLICATION RATE

The application rates, square yards per cubic yard of mix specified are average rates; the surface texture variation throughout the work will dictate the actual spreading rates. The strike-off squeegee shall be adjusted to provide a microsurface thickness which will completely fill the surface voids and provide an additional thickness not exceeding one and one-half times the largest top-size stone. This requirement of 1-1/2 stone depth does not apply to rut filling operations as these depths vary greatly according to the surface irregularities.

361.8.7 JOINTS

No excessive build-up or unsightly appearance shall be permitted on longitudinal or transverse joints. A maximum of 4.0" overlap will be permitted on longitudinal joints. The Contractor shall provide suitable width spreading equipment to produce a minimum number of longitudinal joints throughout the work. Half passes and odd width passes will be used in minimal amounts. If half passes are used, they cannot be the last pass of any paved area. Care shall be taken to ensure straight lines along curbs and shoulders. No runoff on these areas will be permitted.

Construction joints shall be neat in appearance and shall be tapered or feathered to conform to the existing surfacing. All excess material shall be removed from the surface upon completion of each run.

361.8.8 HANDWORK

Approved squeegees and lutes shall be used to spread the mixture in areas inaccessible to the spreader box and other areas where hand spreading may be required.

361.8.9 PROTECTION OF MICROSURFACE

Adequate means shall be provided by the Contractor to protect the uncured product. Any damage done to the product shall be repaired at the Contractor's expense.

361.8.10 DAMAGE TO MICROSURFACE

The Contractor's responsibility to replace microsurface damaged by unexpected rain after spreading shall be limited to the period within four (4) hours of placement of the microsurface.

361.9 PAYMENT

The micro-surfacing shall be paid for by the weight of the aggregate and weight of emulsified asphalt, as shown on certified weight tickets from the supplies delivered to the project less weigh backs. The price shall be full compensation for furnishing, mixing and applying all materials; and for all labor, equipment, tools, design tests, and incidentals necessary to complete the job as specified herein.

PART 400

RIGHT-OF-WAY AND TRAFFIC CONTROL

SECTION 401

TRAFFIC CONTROL

Section 401 TRAFFIC CONTROL: delete this section in its entirety and substitute the following:

401.1 DESCRIPTION:

Traffic control shall consist of traffic control devices and flagger or pilot cars. All traffic control devices, the application of traffic control measures, and traffic regulation in these City of Phoenix supplements are to supplement and are not intended to delete any of the provisions of the Contracting Agency's Traffic Barricade Manual, the Uniform Manual on Traffic Control Devices or any agency's Supplements to these Uniform Standard Specifications.

401.2 TRAFFIC CONTROL DEVICES:

The Contractor shall provide and maintain all necessary traffic controls to protect and guide traffic for all work in the construction area.

Traffic control devices shall consist of providing, erecting, and maintaining necessary and adequate devices for the protection of the work, the workers and the traveling public.

(A) Temporary traffic control devices shall be used to guide traffic through construction areas. They include, but are not limited to, traffic cones to channelize traffic, portable barricades for warning, vertical panel channelizing devices to divert traffic, and lighting devices between the hours of sunset and sunrise.

(B) Advance warning devices shall be used to alert the motorist of an obstruction in the roadway. They include diamond-shaped signs, flags, and flasher-type high level warning devices mounted 8 feet above the roadway.

(C) The Contractor shall in all cases notify the Engineer at the same time as other required notices in this section are made. Notification shall be through the Engineer when so required.

401.3 FLAGGERS AND PILOT CARS:

Flagging of traffic or pilot cars shall consist of providing sufficient flaggers (with proper signing), uniformed off-duty law enforcement officers or pilot cars to expedite the safe passage of traffic. Off-duty law enforcement officers shall be used when flagging two or more traffic lanes in each direction, and at the signalized intersection when one through lane is maintained in any direction.

401.4 TRAFFIC CONTROL MEASURES:

The application of all traffic control measures shall be based primarily upon the conditions existing at the time that such measures are deemed necessary. Prior to the start of any work that would interrupt the normal flow of traffic; sufficient and adequate devices and measures shall be provided and erected required for compliance with the stipulations. The Engineer reserves the right to require additional traffic control measures in any specific instance. These devices shall be immediately removed when no longer needed.

401.5 GENERAL TRAFFIC REGULATION:

Requests for partial or complete street closure permits shall be directed to the Right of Way Management Agent (RMP Agent) through the Engineer or the Permit Inspector on permit work. An advance notice of 72 hours for complete closures on major and collector streets and 48 hours for partial closures on major and collector streets, 24 hours for local streets and alleys or as directed by the RMP agent is required from the Contractor.

A traffic lane shall be a minimum of 10 feet of clear width with a safe motor vehicle operating speed of at least 35 miles per hour.

An intersection shall be all of the area within the right-of-way of intersecting streets plus 300 feet beyond the edge of the intersected right-of-way on all legs of the intersection.

The following are minimum traffic control requirements for all traffic restrictions, unless otherwise provided for in the "Special Traffic Regulations" listed in the special provisions or permit, approved by the RMP Agent, or during emergency conditions:

(A) During the PEAK TRAFFIC HOURS of 6:00 a.m. to 8:30 a.m. and 4:00 p.m. to 6:00 p.m., weekdays, TRAFFIC RESTRICTIONS ARE NOT PERMITTED on Major or Collector streets. Streets with reversible lanes shall not be restricted between 6:00 a.m. and 9:00 a.m. and between 4:00 p.m. and 6:00 p.m. weekdays.

(B) During OFF PEAK WEEK DAYS TRAFFIC hours, when one traffic lane is restricted at multiple lane signalized intersections with left-turn channels, the left-turn channels with special channelization shall be used to provide a minimum of four through traffic lanes (two lanes for each direction).

(C) Except as provided for in items A and B above, a minimum of two traffic lanes (one for each direction) shall be maintained open to traffic on all Major and Collector streets week nights and weekends, at all times. A minimum of two traffic lanes in the same direction shall be maintained open to traffic on "one way" streets at all times.

(D) A traffic lane shall not be considered as satisfactorily open to traffic unless it is paved with hot mix or cold mix asphalt.

(E) The Contractor, utility or other agency shall provide a City Of Phoenix approved uniformed off-duty police officer during OFF PEAK traffic hours to assist with traffic control at multiple lane signalized intersections whenever traffic is reduced to one through lane in any one direction. This requirement may be waived by the Engineer when conditions, in his opinion, do not require it.

(F) Local streets may be closed except for local access, when construction or maintenance requires.

(G) Local access shall be maintained to all properties on all streets (Major, Collector and Local) at all possible times. When local access cannot be maintained, the Contractor, utility or other agency shall notify the affected property owner, resident, or tenant, a minimum of 24 hours in advance and restore access as soon as possible. Unless specifically authorized by the Engineer, access to businesses will not be closed during business hours.

(H) All Contractors doing work in the right-of-way shall promptly remove all traffic control devices when the closure or lane restrictions are no longer in effect. When no construction work is being done, all advance warring signs shall be turned so that they are not readable by drivers. All traffic control devices may be temporarily stored in cluster method behind the sidewalk for short periods of time.

(I) Special Events: If there are special events scheduled to take place during the construction of any project, the Contractor shall coordinate these events with the construction schedule.

401.6 EXISTING TRAFFIC CONTROL DEVICES:

During construction and maintenance operations it is important that all existing traffic control devices be kept compatible with the traffic restrictions imposed. This includes existing signs, parking meters, traffic signals and pavement markings. Some devices will remain applicable to traffic and must be maintained. Other devices must be covered, relocated or removed. Requirements for each group of devices are detailed in this section.

(A) Traffic Signs:

The Contractor, utility or other agency shall maintain all existing STOP, YIELD and street name signs, verifying they are erect, clean and in full view of the intended traffic at all times. If these signs interfere with construction, the Contractor, utility or other agency shall temporarily relocate the signs to permit construction, but the devices must be kept in full view of the intended traffic. Portable signs shall be used to supplement the relocated permanent signs.

Other signs still applicable shall also be maintained erect, clean and in full view of the intended traffic by the Contractor, utility or other agency at all times. Existing signs, not applicable, shall be removed by the Contractor, utility or other agency without damage, and salvaged on the adjacent property lines. The Streets Transportation Department shall be notified of all removals.

(B) Traffic Signals:

The Contractor, utility or other agency shall maintain all existing traffic signal equipment except vehicle detector sensing devices, fully operational in the existing locations and in full view of the intended traffic at all times unless otherwise specified in the Contracting Agency's Traffic Barricade Manual or in the Project or Permit Plans or specifications.

The Contractor, utility or other agency shall notify the Traffic Signal Shop (602-262-6204) 48 hours prior to the start of construction in the vicinity of signalized intersections. The Traffic Signal Shop will, in accordance with the Arizona Blue Stake regulations, provide the approximate locations of all underground traffic signal equipment (conduits, junction boxes, vehicle detector sensing devices, etc.). The exact location of this underground equipment shall be determined by the Contractor, utility or other agency prior to any excavating operations.

The Contractor, utility or other agency shall exercise care to prevent damage to all existing traffic signal equipment. Should damage occur, The Traffic Signal Shop will make the necessary temporary repairs to immediately restore traffic signal operation.

Responsibility for permanent repair or replacement of damaged equipment shall be as follows:

The cost for the permanent repair or replacement shall be at the Contractor's, utilities', or other agency's expense, when the approximate location of the damaged equipment has been made known to them. They will also be charged by the Traffic Signal Shop for any temporary or permanent repairs made by City of Phoenix forces. Permanent repairs or replacements made by a qualified electrical Contractor must be made to the satisfaction of the Traffic Signal Shop Inspector.

All permanent repairs or replacement shall be at the City's expense, when the approximate location of the damaged equipment has not been made known to the Contractor, utility or other agency; provided they have complied with the notification requirements of this section and requested underground locations.

When the existing traffic signal equipment cannot be maintained as provided for in the Manual or in the Project or Permit Plans or specifications, the Contractor, utility or other agency shall, at their expense, have a qualified electrical Contractor relocate said equipment to a temporary location and/or provide additional temporary equipment, such that all functions and indications of the existing signal equipment, except vehicle detector sensing devices, are maintained and in full view of the intended traffic at all times. The location and type of all temporary signal equipment shall be approved by the Streets Transportation Dept. All signal equipment relocations and/or installations of temporary signal equipment shall be coordinated by the Contractor, utility or other agency with the approval of the Traffic Signal Engineer. 72 hours advance notice is required.

When temporary equipment or new equipment is installed to replace existing equipment, the temporary or new equipment shall be fully operational before the existing equipment is removed.

The Contractor, utility or other agency shall restore all traffic signal control equipment to the original locations or new locations, if so specified, as soon as possible after all work in the immediate area is completed.

Signalized Intersection Requirements:

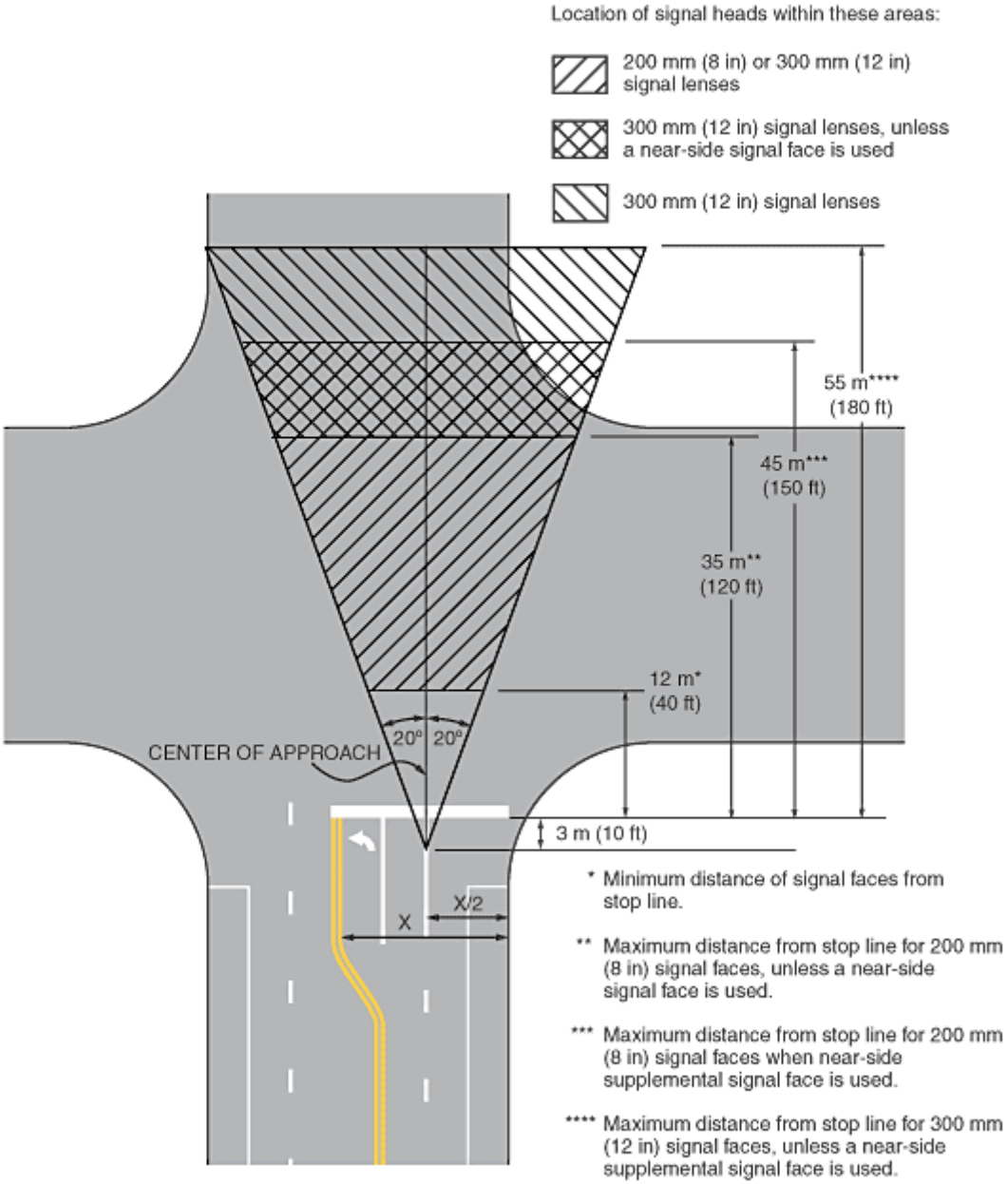
The Contractor shall notify the Engineer and the City Traffic Signal Shop (262-6021) at least 72 hours prior to the start of any construction in the vicinity of a signalized intersection where traffic signals may be affected.

The Contractor shall provide the Engineer and the Traffic Signal Shop a written schedule indicating days, times and specific locations where traffic signals will be interrupted or modified. **When work has been completed, the Contractor shall immediately notify the Traffic Signal Shop.**

Traffic Signal Head Visibility Requirements

The Contractor shall maintain a 40-degree "cone of vision" at all signalized intersections for full view of intended traffic and signal indication. Motorists driving through signalized intersections in a construction zone must always be able to see at least two (2) traffic signal heads within an angle no greater than 20-degrees either side of the straight-ahead position (40-degree cone of vision). If the traffic control setup cannot provide the required 20-degree cone of vision, the Contractor shall contact the City Traffic Signal Engineer at (602) 262-4693 for instructions. Refer to drawing 4D-2 on the next page.

Figure 4D-2. Horizontal Location of Signal Faces



Note: This figure illustrates the horizontal location of signal faces.

(C) Pavement Markings:

Existing pavement markings that conflict with the vehicle path indicated by barricades and channelization and cause driver confusion shall be removed or obliterated by the Contractor, utility or other agency as directed by the Streets Transportation Dept.

Generally, pavement marking removal or obliteration is only required on long term construction projects such as detours for bridge construction or similar fixed location projects. However, removal or obliteration of existing pavement markings may be required at any location when visual inspection and/or accident history shows driver confusion caused by existing pavement markings.

Proper pavement marking removal or obliteration leaves a minimum of pavement scars and completely removes or covers existing markings. Slurry Seal (MAG Specification Section 332) may be used to obliterate existing markings. When used, Slurry Seal shall be applied in strips at least 24 inches wide over existing markings. Markings that become exposed shall be recovered with Slurry Seal. Painting over existing markings with black paint or asphalt material is not satisfactory except in emergency conditions awaiting more permanent removal to follow immediately.

Final Signing and Striping of Roadway: The Contractor, through the City project inspector, shall notify the Street Transportation Department, Traffic Operations Division (602) 262-6456, at least thirty (30) days prior to desired completion of final roadway signing and lane striping.

(D) Parking Meters:

The Contractor, utility or other agency shall maintain all metered parking spaces open for parking at all possible times. When parking meters must be hooded or removed, the Contractor, utility or other agency shall notify the Streets Transportation Dept. 24 hours advance notice is required.

All parking meter post removals, relocations or installations shall be done by the Contractor, utility or other agency as provided for in the plans, or as directed by the Parking Meter Supervisor. The Streets Transportation Dept will provide the parking meter posts.

(E) Coordination with Other Agency Projects:

The Contractor shall coordinate and schedule work to minimize disruption or conflicts with any other Agency projects.

Any work that may affect the project shall be coordinated with the appropriate Agency contact at least fourteen (14) days in advance.

(F) Pedestrian Access Requirements:

The Contractor shall ensure that all sidewalks on this project remain in compliance with the Americans with Disabilities Act (ADA) Standards. All open pedestrian walkway areas, paved or unpaved, shall be maintained and safely usable at all times. Such measures as backfilling or ramping to existing sidewalks or providing alternate sidewalk areas adjacent to existing sidewalks may be used. In high pedestrian use areas, the Engineer may request temporary hard-surface walkways, such as plywood sheets to be installed at no additional cost to the City.

401.7 HOLIDAY SEASON TRAFFIC:

During the holiday season from the 15th of November through the 1st of January, it is imperative that construction and maintenance activities which interfere with traffic flow be reduced to the lowest possible level.

On all major streets, adjacent to, or serving as primary access to large regional shopping centers work that restricts traffic should be minimized. In addition, work within the entire Central Phoenix area should be curtailed (Maricopa Freeway to Bethany Home Road, 27th Avenue to 32nd Street).

Careful planning of work schedules to avoid operations that restrict traffic flow can do much to benefit the traveling public and decrease traffic accidents.

Special Events: If there are special events scheduled to take place during the construction of any project, the Contractor shall coordinate these events with the construction schedule.

401.8 FAILURE TO PROVIDE ADEQUATE MAINTENANCE OF TRAFFIC:

If the Contractor fails to provide adequate maintenance of traffic, the Contracting Agency will have the work accomplished by other sources. The cost of having this work accomplished by other sources will be computed in accordance with the City of Phoenix Supplement to Section 401.10. The total cost will be deducted from monies due to the Contractor.

401.9 MEASUREMENT:

No measurement will be made for traffic control devices.

When a pay item is included in the Contract Documents, flaggers, off-duty law enforcement officers or pilot cars, with driver, will be measured by the hour for each individual, including vehicle and equipment, required to perform traffic control. Minimum payment shall be three hours on any separate call out.

401.10 PAYMENT:

Payment will be made at the contract bid price in the proposal for uniformed off-duty law enforcement officer. If the officer is utilized in excess of 8 hours in any calendar day or in excess of 40 hours in any calendar work week, payment shall be at the rate of 1-1/2 times the contract bid price for all hours worked in excess in either of the above time periods.

Off-duty police officers required by the permit or used but not required by the Contract shall be paid at their regular rate of pay established by their primary employer. This is a non-pay item.

SECTION 404

TRAFFIC SIGNALS
Adding in entirety

404.1 GENERAL:

(A) The following specifications will outline the obligations of the private developer and /or private contractor constructing or relocating City of Phoenix traffic signal equipment. This includes private contractors working for ADOT, other agencies, or other departments within the City of Phoenix. **Any deviations to these work responsibilities will need to be discussed with the City of Phoenix Traffic Signal Engineer (262-4693).**

(B) These specifications and approved, signed traffic signal plans are in addition to other applicable specifications and policies of the City of Phoenix, Maricopa Association of Governments and the Arizona Department of Transportation.

(C) The Contractor shall notify the City of Phoenix, Traffic Signal Shop (262-6733) a minimum of fourteen (14) calendar days prior to beginning any traffic signal work.

404.2 PREPARATION:

(A) Before starting any traffic signal work under the project, **read and review** all project documents and general notes to make certain understanding and agreement is clear with all conditions stated.

(B) **Be sure that the traffic signal plans are the final approved plans.** Final approved plans shall have the signatures of City of Phoenix, Street Transportation Department officials. An approved set of plan documents shall be present on the job site during construction.

(C) Work to be done shall mean all labor, materials, equipment and other incidentals necessary to complete the work in accordance with the project plans. In the event an error or omission is discovered, it should be brought to the attention of the Traffic Signal Engineer immediately. The Traffic Signal Engineer shall make such corrections and interpretations as may be deemed necessary.

(D) The Traffic Signal Engineer has the authority to suspend traffic signal work to correct conditions unsafe for the workers or the general public, for failure to carry out provisions of the contract and/or to carry out orders.

(E) The Contractor shall note that approval is required before ordering or installing any material that is to be used on the project. This approval also includes the paint color for traffic signal equipment. The Traffic Signal Engineer or his designee shall answer all questions that may arise as to quality and acceptability of materials furnished and work performed, interpretation of plans and specifications, and all questions related to acceptable completion of work. It is recommended that the Contractor set a pre-construction meeting to discuss any questions and/or concerns.

(F) The Contractor shall make arrangements with the Traffic Signal Engineer to reimburse the City of Phoenix for any materials and/or work performed under Section 404.2 prior to beginning work.

(G) Submit a list of materials and equipment for approval to the Signal Shop Supervisor (602) 262-6733. To be acceptable, the submittal shall be complete and contain all items supplied on the project by the contractor. The City of Phoenix reserves the right to reject an incomplete or unclear submittal. Contractor supplied materials will be listed on the print.

404.3 MAINTENANCE OF TRAFFIC:

(A) Traffic shall be protected in accordance with The City of Phoenix, Traffic Barricade Manual and the Manual on Uniform Traffic Control Devices. All signs, placement of signs, and the necessity for police officers or flaggers are the responsibility of the Contractor. The contractor shall at all times so conduct his/her work as to ensure the least possible obstruction to traffic. The Contractor shall bear all expenses for installing and maintaining traffic control devices.

(B) Existing traffic signal equipment shall remain operational and in full view of the intended traffic at all times until activation of new equipment. If necessary, temporary overhead cable shall be used to maintain operation of signal equipment, as stated in Section V of the City Traffic Barricade Manual. The Contractor shall be responsible for all work and costs associated with temporary signal work. Traffic Signal Engineer or his designee shall approve any temporary signal work prior to beginning work including temporary vehicle detection.

(C) The Contractor shall provide the Engineer and the Traffic Signal Shop a written schedule indicating days, times and specific locations where traffic signals will be interrupted or modified. When work has been completed, the Contractor shall immediately notify the Traffic Signal Shop.

(D) The Contractor shall maintain a 40-degree “cone of vision” at all signalized intersections for full view of intended traffic and signal indication. Motorists driving through signalized intersections in a construction zone must always be able to see at least two (2) traffic signal heads within an angle no greater than 20-degrees either side of the straight-ahead position (40-degree cone of vision). Refer to drawing 4D-2 on page 34. If the traffic control setup cannot provide the required 20-degree cone of vision, the Contractor shall contact the City Traffic Signal Engineer at (602) 262-4693 for instructions.

404.4 MATERIALS AND WORKMANSHIP:

(A) Materials and construction details shall conform to the latest City of Phoenix Standard Traffic Signal Drawings, the Arizona Department of Transportation, Highways Division, Supplemental Specifications to Standard Specifications for Road and Bridge Construction, latest edition, and the Arizona Highway Department Traffic Signal and Highway Lighting Systems Standard Drawings, latest edition and the current National Electrical Code Standards will be unless otherwise specified herein or on the plans.

(B) Unless otherwise indicated on the prints, the Contractor shall be responsible for all work to be done, except for installing the:

Traffic signal controller cabinet and internal devices
Illuminated street name signs
Audible pedestrian devices
Pre-emption equipment
Detector loops

The contractor shall be responsible for the cost of the supplied equipment and the work done by the City to install the equipment listed above.

(C) Any equipment supplied by the City may be picked up from the Traffic Signal Shop, 2141 E. Jefferson Street, seven (7) days after receipt of a written request. (Mechanical devices and/or personnel for loading equipment onto vehicles for transport shall be the responsibility of the contractor. All equipment and procedures shall conform to OSHA regulations.) Contact the Traffic Signal Warehouse, (602) 495-2083, twenty-four (24) hours in advance for an appointment to pick up materials.

(D) All electrical materials and workmanship shall conform to the requirements of the National Electric Code (NEC).

(E) The Contractor shall call the Blue Stake Center at least 48 hours prior to excavation for information relative to the location of buried utilities. The contractor shall also contact the City of Phoenix Traffic Signals Department at (602) 262-6204 for traffic signal locates.

(F) All underground conduits shall be schedule 40 rigid polyvinyl chloride (PVC) installed 24 inches to 30 inches below finished grade with the exception of loop lead-in conduits which shall be schedule 40 rigid PVC installed in accordance with the latest City of Phoenix Standards. All conduits shall be installed in straight lines (unless otherwise shown on the plans) junction box to junction box or junction box to signal equipment foundation with one 90 degree sweep on each end as specified in the plans. All conduits entering junction boxes shall be vertical, with the top of the conduit six inches below the bottom of the cover.

(G) Foundations shall conform in size, type, and location as shown on the plans. The foundation anchor bolts shall be supplied by the Contractor and installed square with the intersection. The top of the pole foundation shall be set at the finished grade and at the back of sidewalk for each location unless otherwise shown of the plans. Concrete for foundations shall be Class A, 3000 psi concrete with a 6”slump, in accordance with Section 502 of the Standard Specifications of the City. Minimum pole foundation curing times are NO EXCEPTIONS: A-Poles five (5) days, M-poles seven (7) days, Special M-poles (SM) and Special R-poles (SR) ten (10) days. Quick curing compounds will not be acceptable.

(H) The Contractor shall have a Level II IMSA certified Technician/ Electrician on site at all times during construction/maintenance of traffic signal equipment. Conductor splices and terminations shall be made by a qualified Journeyman Electrician, who has successfully completed a recognized four (4) year apprenticeship program or equivalent training, or by a person enrolled in a recognized four (4) year apprenticeship program under the direct supervision of a Journeyman Electrician.

(I) A separate loop lead-in circuit shall be supplied for each inductive loop. Inductive loop lead-in cable shall be continuous without splices from the loop stub-out junction box to the controller cabinet. A minimum of five (5) feet of slack shall be provided in the controller cabinet and a minimum of three (3) feet of slack shall be provided in each junction box.

(J) Detector loops shall be installed and tested ONLY in the presence of an authorized representative of the City of Phoenix Traffic Signal Shop. Detectors installed without said representative in attendance, for any reason, shall be removed from the pavement and new conductors installed, all at the Contractors expense. Each detector shall be installed according to the latest Traffic Signal Standard Drawing. Installations shall be made permanent with approved sealant after successful testing. The loop conductor shall be temporarily spliced to the lead-in cables, as directed by the Inspector, and tested at the controller cabinet. Loop sealant shall be injected into all cuts and, before setting, surplus sealant shall be struck off flush with and removed form the roadway surface.

(K) All traffic signal heads shall be covered until activation except for 12" mast arm heads, which will not be installed until the day of the activation. These coverings must be maintained in good repair.

(L) The contractor shall maintain work and work site in an acceptable manner during the course of the project. Upon completion of the work all surplus earth, construction debris including abandoned foundations, and/or remnant equipment shall be removed and properly discarded by the Contractor and the work area shall be restored to a neat, orderly condition.

404.5 INSPECTION:

(A) The City of Phoenix Traffic Signal Foreman or his designee shall inspect all work performed including these critical components: all trenches and conduit runs including splices before being covered, wiring, junction box installations, loop layout, saw cuts, loop installation, and traffic signal pole foundations before being poured. The contractor shall contact the appropriate Traffic Signal Foreman forty-eight (48) hours in advance to request inspection or call (602) 262-6733.

(B) Inspections are typically at no cost to the Contractor. However, if the Contractor's performance results in the need for additional inspections or excessive inspection time for the Traffic Signal Foreman or his designee the Contractor will be put on notice and subsequent inspection costs shall become the Contractor's responsibility.

(C) The Traffic Signal Foreman or his designee is authorized to inspect all work done and materials furnished and have the authority to reject work or materials until any questions at issue can be referred to and decided by the Traffic Signal Engineer.

(D) In the event the Traffic Signal Engineer finds the materials furnished, work performed, or the finished product in which the materials are used or the work performed are not in reasonably close conformity with the plans and specifications and have resulted in work which is not reasonably acceptable, the work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor.

(E) The Traffic Signal Engineer has the authority to reject defective material and to suspend any work that is improperly performed.

404.6 ACTIVATION OF TRAFFIC SIGNAL WORK:

Notify the traffic signal shop prior to pulling conductors and activating the ultimate traffic signal system. Activation of new traffic signal intersections shall be scheduled through the Traffic Signal Engineer. An off duty Police Officer supplied by the contractor is required to be present for the activation to provide traffic control.

404.7 SALVAGED MATERIALS:

(A) Any existing equipment identified by the Traffic Signal Shop Foreman or his designee as salvageable shall be removed and delivered, in good order, to 2141 E. Jefferson Street and unloaded where designated. Contact the Traffic Signal Shop at (602) 495-2083, 24 hours in advance for an appointment to return salvaged equipment.

(B) Remnants of obsolete traffic signal equipment shall be delivered to the Traffic Signal scrap yard by the Contractor. Contact the Traffic Signal project inspector 24 hours in advance for an appointment to deliver obsolete equipment to the scrap yard.

404.8 WARRANTY:

(A) The warranty period will begin the day the work is accepted by the City.

(B) There will be a two (2) year warranty on all Contractor supplied equipment and detector loops except as noted herein. The Contractor will warranty all materials and workmanship supplied in association with the installation of City supplied equipment for a two (2) year period following acceptance of the work. All LED indication modules furnished by the Contractor will be warranted for five (5) years following acceptance of the project.

404.9 MEASUREMENT:

(A) Measurement for foundations, junction boxes, and loops shall be of the number of units of each satisfactorily constructed.

(B) Measurement for conduit shall be the linear feet of conduit satisfactorily installed as measured along the centerline of the conduit through fittings from end of conduit to end of conduit. Measurement shall be made to the nearest 0.5 feet.

(C) Measurement for the temporary signal cable and the lead-in cable shall be the linear feet of cable satisfactorily installed as measured along the centerline of the cable from end to end. Measurement shall be to the nearest 0.5 feet. The temporary signal cable is a contingency item and may be eliminated without compensation by the Engineer.

404.10 PAYMENT:

Payment for traffic signal work will be made at the unit prices bid in the applicable proposal pay item, which price shall be full compensation for all material and labor required to complete the work, as described and specified herein and on the plans.

SECTION 424

PARKWAY GRADING

Subsection 424.2 ROUGH GRADING: is modified to add:

(C) The parkway area shall be graded at a variable slope from 1 inch below the back of sidewalk to meet the existing surface at the right-of-way line in accordance with the typical section shown on the plans. Material displaced in the grading of parkways shall not be allowed to be placed on base and surfacing material already in place on the roadway. No measurement or direct payment will be made for this work.

Subsection 424.3 FINE GRADING: delete paragraph (B) in its entirety and substitute the following:

(B) Where existing parkways are planted in grass, flowers or shrubs, and the level is somewhat above the top of the curb or sidewalk, the parkway shall be graded as per City of Phoenix Landscape Standards and Guideline Detail "Water Retention on Turf Installation" with the least possible damage to the planted area.

SECTION 429

TRAILS
Adding in entirety

429.1 DEFINITION OF TERMS

(A) Multi-Use Trail (MUT): The MUT shall be a 10' wide compacted decomposed granite (DG) surface stabilized to its full 3" depth and shall also have 2' DG shoulders, allowing pedestrian, bicycle, equestrian and maintenance vehicle use. Switchbacks and clearances for obstacles, vegetation, and plants will be measured from the edge of the MUT excluding the 2' shoulders where installed. All MUTs shall meet or exceed the Americans with Disabilities Act (ADA) requirements and shall be Barrier Free Trails.

(B) Multi-Use Trail Easement (MUTE): The MUT shall be constructed within a dedicated 30' public MUTE.

(C) Shared-Use Path: The Shared-Use Path (SUP) is a non-equestrian 10' wide concrete pathway providing recreation and educational experiences. All SUPs shall meet or exceed the ADA requirements.

(D) Private Trails: The Trails Master Plan does not regulate the locations of Private Trails (PT). Construction and maintenance of PT is the responsibility of the private development. Construction of PT should follow the MUT or SUP guidelines set forth in these specifications.

429.2 SPECIFICATIONS

(A) MULTI-USE TRAIL

(1) Users:

(a) Hikers, joggers, bicyclist, equestrians and the disabled.

(2) Multi-Use Trail Easements (MUTE):

(a) Multi-Use Trails shall be located within an exclusive 30 foot minimum public trail easement.
(b) This easement is exclusive for the trail, landscaping, and PUE unless modified by Development Services.
(c) Trail easements along an open space or wash corridor will be a minimum 25' wide.

(3) Sub Grade:

(a) The sub-grade shall be 90% compacted prior to the installation of the MUT.

(4) Grade:

(a) Maximum sustained longitudinal grade 5% (20:1).
(b) The cross slope shall not exceed 2%.

(5) Tread Surface:

(a) The tread surface shall be a minimum of 10' wide with a 2' shoulder on each side. No shoulder will be required for the MUT in turf area.
(b) Trail shall allow for side-by-side travel and ease of passing by horses and bicycles. Tread conditions must provide an adequate walking or riding surface free of obstacles or hazards.
(c) The MUT surface shall be ¼" minus decomposed granite (DG) of a color contrasting with the surrounding DG and shall be stabilized to its full 3" depth.
(d) When located in turf, the MUT shall have a 6"x8" concrete header that meets or exceeds MAG Standards on each side. Shoulders shall not be required in turf.

(6) Path Locations:

(a) Public Multi-use Trails shall not be placed in retention basins, drainage ways, channels or naturally occurring or man made washes, unless otherwise approved by the Parks & Recreation Department.
(b) There shall be a minimum 5-foot horizontal clearance between trails and other obstacles i.e., fences, walls, utility boxes and other fixed objects. Safety rails or ADA railing are the exception to this requirement.
(c) Where the trail surface ties into another hardscape surface material i.e., sidewalk or curb, the trail shall meet and match the grade of the hardscape surface.
(d) Trails shall feed directly into ADA ramps at all roads and driveway crossings.

(7) Switchbacks:

(a) The inside radius of a trail switchback shall be a minimum of 5'.

(8) Vegetation Clearance and Removal:

(a) Plant material shall not be planted or allowed to grow in the 2' shoulders.
(b) Plant material shall be cleared to a height of 10' measured from the trail surface.
(c) Dead vegetation will remain in place unless considered a hazard or obstruction. Tree and brush cuttings, broken limbs and other vegetative debris including fallen saguaros shall be removed from within 5' of the trail.

(9) Plants with Thorns and Poisonous Plants:

(a) Plants with thorns such as cacti, *Acacia greggi, Dasylirion* species etc., shall not be planted or allowed to grow within 10' of the MUT.
(b) Poisonous plants such as *Nerium oleander*, *Sophora secundiflora, Euphorbia rigida* etc., shall not be planted or allowed to grow within 10' of the MUT.

(B) SHARED-USE PATHWAY

(1) Users:

(a) Hikers, joggers, bicyclist and the disabled.

(2) Easements:

(a) Trails shall be located within 20' public trail/sidewalk pedestrian easements.

(3) Sub Grade:

(a) The sub grade shall be 90% compacted.

(4) Grade:

(a) Maximum sustained longitudinal grade 5% (20:1).
(b) The cross slope shall be 2% maximum.

(5) Surface:

(a) The tread surface shall be 10' wide, standard. No SUP shall be less than 8' wide unless approved by the Parks & Recreation Department.
(b) The tread conditions shall provide an adequate walking surface free of obstacles or hazards and shall allow for side-by-side travel and ease of passing by pedestrians and bicycles.
(c) Concrete shall meet or exceed MAG Standards.
(d) Where the pathway surface ties into another hardscape surface material i.e., sidewalk or curb, the trail shall meet and match the grade of the hardscape surface

(6) Path Locations:

(a) SUP shall not be placed in retention basins, drainage ways, and channels or in naturally occurring or man made washes, unless otherwise approved.
(b) There shall be a minimum 5-foot horizontal clearance between sidewalks and trails and other obstacles i.e., fences, walls, utility boxes and other fixed objects.

(7) Switchbacks:

(a) The inside radius of a pathway switchback shall be a minimum of 5 feet.

(8) Vegetation Clearance and Removal:

(a) Plant material shall not be planted or allowed to grow in the 2' shoulders.
(b) Plant material shall be cleared to a height of 10' measured from the trail surface.
(c) Dead vegetation will remain in place unless considered a hazard or obstruction. Tree and brush cuttings, broken limbs and other vegetative debris including fallen saguaros shall be removed from within 5' of the trail surface.

(9) Plants with Thorns and Poisonous Plants:

(a) Plants with thorns such as cacti, *Acacia greggi, Dasylirion* species etc., shall not be planted or allowed to grow within 10' of SUP.
(b) Poisonous plants such as *Nerium oleander*, *Sophora secundiflora, Euphorbia rigida* etc., shall not be planted or allowed to grow within 10' of the SUP.

(C) GRADE SEPARATED CROSSING (UNDERPASS FOR PEDESTRIAN/EQUESTRIAN USAGE)

(1) When major trails intersect streets or roads, a pedestrian and/or equestrian cell (a barrel within a culvert) or bridge shall be provided for user safety.

(2) The underpass/bridge shall have a minimum 10-foot vertical and 10-foot horizontal clearance and unobstructed sight lines shall be maintained.

(3) Underpasses and bridges more than 50-foot in length shall be artificially lit to an average of 2 foot-candles minimum on the trail surface

(4) The underpass shall be connected to the MUT/SUP with a concrete tread surface, rough broom finished. The MUT shall receive a heavy broom finish to improve equestrian footing. The concrete shall meet or exceed MAG Standards.

SECTION 430

LANDSCAPING AND PLANTING

Section 430 LANDSCAPING AND PLANTING: Delete this section in its entirety and substitute the following:

430.1 DESCRIPTION:

This section shall govern the preparation and planting of landscape areas required in the Plans or Specifications. Materials shall be in accordance with the City of Phoenix Supplement to MAG Specifications Section 795.

Existing utilities and improvements not designated for removal shall be protected in place. The Contractor, at no additional cost to the Contracting Agency, will repair any damages.

Unless otherwise provided, walls, curbs, planter boxes, irrigation systems, and other improvements shall be constructed after rough grading has been completed and prior to finish grading.

430.2 GENERAL:

Furnish all labor, materials, equipment, and incidental needs to install the landscape to the drawings, details and specifications shown in the plans.

Applicable publications listed below form a part of this specification to the extent referenced:

> Arizona Nursery Association Growers Committee Recommended Tree Specification (latest edition)
>
> American Society for Testing and Materials
> (ASTM) C136, Standard method for sieve analysis of fine and coarse grained aggregates;
>
> (ASTM) F1632, Test methods for particle size analysis and sand grading of golf course greens and sports field root zone mixes;
>
> (ASTM) D2974 Method B, Test moisture, ash, and organic matter of peat and other organic soils;
>
> (ASTM) F1647, Test methods for organic matter content of golf course greens and sports turf root zone mixes.

All landscaping and irrigation work shall be installed by a contractor licensed to perform this specialty work.

Perform work in accordance with all applicable laws, codes and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State and local authorities in furnishing, transporting and installing materials as shown or for completing the work identified herein.

430.2.1 Source Quality Control: Ship materials with Certificate of Inspection required by governing authorities.

Do not make substitutions: If specified material is not obtainable, submit proof of non-availability, together with proposal for use of equivalent material, similar in appearance, ultimate height, shape, habit of growth and general soil requirements. The Contractor may make substitution of a larger size of the same species with approval by the Engineer. However, any additional cost for these substitutions will be borne by the Contractor.

Before delivery of the following materials, a letter of compliance shall be submitted, certifying that materials meet the requirements for legal transportation of State and Local government agricultural laws, and are true to analysis as specified. Certify the following:

Nursery propagated plants
Cacti, succulents, and native plants
Soil Amendments, and conditioners
Lawn seeds, stolons, and sod
Native seed mixes

430.2.2 Samples and Tests: The Engineer reserves the right to take and analyze samples of materials for conformity to specifications at any time. Contractor shall furnish samples upon request. Rejected materials shall be immediately removed from the site at the Contractor's expense. The Contractor shall pay cost of testing materials not meeting specifications.

430.2.3 Herbicide / Pesticide Applicators: All herbicide / pesticide applicators shall be properly licensed for application of non-restricted use chemicals with an A-20 license or an A-21 license with Pesticide Endorsement from the State Registrar of Contractors and Structural Pest Control Commission. All Landscape Contractors are required to furnish a copy of their application from the Registrar of Contractors, which shall list the names of those employees approved as applicators by the Registrar of Contractors. Application of non-restricted use pesticides shall not take place until the Engineer receives a copy of the application.

430.3 PLANT ESTABLISHMENT GUARANTEE AND MAINTENANCE:

Unless otherwise authorized, the Contractor shall maintain all landscape areas on a continuous basis as they are completed during the course of work and until final Plant Establishment Guarantee and Maintenance Acceptance. The Contractor shall provide adequate personnel to accomplish maintenance. Maintenance shall include keeping the landscape areas free of debris on a weekly basis, chemical control of weeds and fertilization as needed, cultivating the planting areas, and mowing of turf where lawns are part of the project.

Plants shall be kept in a healthy, growing condition by watering, pruning, spraying, weeding and any other necessary operation of maintenance. Plant saucers and beds shall be kept free of weeds, grass and other undesirable vegetation. Plants shall be inspected at least once per week and appropriate maintenance performed. Pruning and re-staking is to include removal of any growth conflicting with vehicular or pedestrian movement.

Turf from seed or stolons shall be considered established when it is ready for use, and turf exceeds 95 percent coverage of an 18 inch diameter ring when placed on the ground by the Engineer. The turf shall be vigorously growing, uniform in color, and cut to a uniform height designated by the Engineer. Roots shall have penetrated the soil to a depth of not less than 4 inches.

The Contractor shall maintain the irrigation system and make any necessary repairs regardless of cause to assure a complete and operational system as originally designed and constructed. Repairs shall be made within 48 hours of detection.

Chemical mixing for weed control shall be done in the presence of the Engineers representative. The method of application shall be approved by the Engineer.

The Contractor shall request an initial inspection by the Engineer when all planting and related landscape work is accomplished. After this initial inspection, and subject to approval of work by the Engineer, written field notification to the Contractor, setting the effective date for beginning of the Plant Establishment Guarantee and Maintenance Period will be issued. This Period shall last for 90 days or as specified, unless extended by the Engineer. If the landscape areas are improperly maintained; if appreciable plant replacement is required (for whatever reason); if corrective work is required for the operation of the irrigation system; or if other corrective work is necessary; the Plant Establishment Guarantee and Maintenance Period shall be extended and the Contractor shall continue to maintain the entire site until accepted at no increased cost to the Owner.

At the end of the Plant Establishment, Guarantee and Maintenance Period a final inspection will be performed. If, after inspection, the Engineer is of the opinion that all planting areas are weed free, plant materials are in satisfactory growing condition, the Engineer will give the Contractor written Notice of Acceptance of the landscape installation. Any plants which need to be replaced, regardless of the cause, shall be replaced prior to final acceptance.

430.4 JOB CONDITIONS:

Site Examination: The prospective Contractors are encouraged to visit the job site prior to bidding on this project, and to satisfy their concerns as to the magnitude of the work involved.

Water costs are the Contractors responsibility, until Final Acceptance or end of Plant Establishment, Guarantee, and Maintenance Period which ever is longer and the water meters are transferred to the City.

Before the beginning of landscape work, all planting areas shall be left free of construction debris and/or toxic material and subgraded to a level to permit landscape and irrigation construction. Trenches, foundation backfill or other filled excavations shall be compacted prior to the beginning of any landscape work. No soil preparation or planting shall begin before the site has been cleared and cleaned of debris. Commencement of work indicates acceptance of job site conditions.

Cooperate and coordinate with other Contractors and trades working in and adjacent to landscape areas.

430.4.1 Utilities: Determine location of underground utilities and perform work in a manner, which will avoid possible damages. The Contractor, at no additional costs to the Contracting Agency, will repair any damages. Hand excavate, as required. Maintain stakes by others until removal is mutually agreed upon by parties concerned.

430.4.2 Obstructions: If rock or other obstructions are encountered in excavation for planting, notify the owner's representative. Proceed with work only as directed.

430.4.3 Existing Surface Soils (Borrow Excavation): Shall be used for plating non-pave (non-turf) areas, and as part of the backfill mix for planting Nursery Stock.

430.4.4 Imported clean fill: Shall be used for turf areas and amended per 430.11 Preparation for Lawn. Unless otherwise specified the minimum clean fill depth in lawn areas shall be 6 inches.

430.5 DELIVERY, STORAGE, AND HANDLING:

Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored on site.

Sod: Time delivery so that sod will be placed within 24 hours after stripping at the sod farm. Protect against drying, cracking, and breaking of soil on the rolled strips.

Trees and Shrubs: Do not prune prior to delivery unless otherwise approved by owners representative. Do not bend or bind trees or shrubs in such a manner as to damage bark, break branches or destroy natural shape. Provide adequate protection for root systems. Protect root balls from drying wind and sun.

Deliver trees/shrubs just prior to planting. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage. Keep roots moist. Water as often as necessary.

Plant Inspection Prior to Delivery to the Project Site: Before delivery of any species to the project site, the Contractor shall make the necessary arrangements with the Engineer for an inspection of the plant material and tagging of representative plant stock. The Contractor will pay for travel to non-local Nurseries, out of the metropolitan Phoenix area, when plants are not available locally.

The Contractor shall notify the Engineer, at least 7 days in advance for inspection of the plant material. Prior to notification of the Engineer for inspection, the Contractor shall physically verify that the plant material meet the size specified.

After delivery, any plants found to be unsuitable in growth or condition, or plants, which are not true to the specification, or equal to the tagged plant stock, shall be removed, and replaced with acceptable plants at the Contractor expense.

430.6 MATERIALS AND PRODUCTS:

Materials and products shall conform to the requirements of the City of Phoenix Supplement to MAG Specifications Section 795.

430.7 SEQUENCING AND SCHEDULING:

Proceed with and complete landscape work as rapidly as portions of the site become available, working with reasonable limitations for each kind of work required.

Plant or install lawns during normal planting seasons or as directed by the Engineer.

For Bermuda, seed from April 15 to the end of September, provided nighttime temperatures are averaging above 60 degrees Fahrenheit.

For Perennial Rye Grass, when directed by the Engineer.

Coordination: Plant trees and shrubs after final grades are established and prior to planting lawns, unless otherwise accepted in the construction schedule by the Engineer. If tree and shrub planting occurs after lawn work, protect lawn areas and properly repair damage to lawns resulting from tree or shrub planting operations.

430.8 PREPARING THE SITE FOR LANDSCAPING:

All non-paved areas, as directed by the Engineer, shall be treated with a chemical control, such as Round-up or equal, to control and kill weeds. All applications of the chemical control agent shall contain a blue or green dye so that treated areas can be identified. These areas shall be cleared and grubbed, no sooner than two weeks after the last application of chemical weed control, or when week kill has been established to the satisfaction of the Engineer. Any area to receive seed mix or which is to remain undisturbed shall be excluded from treatment.

Clear and grub landscape areas in accordance with MAG Section 201.

Remove or relocate trees, shrubs, grass, improvements or obstructions that interfere with the installation of new work. Removal includes digging out stumps and roots to a depth of 12 inches below existing or proposed grade which ever is lower.

Fill depressions caused by clearing and grubbing operations with satisfactory soil material. Place fill in 6" loose depths and compact to adjacent ground densities.

Soil Preparation in non-turf areas including planters: After clearing and grubbing is complete, rough grade and remove all deleterious materials. Fine grade the areas. Rocks and debris, including miscellaneous concrete spillage clumps, over 1 inch in any dimension, shall be removed and disposed of offsite.

The finish grade for landscape areas shall not vary more than 1 inch from specified grade and cross section and shall be a smooth, uniform surface, free of abrupt grade changes or depressions. Surface drainage shall flow as designated on the plans.

Finished soil grades, adjacent to paving, curbs or headers will consider the depth of applied toppings materials such as granite or river run. Unless otherwise specified the soil grade for granite areas shall be 3 inches below adjacent pavements, for application of 2 inches of granite. Apply a pre-emergent weed suppressant to the finish soil surface; include dye as specified with the application.

430.9 HEADER INSTALLATION:

Headers shall be installed at the locations and elevations shown on the plans.

Concrete forms, shall be approved by the Engineer prior to pouring concrete. Concrete shall be Class B. Follow MAG specifications and City Supplements Section 340.

430.10 EXECUTION OF PLANTING:

Clearing and grading areas shall be free of construction debris and/or toxic materials and graded to permit landscape construction.

Landscape or planting areas shall not be cultivated when they are so wet as to cause excessive compaction or so dry as to cause excessive dust or the formation of large clods. Prior to excavating plant pits, layout individual trees and shrubs for owner's representative to approve the locations. Make minor adjustments as might be requested.

Protect existing vegetation from damage during planting operations. The Contractor is responsible to replace any damaged vegetation in kind as directed by the Engineer.

430.10.1 Deciduous and Evergreen Plantings:

Excavation: Plant pits shall be dug to produce vertical sides and flat, non-compacted but firm bottoms. If pits are dug with an auger and sides of pits are glazed, scarify the glazed surface. The size of the pits shall be twice the diameter of plant root ball or container size, and only as deep as the rootball.

Drainage: Test drainage of plant pits by filling with water twice in succession. Plant pits retaining water for more than 24 hours shall be brought to the attention of the owner's representative. Submit in writing a proposal for correction, for approval by Engineer, before proceeding.

Plant Backfill Mix: Shall consist of 1 part organic mulch, two parts excavated soil and 4 pounds gypsum and 1 pound of sulfur per cubic yard. The backfill shall be produced by thoroughly blending these components into a homogeneous mixture. The Contractor shall notify the Engineer prior to mixing prepared soil so that he may observe the mixing process. When requested submit a letter and test analysis results from a certified horticultural testing laboratory.

Setting and Backfill for Plants: Set plant material on non-compacted firm soil, plumb and in center of pit or trench. The crown (juncture of the root and shoot) shall be at grade when planting is complete. Remove pallets or containers before placing backfill. Do not handle container plants by foliage, branches or trunks. After removing plant from container, scarify side of root ball. Do not plant stock if root ball is cracked, broken, or root bound. When set at the proper elevation and orientation, place additional backfill mix, brace plant, and place fertilizer tablets. Work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3 full, water the plant thoroughly; before placing remainder of backfill. Repeat watering again after placing final layer of backfill mix until soil is completely saturated.

Place fertilizer tablets approximately 6" below grade and evenly spaced around the plant.

For one-gallon container.....1 tablet
For five-gallon container .....2 tablets
For fifteen-gallon container .....4 tablets
For twenty-four inch box.....6 tablets

Plant Saucers: Prepare an example plant saucer for the Engineer's review and approval. Schedule this review with the Engineer before starting planting operations.

Stake All Trees Per Plans: Set stakes vertically and spaced to avoid penetrating balls or root masses. Place tree ties for maximum support with top tie above scaffold branches and second tie midway to the ground level. Avoid "rigid" restraint of tree and allow for some trunk movement. Stakes are to be set into native soil.

430.10.2 Agave, Aloe, Cactus, Ocotillo and Yucca Plantings:

Excavation and Drainage: Shall be completed per Section 430.10.1, except plant pit shall be 6" deeper than rootball.

Backfill Mix: Shall be a mixture of 3 shovel's full of sand, or very coarse dirt (not clay or silt), one shovel of gypsum, one shovel of organic matter (avoid cow manure), 1/2 cup of sulfur, and ½ cup of phosphate (0-45-0). As you need more backfill mix, increase in these proportions.

Setting and Backfill: Do not set plant deeper than the plant grew naturally. Prior to placement, lay the plant down just over the hole. Trim off old dead roots to no longer than 2 inches and clean out any rocks stuck in the plant. All new plant root growth will come from the center of the root ball, not from the old roots or from the side of the stem or trunk. Sprinkle a tablespoon full of phosphate (0-45-0) in the hole. Place plant in the hole and orient to match the previous heliotropic growing condition. Set plant elevation to the visible dirt line mark of the plant and backfill the plant using the specified backfill mix. Plant shall be planted to maintain positive drainage away from the root collar of the plant. Tamp the soil to stabilize the plant. Now drench and wash off the plant.

Monitor watering closely. Normal watering for Agave, Aloe, Cactus, Ocotillo and Yuccas are once per week. During the heat of the summer, briefly spray or mist these plants from a hose, to cool the plants surface temperature. During cooler temperatures, adjust the watering schedule for the time of day and frequency.

430.11 PREPARATION FOR LAWN:

430.11.1 Soil preparation and Fine Grading New Turf areas: Excavate as necessary to accommodate depth of clean fill, topsoil and soil amendments. Prior to placing fills and amendments till to a depth of not less than 4 inches, making alternate passes at right angles. Remove rocks and debris greater than 1 inch, in any dimension. Remove high areas and fill depressions. Apply soil amendments (refer to the City of Phoenix Supplement to the MAG Specifications Section 795 Landscape Materials) as follows:

Organic matter 2 inches deep
Sulfur 10 lbs/1,000 SF
Iron Chelate 1 oz/1,000 SF

Roto-till soil and amendments to homogenous fine mixture, free of lumps clots, stones, roots and other extraneous matter. Till the mixture until it is uniform in color and appearance to the satisfaction of the Engineer.

Forty-eight (48) hours prior to seeding operations fine grade lawn areas to a smooth, even surface with a loose uniformly fine texture. Finish drag or rake lawn areas removing all deleterious material ½" or larger from the surface and to a depth of 2 inches below the surface. Roll the lawn surface to obtain the desired compaction and remove ridges. Finish grade shall be as shown on the plans. Finish grade shall be set 1-1/2" inches below adjacent paving, curb and headers. The Engineer shall be able to push a hand probe to a depth of 4 inches at any location where turf is to be established.

Apply fertilizer, reference City Supplement to MAG Section 795, fertilizer percentages (N-P-K) and the rate of application per soil fertility test results; For bidding purposes, the fertilizer shall be (15-15-15), applied at 5 LBS/ 1000 SF. Apply additional fertilizer at the end of the turf establishment or date agreed upon with the City. Establishing turf is the contractor's responsibility.

430.11.2 Recondition Existing Lawn Areas: Areas damaged by Contractor's operations, including damage caused by movement of vehicles, or from the storage of materials or equipment shall be reconditioned prior to seeding or sodding.

Remove ridges, ruts, and aerate compacted soils. Fill depressions with topsoil soil. Rake surfaces to remove clumps and debris and other deleterious material ½" or larger from the surface. Apply fertilizer, reference City Supplement to MAG Section 795, at the rate recommended by the manufacturer (stated on bag) before initial seeding operations.

430.12 LAWNS

The Contractor shall not begin planting until the irrigation system is completely installed and is adjusted for full coverage and is completely operational.

430.12.1 Sod: Allow for sod thickness in areas to be sodded. Apply commercial fertilizer at rates specified by the manufacturer and thoroughly mix into upper 2 inches of soil. Delay applications of fertilizer if planting will not follow within a few days.

Lay sod within 24 hours of initial cutting. Form a solid mass of sod with tightly fitted joints. Butt ends and sides of sod. Do not overlap joints. Stagger sod strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Sod edges and joints shall be leveled with approved soil mix.

430.12.2 Seeding Lawns: Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

Sow seed using a spreader or seeding machine at a rate of 3 1/2 pounds Bermuda per 1,000 square feet. Do not seed when wind velocity exceeds 5 MPH. Distribute seed evenly over the entire area by sowing equal quantities in two (2) directions at right angles to each other.

Bermuda seed shall be planted only at times when daytime atmospheric temperatures are consistently above 90 degrees F. and the nighttime atmospheric temperatures are consistently above 60 degrees F.. If turf establishment from seed can not be completed during the contract period, then Perennial Rye grass seed will be planted when required by the Engineer, at no additional cost to the City. Apply Rye grass at the rate of 15 pounds per 1,000 square feet. Distribute Rye seed evenly over the entire area by sowing equal quantities in two (2) directions at right angles to each other.

Rake lightly into top 1/8 inch of soil, roll and water with a fine spray.

430.12.3 Hydroseeding Lawn Areas: Contractor shall follow a two-step process of hydroseeding followed immediately by hydromulching. Equipment used shall be manufactured for the purpose of hydroseeding. It shall be equipped with a tank capable of continuous agitation, suspension, and blending of the slurry components. It shall be equipped with a pumping system capable of maintaining a continuous spray. It shall be equipped with nozzles and hoses to obtain a uniform application on designated areas. The tank and accessories shall be cleaned and be free of contaminants. The storage tanks shall have a means of estimating the volume used or remaining in the tank.

For hydroseeding and mulching materials, refer to City of Phoenix Supplement to MAG Section 795. All materials shall be labeled or supplied with test information concerning analysis of the various components. All work shall be performed in a professional manner to the best industry standards. Care shall be taken to avoid drift and displacement of material or any damage to structures and landscape. Protective covering shall be used where material would be objectionable. Clean up shall be done daily. Seeded areas shall be protected from traffic and construction activities.

Water, fertilizer, mulch and seed shall be combined in proportion in the first application to cover the areas at the specified rates. The ingredients shall be allowed to mix thoroughly. Allow the ingredients to mix for a minimum of 5 minutes before application of the slurry, but do not allow seed to be in the tank longer than 60 minutes, inclusive of the time to agitate.

Hydroseed an even first application of the following components:

Bermuda Seed .....200 LBS / Acre
Fertilizer .....200 LBS / Acre
Mulch (100% Wood Cellulose Fiber) .....400 LBS / Acre

Hydromulch an even second application immediately after hydroseeding with the following components:

Mulch (100% Wood Cellulous Fiber) .....1400 LBS / Acre
Tackifier .....100 LBS / Acre

Hydroseeding or mulching deposited on adjacent trees and shrubs, on roadways, structures or other area surfaces where they are not specified shall be removed.

Water the hydroseed to germinate the seed and continue watering until established. Monitor watering every day. DO NOT over water or under water. It may be necessary to water several times a day. Newly germinated areas must be kept moist.

430.13 DECOMPOSED GRANITE AND RIVER RUN AREAS:

The areas on which the granite mulch or river run rock is to be placed shall be graded according to the drawings, prior to the placement of any granite or river run rock. The ground shall be reasonably smooth and rocks larger than 1" in diameter, within the top 1" of soil shall be removed and disposed of off-site.

The Contractor shall stake out all areas to receive granite mulch or river run rock. These areas shall be treated with a pre-emergent control, such as Surflan or equal, prior to and after placement of the cover material.

Decomposed granite shall be evenly distributed on the designated areas to a depth as indicated on the plans and details. If a depth is not indicated the minimum depth shall be two inches.

After placing and grading the granite mulch, the Contractor shall water granite with a light spray to settle the to granite and remove fine materials from the surface. Immediately after watering, the Contractor shall roll the granite mulch with an appropriate device to an extent satisfactory to the owner's representative.

River run rock used shall be as specified on the plans. The rock shall be evenly distributed on the designated areas to depth 1-1/2 to 2 times the maximum gradation size.

430.14 CLEANUP AND PROTECTION:

During Landscape Work, keep pavements clean and work areas in an orderly conditions. Sweep, scrub or hose affected areas as directed by the owner's representative to maintain a clean and neat work area.

Protect Landscape Work and Materials from damage due to landscape installation, operations by other Contractors and trades, trespassers and animals. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged work as directed by the owner's representative. Remove all debris, trash and excess materials generated by the landscape installation.

430.15 MEASUREMENT AND PAYMENT:

The lump sum or unit prices established on the schedule of values shall be full compensation for furnishing all labor, material, tools and equipment and for performing all work necessary to complete the landscaping operation to include planting of trees, shrubs and ground cover.

The quantities of lawn seeding will not be measured but shall be the quantities designated in the contract documents, except that measurements will be made for revisions requested by the Engineer, or for discrepancies of plus or minus five percent of the total quantity designated in the Contract. The quantity of lawn shall include soil preparation, fertilizer, seed, and water, established and accepted.

The quantity of sod to be measured will be the actual number of square feet, including soil preparation, water, fertilizer and sod, established and accepted.

When line item bids or schedule of values do not initially include a cost for the Plant Establishment and Maintenance Period the cost shall be assumed in the schedule of values for landscape items (i.e., plant materials, irrigation, and inert materials, such as decomposed granite, river run and boulders). Ten percent of the sum total of landscape items in addition to retention will be held for distribution during the maintenance period. Equal monthly payments for maintenance will be authorized, based on inspection and subject to extensions, where the Contractor fails to comply with previously stated requirements in the City of Phoenix Supplements to MAG Specifications Section 430.3. Payment may or may not be supplemental to final project payment.

SECTION 431

PALM TREE TRANSPLANTING
Adding in entirety

431.1 DESCRIPTION:

This section shall govern the relocation (transplanting) and planting of palm trees required by the plans or specifications. The Contractor shall furnish all labor, materials and equipment required to complete the excavation, lifting, transporting and transplanting of palm trees.

431.2 GENERAL:

Unless otherwise provided by this section the work shall conform to the City of Phoenix Supplement to MAG Specifications Section 430 and the following.

431.3 PALM ESTABLISHMENT GUARANTEE AND MAINTENANCE:

Palm establishment, guarantee and maintenance shall be per City of Phoenix Supplement to MAG Specifications Section 430 with the following modifications or additions:

The palm establishment, guarantee and maintenance period shall be for 90 days, unless otherwise extended.

Guarantee palms against the vascular disease Penicillium (Gliocladium) vermoeseni, the fungus Fusarium oxysporum, and the root disease Phytophora and similar vascular infections for a period of five (5) years.

Replace without additional cost to the City all dead palms and all palms not in a vigorous condition as determined by the Engineer. Replacement shall be when directed by the Engineer.

431.4 JOB CONDITIONS:

Prospective Contractors are encouraged to visit the job site prior to bidding on this project, and to satisfy their concerns as to the magnitude of the work involved.

It may be necessary to supplement the irrigation system and provide additional water to establish newly planted palm trees. Water from the existing irrigation system will be paid for by the City. The Contractor is responsible for delivery and payment of water from other sources.

Remove all debris, trash and excess materials found on site or generated by the Contractor's operations.

Prior to digging and transplanting of palm trees the Contractor shall notify the Engineer at least two (2) working days before starting any work.

431.5 DELIVERY, STORAGE AND HANDLING:

Palms shall be free of dead or dying fronds with all fronds of a normal size and color.

The Landscape Architect will be available to review and tag palms at place of growth and will again review palms upon delivery for conformity to the specifications. Travel to non-local Nurseries, out of the metropolitan Phoenix area, when requested by the Contractor, will be paid for by the Contractor. In lieu of non-local nursery review, the Contractor may elect to provide photographs with a person adjacent to each palm for preliminary review. Such review shall not impair the right of review and rejection during progress of the work should the palms not meet the specifications. The selected palms shall not exceed the specified height by more than 1 foot. It is unacceptable to plant the rootball deeper than 1 foot above the soil line of the palm.

The Contractor must certify that the palms are free of disease prior to shipment.

After tagging of the palms, remove all thatch from older leaves and cut back all resulting stems to within 2 inches of the base of the trunk. The crown of the palm shall be reduced per standard nursery practice prior to shipping. Use soft rope (organic twine) to tie remaining fronds to protect crown bud. Do not permit fronds to become damaged by means of restraint.

Exercise extreme caution while pruning palms, to prevent spread of vascular diseases. Dip pruning tools in a sterilizing agent before beginning pruning and before moving from one palm to another. Do not use any chain type saws for pruning operations.

Lifting, Off-loading, and Transporting: A lattice type crane, a telescoping type crane or a specially designed tree crane is acceptable for lifting and off-loading palm trees. For transporting, the trailer used shall be long enough to avoid damage to the heart of the palm. Loading and unloading of palms must be accomplished with the aid of nylon or fabric sling/straps with a minimum width of 4 inches. Excessive scarring or trunk damage will not be permitted and will be cause for rejection of the palms at the project site.

If the palms are not planted the day they arrive at the project site, the crowns and root ball should be protected from the sun and from reflected heat from the ground. Avoid storing on an asphalt surface.

Covering material must allow air movement so that heat does not build up under the covering. Do not use plastic or rubberized tarpaulins. Trees may not be stored for more than 48 hours. Do not stack palms, but lay them in a single layer on a flat surface. Covered rootballs must be watered lightly every couple of hours.

431.6 MATERIALS AND PRODUCTS:

All palms shall have been grown in accordance with good horticultural practices under climatic conditions similar to those for the project for at least two (2) years prior to shipment to the site.

All palms shall be well-grown, symmetrical, without curvature or leaning trunk from the perpendicular and so trained or favored in development and appearance as to be superior in form, compactness and symmetry of crown. All palms shall be within one foot above or below the height specified, measured from the bottom of the crown bud to finish grade after installation.

All palms shall be sound, healthy and vigorous, well foliated prior to pruning and showing no signs of disease. They shall be free of disease, insect pests, eggs or larvae. They shall also have well developed root systems. All palms shall be free from physical damage or adverse conditions which would prevent thriving growth.

Verify that all field dug palms contain an adequate root ball to guarantee transplantation. Do not wrap root ball in plastic. Do not install palms that have damaged root balls.

Accessories:

Clean washed river sand.

Frond Tie: Minimum 1/2 inch diameter soft sisal rope capable of maintaining frond in tied condition for 1 year.

Fungicides: Soil Drench: "Subdue" by CIBA-GIEGY

431.7 SEQUENCING AND SCHEDULING:

Coordinate delivery of palms with planting operations to avoid on site storage longer than 48 hours. Planting delays may result in rejection of the palm.

431.8 PREPARING THE SITE FOR LANDSCAPING:

Remove palms designated for replacement. Removal includes digging out stumps and roots to make room for replacement material. Remove all debris, trash and excess materials generated, and dispose of this material off-site.

Protect existing plant material, walls, pavements and other site amenities from damage.

431.9 PALM TREE SALVAGING:

Prior to excavation, the palm tree shall be thoroughly watered.

Excavation: A trenching machine, a backhoe with a narrow bucket or a properly sized tree spade is acceptable as the excavation equipment. The exact equipment used must be approved by the Engineer.

Reduce the crown of palm trees per standard nursery practice. Use soft sisal rope to tie remaining fronds to protect crown bud.

The size of the root ball taken shall be a minimum of 18" to 24" deep and have a 2" to 3" wider radius than the base of the palm, unless otherwise directed by the Engineer. Certify that all field dug palms contain adequate root ball to guarantee successful transplanting.

Carefully lift and transport palm tree to the new location so as not to cause damage to the tree or site.

431.10 EXECUTION OF PLANTING:

Layout palms at locations shown on the plans. Use 3 foot lath, color coded for each palm. The Engineer will check location of palms in the field to exact position before planting begins.

Where palms are to be preplanted to permit site improvements to be installed around them, be responsible for the accurate layout of those palms, measured to their centerlines. Be responsible for the protection of those palms while work is taking place. Provide regular irrigation as necessary until final acceptance.

The palm tree excavation shall be a minimum of 1.5 times (x) larger than the root ball depth and 1 foot larger on all sides. It is acceptable for the final site grade around the palm to be 6 to 12 inches higher than the original soil line of the root ball. The depth of the pit shall be approved by the Engineer prior to planting the tree.

Water test each tree pit for drainage by filling the holes twice in succession with water. If when filled with water the second time the pit fails to drain within 24 hours, then additional excavation is necessary to break through the impermeable layer or provide a thick under layer of sand below the root ball. The cost for over excavation and for the installation of a drainage chimney will be considered should the tree pit not drain.

Clean moist washed river sand should be added to the bottom of the hole and tamped or water jetted, prior to insertion of the tree.

Install drainage and viewing pipe(s) in each tree pit to assure wetting of the whole root ball and to enable monitoring and viewing of the tree pit chamber. The vents shall be 4" diameter perforated PVC, with sufficient length to extend to the bottom of the tree pit. Do not backfill drainage or viewing pipes.

Backfill should be clean washed river or concrete sand amended with 25% native soil. In areas where soils are heavy in cliche, 100% sand shall be used. After placement of the palm, moistened sand shall be thoroughly tamped as backfill is being added to assure stability of the tree.

A 6" deep swale shall be made around each palm tree to provide water holding capability.
Mulch: Apply a 2" layer of decomposed granite in all palm tree watering basins.

After planting, the crown buds of all the palms shall be within 1 foot of the designated palm height above finish grade.

After planting, drench the soil with the fungicide, "Subdue" per manufacturer's recommendations by flooding the planting basin. Reapply as often as label permits throughout the maintenance period.

Irrigation: It is essential that irrigation be deep enough to assure wetting of the whole root ball. The Contractor shall maintain the irrigation system to the existing trees and supplement additional water to newly planted trees as necessary for establishment. Use a tensiometer weekly during the maintenance period to verify correct watering at the surface and at the bottom of the rootball, report moisture levels to the Engineer.

431.11 MEASURE AND PAYMENT:

Measurement will be made on the number of trees that survive the planting operations. Unless otherwise specified by the Engineer, the Contractor shall be responsible for the cost of replacement and planting of any palm tree, in kind, that does not survive. Palms that do not survive become the property of the Contractor for disposal. Payment will be made at the unit bid price for each surviving tree which will be full compensation for all labor, materials, tools and equipment required for excavating, transporting, transplanting, and watering of the tree(s).

SECTION 440

SPRINKLER IRRIGATION SYSTEM INSTALLATION

Section 440 Sprinkler Irrigation System Installation: delete this section in its entirety and substitute the following:

SECTION 440

LANDSCAPE IRRIGATION SYSTEM INSTALLATION

440.1 GENERAL:

The Contractor shall furnish all labor; materials, tools, equipment, and services necessary for the execution and completion of the irrigation system work as indicated on the drawings and as described in these specifications and the General Conditions.

Due to the scale of the drawings, it is not possible to indicate all offsets, fittings and sleeves, which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such offsets, fittings and sleeves as may be required to meet such conditions. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications.

The work of this Section generally includes provisions of an automatic underground irrigation system including the following:

Trenching, stockpiling excavation material, and refilling trenches.

Complete system including but not limited to piping, backflow preventer assemblies, valves, fittings, emitters, controllers and wiring, and final adjustments to insure complete coverage.

Replacement of unsatisfactory materials.

Clean-up, inspection, and approval.

Tests: The system shall efficiently and uniformly irrigate all areas and perform, as required, by the plans and specifications.

No irrigation work is to be performed until all areas are finished to proper grade and until soil preparation is completed, and has been approved by the Engineer.

440.1.1 WORK BY THE WATER SERVICES DEPARTMENT:

The Contractor will coordinate with the Engineer at the Preconstruction Meeting to schedule water service dates well in advance of need. The Engineer will contact the Water Services Department to authorize work required to be performed by Water Services Department crews. At least six weeks prior to need the Contractor will make application with the Water Services Department. At the time of application, the Contractor will contact the Water Services Department to schedule installation of a water tap and meter, and to provide them with his billing address.

The Contractor shall pay for all water used until the project is accepted, or until completion of the Landscape Maintenance period, whichever is later, and the water meter accounts are transferred back to the City. At the close of the project, the Contractor shall submit water meter account numbers to the Engineer and request transfer of the meter to the City. The Contractor will remain responsible for water used and payment thereof, until transfer.

440.1.2 WORK BY THE POWER COMPANY:

The Contractor will be responsible for coordinating with the power company to locate power drops for the irrigation controller(s), when power is not serviced by a Service Entrance Section.

Unless otherwise specified or directed by the Engineer, the Contractor will obtain an account with the utility company and will pay for all electrical power used until the project is accepted, or until completion of the Landscape Maintenance period, whichever is later, and the utility accounts are transferred. At Final Acceptance, Contractor will submit electrical meter account numbers to the Engineer and request transfer of the meter to the City, or the Contractor will remain responsible for electrical use and payment thereof, until transfer.

440.2 REFERENCES:

Conform to the requirements of reference information listed below except where more stringent requirements are shown or specified in the Contract Documents.

American Society of Testing Materials (ASTM) - Specifications and Test Methods specifically referenced in this Section.

Underwriters Laboratories (UL) - UL Wires and Cables.

440.3 QUALITY ASSURANCES:

Work involving plumbing for installation of copper piping, backflow preventer(s), and related work shall be executed by licensed and bonded plumber(s). Secure a permit at least 48 hours prior to start of installation.

440.3.1 Tolerances: Specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment, refilling, re-compaction, and repair of finish grade treatment.

440.3.2 COORDINATE WORK WITH OTHER TRADES:

For a period of one year from Final Acceptance, guarantee/warranty irrigation materials, equipment, and workmanship against defects. The Contractor shall replace any pavement damage resulting from the installation of the irrigation system and repair damage to grading, soil preparation, seeding, sodding, or planting at no additional cost to the owner. Make repairs within 3 days following notification by the Engineer.

440.3.3 Delivery Storage and Handling: During storage protect pipe from heat and sunlight. Provide shade protective cover and allow air to circulate between pipe. Transport pipe so as not to subject pipe to bending or concentrated external loads. Pipe, which is sun tanned, dented, or damaged will be rejected.

440.4 SUBMITTALS:

440.4.1 Shop drawings and product information: Prepare and make submittals in accordance with conditions of the Contract, and as follows: A minimum of ten days prior to beginning work on the irrigation system the Contractor shall submit six (6) copies of manufacturers literature. Highlight product specifics including name, and model numbers of materials listed below and any other items requested by the Engineer. Do not order materials until the Engineer approves products.

Items to be submitted:

Sprinklers (Turf heads, Shrub.....Backflow Preventers .....Flow meters
bubblers and emitters) .....Automatic Valves .....Flushcaps
Pipe & Fittings .....Controllers.....Micro tubing & stakes
Swing joint assemblies.....Quick Coupling Valves
Fittings and Solvents.....Wire and Connectors
Gate Valves.....Wye Strainers
Valve Boxes, pull boxes, et al. .....Pressure Regulating Valves

All items shall be those specified and approved by the Engineer. Substitutions will not be allowed without approval.

440.4.2 Record Drawings: The Contractor shall maintain an accurate set of as-built plans on site. At the end of each day work accomplished shall be updated on the as-built plans. The Contractor shall dimension from two permanent points of reference, building corners, sidewalk, or road intersections, etc., the location of the following:

Connection to existing water lines
Connection to existing electrical power
Gate valves
Routing of Sprinkler pressure lines (dimension at a minimum of 100 feet along routing)
Emitter control valves
Routing of control wiring
Quick-coupling valves
Other related equipment as directed by the Engineer

The Contractor shall indicate any non-pressure pipe routing changes on the as-built drawings.

Before the final inspection, the Contractor shall deliver to the Engineer one copy of the as-built plans to review. Delivery of this set of plans does not relieve the Contractor of the responsibility of furnishing required information that may be requested by the Engineer. The Contractor shall make corrections noted and submit final as-built plans to the Engineer for approval and acceptance. The Engineer will not certify payment requests or make final payment if as-built plans are not current or complete.

440.4.3 Controller Charts: As-Built drawings shall be approved by the Engineer before controller charts are prepared. The chart shall show the area controlled by the automatic controller and shall be 24" x 36" sheet size, unless a reduced size is approved by the Engineer. Identify the area of coverage of each remote control valve, using a distinctively different color, drawing over the entire area of coverage. Following review of the charts by the Engineer, they shall be hermetically sealed between two layers of 20 mm thick plastic sheets. These charts shall be completed and approved prior to final inspection of the irrigation system. When approved by the Engineer a separate card listing stations and areas covered may be substituted for the 24" x 36" hermetically sealed plan sheet(s).

440.4.4 Operation and Maintenance Manuals: Submit four (4) operation and maintenance manuals to the Engineer for review prior to final acceptance. The manuals should include the complete technical description of materials and products used; guarantee statement, complete operating and maintenance instructions on all major equipment. Contractor to provide a demonstration to maintenance personnel, with the Owner's Representative present, of how to adjust and maintain all sprinkler head types, controller functions, and recommended controller programs, as established by the Contractor. Contractor is also to review recommended watering rates for new plant materials.

440.4.5 Equipment to be furnished: All materials to be new and bear the appropriate National Association seal of approval for example, NSF, UL. etc. Similar units shall be procured from the same manufacturer and internal parts shall be common and interchangeable. Parts listing and source replacement will be furnished to the Engineer.

Equipment to be furnished:

a. Two sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve supplied to the project.
b. Two quick-coupler keys and matching hose swivels for each type of quick-coupling valve installed.
c. One five foot valve key for operation of gate valves

Extra Stock to be furnished:

a. 2 sprinklers of each type and 5 nozzles of each precipitation rate.
b. 2 bubblers of each flow rate used.
c. 5 Single Port Emitters of each flow rate used.
d. 2 Multi-port Emitters of each flow rate used.

The above mentioned equipment and stock shall be turned over to the Owner at the conclusion of the project. Before final inspection, evidence that the Owner has received this material must be provided to the Engineer.

440.5 PERMITS:

All permits for installation or construction of the work included under this section, which are required by legally constituted authorities having jurisdiction, shall be obtained and paid for by the Contractor, each at the proper time. He shall also arrange for and pay all costs in connection with any inspections and examinations required by these authorities.

440.6 EXECUTION:

Examine areas and conditions under which work of this section is to be performed. Do not proceed with work until unsatisfactory conditions have been corrected.

440.6.1 Staking: Mark the routing of the pressure supply line with powdered lime, and stake the locations of various components. Coordinate locations with other trades. Coordinate sleeving with other trades. Preliminary adjustments to conform to actual site conditions shall be accomplished during staking. Should changes be required, the Contractor shall obtain approval of the Engineer prior to actual work being performed. Utility connections, both water and electrical, shall be as shown on the plans or as designated by the utility concerned.

440.6.2 Trench Excavation: Trenches and other excavations shall be sized to accommodate the irrigation system components, conduit, and other required facilities. Additional space shall be provided to assure proper installation and access for inspection. Unless otherwise specified, the minimum depth of cover over pipelines and conduits shall be as follows:

a. Electrical conduit - 18 inches cover
b. Waterlines continuously pressurized - 18 inches cover
c. Lateral sprinkler lines - 12 inches cover
d. Plastic lines under pavement - 24 inches cover

The bottom of the trenches shall be true to grade and free of protruding stones, roots or other matter, which would prevent proper bedding of pipe or other facilities. Where ledge rock, hard pan, or boulders are encountered, the trench bottom shall be undercut and filled with sand or fine grained material approved by the Engineer.

Clearances:

a. Piping 3" and larger - minimum trench width of 12 inches.
b. Piping smaller than 3” - minimum trench width of 7 inches.
c. Provide not less than 4 inches of clearance between each line, and not less than 12 inches of clearance between lines of other trades, to permit service or replacement without disturbing the other line.

Grading and Stockpiling of trenched materials shall comply with City of Phoenix Supplement to MAG Section 601.

440.6.3 Sleeving: Piping located under asphalt, concrete, or other pavements shall be sleeved, size and schedule as noted on the plan. If not noted, sleeves shall be Schedule 40, sized to easily accommodate piping. Use separate sleeve for wiring.

Boring will be permitted only where pipe must pass under obstructions, which can not be removed, or when approved by the Engineer. When any cutting or removal of asphalt and or concrete work is necessary, it shall be saw cut in accordance with City of Phoenix Supplement to MAG Section 601. Permission to cut asphalt or concrete shall be obtained from the Engineer. When piping on the drawings is shown in paved areas, but running parallel and adjacent to planted areas, the intent of the drawings is to install the piping in the planted area.

440.6.4 Piping: Provide pipe, schedule and size as shown on the drawings and per these specifications.

PVC Pipe: Snake pipe in trench as much as possible to allow for expansion and contraction. Provide a firm, uniform bearing for the entire length of each pipeline to prevent uneven settlement. Installation of pipe shall be installed in accordance with ASAE Standard: ASAE 376. Pipe shall be clean prior to installation and shall be maintained in that condition during installation. When pipe lying is not in progress, the open ends of the pipe shall be closed by approved means.

If reclaimed water is used, all piping and associated appurtenances shall meet the applicable requirements of the Arizona Administrative Code R18-9-602(G). Signage will be placed to indicate the use of non-potable water.

Sand bedding or fine-grained material shall be provided where ledge rock, hard pan, or boulders are encountered. Compact bedding material is to provide a minimum depth of bed between pipe and rock of 4 inches.

Solvent welded joints shall be made in accordance with ASTM D-2855, and the type of solvent and primer recommended by the pipe manufacturer shall be used. Primer and solvent shall be applied to the pipe ends in such a manner that no material is deposited on the interior surface or forced into the interior of the pipe during insertion. Excess solvent on the exterior of the joint shall be wiped clean immediately after assembly. The pipeline will not be exposed to water for at least 12 hours after the last solvent welded joint has been made.

Schedule 80 pipe shall be used for threaded joints. Field threading shall be accomplished in the same manner as specified for steel pipe, except that a plug will be installed in the bore of the pipe prior to threading to prevent distortion. Solvent will not be used on threaded pipe. Threaded joints shall be hand tightened with final tightening as necessary to prevent leaks with a strap wrench.

The pipe shall be protected from damage during assembly. All vises shall have padded jaws and only strap wrenches will be used. Any plastic pipe, which has been nicked, scarred, or otherwise damaged, shall be removed and replaced. Care shall be exercised so that stress on a previously made joint is avoided.

When PVC to metal pipe connectors are required, these connections shall be accomplished first. A plastic adapter with external pipe threads should be used, screwing it into the metal internal pipe threads. Use a non-hardening pipe dope, such as Permatex #2, or equal, on all plastic to metal threaded joints. The joint shall be hand-tightened. Utilize a light wrench, as necessary, to prevent leaks.

When wrapped pipe is specified, joints and connectors shall not be wrapped until completion of the pressure test.

Use 45 degree fittings at all changes in depth of pipe. Couplings to be schedule 80 unless otherwise noted. Minimum length of PVC nipple shall be 3 inches.

440.6.5 WIRING:

Service wiring shall be installed in rigid conduit from the service point to the controller at the minimum depth specified. A separate disconnect switch or combination meter socket, as required, shall be installed between the source of power and the controller. The minimum Service wire shall be No. 12 AWG copper 600 volt type, TWH or larger, as required by the contract documents or controller manufacturer. Wire splices for Service wiring shall be located in pull boxes where required to facilitate installation of wiring. Pull Boxes shall be shall be plastic, except where subject to vehicular traffic, concrete rated boxes shall be required. Service wiring shall be per current Local, State, National NEC requirements.

Low Voltage Control Wiring issuing from the controller shall be direct burial, type UF, No.12 AWG copper, unless otherwise required and installed in main or lateral waterline trenches wherever practical. Install common ground wire (type UF No. 12 AWG Copper) and one pilot or hot wire (type UF No. 14 AWG Copper) for each remote control valve (These are minimum wire sizes allowed when not noted otherwise on plans.). Multiple valves on a single control wire are not permitted.

Install two (2) control wires along the entire length of the mainline. Locate wire adjacent to main line piping. Never place wire on top of pipe. Bundle wires at 10 foot intervals with plastic electrical tape. Sufficient slack shall be left in the wiring to provide for expansion and contraction. Provide 12" loop (2 feet) at all changes in direction or at a minimum of 250 feet. When control wiring cannot be installed in the pipe trench it shall be installed a minimum of 18 inches below finish grade. Attach wire markers to the ends of the control wires and label valve stations at controller locations.

All pilot or "hot" wires are to be of a different color and all common wires are to be of another (common) color. If multiple controllers are being utilized, and wire paths of different controllers cross both common and control wires, from each controller, shall be of different colors.

Splices in control wire shall be made only in Junction Boxes with approval from the Engineer. Splices shall be made with waterproof connector, approved for underground use. Sufficient slack shall be left to allow splices brought to the surface without disconnecting the wire. No splices shall be permitted under pavements.

All wiring shall be tested for continuity, open circuits, and unintentional grounds prior to connecting the equipment. All controllers shall be grounded independent of any other controller as recommended by the controller manufacturer, and all valves shall be connected to the common ground wire of their respective controller. A single separate pilot or hot wire (different color) shall be extended from the valve to the specified controller. Low voltage wire splices outside of the valve box are not permitted, unless approved by the Engineer, at which case they must be made in a PVC Pull Box.

One spare #12 AGW wire "Pilot" (orange) and one #12 "Common" wire, (total 2 - #12 wires) shall be installed from the controller along the entire length of pressure lines to last (farthest) electric control valve on each and every leg of the mainline. The color of the spare control wire is to be of an alternate color. Provide 3 foot length of all spare wires in each remote control valve box along wire routing.

440.6.6 VALVES, VALVE BOXES, AND SPECIAL EQUIPMENT:

Backflow Preventer Assembly: The Backflow Prevention assembly shall be installed per the details shown on the drawings and associated governing code requirements. Provide pipe supports and the accessories to properly secure the assembly. The irrigation system shall not be operated until the assembly has been tested and certified to meet the requirements of the Water and Wastewater Department - Water Quality Section.

After the backflow assemblies have been properly installed by the Contractor and approved by Development Services Department - Building Safety Division, the Contractor shall pay for testing and be responsible for having the assembly(ies) tested by a certified backflow prevention assembly tester, approved by the City. The tester shall prepare test report(s), showing the condition of the assemblies and confirming that the assemblies are properly functioning. It is the Contractors responsibility to submit the forms to the Engineer and to Water Quality Division, Backflow Prevention Unit. Final acceptance will not be given until the reports are approved by the Engineer.

Valves, Pressure Regulators, and Related Accessories shall be installed as shown on the plans, or as specified. They shall be installed in a normal upright position unless otherwise recommended by the manufacturer, and shall be readily accessible for operation, maintenance and replacement. The equipment shall be set at a sufficient depth to provide clearance between the valve box cover and the valve handle, cap, or key for operation of the system.

Gate Valves and Isolation Valves shall be installed below ground and shall be housed in a concrete or plastic pipe, with bolt down locking cover that will permit access for servicing. The pipe shall be centered on the valve stem. Isolation valves shall not be located within range of the sprinklers they control without approval of the Engineer.

Drain Valves shall be installed at all low points in pressure supply line as detailed. Provide drainage sump for each drain valve based on the table below:

TABLE 440-1
CUBIC FEET OF GRAVEL PER DRAIN VALVE
DISTANCE OF PIPING TO BE DRAINED

Pipe Size	0-250 LF	251-500 LF	501-750 LF	751-1000 LF
1"	0.75	1.50	2.25	3.00
1-1/4"	0.75	1.50	2.25	3.00
1-1/2"	1.50	3.00	4.50	6.00
2"	2.50	5.00	7.50	10.00
2-1/2"	4.00	8.00	12.00	16.00
3"	6.00	12.00	18.00	24.00
4"	11.00	22.00	33.00	44.00
6"	25.00	50.00	50.00	50.00

Quick Couplers and Hose Bibcocks shall be installed as shown on the plans, or as specified. Their location shall be a minimum of 3 feet from curbs, pavements and walks, unless approved otherwise by the Engineer. Hose bibcocks shall be set 12 inches above finish grade and installed on a galvanized riser or as detailed.

Quick Coupler Assemblies: shall have double swing joint mobility to allow for full and optimal positioning. A pre-manufactured swing joint assembly as manufactured by Lasco Inc., or approved equal is specified. All quick couplers shall be set perpendicular to finish grade unless otherwise designated on the plans or instructed by the Engineer.

Valve Boxes: Install one valve box for each valve installed as shown on the plans, or specified unless directed otherwise by the Engineer. Install gravel sump after compaction of all trenches. Place final portion of gravel inside valve box after valve box is backfilled and compacted. Set valve boxes 1/2 inch above finish grade.

The valve boxes shall be branded with the controller letter and station number of the contained valve. The letter and number size shall be no smaller than 1 inch and no greater in size than 1-1/2 inches. Depth of branding shall not be more than 1/8 inch into the valve box lid. All labeling shall be neat and legible.

440.6.7 SPRINKLERS, BUBBLERS, AND EMITTERS

Sprinklers, Bubblers, and Emitters: Install where indicated on the drawings, staked and approved. Set to finish grade as detailed; spacing of Sprinklers shall not exceed maximum recommended by the manufacturer without approval of the Engineer. Assemblies shall be installed as detailed, provide at least 4 inches clearance from vertical elements projecting above grade such as walls, planter boxes, curbs, and fences.

Turf Heads Assemblies shall have double swing joint mobility to allow for full and optimal positioning. A pre-manufactured swing joint assembly such as that manufactured by Lasco Inc., or approved equal is specified. All sprinkler heads shall be perpendicular to finish grade unless otherwise designated on the plans or instructed by the Engineer. Install for head to head coverage and uniform distribution throughout the turf area.

Plant Bubbler Assemblies shall consist of a horizontal connection to the lateral line with 1/2" S.D.R. 13.5 PVC lateral extension, schedule 40 fittings, and 1/2" flex hose riser (sch 40) with male adaptor (slip x thread) to receive the bubbler. Install bubbler assemblies as detailed on the plans. Locate the top of bubbler:

a. 1" above finish grade in shrub beds.
b. In turf areas - provide 4" diameter (times 12" long) PVC class 200 vertical sleeve filled with pea gravel. Install bubbler 3" below top of sleeve. Set top of pipe flush with finish grade of turf.

Emitter Assemblies provide a horizontal connection to the lateral line using schedule 40 PVC fittings and PVC to flex adapters (slip x slip), 1/2" schedule 40 flex tubing (max. length, 20') and slip x threaded male adaptor to receive the emitter. Emitter outlets shall be installed to the high side of the plant. Provide a minimum of 1 outlet per shrub, and 3 outlets per tree, equally space around the plant, unless otherwise noted in the plans. Single port emitters shall be located 1 inch above grade as detailed. Multi-port emitters shall be located below finish grade, as detailed, and the distribution tubing staked in place then covered with 2 inches of mulch. The distribution tube outlet end shall be exposed above the soil/mulch surface to water the root ball of the plant.

440.6.8 Controller System: The controller and accessories shall be installed at the locations designated and per the details shown on the contract documents. Submit shop drawings of components.

Controllers located outdoors shall be installed in cabinets specifically design to house the controller, or as detailed on the plans. The concrete pad for controller enclosures shall be Class B, size shall be as shown, or if not shown, as recommended by the manufacturer. All copper pipes in contact with concrete shall be type k copper and sleeved or wrapped with “Scotchwrap #50” or equal minimum thickness 40 mils.

Controllers located in building: Prepare an elevation plan detailing placement of equipment, conduit, sleeves and wire gutter runs to the Engineer, for approval. Stub out all conduit 2 feet beyond concrete foundations or walls and provide bushings for all conduit. All RGS conduit in contact with earth shall be wrapped with “Scotchwrap #50, or equal, minimum thickness 40 mils.

440.6.9 PIPE BEDDING, BACKFILL, AND COMPACTION:

Bedding: Pipe shall be bedded in at least 4 inches of finely graded native soil or sand to provide a firm uniform bearing. After laying the pipe shall be surrounded with additional finely grained native soil, or sand, then covered with not less than 4 inches of the same material. Bedding sand shall be required when site conditions dictate and clean finely grained native soil is not available. Contractor shall verify site conditions and satisfy his concern prior to bidding; no separate payment shall be made for bedding sand.

Backfill trenches and excavations with clean material. Remove organic material, as well as rocks larger than 1 inch in diameter. Place acceptable backfill material in lifts, the height of which shall not exceed that which can be effectively compacted, pending on the type of equipment and methods used. Trenches and excavations shall be backfilled to match engineered earthwork sections.

Partially backfill the irrigation trenches and pressure test the system, prior to completing backfill operations. Center load the pipe with sufficient backfill to hold the line in place, keeping the joints exposed for observation until completion of testing.

Compaction shall be in accordance with MAG Section 301. Water settling of the trenches is not permitted unless approved by the Engineer.

440.6.10 Cleaning: Maintain continuous cleaning operations throughout the duration of the work. Dispose of, off-site at no additional cost to the Owner, all trash or debris generated by installation of the irrigation system.

440.7 FLUSHING AND TESTING:

After completion and prior to the installation of any terminal fittings, the entire pipeline system shall be thoroughly flushed to remove all foreign material. After flushing, the following tests shall be conducted in the sequence listed below. All equipment, materials, and labor necessary to perform the tests shall be furnished by the Contractor, and all tests shall be conducted in the presence of the Engineer.

Pipeline Pressure Test: A water test shall be performed on all pressure mains. Pressure mains shall be tested with all control valves installed and in the closed position. The constant test pressure and duration of the test shall be for 6 hours at 125 psi. Any leaks, which occur during the test period, will be repaired immediately following the test. The pressure mains will then be re-tested until accepted by the Engineer.

Sprinkler Coverage Test: The coverage test shall be performed after the sprinkler heads have been installed and shall demonstrate that each section or zone in the irrigation system is balanced to provide uniform and adequate coverage of the areas served. The Contractor shall correct any deficiencies in the system.

Operational Test: The Contractor shall perform an operational test of the system to ensure proper and even distribution of water to all plants. Adjust or replace any type of irrigation equipment not operating correctly prior to the walk-through inspection.

440.8 PRELIMINARY, SUBSTANTIAL AND FINAL WALK-THROUGH INSPECTIONS:

Arrange for a preliminary walk-through with the General Contractor's Superintendent, when the entire system is operational. Operate each zone in its entirety, additionally, open all valve boxes and expose items covered, if directed. Generate a list of items to be corrected and make adjustments, "fine tuning" the entire system by regulating valves, adjusting patterns and break-up devices, and setting pressure regulators at proper and similar pressure to provide optimum and efficient coverage. Flush and adjust all outlet devices for optimum performance and to prevent run-off or spray on to walks, roadways, and buildings.

Arrange for a Substantial Completion walk-through with the Engineer when all items generated from the preliminary walk-through have been corrected. Items deemed not acceptable by the Engineer shall be reworked to complete satisfaction. The Landscape Maintenance Period will not begin unless the irrigation system is operating correctly and until authorization by the Engineer. All accessories, charts, record drawings and equipment, as required, will be provided before scheduling the Final walk-through.

Following the Landscape Maintenance Period a Final walk-through inspection will be scheduled to review the system and make adjustments to the watering schedules.

440.9 MEASUREMENT AND PAYMENTS:

Measurement and payment shall be in accordance with the General Conditions. The lump sum established in the schedule of values shall be full compensation for furnishing all labor, materials, tools and equipment, and performing all work necessary for completion of the irrigation system described or specified in the contract documents.

When unit bid items are included in the proposal sheets, the unit prices quoted shall include the following items of work and material.

(A) Water Service Tap and Meter: The work under this item will be performed by the City of Phoenix Water and Wastewater Department and consists of furnishing and installing a curb stop, concrete meter box with cover, tap to main and pipeline to the curb stop at the locations and in accordance with the details shown on the plans. The curb stop and water meter box will be paid for under this item. Payment will be made at the current price for this service as charged by the City of Phoenix. With some projects an allowance may be shown in the bid proposal for this item, reference the City of Phoenix Supplement to MAG Specifications Section 440.1.1.

(B) Backflow Prevention Unit: The unit price for this item shall include the backflow prevention unit, locking cage assembly, risers and concrete thrust blocks, complete and in place.

(C) Electrical Remote Control Valve and Assembly: The unit price for this item shall include the valve, the valve box with stainless steel hex bolt secured cover, pea gravel and specified pipe to the meter or backflow prevention unit.

(D) Sprinkler Controller: The unit price for this item shall include:

Cost of sprinkler controller (automatic);

All wiring for a complete underground control system, including trenching, wire, conduit, boring or jacking;

Steel security cabinet with concrete base, grounding system, metal hasp and padlocks, and all wiring within the cabinet unless controller is placed on a building or within a walled enclosure.

The junction box and any work and materials required from the stub out provided by the power company in order to complete the installation of the controller.

(E) Irrigation Pipe: The contract price for this item shall include the pipe and fittings, trenching, backfilling and any necessary boring or jacking to install the pipe. Sleeves shall be Schedule 40.

(F) Pull Box: The contract price for this item shall include the pull box (plastic irrigation valve box with stainless steel hex bolt secured cover).

(G) Sprinkler Head: The contract price for this item shall include the head and all fittings, nipples and risers from lateral to the head.

PART 500

STRUCTURES

SECTION 520

STEEL AND ALUMINUM HANDRAILS

Subsection 520.2 FABRICATION: Add the following sentence to the fourth paragraph:

Aluminum railings or members shall be Aluminum Alloy 6063-T6 as per the Aluminum Alloy Association Standards for Handrails.

Aluminum railings shall be approved for use by the City Engineer or City Materials Lab Supervisor prior to being installed in concrete. This will insure that the Aluminum railing has a protective coating on any surface that will be in or next to any concrete.

PART 600

UNDERGROUND WORK FOR UTILITIES

AND

UNDERGROUND FACILITIES

SECTION 601

TRENCH EXCAVATING, BACKFILLING AND COMPACTION

Section 601 TRENCH EXCAVATING, BACKFILLING AND COMPACTION is deleted in its entirety and the following section substituted:

601.1 DESCRIPTION:

The work covered by this specification consists of furnishing all plant, labor, equipment, appliances and materials, and performing all operations in connection with the excavation and backfilling of trenches in accordance with the plans and special provisions.

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

601.2 EXCAVATION:

601.2.1 GENERAL:

No extra monetary compensation or additional time will be authorized for claims that soil conditions differ from those anticipated or those indicated by soil logs and/or reports. It is the Contractor's responsibility to make his own determination as to actual existing conditions.

601.2.2 Trench Widths: Trenches for other than cast-in-place concrete pipe shall conform to the following dimensions, unless otherwise specified in the special provisions, indicated on the plans, and/or approved by the Engineer.

Table 601-1

Size of Pipe (I.D.)	Max. Width at Top of Pipe Greater Than O.D. of Barrel	Min. Width at Springline Each Side of Pipe
Less than 18"	16"	6"
18" to 24" inclusive	19"	7-1/2"
27" to 39" inclusive	28"	12"
42" to 60" inclusive	1/2 O.D.	12"
Over 60"	36"	12"

The width of the trench shall not be greater than the maximum indicated above, at and below the level of the top of the pipe. If the maximum trench width as specified above is exceeded at the top of the pipe, the Contractor shall provide, at no additional cost to the Contracting Agency, the necessary additional load bearing capacity by means of bedding, having a higher bedding factor than that specified, higher strength pipe, a concrete cradle, cap or encasement, or by other means approved in writing by the Engineer.

The width of the trench above the top of the pipe may be made as wide as necessary for shoring, sheeting or other wall support measures necessary for a safe and proper installation. The Contractor may elect to slope the trench walls in leiu of shoring, sheeting or other wall support measures. In all cases the Contractor shall be responsible for any and all problems encountered and costs incurred as a result of increased trench width.

No increases in contract time will be allowed as a result of sloping trench walls. The MAG Trench Pay Width (City of Phoenix Supplement to MAG Specifications Section 336) will be used for computing payment.

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

For all pipe 8 inches or greater in diameter, the Contractor shall excavate for and provide an initial granular bedding at least four inches thick or 1/12 the O.D. of the pipe whichever is greater. This bedding material shall be placed at a uniform density with minimum compaction and fine graded as specified below.

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

If the Engineer determines that overexcavation and backfilling, below the normal foundation and bedding depth, are required as a result of unsuitable material, it will be considered extra work. Payment and construction time extension will be negotiated with the Contractor. As a condition of the Contractor receiving payment for the extra work, agreement on method of payment and construction time extensions shall be reached prior to start of work.

601.2.5 Excavation for Manholes, Valves Inlets, Catch Basins and Other Accessories: When placing concrete for a poured-in-place structure, the Contractor may place the poured concrete directly against the excavated surface, provided that the faces of the excavation are firm and unyielding and are at all points outside the structure lines shown on the plans. If the native material is such that it will not stand without sloughing or if precast structures are used, the Contractor shall overexcavate to place the structure.

When the structure is within the open trench limit, backfilling shall be in accordance with the requirements specified for the adjoining pipe. If the item is being constructed outside of the open trench limits, the overexcavation shall be backfilled with ABC compacted to 100%.

Any excavation below the elevation indicated for the foundation of any structure shall be filled with ABC per MAG Section 702 and compacted to at least 95% at the expense of the Contractor.

601.2.6 Grading and Stockpiling: All grading in the vicinity of trench excavation shall be controlled to prevent surface water from flowing into the trenches. Any water, either surface or ground, accumulated in the trench(es) shall be removed by pumping or by other approved methods. There shall be no additional payment for this work.

Excavated material, with excessive or inadequate moisture content, shall be considered unsuitable for proper compaction. The Contractor shall, at his own expense, remove or add moisture to the excavated material to bring it within the range of +2 to -4 percent of the optimum moisture content in order that proper compaction, as per Table 601.2, can be obtained.

In lieu of the above, the Contractor may, at no cost to the Contracting Agency, haul-off and dispose of excessively wet or dry material and replace it with material conforming to the backfill specifications. Disposal shall be in accordance with the project specifications.

In either event, the proper compaction and stability shall be obtained.

There will be no additional payment or time extension for this work.

601.2.7 SHORING AND SHEETING:

All shoring and sheathing deemed necessary to protect the excavation and to safeguard the Engineer's representatives during inspection and testing procedures shall be installed. See Section 107.

601.2.8 OPEN TRENCH:

Where a trenching operation undercrosses ACP waterlines (12 inches or smaller excluding service lines) and four feet or more of the existing pipe is exposed, the Water Distribution Division will isolate the conflicting waterline by either cutting in any necessary valves or by the use of existing valves. After the crossing section has been isolated, the Contractor shall remove that part of the waterline and install the new mainline as per plan. The waterline shall then be replaced with the same size ductile iron pipe by the Contractor. The replacement section shall extend at least five feet beyond the new mainline trench wall and into undisturbed ground. The Contractor shall request a shut-down, at least one week in advance, from Water Distribution (262-4711 or 4712). City forces will perform the shutdown and/or valve cut-in. There will be no charges to the Contractor for this work. On permit work, the Contractor shall pay for any and all work required.

The Contractor will be paid for the ductile iron pipe at the unit price bid per each crossing under the bid schedule item WATERLINE REPLACEMENT. If there is an unanticipated conflict at the crossing which can be resolved with "offset pipe joints", the Water Department will supply the offset joints to the Contractor at no cost. Offset pipe joints will be picked up by the Contractor at the City's Water Stores Warehouse at 2640 South 22nd Avenue. Requests to pick up such material must be conveyed to the Water Department at least 24 hours in advance by the City Inspector. The Contractor shall install the offset joints at no additional cost. The WATERLINE REPLACEMENT item shall include costs for trench excavation, backfill, compaction, and surface restoration.

Traffic control and maintenance of traffic shall be in accordance with City of Phoenix Supplement to MAG Specifications Section 401 and MAG Section 104.

601.3 FOUNDATION, BEDDING, BACKFILLING AND COMPACTION:

601.3.1 Bedding: Bedding is the material placed in the area from the bottom of the trench to one foot above the top of the pipe or conduit. Bedding shall be Select Material Type B or Aggregate Base as per Table 702-1. Open graded rock will not be used without the written approval of the Engineer.

Where water consolidation is used, bedding for conduits, 24 inches or less in I.D., may be placed in one lift. For larger conduits, the first lift shall not exceed the springline of the pipe. Where mechanical compaction is used, the moisture content shall be within a range of +2 to -4 percent of the optimum moisture content prior to placing the material in the trench. The first lift shall be eight inches or 2/3 of the distance to the springline whichever is greater. Succeeding lifts shall not exceed one foot loose and extreme care will be taken to prevent damage to or movement of the conduit by the compaction equipment.

601.3.2 Backfill: The type of backfill required shall conform to the specifications in City of Phoenix Supplements Section 336.3. Backfill shall be sound material free from broken concrete, broken pavement, wood or other deleterious material. Unless otherwise specified, this may be native material with no piece larger than eight inches, select material or aggregate base course. Under pavement, parking lots, sidewalks, etc., pieces larger than three inches will not be used in the final 12 inches below the pavement subgrade.

Where water consolidation is used, backfill will be placed in lifts as required in the following table prior to settlement.

TABLE 601-2

TRENCH WIDTH	BACKFILL LIFTS
18" TO 24"	NOT TO EXCEED 4'
25" TO 36"	NOT TO EXCEED 6'
OVER 36"	NOT TO EXCEED 8'

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

When mechanical compaction is to be used, the Contractor will provide a test section demonstrating his proposed method and equipment to be used. Upon agreement with the Engineer as to the acceptability of the Contractor's proposed method and equipment, they shall not be changed without the prior approval of the Engineer. Mechanical compacted lifts in excess of one foot will not be allowed without the written consent of the Engineer.

Backfill material shall be within the range of +2% to -4% of the optimum moisture content, prior to placing the material in the trench. The moisture content shall be uniform throughout the backfill material.

Material not meeting these requirements may be required to be removed from the trench and moisture added or removed to correct the deficiencies prior to replacement, all at no increase in cost to the Contracting Agency.

It shall be the Contractor's responsibility to blend excavated material, removing or adding moisture as may be necessary to meet the requirements of the specifications, all at no increase in cost to the Contracting Agency.

Excavated material, when used for backfill, shall meet the requirements of City of Phoenix Supplement to MAG Specifications Subsection 601.2.6.

The moisture content requirements contained herein are waived when granular material is used and water settled.

The Engineer may require all or any part of the trench to be load tested for stability with Contractor's equipment prior to placement of asphalt or Portland cement concrete pavement. Unstable areas as determined by the Engineer shall be corrected by the Contractor at no increase in cost to the Contracting Agency.

TABLE 601-3
MINIMUM DENSITY REQUIRED FOR TRENCH BACKFILL

Compaction Type	Location	From Surface to 2' Below Surface	From 2' Below Surface to 1' Above Top of Pipe	From 1' Above Top of Pipe to Bottom of Trench
I	Under any existing or proposed pavement, curb, gutter, sidewalk, or such construction included in the contract, or when any part of the trench excavation is within 2' of the above.	100% granular 100% for non-granular	95%	95%
II	On any utility easement, street, road or alley right-of-way outside limits of (1)	85%	85%	95%
III	Around any structure or exposed utilities.	95%	in all cases	in all cases

(1) Note: The type required will generally be shown on the plans and the plans will govern. Where no type is shown on the plans the type shall comply with the above.

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

601.3.3 Compaction Methods: Water consolidation by jetting shall be accomplished with a 1-1/2" pipe of sufficient length to reach the bottom of the lift being settled with adequate hose attached and a water pressure of not less than 30 psi.

All jetting shall be accomplished transversely across the trench at intervals of not more than 6 feet with the jetting locations on one side of the trench offset to the jetting locations on the other side of the trench. The entire lift shall be leveled and completely saturated working from top to the bottom.

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

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

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

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

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

Where Type I backfill is required, water consolidation will not be permitted for non-granular material.

601.3.4 New Residential Development Area: In a new development area, prior to paving and prior to opening the area to public traffic, the following deviation to water consolidation, bedding, and compaction shall apply to new local streets only:

(A) Water consolidation by jetting of non-granular material will be permitted at the Contractor's discretion. Increased compaction testing (100% increase per lift) will be required in accordance with the Streets Lab minimum testing requirements.

(B) Water consolidation by flooding shall be allowed ONLY where backfill material meets the specification for granular material (City of Phoenix Supplement to MAG Specifications Subsection 601.4.6) OR the bottom of the lift is less than 4 feet from top of subgrade. Increased compaction testing (100% increase per lift) will be required in accordance with the Streets Lab minimum testing requirements.

(C) The minimum density required for bedding shall be 90%. Manholes shall be compacted to 95% within 24" of the structure. Outside these limits, 90% shall be required. Native material is acceptable.

(D) The minimum density required for backfill from 2 feet below the surface to 12 inches above the conduit shall be 90%. The minimum density from the surface to 2 feet below the surface shall be as prescribed in Table 601-3.

(E) Sewer services shall require compaction tests on 30% of the total sewer services in new subdivision.

601.3.5 Specifications for Granular Material: For purposes of this specification, granular material shall be defined as material for which the sum of the plasticity index and the percent of the material passing No.200 sieve shall not exceed 23. The plasticity index shall be tested in accordance with AASHTO T-90.

601.3.6 Rights of way belonging to others: Backfill and compaction for irrigation lines of the Salt River Valley Water User's Association and Roosevelt Irrigation Districts and for trenches on State of Arizona and Maricopa County rights-of-way, outside the limits of the Contracting Agency, shall be accomplished in accordance with their permit and/or their specification.

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

601.3.8 Foundation and Bedding for Electronic, Telephonic, Telegraphic, Electrical, Oil and Gas Lines: Foundation and bedding for these underground facilities shall be native material or sand which conform the grading requirement of ASTM C-33 for fine aggregate. When backfill material consists of aggregate base course, crushed stone or other material containing stones, only sand will be used for foundation and bedding. The foundation depth shall be six inches and bedding depth shall be one foot above the top of the facility. Compaction will be in accordance with Section 601.

601.4 PAVEMENT REPLACEMENT AND SURFACE RESTORATION:

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

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

601.4.3 Clean-Up: The job site shall be left in a neat and acceptable condition. Excess soil, concrete, etc., shall be removed from the premises.

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

601.5 PAYMENT:

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

SECTION 604

PLACEMENT OF CONTROLLED LOW STRENGTH MATERIAL

604.1 DESCRIPTION: Subsection 604.1 is modified to read:

The work covered by this specification consists of furnishing all materials, labor and equipment for the placement of controlled low strength material (CLSM).

The following is a brief description of the type of controlled low strength material (CLSM) and its intended use:

½ SACK: One half sack CLSM can be used as a general trench backfill in areas where future excavation into the backfill is anticipated or in areas of low loading such as street, parking areas, behind retaining walls, etc. The one half sack DLSM shall be identified by the product code PHCLSM.

Only ½ Sack is allowed, unless specified in the special provisions, plans or by the Engineer.

SECTION 610

WATERLINE CONSTRUCTION

610.3 Materials: Subsection (B) is changed to read:

(B) Pipe eighteen (18) inches and larger may be either ductile iron, or concrete pressure pipe - steel cylinder type.

Subsection 610.4 CONSTRUCTION METHODS: is modified to add:

610.4.1 Construction Work by City Forces:

(A) City forces shall perform all valve cut-ins, waterline shutdowns, and wet taps that are necessary for construction.

The Contractor shall contact the inspector to make the necessary arrangements to have the City forces perform the required work. With the exception of permit work, there will be no charge for valve cut-ins, waterline shutdowns, and wet taps that are necessary for construction.

For any valve cut-ins, waterline shutdowns, or wet taps requested by the Contractor, which are not necessary and are for the convenience of construction, the Contractor shall make application and pay the required charges to the Contracting Agency.

On permit work, the Contractor shall pay all costs incurred.

(B) When an existing waterline, other than as noted on the plans, conflicts with any proposed new work in the contract and no provision has been made in the proposal for relocating such lines, the City has the option to make any necessary adjustments or relocations, alter the proposed new work or negotiate with the Contractor for relocating the obstructing line.

610.4.2 Construction work by Other Utility Owners: Except as otherwise provided in the plans or project specification, all utilities in conflict with the new work will be relocated by the owner thereof. Qwest, any telecommunications companies, Arizona Public Service Company and all utility companies will adjust their manholes. In the event of an unanticipated conflict between the new work and a utility and the owner thereof disclaims responsibility for relocation, the City will negotiate with the owning utility and the conflict shall be resolved without extra cost to the Contractor. It will be necessary for the Contractor to coordinate his work with the utility companies in the relocation of their facilities during construction.

610.4.3 CONSTRUCTION WORK BY THE CONTRACTOR:

(A) The Contractor shall adjust valve and meter boxes to final grade as described in MAG Section 345 and the City of Phoenix Supplement. All valve boxes, manhole covers, etc., shall be adjusted after the asphalt concrete base is placed and prior to placing the 1-1/2 inch of asphalt concrete finishing course.

(B) Where the centerline of the new waterline parallels the existing curb and gutter and is approximately two feet from the lip of the gutter, the Contractor shall remove and replace the pavement to the lip of the gutter. The Contractor will be paid for the extra pavement replacement in addition to the normal pavement re-placement over the pipe trench in accordance with MAG Section 336.

(C) The Contractor shall accomplish the cutting and plugging of City water mains, where required on the plans, in accordance with City of Phoenix Supplement to MAG Detail P1343.

The cuts and plugs will remain exposed until line pressure is restored and they can be inspected for leakage. The Contractor shall schedule the restoration of line pressure through the Engineer.

Payment shall be at the unit bid price or lump sum bid price for "CUTTING AND PLUGGING EXISTING WATER LINES." This payment shall be full compensation for material, labor, tools and equipment necessary to complete the work.

(D) Unless otherwise noted on the plans, the Contractor shall relocate existing water service lines and meters and remove or relocate fire hydrants. Unless other adequate provisions are made for fire protection, a fire hydrant will not be out of service for a period exceeding 24 hours. When relocating water meters which utilize either galvanized or polyethylene service pipe (or any other non-standard service pipe) the entire service piping shall be replaced using the approved service pipe material for that particular meter size. The existing corporation stop can be used provided and approved copper pipe adapter is used. Approved adapters are the Ford C04-43 and C04-54 conversion assembly or equal.

610.4.4 Approved Water Service Components: Approvals shown are not necessarily exclusive. If approval of a similar device, believed to be comparable and equal, is desired, a request should be submitted supported by appropriate information and data.

If general approval is desired, request should be submitted directly to the Water Services Department.

TABLE 610-1
CORPORATION STOPS

MANUFACTURER	COPPER SERVICES	W/DIELECTRIC INSULATION
FORD	P-1600	F-1000
HAYES		
JONES	J-3401	
McDONALD	4701 T	
MUELLER	H- 15028 B- 25028	

TABLE 610-2
ADAPTERS

MANUFACTURER	IPS COPPER, ELL
FORD	L-84-33 L-84-44
HAYES	
JONES	J-2619
MUELLER	H-15531
McDONALD	4779 MT

TABLE 610-3
CURB STOPS AND METERING COUPLINGS

MANUFACTUREER	CURB STOPS *	METERING COUPLINGS
FORD	B-11-333 B-11-666 B-11-444 B-11-777	SPM-2R
JONES	J-1900	J-130 J-134
McDONALD	6101	4622 or 4624
MUELLER	B-20283	H-10890 H-10891
HAYES	4000	5680 or 5682

*Heads of all curb stops shall be drilled 1/4" diameter for locks.

610.4.5 Concrete Pressure Pipe - Steel Cylinder Type: Where concrete, steel cylinder, pressure pipe is installed the following shall apply:

(A) General:

(1) The Contractor shall mortar the inside and outside of all pipe joints. The mortar shall be applied in the field on the inside joints such that the mortared surface is flush with the adjacent pipe mortar lining. The outside of the joints shall be mortar coated by the diaper method. The mortar shall be a Type "M" mortar per MAG 776 using Type II, low alkali cement.

(2) All non-mortar coated steel, including flanges, shall be covered with a minimum of two (2) inches of hand-packed mortar. Wire mesh shall be used to hold the mortar in place. Mortar shall be the same as applied to the joints. Field-applied coal tar coatings will not be accepted in lieu of mortar. Except, coat tar enamel in accordance with AWWA C-203 shall be applied to the non-mortar coated steel and flanges on the 24" side outlets in access manholes.

(3) Joint restraints shall be provided by means of welded joints. The extent of welded joints shall be as shown on the pipeline and layout drawings, and shall in no case be less than that shown on the plan drawings. Where welded joints are required, the weld shall be continuous about the entire circumference of the pipe joint. Welds shall be made intermittently, in short sections of about six (6) inches, to avoid overheating the gaskets on points where a gasket is used. Welds shall conform to that shown on the approved shop drawings and calculations.

610.4.6 FOR MAINS EIGHTEEN (18) INCHES AND LARGER, THE FOLLOWING SHALL APPLY:

(A) Backfill and compaction for the full distance encompassed by welded/restrained joints shall be completed prior to testing.

(B) All mainline valves shall be covered with a minimum of two (2) inches of hand-packed mortar. Wire mesh shall be used to hold the mortar in place. Field applied coal tar coatings will not be accepted in lieu of mortar. Portions of valves within manholes shall not be mortar coated. The mortar shall be a Type "M" mortar per MAG 776 using Type II, low alkali cement.

(C) Where plans call for welding joints and ductile iron pipe is furnished, the Contractor shall restrain the joints by an approved joint restraint method.

610.4.7 Where restrained joints are specified on mains less than eighteen (18) inches in diameter, ductile iron pipe shall be used with an approved joint restrain method.

610.4.8 Joints in fire hydrant "run-out" piping to conform to the City of Phoenix Supplement to MAG Specification Section 750.3. All joints in the fire hydrant "run-out" from the main through the shut-off valve shall be restrained by an approved joint restraint method, which may include the use of thrust blocks as approved the City Of Phoenix Engineer.

610.4.9 Payment for Water Used During Construction: The Contractor shall pay for all water used during the course of construction. This cost shall be included in the unit bid price for pipe. The final fill of the pipeline with replacement water shall not be included in the cost. Water rates shall be obtained from the Water Services Department - Accounting Division (602) (262-6687).

Measurement will be through a fire hydrant meter or, if this is not possible, calculated by one of the procedures listed below:

(A) Unmetered water used for testing, flushing and chlorination shall be calculated on a cubic foot basis, using the volume per foot pipe multiplied by the number of times the pipe is filled and by the total length of pipe installed for each hydrostatic test, flushing and chlorination procedure. If any additional testing, flushing or chlorination is required, because of failure to meet any of the above conditions, the volume of water used for each procedure shall be calculated as on the above basis for first procedure.

TABLE 610-4
FOR ONE FOOT LENGTH OF PIPE

Diameter (Inches)	Cubic Feet	Gallons	Gallons Per Mile
3	.0491	.3673	1,939
4	.0873	.6528	3,447
6	.1963	1.469	7,756
8	.3490	2.611	13,786
10	.5455	4.081	21,547
12	.7854	5.876	31,025
14	1.069	7.977	42,224
16	1.396	10.44	55,123
18	1.767	13.22	69,802
20	2.182	16.32	86,170
24	3.142	23.50	124,080
30	4.909	36.72	193,882
36	7.069	52.88	279,203
42	9.620	71.96	379,950
45	11.044	82.62	436,233
48	12.566	94.02	496,326
54	15.90	118.97	628,162
60	19.63	146.88	775,526
66	23.76	177.72	938,362
72	28.27	211.44	1,116,403

(B) Unmetered water used for settling trench backfill for small waterlines 12" and less in diameter shall be estimated at a volume of 2.66 cubic feet of water per linear foot of trench settled.

(C) Water used for settling trench backfill on waterlines 14" and larger, shall be metered by a fire hydrant meter, or other means approved by the Engineer.

Subsection 610.9 FIRE HYDRANTS: is modified to add:

Except where otherwise required on the plans, the City of Phoenix will furnish the Contractor fire hydrants without cost for City of Phoenix projects. To secure the hydrants, the Contractor shall obtain a permit at the Water Distribution Special Operations office at 3045 S. 22nd Avenue, and then pick up the hydrants at the City of Phoenix Water Stores, 2500 South 22nd Avenue.

Whereas a new fire hydrant furnished by the City of Phoenix is found to be defective, the Contractor shall remove the defective hydrant, return it to the **water stores**, pick up a new one and install as indicated on the plans. The second installation will be treated as a new fire hydrant installation and the Contractor will be paid for both installations, each at the unit bid price in the proposal for fire hydrant installations.

All connections from the main to the fire hydrant shall be cast iron or ductile iron pipe as shown on the detail drawings. Fire hydrants shall be the dry-barrel type. If plugs are present in the weep holes, they shall be removed before installation.

Extenders for hydrants or valves are not permitted on new fire hydrant installations unless approved by the Water Services Department.

Subsection 610.11 METER SERVICE CONNECTIONS:

Delete the second paragraph which reads "When plans call . . . except as follows." in its entirety and substitute the following:

All water service connections shall be made using Type K copper tubing which conforms to MAG Section 754.1 and fittings which conform to MAG Section 754.2. Joints in the copper tubing shall be made by the use of approved compressing fittings such as flared joints or pack joints. Soldered joints are not acceptable.

Subsection (A) is changed to read:

When a meter is specified to be relocated, the Contractor shall replace and/or extend water service lines in accordance with Detail P1342. The Engineer will determine when the existing service lines are unsatisfactory and must be replaced. Existing copper services in good condition, with sufficient cover, may be extended. Where the existing service pipe material is other than copper, the entire service shall be replaced from main to meter.

Add the following paragraph:

(E) The use of direct taps on water mains for meter service connections will not be allowed. New service taps shall be installed using an all bronze double-strap tapping saddle or a tapped coupling.

610.15 TESTING: is deleted in its entirety and the following is substituted:

The Contractor shall test waterlines for water tightness, including all fittings and connections to the waterlines. Each pipe shall be tested for leakage and pressure in accordance with applicable provisions of AWWA standards and/or Manuals, except as modified below.

The Contractor shall provide all vents, piping, plugs, bulkheads, valves, bracing, blocking, pump, including measuring device and all other equipment necessary for making the tests, except pressure gages.

The pipe shall be tested between each valve or between a valve and the closed end of the pipe. Pipe test section shall be limited to 1/2 linear mile, or less, unless otherwise approved in writing by the Engineer.

The test shall be made after the backfilling is completed or compacted, regardless of the compaction method.

All connections, blowoffs, hydrants and valves shall be tested with the main, where practical.

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

(A) Pressure Tests: Waterlines, including all fitting and connections shall be tested for water tightness by subjecting each test section to pressure test. The test pressure shall be measured at the lowest end of the test section. The test pressure shall be 188 psi unless otherwise specified. The duration of each pressure test shall be at least 2 hours.

The pressure test shall begin after the pipe has been filled with water for at least 24 hours to allow for absorption.

(B) Leakage Tests: Leakage tests shall be made after pressure test has been completed, pressure test results are satisfactory, and all backfilling and compaction is completed.

The duration of each leakage test shall be at least 2 hours. Leakage test pressure shall be at least 150 psi and the test pressure shall be maintained within 5 psi during the test.

The maximum allowable leakage from the pipe line shall be determined by the applicable formula:

$$\mathbf{L} = \frac{ND\sqrt{P}}{4500}$$

(Pipe Larger than 16")

$$\mathbf{L} = \frac{ND\sqrt{P}}{7400}$$

(Pipe 16" and smaller)

in which:

L = allowable leakage in gallons per hour

N = number of joints in the pipe being tested, with no allowance for joints at branches, blowoff, fittings, and similar appurtenances. "N" is calculated using the standard length of pipe installed divided into the length being tested.

D = nominal inside diameter of pipe in inches.

P = average test pressure, in psi gage, as measured at the lowest point in the test section.

Should the test on any section of the pipeline show leakage greater than specified above, the Contractor shall locate and correct until the leakage is within the specified allowance for a 2-hour duration. All repairs and retests shall be at the Contractor's expense.

Leakage is defined as the quantity of make-up water necessary for the test section to maintain the specified leakage test pressure after the pipeline has been filled with water and all air expelled.

Connections to existing pipelines or existing valves shall be made after new construction has satisfactorily passed both the pressure and leakage tests.

SECTION 611

DISINFECTING WATER MAINS

Subsection 611.15 shall be modified to read as follows:

611.15 FINAL FLUSHING, SAMPLING AND TESTING:

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipeline at its extremities until the replacement water throughout its length shall, upon testing, be proved comparable in quality to the water served to the public from the existing water system. Prior to sampling for laboratory testing, the residual chlorine shall be reduced to 1.0 ppm or less throughout the length of the pipeline. Once the required residual chlorine level in the pipeline is achieved, samples shall be taken as outlined below. The quality of water in the new main shall be as determined by laboratory examination and analysis of the samples over a period of at least three full days (72 hours).

Water Services Department laboratory technicians will perform sampling for tests of new water mains upon receipt, from the inspector, of a written request by the Contractor. The written request should be made to the Water Services Department no less than 24 hours prior to the time when samples are to be taken, so that the Department can properly schedule laboratory work. Waterlines less than 150 feet in length require one sampling riser installed as near the end as possible; lines 150 feet to 300 feet in length, two sampling risers, one near each end of the line; lines 300 feet to 3,000 feet in length, a minimum of three sampling risers. In addition, dead ends on main lines should be represented with a sampling riser.

Samples shall be taken from a tap and riser located and installed in such a way as to prevent outside contamination. Samples shall never be taken from an unsterilized hose or fire hydrant, because such samples will seldom meet bacteriological standards. One sample shall be taken at each sampling riser.

Results of all tests shall be sent by the laboratory to the Water Services Department. Results of laboratory analysis will be interpreted by the Water Services Department, and reported to the Engineer. Under no circumstances shall the Contractor contact the laboratory. If there is need for test results before written reports are submitted, such information shall be obtained only from the Water Services Department.

SECTION 615

SEWER LINE CONSTRUCTION

Subsection 615.3 LAYING PIPE: is modified to add the following paragraphs:

Where called for on the plans, sanitary sewers shall be concrete encased in conformance with MAG Standard Detail No. 404-1, 404-2 and 404-3.

Measurement and payment for concrete sewer encasement shall be by the linear foot of sewer concrete encased, which price shall include trenching, backfill, compaction, materials, and any pavement and surface replacement in excess of the applicable pay widths assigned to the adjacent water pipe.

Subsection 615.7 SANITARY SEWER SERVICE TAPS: is modified to add:

When sewer taps are found to be in conflict with the new work and no provision has been made in the proposal for relocating such taps, they shall be relocated by the Contracting Agency or the Contracting Agency will negotiate with the Contractor for their relocation. When a sewer tap or other sewer line is in conflict with the new work and it is impractical or impossible to raise or lower the tap or sewer to clear the new work, the City will negotiate with the Contractor to relocate the sewer on a different alignment or grade to avoid the conflict.

Subsection 615.11 TESTING: is modified to add:

615.11 TESTING:

In addition, sewer lines eight inches and larger, shall be subject to closed circuit T.V. inspection in accordance with the following procedures.

615.11.1 Closed Circuit T.V. Inspections: After backfilling has been completed and prior to acceptance, sanitary sewer lines shall be subject to a closed circuit T.V. inspection. The Contractor shall notify the Engineer at least 48 hours prior to completion of the backfilling so that the inspection may be scheduled. The inspection will be accomplished by the Water Services Department.

615.14 MEASUREMENT AND PAYMENT: is modified to add:

(D) There will be no measurement and payment for testing. The Contractor shall include all associated costs in the unit bid price for sewer pipe installation.

SECTION 618

STORM SEWER CONSTRUCTION WITH CONCRETE PIPE

Subsection 618.1 DESCRIPTION: is modified to add:

In general, the specified D loads for design of concrete and reinforced concrete pipe will be based upon the loads to which to pipe will be subjected upon completion of the project.

Should the Contractor, as a result of his construction methods, or for any other reason, subject the pipe to loading which is greater than that for which the pipe was designed, it shall be the Contractor's responsibility to take whatever steps are required to strengthen or otherwise protect the pipe from damage.

Pipe stronger than that specified may be furnished at the Contractor's option and expense.

Subsection 618.2 (C) Change the sentence to read:

(C) Cement Mortar Joints for R.C.P. and N.R.C.P. will be in accordance with MAG Subsection 736.3.1.

Subsection 618.2 (E) STORM SEWER PIPE SIZE OPTION Adding in entirety:

The Contractor may substitute the next larger multiple of 6-inch size storm sewer pipe for the intermediate 3-inch size pipes shown on project plans at his discretion. The cost of the increase in size shall be borne by the Contractor. The intermediate 3-inch size pipe will remain in the bid proposal as the required size. If the Contractor elects to use the next larger multiple of 6-inch size pipe he shall be responsible for any utility or any other conflict caused by the increase in the size of the pipe. There shall be no extension of time granted for any delay caused by these conflicts.

Subsection 618.3 CONSTRUCTION METHODS: Delete the third paragraph which reads "Where the cover over . . . by Section 601 and 603 for HDPE pipe." in its entirety and substitute the following:

The structural design of the pipe for any depth of cover shall be based on an unlimited trench condition. The pay width for pavement replacement shall remain in accordance with MAG Section 336.

Subsection 618.3 CONSTRUCTION METHODS: Delete the second sentence in the fifth paragraph that reads "For closures and deflection . . . per standard details." and substitute the following:

Curves, bends and closures shall be made in accordance with MAG Section 735.

Subsection 618.3 CONSTRUCTION METHODS: is modified to add:

618.3.1 Pipe Joints for R.C.P. and N.R.C.P.: Pipe Joints for pipe 48 inches or greater in diameter may be either tongue in groove, O-ring gasket joints or profile gasket/single offset joints. For pipes smaller than 48 inches in diameter, either O-ring gasket joints or profile gasket/single offset joints will be used. Hydrostatic water tests may be required at the discretion of the Engineer. Certification for Hydrostatic tests will be required for all pipe joints. The O-ring gasket joints will not require mortaring and grouting. Mortaring and grouting of the tongue in groove joints will be in accordance with the following paragraphs.

Tongue in groove joints will not require outside grouting except where the pipe is used on curves or angle points. All joints shall be butted together. The overlap of the tongue with the groove portion of the joint shall not be less than 50% of the overlay measured from the manufacturer's designed full seat position. The material and layout drawings shall specify the maximum inside annular space that satisfies this specification. The inside annular space between pipe sections shall be completely filled with mortar and finished smooth with the inside pipe surface. The entire depth of the finished inside joint shall be filled with mortar in such a manner as to ensure a strong, tight joint. Curves or angle point joints will require outside grouting or a concrete collar as determined by the Engineer. Joints will not be mortared until the next two joints are in place.

All cement mortar or grout joints will be in accordance with MAG Subsection 736.3.1.

618.3.2 Procedure for Connecting Pipes to New Storm Sewer and Temporary Pipe Closure:

(A) All inlet connecting pipes and lateral pipes shall remain temporarily plugged until all lines and facilities downstream have been completed to the satisfaction of the Engineer.

(B) Existing storm sewers shall be connected to the new storm sewer where indicated on the plans. However, existing storm sewer systems shall remain intact or a by-pass maintained until mainline downstream has been completed to the satisfaction of the Engineer.

(C) All pipes shall have a temporary closure placed at the open end at the end of each work day.

618.3.3 Structures: Inlets, manholes and similar reinforced concrete structures generally built underground as part of the storm sewer are shown on the plans and shall conform to Section 505. Castings shall conform to Section 787. Miscellaneous steel shall conform to Sections 727 and/or 770.

Through manhole, lateral manhole or transition manhole, when specified on the plans, shall denote the construction and installation of a complete manhole including the base, shaft, reinforced concrete rings, frames and covers, concrete caps, frame adjustment to grade, etc., as shown on the plans and Standard Details. Note: Manhole steps shall not be installed. If installed they shall be removed and the holes filled with epoxy or Class `B' concrete.

As an option, Standard Detail 522 is hereby modified to allow precast unreinforced manhole shaft pipe and cones which shall have a thickness of 6 inches and be manufactured of Class `A' concrete per section 725. All other features of Standard Detail 522 shall remain unchanged, except that manhole steps will not be installed.

618.3.4 Leakage Tests: The Leakage test will be conducted in accordance with the procedure outlined in the project specifications and Section 618.3.9 provided below.

618.3.5 Cleaning Conduits: All conduits shall be swabbed, flushed with water, or subjected to a combination of these or other methods in order to leave the pipeline clean and free from debris, garbage, rubbish, stones, and deposits, and like foreign materials.

618.3.6 Material and Layout Submittals

At least 6 weeks prior to the manufacture and delivery of the storm sewer pipe, the Contractor shall submit material and layout drawings to the Engineer for review and approval.

Submittals shall show pipe material type, layout, stationing, laying length, D-load or gauge thickness (as appropriate), detailed fabrication drawings for mainline, curvilinear sections, prefabricated bends, special sections, etc., and any other pertinent data.

In addition, a list of catch basin connector pipes shall be submitted. The list shall contain the following information:

1. Inside diameter and type of material to be used, (RCP, CSP, HDPE).

    a. If RCP is used for connector pipe, the D-load rating shall be shown.

    b. If CSP is used for connector pipe, the gauge shall be shown. Only Aluminized, Type 2 CSP will be allowed.

    c. If HDPE is used for connector pipe, only Type ‘S’ Corrugated with watertight joints conforming to ASTM D-3212 will be allowed.

2. Station at which connector pipes join mainline.

3. Number of sections of pipe and laying length of sections.

618.3.7 Leakage Test for Mainline CSP or HDPE Storm Sewer Pipe Only

In addition to full encasement of CSP and HDPE mainline storm sewer pipe with cement-enriched slurry aggregate base course material, the Engineer may require the Contractor to also perform random leakage tests on the mainline. Field leakage tests, if requested, will be conducted in accordance with the following criteria:

A. After cement-slurry bedding to 1 foot above pipe, the Engineer will select a minimum of three (3) joints of mainline pipe to be tested in accordance with the following procedure:

   1 Testing shall be accomplished by plugging the pipe test section and all branch lines and filling the pipe with water. Equipment for the test shall be furnished by the Contractor, and shall include a standpipe, a suitable meter or other acceptable method of measuring the quantity of water used. A period of at least one (1) hour shall be allowed for absorption before making the test.

   2 The allowable water loss shall not exceed 1.0 gallon per hour per 100 linear feet of pipe per inch of pipe diameter under a minimum test head of 4-feet above the top of the pipe at the upper end of the test section. A minimum test time of one (1) hour shall be required after the initial one (1) hour for absorption.

   3. The leakage test shall be made by the Contractor in the presence of the Engineer.

B. If the first test exceeds the specified leakage limit, the Contractor shall repair or replace all sections that fail the leakage test at no additional cost to the City of Phoenix. All repaired or replaced pipe sections shall be retested for compliance.

   1. The Engineer reserves the right to require additional leakage tests as deemed necessary during the course of construction to ensure that the remainder of the pipeline is leak resistant.

   2. There will be no separate payment for the leakage tests. Payment for leakage tests shall be included in the cost of the pipe.

618.3.8 Videotaping of all New Mainline Storm Sewer Pipelines

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

Subsection 618.5 MEASUREMENT: is modified to add:

(D) Prefabricated Tees and Wyes: Shall be the number of such tees and wyes constructed.

(E) Concrete Pipe Collars: There shall be no measurement for construction of pipe collars for pipe less than 24-inches in diameter.

For pipe collars on pipe 24-inches or larger, measurement shall be the number of such pipe collars constructed.

Subsection 618.6 PAYMENT: is modified to add:

(D) Prefabricated Tees and Wyes: The cost of the basic pipe and material required to construct and install prefabricated tees and wyes is included in the unit price bid for main and connector pipes. Bid item for prefabricated tees and wyes is for cost of manufacturing only.

(E) Concrete Pipe Collars: There shall be no payment for construction of pipe collars for pipe less than 24-inches in diameter.

For pipe collars on pipe 24-inches or larger, payment will be made at the unit bid price for the proposal bid item "CONCRETE PIPE COLLARS FOR PIPE 24-INCHES OR LARGER, STANDARD DETAIL 505" and will be compensation in full for all labor, material, equipment and incidentals required for construction.

SECTION 620

CAST-IN-PLACE CONCRETE PIPE

MAG Section 620 CAST-IN-PLACE CONCRETE PIPE: is deleted in its entirety and the following section substituted:

620.1 GENERAL:

This specification covers cast-in-place non-reinforced concrete pipe intended for use as storm sewers or irrigation lines. The abbreviated title is CIPP. CIPP is conduit made of portland cement concrete cast monolithically in a properly prepared trench, using equipment specifically designed for this purpose. The type of equipment to be used by the Contractor must be approved by the Engineer and the Contractor may be required to furnish evidence of the successful use of this equipment on prior work. CIPP will be placed only:

(A) By experienced operators. The Engineer will be the sole judge as to experience level.

(B) In the presence of the Engineer.

(C) In ground capable of standing unsupported from the bottom of the trench to the top of the pipe without sloughing.

(D) In fill when it can be demonstrated to the satisfaction of the Engineer that the fill will adequately support the pipe.

(E) When designated as an allowable storm sewer pipe material in the project specifications, this designation is no warranty, expressed or implied, that conditions will be suitable for the use of CIPP. Any costs incurred and/or time required to provide suitable conditions or to substitute an alternate pipe acceptable to the Engineer, in whole or part, shall be the responsibility of the Contractor.

620.2 MATERIALS:

620.2.1 Cement shall be ASTM C-150, Type II, low alkali as per Section 725.

620.2.2 Sand aggregate used for concrete and mortar shall conform to Section 701. Maximum size of the aggregate shall not be greater than 1/3 of the minimum wall thickness up to and including a wall thickness of 4-1/2 inches (114MM). The maximum aggregate size is 1-1/2 inches (38MM).

620.2.3 Water used for concrete and for curing the pipe shall be as per Section 725.

620.2.4 Concrete shall be Class >A= in accordance with Section 725. Slump shall be the minimum required for satisfactory placement of the concrete by the equipment used by the Contractor. The slump shall not exceed 3 inches (75MM).

620.2.5 Bonding mortar shall consist of two (2) or more parts of cement to three (3) parts of sand by volume.

620.3 CONSTRUCTION METHODS:

620.3.1 Excavation: The trench will be neatly excavated with vertical sides and semi-circular bottom. The trench shall be shaped to form the bottom outside of the pipe on the alignment and to the grades specified in the plans. Departure from and return to the established grade for the finished trench and the invert of the installed pipe shall not exceed 1 inch per 10 linear feet with a maximum allowable departure of 0.10 feet. Departure from and return to specified alignment for the trench and pipe shall not exceed the allowable tolerances specified for the grade. The bottom of the trench, hereinafter known as the trench form, will be shaped to provide full, form, and uniform support by undisturbed earth or compacted fill for at least the bottom 210 degrees of the pipe. Density of the fill shall be at least five percent (5%) greater than the natural in place soil, but in no case less than 85 percent (85%) when tested in accordance with AASHTO T-99, Method A and T-191 or ASTM D-2922 and D-3017.

When it is necessary to install the pipe in rocky areas, the rock will be removed and replaced with suitable fill material compacted to proper density. The rock will be over-excavated to leave a 6-inch (150MM) minimum compacted soil cushion between the rock and the pipe. For construction accuracy, areas left void by rock removal will be completely filled with compacted material then trenched for the pipe as though natural ground. If the rock below the pipe subgrade is fractured or fragmented or if it consists of large cobblestones or boulders, the replacement fill material will be carefully selected to ensure that it is of such gradation that it will not be removed downward by fluctuation of the water table. In no case will expansive soils be used for fill. A similar procedure of over-excavation, backfill, compaction, and retrenching will be used where sloughing sand or where soft or spongy soil conditions are encountered. When expansive clays are encountered, they will be thoroughly moistened by ponding, to completely expand the soil, and the moisture maintained until the concrete is placed. The Contractor may substitute non-reinforced or reinforced concrete pipe for CIPP in these unsuitable areas. There will be no additional payment for this substitution.

Excavated trench shall be checked for compliance with requirements for grade and alignment prior to placement of concrete. The Contractor shall submit his proposed method of grade and alignment control and checking of same for conformance with specifications to the Engineer for his approval prior to start of work. The Contractor shall supply manpower, equipment and materials, as are required, to provide and confirm compliance with grade and alignment requirements. This is a non-pay item and all costs incurred shall be included in the bid item(s) for the pipe installation.

620.3.2 Placement: At the time of concrete placement, all soil in the trench will be adequately moistened so that water is not drawn from the freshly placed concrete. However, the trench form will be completely free of water, mud, and debris. All forming devices, including the slipforms and hopper of the placement device, shall be thoroughly moistened.

Concrete shall not be placed when temperature of the concrete exceeds 90 degrees Fahrenheit (32 Celsius) or is less than 50 degrees Fahrenheit (10 Celsius). The soil adjacent to the trench shall be at a temperature above freezing.

The pipe shall be constructed in one placement, the entire cross-section being placed monolithically. Inside forms shall be sufficiently rigid to withstand consolidation of the fresh concrete. Placement shall be such as to produce a thoroughly consolidated homogeneous concrete mixture conforming to the test requirements of this specification. Effective consolidation means shall be applied to the fresh concrete over the entire circumference and from within the pipe shell. Consolidation means shall be capable of effectively placing and consolidating fresh concrete at production speeds. Methods of consolidating shall be capable of building up sufficient pressure to effectively bond the concrete to the surrounding earth and to keep loose sand, mud and water out of the pipe shell.

Under no circumstances will the Contractor be allowed to continue the pipe installation if the vibrators of the cast-in-place machine are inoperable. Portable vibrators or "stingers", shall only be used to supplement internal vibrators on the machine and <u>not</u> as a sole source to consolidate and distribute the concrete mix.

The Contractor shall make provisions for removing sloughed material, debris and any foreign objects from trench before and during placement of concrete such that buildup of material does not occur ahead of the machine. In addition, small transverse trenches shall be dug across trench bottom, at distances not to exceed 25 linear feet, to receive soil built up and pushed ahead of the slipform.

(A) Construction Joints:

When pipe placement stops in excess of ninety (90) minutes, a construction joint shall be formed. The ends of the pipe that are to be butt contact shall be left in rough condition with a slope between 20 and 45 degrees. Number 4 reinforcing bars shall be embedded 12 inches in the previous pour and 12 inches into the next pour and shall be placed 12 inches on center for pipe 42 inches in diameter or less and shall be placed 18 inches on center for pipe diameters in excess of 42 inches. Immediately before resuming concrete placement the surface to be bonded shall be cleaned of all laitance, coatings, foreign materials, and loose or defective concrete thoroughly wetted and coated with a layer of bonding mortar (Section 620.2.5) approximately 1/4 inch (6MM) thick. In lieu of the bonding mortar, neat cement paste may be thoroughly scrubbed onto the wet surface of the previously placed concrete.

For a joint that may be used for connections to another pipe or structure, a joint shall be made by squaring off the end of the pipe. An excavation shall be made along the sides and bottom of the cast-in-place pipe, for any diameter, to permit casting of a concrete collar as described above.

(B) Pipe Dimensions and Tolerances:

(1) The internal diameter of the pipe at any point shall not be less than 95% of the nominal diameter, and the average of any four (4) measurements of the internal diameter made at 45 degree intervals shall not be less than the nominal diameter.

(2) For pipe less than 15 inches (381 MM) inside diameter, the minimum wall thickness shall be 2 inches (50 MM).

For pipe with an inside diameter of 15 inches (381 MM) to 24 inches (610 MM) the minimum wall thickness shall be 2-1/2 inches (63 MM). For pipe exceeding 24 inches (610 MM) inside diameter the minimum wall thickness shall be 1/12 of the inside diameter, plus **1"** inch (**25** MM).

(3) Offsets at form laps and horizontal edges shall not exceed 1/2 inch (13 MM) for pipe having inside diameter not greater than 42 inches (approx. 1 M); 3/4 inch (19 MM) for pipe having inside diameter greater than 42 inches, but not greater than 72 inches (approx. 2 M); and 1 inch (25 MM) for pipe having inside diameter greater than 72 inches (1.8 M).

(C) Pipes Placement:

(1) It is essential that concrete placement be done in a smooth and steady manner with as few starts and stops as is possible. The Contractor shall schedule materials and operate the pipe machine at speeds and in a manner that will achieve this.

(2) The Contractor shall provide an anchoring system for pull of the machine in a manner which will provide the least probability of causing deviations in grade and/or alignment. Adjustments to or modifications in anchoring system when required in the opinion of the Engineer shall be made at no additional cost to the project.

620.3.3 Curing and Backfilling: The Contractor shall be responsible for proper curing of the concrete and backfilling the trench to an even grade. Final backfill and compaction shall not be started until concrete has developed a compressive strength of at least 3000 psi. The pipe shall be checked for grade, alignment and thickness prior to backfilling. Curing shall be performed in such a manner as to prevent the premature drying of the concrete. The Contractor shall use the method described below.

(A) Polyethylene film complying with ASTM C-171, nominal thickness 0.0015 inches (0.038 MM), shall be placed on the exposed top surface of the pipe immediately after the pipe is cast. The film shall be anchored in place with loose soil to assure continuous, adequate curing.

A humid atmosphere within the pipe, as evidenced by condensation on the interior surface, shall be maintained for at least seven (7) days following placement, except for a maximum period of 24 hours allowed for removing forms and making repairs. To prevent air drafts which may dry the pipe and to maintain a humid atmosphere inside the pipe, all openings, ends, manholes, connector pipes shall be kept closed or securely covered, except when actual work is in progress on the inside of the pipe. The pipeline shall be partially filled with water during the curing period when work is not being performed on the inside of the pipe.

620.3.4 Repair: Immediately after removal of the forms, the inside of pipeline will be inspected for required repairs and conformance with all dimensional requirements including alignment and grade. The Engineer shall be the sole judge as to the repairability of deficiencies. He shall require removal and replacement of those sections of pipeline which he judges to be non-repairable or which is not within required dimensional tolerances including alignment and grade.

When concrete placement is done by a method requiring the use of metal inner forms, the Contractor shall schedule his work force, by extended, staggered or multiple shifts, as required, to provide for removal of forms within 4 to 6 hours of placement of concrete and start of repairing, patching and finishing of pipeline to conform with specification requirements.

When concrete placement is done by methods using pneumatically inflated inner liner, the Contractor shall schedule his work force, by extended, staggered or multiple shifts, as required, to provide for removal of the pneumatic inner liner within 12 hours of placement of concrete and start of repairing, patching and finishing of pipeline to conform with specification requirements.

All rock pockets, non-longitudinal cracks or indentations shall be cleaned out, moistened and filled with 1:2 cement grout or approved epoxy material. Except where, in the opinion of the Engineer, the width and/or length of the crack may indicate a structural deficiency, repairs shall be made as required for longitudinal cracks.

At the discretion of the Engineer, longitudinal cracks exceeding 0.01 inches in width and 12 inches in length may be cause for rejection and removal and replacement of that portion of the pipe. Subject to the approval of the Engineer, cracks may be repaired using a pressure applied epoxy compound capable of providing structural correction to the area in addition to sealing the void. A longitudinal crack shall be defined as one which has the general direction of a 30 degree angle or less with the alignment of the pipe.

Irrespective of concrete placement method, all repairs, patches and finishing shall be completed within 24 hours of concrete placement.

The Contractor, prior to start of concrete placement on project shall submit a written schedule of his proposed work activities and work time schedules for the Engineer's review and approval. No time schedule requiring overtime by the Engineer's staff is authorized without specific written approval of the Engineer.

Compliance with this section is a non-pay item and any costs incurred shall be included in the bid proposal item(s) for the pipe.

620.3.5 Finishing: Except for the form offsets, the interior surface of the pipe shall be equivalent to or better than a wood float finish. Form offsets shall be trimmed so as to provide a reasonably tapered slope from surface to surface. The bottom of the pipe below the metal forms shall be finished in a workmanlike manner and shall conform to the general circular circumference of the pipe without sags, dips and humps. All extraneous concrete shall be removed from the interior surface.

620.4 TESTS:

Random tests shall be made of the wall thickness at the top, bottom and sides, approximately every 100 feet, on a daily basis by probes through fresh concrete or small holes drilled through the concrete. Holes shall be properly and permanently closed and sealed, flush with the inside surface of the pipe, after measurements are made, in accordance with the requirements of the fifth paragraph of the City of Phoenix Supplement to MAG Specifications Subsection 620.3.4, contained herein.

Test cylinders shall be prepared and tested as per Section 725. If the cylinder tests indicate that the concrete does not meet the specified strength requirements, cores shall be taken from the same section of concrete represented by the faulty test cylinder under the supervision of the Engineer.

The concrete should be at least 14 days old before the core specimens are taken. The diameter of the core specimens for the determination of compressive strength should be at least three (3) times the maximum nominal size of the coarse aggregate used and must be at least twice the maximum nominal size of coarse aggregate.

The length of the specimen, when capped, should be twice the core diameter. A core having a maximum height of less than 95 percent of its diameter before capping or a height less than its diameter after capping shall not be tested.

If cores are taken, the Contractor shall patch all core holes in such a manner that the patch will be permanent, will not leak, and will have a smooth interior finish flush with the interior surface of the pipe.

Procedures and payment for coring shall be in accordance with applicable portions of Section 725.

The Engineer will evaluate the test results and his decision as to required corrective action will be final.

620.5 MEASUREMENT:

Measurement of cast-in-place concrete pipe will be the number of linear feet of pipe measured horizontally along the pipe axis from end to end of pipe. At change in diameter, the measurement shall be to center of manhole or transition.

620.6 PAYMENT:

Payment will be made at the contract unit price bid per linear foot to the nearest foot for each size of pipe and shall be compensation in full for furnishing and installing the cast-in-place concrete pipe as specified including removal of obstructions, excavation, backfilling, compacting, testing, and all incidental costs not specifically covered in other items in the proposal.

SECTION 621

CORRUGATED METAL PIPE AND ARCHES

621.2 MATERIALS: Add the following paragraphs:

All prefabricated fittings for lateral pipes larger than 24 inches shall be welded fittings.

The rubber O-ring gasket shall conform to the requirements of ASTM C-361. The sleeve gasket shall be a closed cell rubber in accordance with ASTM D-1056, grade SCE 43.

621.3 INSTALLATION: Add the following paragraphs:

For the concrete lined pipe, cracks 1/16 inch or more in width and 36 inches or greater in length shall be repaired with an approved epoxy.

Where a curved alignment is indicated, curves shall be formed by straight pipe and fabricated specials. Pipe shall be of such length that no deflection angle of the pipeline exceeds 10 degrees. All deflection angles shall occur between the point of curvature and point of tangent of the curve as shown on the plans.

Transition manhole bases, for pipe larger than 48 inches, may be constructed with a prefabricated transition and a 48 inch stubbed manhole shaft casted as one structure. Dimensions of this structure shall be equivalent to those shown in the Standard Detail. A shop drawing of this option shall be submitted to the Engineer for review. Corrugated steel manhole shafts will not be permitted unless a detail of construction is included and reviewed with the shop drawing.

Pipe layout shall be such that for manholes not located at a joint, the outside edge of the manhole shaft shall be a minimum of 1.5 pipe diameters away from the nearest joint, on both sides of the manhole.

If the manhole cannot be so located, then the concrete encasement shall be extended to include the joint or joints, not outside to minimum distance of 1.5 pipe diameters from the outside of the manhole shaft.

621.3.1 Joints: Delete this Subsection and substitute to following: For bituminous coated pipe, the thickness of the exterior pipe coating under the connecting band and that of the connecting band shall be a minimum of 0.050 inches with a smooth, neat appearance that will permit the connecting band to properly seat and lock into angular corrugations and compress the gasket.

Pipe sections shall be joined together with annular corrugated type bands or hugger type bands locking in at least one annular corrugation and shall be designed to form a leak-resistant joint. The hugger type band shall use an O-ring gasket. The annular corrugated type band shall use a 1/4 inch thick rubber sleeve gasket the same width as the connecting band.

One-piece bands may be used on pipe with diameters up to and including 48 inches. O-ring gaskets or one-piece bands shall be a minimum of 3/4 inch diameter. Two or more piece bands shall be used on all pipe diameters exceeding 48 inches. For pipe with diameters exceeding 48 inches, O-ring gaskets shall be a minimum of 7/8 inches in diameter. The minimum connecting band width shall be 7 inches for pipe diameters of 12 inches through 30 inches, 10-1/2 inches for pipe diameters of 33 inches through 60 inches, and 13-1/2 inches for pipe diameters greater than 60 inches through 120 inches. The connecting bands may be two numerical gage thickness lighter than the gage specified for the pipe material, but not less than 0.064 inches (16 gage) nor more than 0.109 inches (12 gage).

The band shall be tightened evenly, keeping equal tension on the bolts. The joint shall remain uncovered over a period designated by the Engineer, and before covering the joint, the nuts shall be testing for tightness. If the nut has a tendency to loosen its grip on the bolt, it shall be tightened again and remain uncovered until a tight, permanent joint can be obtained. Prior to backfilling around the joint, the bolts, lugs, and nuts shall be given a coating of bituminous mastic. For the bituminous lined pipe. The annular space between abutting pipe sections shall be filled with bituminous mastic after joining. For the concrete lined pipe, all internal joints shall be mortared to a smooth trowel finish around the entire pipe. The leakage test will not be performed until all internal joints have been filled or mortared. Corrugated Steel Pipe (CSP) storm sewer pipelines, except culverts and catch basin connector pipes shall be subjected to a test for leakage conducted in accordance with City of Phoenix Supplement to MAG Specifications Subsection 618.3.7, contained herein.

621.4 PRECONSTRUCTION DEMONSTRATION

For projects utilizing concrete-lined, corrugated steel, mainline storm drain pipe, a preconstruction demonstration shall be held at the pipe manufacturer's plant. The meeting shall be attended by the Contractor's superintendent and pipeline installation representatives; the Engineer; and a representative from the pipe manufacturer. This demonstration shall be held prior to pipe installation in accordance with the following criteria:

The pipe manufacturer shall connect two pieces of pipe using O-ring gaskets and HUGGER bands in the presence of the Engineer and the Contractor. The connection shall be made in accordance with the manufacturer's recommendations for water-tight installations.

There will be no separate measurement or payment for this demonstration. The cost shall be considered incidental to the cost of the pipe.

SECTION 622

HIGH DENSITY POLYETHYLENE PIPE & FITTINGS FOR STORM DRAIN
Adding in entirety

622.1 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

HDPE pipe is approved for storm drain use in diameters up to and including 48-inches.

All HDPE shall be manufactured, designed and installed in accordance with current standards of AASHTO M252, AASHTO M294, MAG 603, MAG 738 and City of Phoenix Supplement to MAG Specifications.

All HDPE storm drain pipe shall be Type "S" corrugated, with watertight joints. In addition, all HDPE pipe connections to concrete structures (e.g., catch basins, manholes, etc.) shall be made with watertight connections meeting the same watertight criteria as the pipe joints.

HDPE pipe shall not be allowed within a minimum of twenty-four (24) linear feet of an open end (inlet or outfall). The open-end segment of storm drain pipe shall be concrete or concrete-lined as shown on the plans. The cost of the adapter fitting/connection between HDPE and the other type pipe shall be considered incidental to the cost of the pipe.

At a minimum, all HDPE storm drain pipe joints shall meet the ASTM D-3212 watertight requirement of 10.8 psi (25 column feet of water head).

The Contractor shall provide a copy of an accepted independent lab certification that the pipe and joints to be used on the projects meet the ASTM D-3212 watertight standard.

The Contractor shall ensure that when installing HDPE storm drain pipe, all pipe sections shall be rammed fully to the “HOME” mark to maintain watertightness of the system.

Prior to bedding mainline HDPE storm drain pipe with the cement-enriched slurry aggregate base material, the Contractor shall pin down the pipe with #4 rebar pins at minimum eight (8) foot intervals, and take any other measures necessary to ensure that the pipe will maintain grade and not "float" when the slurry is poured around it. The Contractor shall also provide means to ensure that the pipe will maintain roundness of shape during and after cement slurry bedding encasement is placed.

Waterstops shall be installed at all HDPE storm drain pipe to manhole connections.

Prior to installation of mainline HDPE storm drain pipe, the Contractor shall set a meeting with his HDPE pipe supplier and the Engineer to review and discuss proper installation procedures that will be used for the project.

High Density Polyethylene Pipe (HDPE) storm sewer pipelines, except culverts and catch basin connector pipes shall be subjected to a test for leakage conducted in accordance with City of Phoenix Supplement to MAG Specifications Subsection 618.3.7, contained herein.

SECTION 623

SPECIAL BEDDING FOR MAINLINE STORM DRAIN PIPE
Adding in entirety

The Contractor **shall** utilize a commercial-source cement-enriched slurry aggregate base course bedding from the outside bottom of the pipe to the springline of the pipe for all mainline storm drain pipe, except cast-in-place pipe. The slurry aggregate base course shall be per MAG Specification Section 728. The slurry shall have a minimum 8-inch slump, and a minimum of 25 psi compressive strength and a maximum of 100 psi based on a 28 day test. Cement slurry aggregate base course bedding is not required for catch basin connector pipes.

Only commercial-source cement-enriched slurry ABC will be allowed. Batch mixing of slurry on-site by the Contractor will not be allowed. The Contractor shall submit the commercial source mix design for cement-enriched slurry ABC at the pre-construction meeting, along with all other required commercial mix designs.

The Contractor, **at his option**, may excavate a trench having a cross-section with a rounded bottom rather than a flat bottom. If this option is chosen, the trench cross-section must maintain a minimum of 6-inches between the outside wall of the pipe and the trench wall. The minimum trench width at the springline for each side of the pipe, as specified in Section 601, may be reduced to 6-inches for all pipe sizes if this option is used.

The Contractor, **at his option**, may use cement-enriched slurry aggregate base course for the bedding material specified in the City of Phoenix Supplement to MAG Section 601.3.2 **from the springline to one (1) foot over the outside top of pipe**.

If the Contractor elects to use corrugated steel (CSP) or high density polyethylene (HDPE) storm drain pipe, the Contractor shall use cement-enriched slurry aggregate base course material for the entire pipe bedding, to one (1) foot over the outside top of pipe—no option.

There will be no separate measurement or payment for special cement-enriched slurry aggregate base course bedding. The cost shall be considered incidental to the cost of the pipe.

SECTION 624

CONNECTING EXTENSIONS TO MAINLINE STORM DRAINS
Adding in entirety

Prior to extending any existing mainline storm drain, the Contractor shall verify the depth, size, pipe type, and horizontal location of the existing storm drain in the field. If the new pipe extension is the same type and size as the existing, or if the pipe manufacturer makes a standard watertight adapter fitting made specifically to join with the existing pipe type, a standard manufacturer-recommended connection may be used. Otherwise, a concrete field collar in accordance with COP Standard Detail P1505 shall be used. The cost of connections shall be considered incidental to the cost of the project. No separate measurement or payment will be made for field connecting extensions to existing mainline storm drain pipes.

SECTION 625

MANHOLE CONSTRUCTION AND DROP SEWER CONNECTIONS

625.3 CONSTRUCTION METHODS: Add the following:

625.3.1 MANHOLES

Manhole steps are not allowed.

625.3.3 SANITARY SEWER MANHOLE TESTING

All new sanitary sewer manholes installed shall be tested for exfiltration either by a watertightness test or by a negative air pressure (vacuum) test modified for the timeframes listed below. Exfiltration testing shall be performed in accordance with MAG Section 615.11(B) and Arizona Department of Environmental Quality (ADEQ) Engineering Bulletin No. 11, Chapter 4, Section B.

When using the watertightness test method, exfiltration loss shall not exceed 0.1 gallons per vertical foot of manhole in a 24-hour period.

Negative air pressure (vacuum) testing shall be performed in accordance with ASTM C 1244, modified for the timeframes below. Testing shall be performed at the top of the manhole cone for manholes located in paved areas. Manholes outside paved areas shall be vacuum tested at the ring and cover. A negative air pressure of ten (10) inches of mercury shall be drawn on the manhole. The time shall be measured for the vacuum to drop from ten (10) inches to nine (9) inches of mercury. The manhole shall pass this test if the time to drop in mercury meets or exceeds the following values:

TABLE 625-1

MANHOLE DEPTH	MINIMUM TEST DURATION (SECS) 48-INCH DIAMETER MANHOLE	MINIMUM TEST DURATION (SECS) 60-INCH DIAMETER MANHOLE
12 feet or less	60	75
Greater than 12 feet to 15 feet	Not Applicable*	90
Greater than 15 feet	Not Applicable*	105

*Manholes greater than 12 feet in depth shall be 60-inch diameter

If manhole joint compound is pulled out during the vacuum test, the manhole shall be disassembled and the joint repaired or replaced as necessary. The vacuum testing shall then be repeated until the manhole passes.

Exfiltration testing of sanitary sewer manholes is considered incidental to the cost of furnishing and installing the manhole. There will be no separate measurement or payment for this testing.

SECTION 626

COATING OF FIVE FOOT SANITARY MANHOLES
Adding in entirety

626.1 GENERAL

626.1.1 DESCRIPTION

Scope: this section specifies the lining of sanitary sewer manholes to provide protection against corrosion of the manhole interior and sewer located below the manhole.

(A) Requirements

(1) Contractors shall furnish all labor, materials, and equipment required to clean and line the manholes.

(2) Contractor shall comply with the local authority and all occupation safety and health administration (OSHA) requirements for confined space entry.

(3) All materials specified by name brand or manufacturer shall be delivered unopened to the job in original containers.

(4) All Safety precautions recommended by the manufacturer in printed instructions or special bulletins shall be obtained and followed.

(5) The work shall be carried out after the sewer is installed.

626.1.2 Quality Assurance.

(A) Standardization: Materials and supplies provided shall be the standard products of manufacturers. The standard products of manufacturers other than those specified will be accepted when it is demonstrated to the Engineer that they are equal in composition, durability, and usefulness for the purpose intended. Requests for submission shall include directions for the application, descriptive literature, safe storage, handling, and disposal of the product.

(B) Warranty:

(1) A written warranty against coating failure shall be provided for the entire coating system, including all repair material, defect fillers, primers, intermediate, and finish coats. The minimum duration of the warranty shall be five (5) years. The product and the installation may be both covered by the manufacturer's warranty, or separate warranties may be issued by the manufacturer and installer.

(2) This warranty shall state that the coating will not fail for a minimum period of five years. Coating failure is defined as blistering, cracking, embrittlement, or softening, or failure to adhere to the substrate. The warranty shall also apply to any repair materials, primers, or other products used in the application. If any repair or replacement is necessary within the warranty period, a new 5 year warranty period shall start at the date that the manhole is placed back into service.

626.1.3 Submittals

(A) Contractor Shall Submit:

(1) Manufacturer's Data

(a) Manufacturer's technical literature on coating material.
(b) Description of installation method including:

(I) Product material safety data sheets (MSDSI).
(II) Maximum storage life and storage requirements.
(III) Mixing and proportioning requirements (as applicable).
(IV) Environmental requirements for application and worker safety, including ventilation, humidity, and temperature ranges.
(V) Application film thickness PM coat of primer and finish coat.
(VI) Curing time required.

(2) Sample of finished product showing final color. Lining color shall be white.

626.2 PRODUCTS

626.2.1 COATING MATERIAL

(A) Approved Materials: Coating materials shall be one of the following pre-approved types or an approved material equal to or better:

(1) Sauereisen corrosion-clad polymer lining No. 210, Sauereisen underlayment. No. F-120, as manufactured by Sauereisen Cements, Pittsburgh, PA 15238. The underlayment shall be used to repair the cleaned surfaces in accordance with the manufacturer's recommendations. The number 210 lining shall be applied to a minimum thickness of 1/8-inch (125 Mills) according to the manufactures recommended procedures.

(2) Sewer shield 100 topcoat with C120 calcium aluminate cement underlayment as manufactured by Environmental Coating, Mesa, AZ 85207. The C120 Calcium Aluminate cement shall be trowel applied to repair the cleaned surfaces in accordance with the manufacturer's recommendations. The sewer shield 100 topcoat shall be spray applied to a minimum thickness of 1/8-inch (125 mills) according to the manufacturer's recommended procedures.

(3) Raven 405, as manufactured by Raven Living Systems, 1024 North Lansing Avenue, Tulsa, OK, 74106. An underlayment recommended by the manufacturer shall be used to repair the cleaned surfaces. The Raven 405 coating shall be applied to a minimum thickness of 1/8-inch (125 mills) according to the manufacturer recommended procedures.

NOTE: This product is a trial product with a limit of 50 manhole applications until November 27, 2012. All applications shall be reported to the Water Services Department, Distribution and Collection Division.

626.2.2 PRODUCT DATA

The Contractor shall provide the following information:

(A) Manufacturer certification of applicators used for the coating installation work, including spray operators as applicable.

(B) Samples of coating and color chart.

(C) Coating applicator shall be an Arizona licensed Contractor.

626.3 EXECUTION

626.3.1 MANHOLE CLEANING

(A) Cleaning shall remove all sediment, rocks, debris, roots, grease accumulations, and obstructions from the manholes. Cleaning of the manhole walls, bench, and channel shall remove all grease, scale encrustation, and loose mortar so that no foreign intrusion shall cause imperfections in the coating. Cleaning methods shall include washing with high-pressure water, mechanical removal, or other as approved by the Engineer.

(B) The Contractor shall use water blasting with a minimum water pressure of 3,000 PSI to clean the manhole prior to applying the coating. Contractor shall also be responsible for any additional surface preparation beyond water blasting as required by the coating system manufacturer. Where additional preparation is required, the Contractor shall provide all labor materials and equipment as necessary at no additional cost to the City.

(C) Before installation of the coating system, the surface must be clean. Excess water shall be blown from the surface using compressed air equipment with oil-trapping filters. Suitable heaters shall be used as needed to produce a surface-dry condition. The surface shall be vacuumed to make sure that loose particles are not present.

(D) Any sediment or debris from cleaning operations larger than U.S. #8 sieve shall not be deposited downstream in the sewer. Sedimentation deposited downstream, as determined by the Engineer, shall be removed at no cost to the City.

626.3.2 INSPECTION AND TESTING

(A) Contractor shall give Engineer a minimum of three days advance notice on start of field surface preparation work or coating application work, and a minimum of seven days advance notice start on any shop surface preparation work.

(B) All work shall be performed in presence of Engineer, unless Engineer has granted prior approval to perform work in absence. The Contractor shall provide testing performed by an independent Special Inspection Testing Agency or Laboratory approved by the City of Phoenix. Cost of this special inspection and testing shall be the responsibility of the Contractor.

(C) Inspection by Engineer or waiver of inspection in any particular portion of work shall not relieve Contractor of responsibility to perform work in accordance with Specification.

(D) Scaffolding shall be erected and moved to locations to facilitate inspection by Engineer. Additional illumination shall be furnished when Engineer requests.

(E) Contractor shall furnish (until final acceptance of coatings) inspection devices in good working condition for detection of holidays and measurement of wet and dry-film thickness of protective coatings. Wet and dry-film thickness gauges shall be available for Engineer's use until acceptance of coating process is complete and final acceptance of coatings made. Contractor shall furnish services of trained operator in holiday detection devices until final acceptance of coatings. Holiday detection devices shall be operated in presence of Engineer.

(F) Contractor shall holiday test in presence of Engineer all coated surfaces. Holiday testing equipment and procedures shall be performed in strict accordance with latest edition of NACE "Standard Recommended Practice-Discontinuity (Holiday) Testing of Protective Coatings." Areas containing holidays shall be marked repaired or re-coated and re-tested in accordance with coating manufacturer's printed instructions. Holiday detectors shall be:

High voltage pulse-type holiday detectors as manufactured by Tinker & Rasor or D.E. Stearns Co. Unit shall be adjusted to operate at voltage required to cause sparks jump across air gap equal to twice specified coating thickness.

(G) Wet film thickness measurement shall be supplemented by report submitted by Contractor or Engineer. The report shall be presented after completion of underlayment, top coating operations, and shall state number of manufacturer's product units used and total square footage of surface area covered. Engineer shall have option of requiring Contractor to document number of units (coating materials) on hand before and after coating operations to verify actual minimum dry film thickness applied.

All film thicknesses not meeting required minimums will be re-coated per manufacturer's recommendations.

626.3.3 CORRECTION PERIOD INSPECTION

(A) Inspection shall be conducted during the eleventh month following completion of all coating work. Contractor and representative of coating manufacturer shall attend inspection. Defective work shall be repaired in accordance with specifications and satisfaction of Owner. Owner may, by written notice to Contractor, reschedule warranty inspection to another date within one-year correction period, or may cancel warranty inspection altogether. If warranty inspection is not held, Contractor is not relieved of responsibilities under Contract Documents.

626.4 MEASUREMENT

Measurement shall be per square foot of manhole wall coated.

626.5 PAYMENT

Payment shall be made at unit price bid per square foot, and be full compensation for cleaning, surface preparation materials, application, testing, and any incidentals, thereto, in conformance with the plans and specifications.

SECTION 627

SPECIFICATIONS FOR PAINTING SANITARY SEWER MANHOLES WITH INSECTICIDE
Adding in entirety

627.1 GENERAL

627.1.1 DESCRIPTION

(A) This specification pertains to manholes on sewer, 15-inch in diameter and under.

(B) All new manholes shall be painted with insecticide.

(C) After the new pipe has been tested, inspected, and accepted for service and the manhole has been adjusted to final grade, the top 8 feet or from the manhole bench to the finish grade which ever is less shall be painted. The entire interior circumference shall be covered, including adjusting rings.

(D) The interior of the manhole shall be free from all loose material to provide a clean bonding surface. Refer to manufacturer's specifications for preparation instructions.

(E) Existing manholes to which corrosion coatings are applied, shall be painted with insecticide.

627.2 PRODUCTS

627.2.1 INSECTICIDE PAINT

(A) The insecticide paint shall be the same product specified in the current Manhole Insecticide Application - IFB Requirements Contract.

627.3 EXECUTION

627.3.1APPLICATION

(A) The paint must be applied by a "State of Arizona Licenses Pest Control Applicator". Spray application is preferred; however, hand application is allowable provided that all applicable safety requirements are met.

(B) Existing manholes to which a tap or main connection is made do not require insecticide paint.

(C) Further technical information can be obtained from current contract, IFB 08-088 MH.

627.4 MEASUREMENT
Measurement shall be per manhole.

627.5 PAYMENT
Payment shall be made at unit price bid per manhole, and be full compensation for cleaning, surface preparation, materials, application, and any incidentals, thereto, in conformance with plans and specifications.

SECTION 630

TAPPING SLEEVES, VALVES AND VALVE BOXES ON WATER LINES

Subsection 630.3.2: Add the following:
Iron body resilient-seated gate valves are allowed up to 30 inches in accordance with AWWA C509-01.

Subsection 630.4.2(A): Add the following:

All tapping sleeves where the tap size is the same size as the size of the main to be tapped shall conform to MAG Specifications Subsection 630.4.2 (A) (1).

Subsection 630.5 BUTTERFLY VALVE: (A) 16 INCHES AND LARGER: add the following:

(14) The rubber valve seats shall be located in the valve body for valves 16-inches in diameter and larger. Valve seat configurations which rely on the mating pipe flange to hold the seat in position in the valve body will not be acceptable. The seating surfaces mating with rubber seats shall be AISI Type 304 or 316 stainless steel, monel or plasma-applied nickel-chrome overlay for all valves.

(15) Valve shafts shall be fabricated of AISI Type 304 or 316 stainless steel. The use of shafts with a hexagonal cross section is not acceptable. The connection between the shaft and the disc shall be mechanically secured by means of a solid, smooth sided, stainless steel or monel taper pin or dowel pin. Each taper pin or dowel pin shall extend through or shall wedge against the side of the shaft and shall be mechanically secured in place. The use of bolts, setscrews, knurled or fluted dowel pins, expansion pins, roll pins, tension pins, spring pins, or other devices instead of the solid, smooth sided, stainless steel or monel taper pins or dowel pins shall not be acceptable.

(16) Prior to installation of the butterfly valve, contractor shall provide to the inspector, certification statements from the valve manufacturer indicating the leakage tests in both directions, proof of design tests were performed and successfully met per AWWA C504-06 Section 5.1.2. If certifications are not provided, contractor can elect to perform tests per AWWA C504-06 Section 5.1.2 and witnessed by the inspector. If the tests are not successful, the contract is required to contact the manufacturer to have the seats adjusted until such a time the tests are successful in both directions.

PART 700

MATERIALS

SECTION 702

BASE MATERIALS

Subsection 702.1 GENERAL: is modified to add:

For all City of Phoenix projects, aggregate base or ABC as used on the plans and Standard Details shall be crushed aggregate, with gradation as for aggregate base per Table 702-1, and shall be placed in conformance with Section 310 for Untreated Base.

SECTION 705

PORTLAND CEMENT TREATED BASE

Subsection 705.1 GENERAL: Change the second sentence that reads "The estimated cement requirement is 3-1/2 percent by weight of the dry aggregate." to read:

The estimated cement requirement is 5 percent by weight of the dry aggregate.

SECTION 710

ASPHALT CONCRETE
Adding in entirety

710.1 GENERAL

Asphalt concrete shall consist of a mixture of paving asphalt and mineral aggregate which, with or without the addition of mineral filler and blending sand as may be required, shall be mixed at a central mixing plant in the proportions hereinafter specified to provide a homogeneous and workable mixture.

Asphalt concrete is designated at Type A-1½ Base Course; Type C-3/4 Base, Surface or Single Course; and Type D-½ Single or Surface Course.

710.2 MATERIAL

710.2.1 Asphalt: The asphalt to be mixed with mineral aggregate shall be paving grade asphalt conforming to Section 711, and shall be PG 64-16 to PG 70-10 as directed by the Engineer, unless otherwise specified in the special provisions.

710.2.2 Aggregate: Coarse and fine aggregates shall conform to the applicable requirements of Section 701 except as modified herein.

Coarse aggregate is material retained on the No. 4 sieve and fine aggregate is material passing the No. 4 sieve.

Blending sand shall be clean, hard and sound material, either naturally occurring sand or crushed fines, which will readily accept asphalt coating. The exact grading requirements shall be such that, when it is mixed with the mineral aggregate, the combined product shall meet the requirements of the designated mix as specified elsewhere in this specification.

710.2.3 Mineral Filler and Anti-Stripping Agent:

(A) Mineral filler shall conform to the requirements of AASHTO M-17. The mineral filler shall be dry hydrated lime conforming to the requirements of ASTM C-207 Type N, or Portland cement conforming to Section 725 or other approved mineral filler shall be added to the aggregate in accordance with the requirements contained herein. The amount of mineral filler to be used shall be determined by the Engineer. The method of adding the mineral filler shall be such that the aggregate is uniformly coated and the mineral filler is uniformly distributed without loss or waste within the material prior to adding the asphalt to the mixture.

(B) When aggregate is subject to stripping, as determined by one of the two procedures below, dry hydrated lime conforming to the requirements of ASTM C-207 Type N, portland cement conforming to Section 725 or other approved anti-strip agent shall be added. Hydrated lime and Portland cement shall be added in accordance with Subsection 710.2.3.

Other approved no strip agents shall be added in accordance with the manufacturer's recommendations and approved by the Engineer.

(1) From a field sample, cut out 800-1000 grams of asphalt mix. Spread the mix out in loose thin layer, the thickness being no larger than the largest size aggregate. Allow the sample to air-season at room temperature for 24 hours $\pm$ 2 hours. Then place the entire sample in non-breakable container with a water tight lid. The sample should not exceed half of the container's volume. (A 4-inch x 8-inch plastic concrete field test mold may be used. The lid can be taped to obtain a water tight seal). The sample shall be completely covered with distilled water at room temperature. The container shall be covered (sealed) and allowed to stand for a period of 24 hours $\pm$ 2 hours. Then the container with sample shall be shaken vigorously for a period of 15 minutes. Shaking shall be accomplished by use of gyro sieve shaker or similar type device.

After shaking, decant the sample over a No. 8 plus material and air dry for a visual examination. The amount of stripping shall be visually estimated in 10 percent increments and classified under the following: 0% to 20% stripping observed - excellent; 20% to 40% - above average; 40% to 60% - average; 60% to 80% - poor; 80% to 100% - very poor. NOTE: The average may vary slightly depending on the aggregate source. Approximately ten selected samples may be retained representing each 10% increment for use in establishing a comparison rating chart.

(2) ASTM D-1075 with a minimum dry strength of 250 psi and a minimum wet strength equal to or greater than 60% of the dry strength test value.

710.2.4 Combined Aggregates: The combined aggregates sampled after all processing, except the adding or asphalt and mineral filler, shall conform to the following quality requirements.

The ratio of the percentage of aggregate by weight passing the No. 30 sieve, to that passing No. 8 sieve, shall not exceed 65 percent of all dense graded asphalt concrete mixes.

At least 75 percent by weight of the aggregate retained on the No. 8 sieve shall consist of particles which have at least one rough, angular surface produced by crushing.

710.2.5 Job-Mix Formula: The City of Phoenix Materials Lab will provide the Job Mix Formula (JMF) letter for "The Standard Mix". If the Contractor chooses to use a mix other than the "Standard Mix", He must establish a satisfactory job mix formula based upon tests performed on the material. The contractor or his supplier must submit samples of this mix, at least 3 weeks prior to use, to the City of Phoenix Materials lab for verification. The formula shall indicate the definite percentage for each sieve fraction of aggregate, and for bituminous cement; also the intended temperature of completed mixture at the time it is discharged from the mixer. The material furnished shall conform to the approved job-mix formula within the tolerances specified herein.

Job-Mix Tolerances

Aggregate passing sieve No. 4 and larger	± 7 percent
Aggregate passing sieves No. 8 and 30	± 5 percent
Aggregate passing sieve No. 200	± 2 percent
Temperature of mixing and placing	280° to 310° F

The tolerances used in conjunction with the job-mix formula shall be such that the resulting gradation shall be within the specification limits. The amount of liquid asphalt, by weight, to be added to the different gradations of the mineral aggregate shall be as specified and determined by the Engineer. The amount specified by the Engineer shall be within the following range of the percentages of the total mixed material:

Mix Description	Percentage of Asphalt Range
A – 1 ½ "	4.0 to 5.0
C – ¾	5.0 to 6.0
D – ½	5.0 to 6.0

The allowable tolerance in percentage of asphalt content from that percentage specified by the Engineer, when sampled and tested in accordance with AASHTO T-164 and T – 168 as modified by Contracting Agency shall be plus or minus 0.4 percent.

After the job-mix formula has been approved and the mixing plant selected, the Contractor and/or his supplier shall not change either of the above or utilize additional mixing plants without prior approval of the Engineer.

710.3 COMPOSITION AND GRADING:

The grading of the combined aggregates shall be such as to conform to the requirements indicated on the approved list. See city inspector for approved list.

710.4 STORING, DRYING, AND SCREENING AGGREGATES:

710.4.1Stockpiling (Cold Feed Separation): Aggregate for Dense Graded Mixes shall be separated and stockpiled into two or more sizes of aggregate: If the mineral aggregate is separated into two sizes, one stockpile or bunker shall contain material of which a minimum of 80 percent will pass a No. 4 sieve and the other stockpile or bunker shall contain material of which a minimum of 80 percent will be retained on the No. 4 sieve. If the mineral aggregate is separated into more than two sizes, at least two of the stockpiles or bunkers shall comply with the above and the sizes and tolerances shall be as approved by the Engineer.

The grading of the cold feed stockpiles, or bunkers, for the duration of any one project shall not deviate from the grading as determined at the beginning of the project by more than the following tolerances:

Stockpile Tolerances

Aggregate passing ¾"; 3/8", No. 4, No. 8, & No. 30 ..... ± 10 Percent
Aggregate passing No. 200 ..... ± 4 Percent

Any material added to the stockpiles, or bunkers, during the progress of the project shall comply with the above requirement; however, the resulting gradation shall be within the specification limits.

In placing materials in storage or in moving them from storage to the drier, any method which may cause the segregation, degradation, contamination, or the combining of materials of different gradings which will result in any stockpile or bunker failing to meet the requirements shall be discontinued and the material shall be reprocessed or wasted.

710.4.2 Drying and Heating: The mixing plant shall be provided with accurate mechanical means for feeding the aggregates from the stockpiles or bunkers into the drier at such a rate that a uniform production and temperature of dried aggregates will be obtained.

The feeders may be of the apron belt, reciprocating plate, vibrating type or tip gate, and shall have accurate and separate adjustments. These adjustments shall be capable of being locked in any position and the feeders shall be capable of delivering the required aggregate in the proper proportions.

Drying shall continue until the moisture content is not greater than 0.75 percent. In special cases when the aggregate is unusually porous, moisture content in excess of 0.75 percent may be permitted at the discretion of the Engineer. In no event shall the aggregate be heated beyond the lowest temperature necessary for proper drying, mixing, spreading, and compacting.

The drier shall be provided with a heat-indicating device in order that the temperature of the aggregate leaving the drier may be determined. The heat-indicating device shall be accurate to the nearest 10°F., and shall be installed in such a manner that a fluctuation of 10°F in the aggregate temperature will be shown by the heat-indicating device within one minute.

The drier shall be equipped with an approved type of dust collector system capable of removing objectionable or excess dust from the aggregate and either wasting the material so collected or returning all or any portion of it uniformly to the mixer, as the Engineer may direct. Dust collector shall comply with the Maricopa County Bureau of Air Pollution Control Rules and Regulations as adopted by the County Board of Supervisors and applicable State laws or local ordinances.

710.5 BIN SEPARATION BATCH PLANT:

After being dried and in advance of mixing with asphalt, the mineral aggregate shall be separated into three or more sizes and stored in separate bins.

All mineral aggregate for mixes A – 1½ and C – ¾, Dense Graded, shall be separated into three or more bins as follows:

(A) Bin No. 1

Not less than 80 percent of the material in Bin No. 1 shall pass a No. 8 sieve.

(B) Bin No. 2

The sum of the percent of the material retained on a 3/8 inch sieve and the percent of the material passing a No. 8 sieve shall not exceed 25 percent.

(C) Bin No. 3

Not more than 20 percent of the material in Bin No. 3 shall pass a 3/8 inch sieve.

Mineral aggregate for mix D – ½ Dense Graded, shall be separated into two or more separate bins as follows:

(A) Not less than 80 percent of the material in Bin No. 1 shall pass a No. 8 sieve.

(B) Not more than 20 percent of the material in Bin No. 2 shall pass a No. 8 sieve.

Failure to comply with the requirements shall be corrected by drawing the bin and re-screening the material. If there is evidence of fine material hanging on the sides of the fine bin, the fine bin shall be equipped with a vibrating unit, which will effectively vibrate the side-walls of the bin and prevent any hang-up of segregated sizes while the plant is operating. A positive signal system shall be provided to indicate the low level of material in each bin. Each bin shall be provided with an overflow chute to prevent spilling into adjacent bins and to waste excess material from the bin. The inter-mingling of material between bins by the removal of patch-plates, or by other openings between bins, will not be permitted. The composite analysis of the bins as proportioned, shall comply with the grading limits required for the size mineral aggregate designated.

710.5.1 Proportioning: Subsection 705.1 GENERAL: Change the second sentence that reads "The estimated cement requirement is 3-1/2 percent by weight of the dry aggregate." to read:

The estimated cement requirement is 5 percent by weight of the dry aggregate.

One set of documentation shall be provided for each **500 tons** produced, however not less than one per each time the plant is placed in production.

710.6 GENERAL MIXING:

All hot asphalt mixing facilities must be certified using the certification standards established by the Arizona Rock Products Association. Re-certifications must be performed on an annual basis. Copies of the certification or re-certifications shall be provided to the Engineer.

The mineral aggregate and asphalt shall be mixed at a central mixing plant of the batch type mixes, continuous type mixes, or drum type mixer, as the Contractor may elect.

The right is reserved to order the use of any drying, proportioning, and mixing equipment discontinued which, in the opinion of the Engineer, fails to produce a satisfactory mixture.

Filler material, if required, shall be added separately and in a thoroughly dry condition. Heating of filler material will not be required.

The amount of filler material to be used will be specified by the Engineer and shall be accurately proportioned by weight or by volumetric methods.

The amount of asphalt to be added to the mineral aggregate shall be as specified in this specification.

The temperature of the mineral aggregate shall not be higher than necessary for spreading and finishing at the time of adding the paving asphalt, and in no case shall the temperature for the Dense Graded Mixes exceed 325 degrees F.

Asphalt shall be added to the mineral aggregate at a temperature conforming to the range of temperature specified in Section 711.

Thermometric equipment shall be provided to indicate the temperature of the asphalt near the charging valve at the mixer.

All scales shall be certified as to accuracy and sealed at least annually by the Sealer of Weights and Measures, and rechecked as ordered by the Engineer. Each scale installation shall be provided with certified weights as follows:

The Contractor shall provide not less than 20 certified weights, each weighing 50 pounds, to be used by the Engineer in checking scales used on the project. Each weight shall be numbered and show the corresponding certified weight. The scales and weights shall remain the property of the Contractor and no payment will be made for their use.

The asphalt concrete manufacturer shall make whatever alternations are necessary to his equipment to enable the Sealer of Weights and Measures to conveniently check, calibrate, and seal the aggregate and asphalt scales used in production of asphalt concrete.

Scales shall be so located that the mixer operator and the plant inspector have an unobstructed close-up view of the indicating or registering devices. They shall indicate the true net weight without the application of any factor. The dial for dial type scales shall not be less than 12 inches in diameter and the figures thereon shall be clearly legible.

Subsection 710.7 BATCH MIXING:

710.7.1 General Requirements: The mixer shall be of the twin-shaft pug mill type and shall be operated at the speed recommended by the manufacturer. If shall be equipped with paddles of sufficient size and number to deliver a thorough and uniform mixture. Should the paddles or other parts of the pug mill become worn to such extent as to adversely affect the quality of the mixing or allow leakage from the discharge gate, they shall be promptly replaced.

The amount of material that may be mixed per batch shall not exceed the rated capacity of the plant, or that which will permit complete mixing of all the materials.

Dead areas in the mixer, in which the material does not move or is not sufficiently agitated, shall be corrected either by a reduction in the volume of materials or by other adjustments.

All boxes, hoppers, buckets, or similar receptacles used for weighing mineral aggregate, filler material, and asphalt, as well as all scales used in batching materials shall be insulated against the vibration or movement of the rest of the plant, so that the error in weighing, with the entire plant operating, will not exceed 2 percent for any setting nor 1½ percent for any batch.

Dial heads or readout devices shall be mounted separate from batch plant or tower supports. This will nullify most vibrations from readout.

710.7.2 Aggregate: The aggregate scales shall be either multiple beam or springless dial type having a capacity exceeding 1 ½ times the total amount of materials to be weighed in one operation. Each scale graduation shall be approximately 1/1000 of the total capacity of the scale.

710.7.3 Asphalt: For mixers with a manufacturer's rated capacity of 4,000 pounds or less, the asphalt shall be measured by weight in a heated insulated bucket suspended from a springless dial scale system having a capacity of not more than 500 pounds with one-pound gradations. Form mixers with a manufacturer's rated capacity of more than 4,000 pounds, the scale system shall have a capacity of not more than 1,000 pounds with one-pound gradations.

Asphalt shall be introduced into the mixer by means of a distributing pan fixed to the side of the mixer, by gravity distribution along the center of the mixer parallel to the mixer shafts, or by pressure spraying. The pan shall be equipped with movable vanes in order that the flow of asphalt may be directed across the width of the pan as desired. The vanes shall be equipped with a means of quick adjustment and a positive lock to prevent shifting.

710.7.4 Filler Material: Filler material shall be introduced into the mixer through the weight box, or introduced into the center of the mixer.

710.7.5 Mixing: The entire batch shall be continuously mixed until all the materials are thoroughly blended into a homogeneous mass. The maximum mixing time for any one batch shall be as hereinafter specified for that particular type mix. The time of mixing a batch shall begin on the charging stroke of the weigh hopper dumping mechanism and shall end when discharge from the mixer has started. The mixer shall be equipped with a time lock mechanism which locks the mixer discharge gate for the mixing period and activates an indicator light, or bell, which shall be used in signaling the end of the mixing time. The time lock and indicator light or lights, shall be actuated by the charging stroke of the weigh hopper charging mechanism. There shall also be provided an interlock and indicator light to provide for the dry mixing time for the introduction of filler which shall be a minimum of 4 seconds and not more than 15 seconds as required by the Engineer. The device shall be accurate to within 2 seconds. The time of mixing shall be not less than 30 or more than 45 seconds or as otherwise directed by the Engineer. If for any reason the mix cannot be discharged when the mixing cycle is completed, power to the mill shall be cut off or the mix shall be wasted. The mixing shall begin with the introduction of the asphalt into the mixer, and shall end when the mixer gate is opened. When asphalt is introduced by spraying, the spraying time shall not exceed 15 seconds. In any event, mixing shall continue until uniform coating of the aggregate is obtained.

The mixer platform shall be of ample size to provide safe and convenient access to the mixer and other equipment. Mixer and weigh-box housing shall be provided with hinged gates of ample size to permit ready sampling of the discharge of aggregates from each of the plant bins.

Means shall also be provided for convenient and accurate sampling of the mixture.

Subsection 710.8 CONTINUOUS MIXING:

710.8.1 General Requirements: In addition to the general requirements above specified, continuous mixing of the materials shall conform to the following:

(A) No asphalt concrete shall be produced until the plant has been calibrated to the satisfaction of the Engineer. When there is a change in the weight per cubic foot of the aggregate, the Engineer may require that the plant be recalibrated.

(B) The maximum rate of production at which the plant will be permitted to operate shall not exceed the manufacturer's recommendations.

710.8.2 Storage Bins: Storage bins shall be equipped with overflow chutes for each compartment. If there is evidence of fine material hanging on the sides of the fine bin, the fine bin shall be equipped with a vibrating unit which will effectively vibrate the side walls of the bin and prevent any hang-up of segregated sizes while the plant is operating. A positive signal system shall be provided to indicate the low level of material in each bin and as the level of material in any on bin approaches the strike off capacity of the feed gate, the device will automatically close down the feed of all materials to the mixer instantly. Unless this automatic signal system is in good working condition, the plant will not be permitted to operate. Openings in the partitions between the bins will not be permitted.

710.8.3 Feeder: The correct proportions of each aggregate size and filler material introduced into the mixer shall be drawn from the storage bins by an approved type of continuous feeder, which shall supply the correct amount of aggregate and filler material in proportion to the asphalt, and be so arranged that the proportion of each size can be separately adjusted. The continuous feeder for the aggregate may be mechanically or electrically actuated.

Aggregate feeders that are mechanically driven shall be directly connected with the drive on the asphalt pump.

Aggregate feeders that are electrically driven shall be actuated from the same circuit that serves the motor driving the asphalt pump. Current for operation of plants equipped with electrically driven feeders shall be actuated from the same circuit that serves the motor driving the asphalt pump. Current for operation of plants equipped with electrically actuated aggregate feeders shall not vary in frequency in excess of one cycle or in voltage in excess of ten percent. The drive shaft on the feeder shall be equipped with a revolution counter reading to one one-hundredth of a revolution.

710.8.4 Asphalt Pump: The asphalt pump shall be a positive displacement type pump. The use of pressure relief valve will not be permitted. The plant shall be equipped with an indicating meter between the pump and spray, and the meter shall be in good working condition and accurately record the gallons of material pumped. All pipe, bins, fittings, and meter shall be steam jacketed or otherwise properly insulated.

The asphalt storage system shall be equipped with a device for automatic plant cut-off when the intake of the positive displacement pump is not working under positive pressure.

A suitable by-pass shall be installed between the pump and the spray bar to divert the flow of asphalt into an auxiliary container of not less than 25-gallon capacity in order that the Engineer may check the rate of delivery of the pump.

710.8.5 Discharge Hopper: The material from the mixer shall be discharged into a hopper in order that segregation of the mixture will be at a minimum. The hopper shall be approved by the Engineer.

710.8.6 Facilities for Samplings: Continuous mixing plants shall be equipped with three or more sampling hoppers. These shall be so placed that the discharge from each aggregate feeder may be diverted into each hopper while the feeders are in full operation. The weight of the hoppers shall be determined by means of a springless dial or a beam type scale.

The area around the hoppers shall be kept free of all aggregate and debris and the Contractor shall furnish all labor required in handling the hoppers and weighing the materials and in disposing of all excess materials.

Means shall be provided for convenient and accurate sampling of the mixture as it leaves the mixer.

If the results obtained indicate that uniform proportioning of the aggregate from the bins or uniform and correct amounts of asphalt are not being delivered, the Engineer shall order that operations cease until proper corrections have been made.

Subsection 710.9 DRUM MIXING:

710.9.1 General Requirements: The drum mix plant shall be capable of producing a thorough and uniform mixture. The production of the drum mix plant shall be governed by the rate required to obtain a thorough and uniform mixture.

No asphalt concrete shall be accepted until the plant has been calibrated to the satisfaction of the Engineer. When tests indicate material produced is not in conformance with the approved job-mix design, no asphalt concrete will be allowed to be used on the job until the plant has been re-calibrated to the satisfaction of the Engineer.

710.9.2 Aggregate Delivery System: An automatic plant shut-off shall be provided to operate when any aggregate bin becomes empty. Provisions shall be provided for conveniently sampling the full flow of materials from the total cold feed. Total cold feed shall be weighed continuously. The weighing system shall have an accuracy of 0.5 percent when tested for accuracy. The plant shall provide weight control of the cold aggregate feed by use of a belt scale, or other appropriate device, which will automatically regulate the feed gate and permit instant correction of variations in load. The cold feed flow shall be automatically coupled with the asphalt flow to maintain the required proportions of each material. Provisions shall be made for introducing the moisture content of the cold feed aggregates into the belt weighing signal and correcting wet aggregate weight to dry aggregate weight. Screens or other suitable devices which will reject oversize particles or lumps of aggregate that have been cemented together shall be installed in the feeder mechanism between the bins and the dryer drum.

Dry weight of the aggregate flow shall be displayed digitally in appropriate units of weight and time and totaled.

710.9.3 Additive Delivery Systems: Satisfactory means of metering shall be provided to introduce the proper amount of additives into the mix. Delivery systems shall prove accurate to plus or minus one percent when tested for accuracy. The additive flow shall be displayed digitally in appropriate units of (weight) and time shall be totaled.

710.9.4 Thermometric Equipment: A recording thermometer of adequate range shall be located to indicate the temperature of the bituminous material in storage. The plant shall also be equipped with approved recording thermometers, pyrometers, or other approved recording thermometric instruments at the discharge chute of the drum mixer.

710.9.5 Asphalt Delivery System: The drum mixer plant shall be equipped with a positive displacement type asphalt pump and an indicating meter between the pump and spray to monitor the proper amount of asphalt being introduced into the mix when displaced digitally in appropriate units of volume or weight. The asphalt delivery shall be interlocked with the aggregate weight and accurate to plus or minus one percent when tested for accuracy.

The asphalt delivery system shall be equipped with a device for automatic plant cut-off when the intake of the positive displacement pump is not working under positive pressure.

A suitable by-pass shall be installed between the pump and the spray bar to divert the flow of asphalt in order that the Engineer may check the rate of delivery of the pump.

710.9.6 Temporary Storage of Bituminous Mixture: Use of surge bins or storage bins for temporary storage of hot bituminous mixtures will be permitted as follows:

The bituminous mixture may be stored in insulated and heated storage bins for a period of time not to exceed 12 hours, provided an inert gas atmosphere is maintained in the bin during the storage period.

If the Engineer determines that there is an excessive amount of heat loss, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bin will be discontinued.

Subsection 710.10 GENERAL REQUIREMENTS:

The temperature indicating device reading to 500 degrees F. and accurate to 5 degrees F. shall be fixed in the asphalt line or storage tank at a suitable location.

The temperature of the mixture discharged into the hauling vehicles shall not vary more than 30 degrees F. for successive batches. The discharge end of the asphalt binder circulating pipe shall be maintained below the surface of the asphalt binder in the storage tank to prevent discharging hot bituminous binder into open air. The Contractor shall provide a suitable sampling outlet in the asphalt feed lines connecting the plant storage tanks to the asphalt weighing system or spray bar. The sampling device shall consist of a ½ inch or ¾ inch valve constructed in such a manner that a one-gallon sample may be withdrawn slowly at any time during plant operations. The valve shall be maintained in good condition and if it fails to function properly, it shall be replaced. The sampling device shall be placed in a location that is readily accessible and in an area free of dangerous obstructions. A drainage receptacle shall be provided for flushing the devices prior to sampling.

Mixtures shall be delivered to the site of the work without segregation of the ingredients and within the temperature range specified in Section 321.

At the time of delivery to the job site, the Engineer shall be provided with a legible weight master's certificate (delivery ticket) containing the following information:

(1) Date
(2) Supplier's name;
(3) Plant location and/or plant number;
(4) Ticket number;
(5) Truck number;
(6) Contractor's name;
(7) Project name and/or location;
(8) Product code/description with percent asphalt;
(9) Mineral filler/additive and percent;
(10) Temperature at batching;
(11) Time of batching, arrival and unloading;
(12) Material weight or vehicle weight with and without material;
(13) Weight of accumulative loads.

SECTION 725

PORTLAND CEMENT CONCRETE

Section 725.10 TESTS: Change the fourth and fifth paragraphs, first sentences, to read:

Two Cylinders shall be tested at 14 days. If their strength meets or exceeds the minimum 28-day requirement the Contracting Agency will accept the concrete.

If this strength does not meet the 28-day requirement, the Contractor shall schedule and pay for two cores to be taken on the 29th day, from the area of concrete represented by the cylinders.

TABLE 725-1
CONCRETE CLASSES MINIMUM REQUIREMENTS

Class of Concrete	Min. Cement Content Lb. Per Cu. Yard	Minimum Compressive Strength at 14 Days* psi	Minimum Compressive Strength at 28 Days psi
AA	600	3200	4000
A	520	2400	3000
B	470	2000	2500
C	420	1600	2000

* To be used as information only

SECTION 735

REINFORCED CONCRETE PIPE

Subsection 735.4 MATERIALS: Paragraph (C) Steel Reinforcement. Change the last sentence that reads "The number of steel wraps . . . for any one pipe." to read:

The area of steel used shall be the same as that shown on the shop drawing for that pipe.

Section 735.4 MATERIALS: Paragraph (D). Delete this paragraph in its entirety and substitute the following:

(D) Rubber gaskets for pipe used for storm sewers, drainage or irrigation purposes shall be in accordance with MAG Specifications Section 618.2. Rubber gaskets for sanitary sewer pipe shall be in accordance with MAG Specifications Section 765.

SECTION 736

NON-REINFORCED CONCRETE PIPE

Subsection 736.3 PIPE JOINTS: Delete in its entirety. The specification for pipe joints is included in the City of Phoenix Supplement to Section 618.

Subsection 736.3.2 Rubber Gaskets Joints: Delete this subsection in its entirety and substitute the following:

736.3.2 Rubber Gasket Joints: Rubber gaskets shall conform to MAG Subsection 618.2.

SECTION 741

LINING FOR REINFORCED CONCRETE SANITARY SEWER PIPE
Adding in entirety

741.1 GENERAL:
The interior area of the reinforced concrete pipe as indicated on the plans shall be protected with lining, as specified below.

The installation and application of the pipe lining shall be accomplished by the supplier of the reinforced concrete pipe.

All work for and in connection with the installation of lining in concrete pipe and the field welding of joints shall be done in strict conformance with all applicable published specifications, instructions and recommendations of the approved lining manufacturer.

741.2 MATERIALS:

741.2.1 Material Composition:
The material shall be a liner plate which is a combination of inert, synthetic resins, pigments, and plasticizers, compounded to make a permanently flexible sheet.

The liner plate shall be resistant to the following: Oxidizing agents, sulfuric, phosphoric, nitric, chromic, oleic, and stearic acids; sodium and calcium hydroxides; ammonia, sodium, calcium, magnesium, and ferric chlorides; ferric sulfate, petroleum oils and greases; vegetable and animal oils, fats, greases and soaps that normally occur in sanitary sewers.

Liner plate shall be impermeable to sewage gasses and liquids and shall be nonconductive to bacterial or fungus growth. All liner plates shall be factory checked electrically to insure freedom from any porosity with a high voltage holiday detector set at a minimum of 20,000 volts.

Joint strips and welding strips shall have the same general composition and corrosion resistance as liner plate, but shall not have locking extensions.

The lining shall have good impact resistance, shall be flexible and shall have an elongation sufficient to bridge up to a ¼ inch settling crack which may take place in the pipe or in the joint after installation without damage to the lining.

Once cast into the pipe, the lining shall be permanently and physically attached to the concrete by locking extensions and shall not rely on an adhesive bond.

741.2.2 Material Details and Dimensions:
The liner plate shall not be less than 0.065 inches in thickness. Locking extension shall be of the same material as the liner and shall be integrally extruded with the sheets. If steel bands are used to secure the liner plate to the forms transversely, strap channels shall be formed by removing the locking extensions as required.

Liner plate shall be supplied either as pipe size sheets or tubes and fabricated by shop welding together using the di-electric welding process. Tensile strength measured across the shop welded joint shall be in accordance with ASTM D412 using Die B and shall be at least 2000 PSI.

Joint strips shall be 4-inches ± 0.25 inches in width and shall have each edge beveled prior to application.

Welding strips shall be 1-inch ± 0.125 inch in width and shall have the edges beveled at time of manufacture.

The Contractor shall submit a shop drawing showing liner plate details for approval by the Engineer, prior to fabrication of the pipe.

741.3 Installer Qualifications:
The application of joint strips, weld strips and plastic liner to forms and other surfaces is considered to be specialized work. Personnel performing such work shall be adequately trained in the methods of liner installation and shall demonstrate their ability to the Engineer prior to commencing work.

Each welder shall pass an approved qualification welding test before doing any welding. Certification shall be renewed on a yearly basis and the list of qualified personnel shall be maintained by the pipe manufacturer. All test welds shall be made in the presence of the Agency's representative and shall consist of the following:

(A) Two pieces of liner at least 15-inches long and 9-inches wide, shall be lapped 1 ½-inches and held in a vertical position.

(B) A welding strip shall be positioned over the edge of the lap and welded to both pieces of liner. Each end of the welding strip shall extend at least 2-inches beyond the liner to provide tabs.

The weld sample shall be tested by the Engineer as follows:

(A) Each welding strip tab, tested separately, shall be subjected to a 10-pound pull normal to the face of the liner with the liner secured firmly in place. There shall be no separation between the welding strip and liner

(B) Three test specimens shall be cut from the welded sample and the weld shall be tested for tensile strength in accordance with ASTM D412 using Die B. Tensile strength measured across the welded joint shall be at least 2000 PSI.

(1) If none of these specimens fails when tested as indicated above, the weld will be considered as satisfactory.

(2) If one specimen fails to pass the tension test, a retest will be permitted. The retest shall consist of testing three additional specimens cut from the original welded sample. If all three of the retest specimens pass the test, the weld will be considered satisfactory.

(3) If two of three specimens fail, the welder will be considered to be an unqualified welder and shall be disqualified.

A disqualified welder may submit a new welding sample when he has had sufficient off-the-job training or experience to warrant re-examination.

741.4 INSTALLATION OF LINER PLATE:
The installation of liner plate, including the welding of all joints, shall be done in accordance with the manufacturer's recommendations. Liner plate shall be installed with locking extensions parallel with the longitudinal axis of the sewer, unless otherwise shown on the plans. All joints between individual sheets or sections of liner plates shall be continuously heat-welded by the use of welding strips of the same general composition and equivalent thickness of material as the liner plates (with the exception of the integral extension ribs).

Liner plate shall be held snugly in place against inner forms by means of light gage steel wire, light steel banding straps or other suitable means. If steel banding straps are used, they shall be applied in strap channels provided for this purpose or onto flaps created at pipe ends.

Locking extensions (T-shaped) shall be integrally extruded to all lower, terminal or longitudinal edges of liner plate as applied to concrete pipe. If banding straps are used, a steel rod ¼-inch in diameter may be inserted in each locking extension along the longitudinal edges of each sheet of liner plate for concrete pipe or some other approved method for holding the lower edge of the liner plate snugly against the form shall be provided. Concrete poured against liner plate shall be compacted in a careful manner so as to protect the liner plate and to produce a dense, homogeneous concrete securely anchoring the lock extensions into the concrete.

In removing forms, care shall be taken to protect liner plate from damage. Sharp instruments shall not be used to pry forms from lined surfaces. All holes, cuts, torn or seriously abraded areas in the liner plate shall be patched. Patches made entirely with welding strip shall be fused to the liner plate over the entire patch. Larger patches may consist of smooth liner plate applied over the damaged area with adhesive. All edges must be covered with welding strip fused to the patch and the sound liner plate adjoining the damaged area.

The Contractor shall take all necessary measures to prevent damage to installed liner plate from equipment and materials used in or taken through the work.

The applied lining shall be free from bubbles due to poor workmanship, and the Contractor shall cut out said bubbles and weld a similar sheet in place of the bubble, unless otherwise directed by the Engineer.

Application on Concrete Pipe-Special Requirements: Type P-1 joint, Liner plate shall be set to within ¼” of the inner edge of the bell or groove end of a pipe section and shall extend to within ¼” of the spigot or tongue end. Type P-2 joint, Liner plate shall be set to within ¼” of inner edge of the bell or groove end of a pipe section and shall extend a minimum of 3” beyond the spigot or tongue end.

Wherever concrete pipe, which are protected with liner plate, join structures not so lined, such as brick structures, concrete pipe, cast-in-place structures or clay pipe, the liner plate shall be extended over and around the end of the pipe and back into the structure for not less than 2-inches.

Where a pipe spur, not of plastic lined concrete, is installed through lined concrete pipe, the liner plate shall be returned not less than 2-inches at the surface of contact. The seal between the liner plate and the spur shall be made using an approved adhesive material and strapped in place. If the joint space is too wide or the joint space surface too rough to allow satisfactory sealing with this adhesive, the joint space shall be filled with 2-inches of densely caulked lead wool or other approved caulking material.

Lined concrete may be cured by standard curing methods. Care shall be exercised, in handling, transporting and placing lined pipe to prevent damage to the liner plate. No interior hooks or slings shall be used in lifting pipe. All handling operations shall be done with an exterior sling or with a suitable forklift lifting the pipe only from the exterior.

No pipe with damaged lining will be accepted until and unless the damage has been repaired to the satisfaction of the Engineer.

741.5 FIELD JOINTS:
The Contractor shall obtain the services of qualified and approved personnel to weld the liner plate field joints. Pipe joints must be dry before the liner plate joints are made. All mortar and other foreign material shall be removed from liner plate surfaces adjacent to the pipe joint, leaving them clean and dry.

No field joint shall be made in liner until the lined pipe or structure has been backfilled and 7 days have elapsed after the flooding, jetting, or other means of compaction has been completed. Where groundwater is encountered, the joint shall not be made until pumping of groundwater has been discontinued for at least 7 days and no visible leakage is evident at the joint. The liner at the joints shall be free of all mortar and other foreign material and shall be clean and dry before joints are made. When the pipe liner coverage is 360 degrees, 6 to 8-inches of the downstream side of the joint strip or flap at the pipe invert shall not be welded.

Heated joint compound shall not be brought in contact with liner.

No coating of any kind shall be applied over any joint, corner, or welding strip, except where nonskid coating is applied to liner surfaces.

Field joints in the liner plate at pipe joints may be either of the following described types:

Type P-1 joint shall be made with a separate 4-inch joint strip and two (2) 1-inch welding strips. The 4-inch strip shall be centered over the joint, secured to the liner plate by heat sealing with hot air and welded along each edge to adjacent liner plate with a 1-inch weld strip. The width of the space between adjacent liner plate sheets shall not exceed 2-inches. The 4-inch joint strip shall lap over each liner plate a minimum of 1-inch.

Type P-2 joint shall be made with an integral joint flap with locking extensions removed, extending a minimum of 3-inches beyond the spigot end of the pipe. The flap shall overlap the adjacent lined pipe and shall be heat sealed to this lining and then welded on the edge to the adjacent liner with 1-inch weld strip. Care shall be taken to protect the flap from damage. Excessive tension and distortion while bending the flap back to facilitate laying and joint mortaring shall be avoided. Heat shall be applied to straighten the PVC flaps as needed to prevent cracking of the PVC.

Any flap which has been bent back and held shall be allowed to return to its original shape and flatness well in advance of making the liner joint.

If joints are to be mortared, field joints on liner at pipe joints shall not be made until the mortar in the pipe joint has been allowed to cure for at least 48 hours and the pipe has successfully passed the leakage tests.

741.6 INSTALLATION OF WELDING STRIP:
Welding strips shall be fusion welded to joint strips and liner by welders approved by the Engineer, and trained by the manufacturer, using only approved methods and techniques.

Adequate ventilation shall be maintained during all welding operations.

Hot air welding tools shall provide clean effluent air at constant pressure to the surfaces to be joined within a temperature range between 260ºC and 315ºC (500ºF and 600ºF).

For lap welds, the welding strip shall be positioned so that approximately 1/3 of the width is placed on the high side of the lap and properly fused. The weld strip shall be completely fused across its' entire width, except for a small allowable gap in the center. Incomplete fusion, charred, or blistered welds will be rejected by the Engineer.

741.7 Joint Reinforcement:
A 12-inch long welding strip shall be applied as reinforcement across each transverse joint, weep channel, or return which extends to the lower terminal edge of liner. These reinforcement strips shall be centered over the joint being reinforced and located as close to the edge of liner as possible.

741.8 TESTING AND REPAIRING DAMAGED LINER SURFACES:
After the pipe is installed in the trench, all surfaces covered with liner plate shall be tested with an approved electrical holiday detector set at a minimum of 20,000 volts. All welds shall be physically tested by a non-destructive probing method. All patches over repairs to the liner plate wherever damage has occurred shall be done in conformance with the instructions and recommendations of the liner plate manufacturer.

The Contractor shall provide adequate ventilation, ladders for access, barricades or other traffic control devices, and shall be responsible for opening and closing entrances and exits. All areas of liner failing to meet the field test shall be properly repaired and retested. The electrical holiday detector shall be supplied by the Contractor and shall be a Tinker & Rasor Holiday Detector (Model AP-W).

The Contractor, at his expense, shall have an independent inspection service perform the visual inspection and the probing of all weld joints. The independent inspection service and the inspection and probing procedures shall be approved by the Engineer. In addition, the independent inspection service shall witness the spark testing and any repairs performed by the Contractor. Inspectors employed by the independent inspection service to test the welds shall have passed the qualification welding test specified in Section 741.3. Upon completion of all liner testing and inspection, the Contractor shall submit certification by the independent inspection service that all installation and weld joints have been tested and inspected and are in compliance with the Specifications. However, this certification shall not relieve the Contractor of the responsibility to correct defective work.

741.9 PAYMENT:
Payment for plastic liner materials, their installation and testing shall be included in the price bid for the pipe or structure to which they are applied.

SECTION 750

LINING FOR DUCTILE IRON SEWER PIPE AND FITTINGS

Section 750.1: replace in entirety

All ductile iron pipe for conveying sewerage shall be in accordance with AWWA C-150:

- 14" inside diameter and smaller shall be pressure class 350
- 16" inside diameter through 24" inside diameter shall be pressure class 250
- 30" inside diameter and larger shall be pressure class 150

Ductile iron pipe with a minimum wall thickness of Class 50 may be substituted in lieu of the above.

The lining shall cover, at a minimum, the inner surfaces of the pipe and the fitting from the plain end or beveled spigot end to the rear of the gasket socket. If flanged fittings and pipe are included in the project, the lining must not be used on the face of the flange, however full face gaskets must be used to protect the ends of the pipe. At the ends of the pipe and fittings, the lining thickness shall taper for a distance of four inches to a minimum thickness of ten mils.

All ductile iron sewer pipe shall have a protective lining with a nominal thickness of 40 mils and a minimum thickness of 35 mils of Protecto 401 (ceramic epoxy), Polythane (polyurethane), throughout the barrel area of the pipe. However, the lining in the bell area shall transition to a minimum thickness of ten mils at the edge of the gasket socket. The ten-mil lining shall extend into the gasket socket area to a point where the gasket would overlap the lining when it is compressed due to pipe assembly during construction. The ten-mil lining shall also continue from inside the barrel area, around the spigot end of the pipe and along the outside of the pipe to a point where the center of the gasket of the next pipe section would contact the edge of the lining on the spigot end of the previous pipe section. The thickness of the linings shall be determined by using a dry film thickness magnetic gauge at four quadrants.

Each section of pipe and each fitting shall be tested and shall have an absence of holidays when tested by a suitable holiday detector. In all cases, the barrel area of the pipe shall be tested using a voltage of 2, 500 volts and a dry conductive probe.

Holiday testing shall conform to ASTM G 62-87 and NACE Standards RP0274-74 and RP0188-90 (latest revision).

The pipe manufacturer shall be solely responsible for the quality of the lining and shall supply a certification as to compliance to the specification. The certification shall state specifically the following items:

(A) All ductile sewer pipe and fittings have a protective lining of 40 mils (35 mils min) in the barrel area, ten mils in the bell area and ten mils minimum on the exterior of the spigot end.

(B) Each section of pipe and each fitting have been tested for holidays utilizing a test voltage of 2,500 volts with a dry conductive probe in the barrel area and a test voltage of 67.5 volts with a wet sponge in both the bell area and the exterior of the spigot end, and no holidays were found.

(C) The lining material used meets the current specifications and that the material was applied as required by the specification.

If the Contractor makes a field cut of the lined ductile pipe, the Contractor shall comply with the recommendations of the pipe manufacturer in applying a field coating to the end of the pipe ends. In all cases, as a minimum, a ten mil coating shall be applied to the pipe end and shall overlap the lining by four inches and extend around the pipe end and along the outside of the pipe a minimum of ten inches. The coating shall be allowed to dry before assembly. In addition, the overlapped surface of the lining shall be roughed up to produce a three to five mil profile over the entire surface. The end result of this process is to insure proper adhesion of the field coating.

750.1.1 Repair

Repair of the damaged sections of the lining shall be in accordance with the lining manufacturer's recommendation or as specified above so that the repair area is equal to the undamaged lined area in all respects. All damaged lined areas and holidays shall be repaired immediately after discovery.

Holiday testing may be required by the Engineer before pipe assembly when deemed appropriate. The testing and repair requirements shall follow the procedures called for in this specification and all cost for such repairs will be the responsibility of the Contractor.

There will be no other provision for repair of the lining of DIP.

750.1.2 Protective Collar

In order to protect the exterior spigot end against abrasion and damage during shipping and handling, the manufacturer shall install temporary collars on the exterior of each spigot end of each pipe section. The manufacture shall secure the collars to the pipe to prevent accidental removal during shipping and normal handling by the Contractor. The collars are not to be removed from the pipe until right before the pipe section is to be installed or field cut.

IRON WATER PIPE AND FITTINGS

Subsection 750.2 DUCTILE IRON WATER PIPE: is modified to add:

Ductile iron water pipe shall be of minimum pressure class as follows in accordance with AWWA C-150:

14" and smaller 350
16" through 24" 250
30" and larger.....150

All ductile iron water pipe shall be cement-mortar lined and seal coated in accordance with AWWA C-104.

For ductile iron pipe eighteen (18) inches and larger, a manufacturer's pipeline layout shall be submitted showing the line layout with each fitting specified and detailed. Numbering of each standard joint is not required.

Subsection 750.3 Joint Requirements: is modified to add:

The following are approved integral restrained joint ductile iron pipes:

Pacific States Pipes ..... Thrust-Lock
U.S. Pipe ..... TR Flex
American Ductile Iron Pipe ..... Flex Ring
American Ductile Iron Pipe ..... Lok-Ring
Clow Water Systems..... Super-Lock
Griffin Pipe ..... Snap-Lok
Griffin Pipe ..... Bolt-Lok

The following are approved restrained joint glands for mechanical joint pipe and fittings:

Star Pipe Products ..... Stargrip Series 3000
Romac Industries ..... Romagrip
Romac Industries ..... GripRing
EBAA Iron ..... Megalug Series 1100
Ford Meter Box ..... Uni-Flange Series 1400

Split restrained joint glands for mechanical joints, or wedge action restrained joint glands for push (non-mechanical) joints, are only allowed for connection or repair to existing installed pipe. The following are approved split restrained joint or wedge glands:

Star Pipe Products ..... Stargrip Series 3000S, 3100P, 3100S
EBAA Iron ..... Megalug Series 1100SD, 1100HD
EBAA Iron ..... Megalug Series 1700
Ford Meter Box ..... Uni-Flange Series 1450

Flanged joints are allowable for above ground piping installations only.

Where tangential outlets are shown on plans, tangential outlets shall be furnished.

Weld-on boss outlets are not acceptable.

750.3.1 WELDED-ON OUTLETS FOR DUCTILE IRON PIPE LARGER THAN 16 INCHES

750.3.1.1 SCOPE:

Welded-on outlets shall be limited to branch outlets having a nominal diameter not greater than 70% of the nominal diameter of the main line pipe or 30-inch whichever is smaller (see Table No. 1). Welded-on outlets may be provided as a radial (tee) outlet, tangential outlet, or lateral outlet fabricated at a specific angle to the main line pipe, as indicated on the drawings. Welded-on outlets shall be fabricated by the pipe manufacturer at the same facility where the pipe is produced. The pipe manufacturer shall have a minimum of 5 years experience in the fabrication and testing of outlets of similar size and configuration.

Table 750-1
Main Line Nominal Diameter Versus Maximum Nominal Branch Outlet Diameter

Main Line Nominal Diameter	Maximum Nominal Branch Outlet Diameter
18"	12"
20"	14"
24"	16"
30"	20"
36"	24"
42"	30"
48"	30"
54"	30"
60"	30"
64"	30"

750.3.1.2 OUTLET JOINT TYPES:

The joints on welded-on branch outlets shall meet, where applicable, the requirements of ANSI/AWWA C111/A21.11 and/or ANSI/AWWA C115/A21.15.

750.3.1.3 DESIGN:

Weldment for welded-on outlets shall be based on the method described in Section VIII of the ASME Unfired Pressure Vessel Code. Reinforcing welds shall be placed using Ni-Rod FC 55o cored wire or Ni-Rod 55o electrodes manufactured by INCO Alloys (or an electrode with equivalent performance properties). Carbon Steel electrodes are not acceptable.

Parent pipe and branch outlet pipe shall be centrifugally cast ductile iron pipe designed in accordance with ANSI/AWWA C150/A21.50 and manufactured in accordance with ANSI/AWWA C151/A21.51. Minimum classes shall be: for sizes 4-inch through 54-inch, Special Thickness Class 53; for sizes 60-inch through 64-inch, Pressure Class 350.

750.3.1.4 TESTING:

All welded-on outlets shall be rated for a working pressure of 250 psi and must have a minimum safety factor of 2.0 based on proof of design hydrostatic test results. The manufacturer shall, at the request of the owner or owner's Engineer, provide representative proof test data confirming hydrostatic test results and safety factors.

Prior to the application of any coating or lining in the outlet area all weldments for branch outlets to be supplied on this project shall be subjected to an air pressure test of at least 15 psi. Air leakage is not acceptable. Any leakage shall be detected by applying an appropriate soapy water solution to the entire exterior surface of the weldment and adjoining pipe edges or by immersing the entire area in a vessel of water and visually inspecting the weld surface for the presence of air bubbles. Any weldment that shows signs of visible leakage shall be repaired and retested in accordance with the manufacturer's written procedures.

750.3.1.5 QUALITY ASSURANCE:

The manufacturer shall have a fully documented welding quality assurance system and maintain resident quality assurance records based on ANSI/AWS D11.2, the Guide for Welding Iron Castings. The manufacturer shall maintain appropriate welding procedure specification (WPS), procedure qualification (PQR), and welder performance qualification test (WPQR) records as well as appropriate air test logs documenting air leakage tests. The manufacturer shall have ISO 9001 or 9002 registration.

Prior to the start of manufacturing any proposed manufacturer not meeting ISO 9001 or 9002 registration requirements shall submit to the owner or owner's Engineer the name of an Independent Inspection Agency and the agency's qualifications. Submitted qualifications shall include but are not limited to the following:

(A) List of project references for projects of similar type and size

(B) Resumes for inspection and testing personnel

(C) Capacities for chemical and mechanical testing of material specimens

(D) Frequencies for all instrument and testing equipment certifications

The independent inspection agency shall be responsible for all of the following:

(A) Verify compliance to written welding procedures specification (WPS) and procedure qualification (PQR)

(B) Verify qualification of all welders (WPQR) per ANSI/AWS D11.2 criteria

(C) Document use of Ni-Rod FC 55o cored wire or Ni-Rod 55o electrodes manufactured by INCO Alloys (or an electrode with equivalent performance properties)

(D) Witness and document all air testing of outlet welds

750.3.1.6 FIELD WELDING:

No field welding shall be allowed. Should a leak be detected at a welded-on outlet after installation, the piece shall be removed and returned to the pipe manufacturer's facility, where originally produced, for repair.

750.4 FITTINGS: Change the second paragraph to read:

Fittings for water pipe shall be cement mortar lined and seal coated in accordance with AWWA C-104.

SECTION 756

DRY BARREL FIRE HYDRANTS

Subsection 756.3 Hydrants: Add the following:

Approved fire hydrants allowed for installation in the City of Phoenix include:

Mueller Super Centurion 250
Clow Medallion (new model)
Kennedy K-81 Guardian
American Darling B-84-B
East Jordan Iron Works CD-250

All fire hydrants shall be supplied to meet a 42-inch bury depth.

SECTION 757

LANDSCAPE IRRIGATION SYSTEM

Comply with Section 757, SPRINKLER IRRIGATION SYSTEM, in the standard MAG Specifications with the following modifications:

Change Section title to LANDSCAPE IRRIGATION SYSTEM as shown above since the Section refers to all types of underground irrigation systems.

757.1 GENERAL: Add the following paragraph:

The Manufacturer of component equipment shown on the drawings or specified in the Special Provisions form the basis of the irrigation design as well as the physical and operational standards for which the components were selected. Component equipment from other manufacturers may be submitted, by the Contractor, to the Engineer for approval. No equipment however is to be ordered without approved shop drawings.

757.2 PIPE AND FITTINGS: add the following subsections:

757.2.2 Plastic Pipe: Change this subsection to read:

(A) Rigid Plastic Pipe shall be extruded from 100% virgin normal impact unplasticized polyvinyl chloride (PVC) Type I, Grade I or II resin 2000 psi (PVC 1120 or PVC 1220), design stress ASTM D1784, Department of Commerce PS-21-70, PS-22-70, Standard Dimension Ratio (SDR) 26 or less than 160 psi. Pipe shall conform to ASTM D-2241 and D-2672.

Testing of pipe: Provide written certificate by supplier that polyvinyl chloride pipe has successfully passed the following tests:

Acetone test: Immerse a sample of pipe in 99% pure anhydrous acetone for 15 minutes; at the end of this time there should be no evidence of flaking or delamination on the inner or outer walls of pipe. Evidence of softening or swelling shall not constitute failure.

Flattening: Cut a specimen two inches long from each end of the pipe sample. Flatten each test specimen from parallel plates of a press until the distance between the plates, in inches, is equal to sixty (60) percent of the pipe O.D., and there shall be no evidence of cracking, splitting or breaking.

The pipe shall be homogeneous throughout, free from visible cracks, holes, or foreign materials. The pipe shall be free from blisters, dents, wrinkles or ripples and die and head marks.

Piping up to and including 2-1/2" size shall be SDR solvent welded.

Pressure mainline piping 3" size and larger shall be gasket pocket type, as manufactured by the Swanson Co. or approved equal, and shall conform to ASTM F-477.

Continuously and permanently mark pipe with manufacturer's name or trademark, kind and size (IPS) of pipe, material, manufacturer's lot number, schedule or type and NSF seal of approval.

(B) Plastic Pipe Fittings and Couplings: For pipe fittings up to and including 2-1/2" size, fittings and couplings shall be either threaded type or slip fitting tapered socket solvent weld type. Schedule 80 pipe will only be used for threaded joints. Tapered socket solvent weld fittings may be either Schedule 80 or Schedule 40, but in either case, will be equal to or greater than the schedule and Pressure Rating of the plastic pipe being joined. Tapered fittings shall be sized so that a dry, unsoftened taper cannot be inserted more than halfway into the socket. Plastic saddles and flange fittings are not permitted.

PVC fittings shall be marked with manufacturers name or trademark, type PVC, size and NSF seal of approval. Extruded couplings to be produced from NSF rated raw materials and meet ASTM standards.

For pipe 3" and greater, fittings shall be ductile iron, grade 80-55-06, in accordance with ASTM A-536. Fittings shall have mechanical joints with gaskets meeting ASTM F-477. Fittings shall have radii of curvature conforming to AWWA C110.

757.2.5 PVC Primer: add Subsection: The primer shall be specifically formulated for the pipe and type of connection, as recommended by the pipe manufacturer.

757.3 VALVES AND VALVE BOXES: modify the subsections as follows:

757.3.4 Electrical Remote Control Valves: change this section to read:

The electric remote control valve listed on the plans or specifications and described by the manufacturer's most recent literature (catalogue cut sheet), constitute the quality and performance standards for the specified valve.

757.3.7 Valve Boxes: change this section to read:

All valve boxes shall have stainless steel bolts and washers with lock down covers. Valve boxes and covers shall be molded, non-corrosive plastic, ASTM D638, D-356, except when located in paved surfaces. These shall be concrete boxes with lock down steel or concrete cover rated for traffic conditions to which it will be exposed.

757.4 BACKFLOW PREVENTER ASSEMBLY: change this section to read:

The Backflow Preventer Assembly shall consist of Pressure type or Reduced Pressure type backflow preventer unit and associated components conforming to the governing code requirements and as shown on the plans or specifications. The backflow preventer unit shall be equal in quality and performance to the unit listed in the Contract Documents.

757.4.1 Backflow Preventer Cage: Pre-manufactured units shall be approved for use by the Engineer. The Contractor shall submit catalog information. Pipe used to support the units shall be not less than 1-¼" schedule 40 and shall be ASTM A-53 Grade A electric weld Pipe, expanded metal shall be ½" spacing, #13 gauge flattened diamond pattern steel. There shall be no exposed ends of expanded metal on the outside of the enclosure. The expanded metal shall be "die formed" for uniformity. Welds shall be a minimum of ¼" long weld on a 4" spacing. All units shall withstand a minimum of 200 lbs. per square foot for 24 hours without deflection or distortion. Cage locking mechanism shall be vandal resistant. Cage shall be powder coated by electrostatic application to 1.5 to 2 mil thickness. Color shall be approved by the Engineer.

757.5 SPRINKLER EQUIPMENT: delete the last two paragraphs and substitute the following:

Spray heads, impact sprinkler heads, rotor pop-up sprinkler heads, bubblers, emitters, etc., as shown on the plans or specifications and as described in the Manufacturer's latest literature (Catalogue cut sheets) constitute the performance and quality standards for this equipment.

757.6 ELECTRICAL MATERIAL: Modify the sections as follows:

757.6.3 Electro-Mechanical Controller Unit: delete this subsection.

757.6.4 Controller Unit and Assembly: add subsection:

Controller Unit and Assembly: The Controller unit and assembly listed on the plans or specifications and as described in the Manufacturer's latest literature (Catalogue cut sheets) constitute the quality, performance and operational standards for the specified Controller.

SECTION 758

CONCRETE PRESSURE PIPE - STEEL CYLINDER TYPE

758.1 GENERAL: is modified to add:

All pipe shall be designed for 150 psi working pressure plus 60 psi surge pressure. Test pressure shall be188 psi.

The pipe shall be designed to support the earth cover over the pipe as shown by the pipeline profiles on the plans. Where the earth cover over the pipe is less than eight (8) feet, the design shall be based on eight (8) feet minimum cover. When the plans show both existing and future surface profiles, the critical cover shall be used for design purposes.

Earth loads on pipe shall be calculated assuming the pipe is installed in a positive projecting embankment condition. The loading for positive projecting embankment condition shall be derived using a product of the projection ratio and the settlement ratio of 0.5. The Ku factor shall be 0.150. The soil unit weight shall be 140 pounds per cubic foot.

Pipe reinforced with ring stiffeners will not be permitted. Dimensions of fittings and specials shall conform to AWWA C-208.

Field joints for specials and fitting shall be as called for on the plans. Flanges shall be Class D steel ring flanges in accordance with AWWA C-207.

758.1 (A) change second paragraph to read:

Reinforced concrete pressure pipe may be furnished in pipe diameters of eighteen (18) inches through forty-two (42) inches.

758.1 (A) Change the third paragraph to read:

Pipe and fittings shall be designed by the methods described in AWWA Manual M9 to resist the internal pressures and external loading conditions designated on the approved plans or in the project specifications.

758.1 (A) is modified to add:

The pipe shall be designed for the maximum stress to be encountered in place as indicated on the plans, whether it is internal pressure, external backfill load, H-20 truck load on the backfill, or any combination of loading.

The pipe shall be designed to limit the deflection of the pipe, in inches, under the external loads specified to not more than the square of the diameter of the pipe in inches divided by 4,000. Deflection shall be calculated by "Spangler's" formula using a bedding constant (K) of 0.1 and a module of soil reaction (E') of 1,000.

The pipe shall be designed for external loading based on an H-20 truck loading and impact factors recommended by AASHTO for highway truck loads in "Standard Specifications for Highway Bridges."

Immediately after the cement-mortar coating has been placed, the ends of each section of pipe shall be tightly capped with waterproof covers to prevent the escape of moisture when water curing. When steam curing, waterproof covers may not be necessary until completion of cure, provided prompt application of steam is begun. The waterproof covers shall become a component part of the completed pipe section, to protect the interior of the pipes, and shall remain on the pipe until it is installed in the trench.

The minimum steel plate thickness for fittings and special pipe shall be 0.25 inches.

For fittings and special pipe, the minimum cement mortar or concrete lining thickness shall be 0.75 inches and the 0.75 inches shall be the maximum thickness allowed for resisting any external loads and shall be so used and shown in any design calculations. External or outside cement mortar coating shall be limited to a maximum of 1.25 inches for the purpose of resisting any external loads.

For standard pipe, the maximum allowable cement mortar coating shall be 1.25 inches, measured from the steel cylinder.

758.1 (B) Change the end of the first paragraph to read: "and AWWA C-304"

758.1 (B) Change the third paragraph to read: Pipe shall be designed by the methods described in AWWA C-304 to resist the internal pressures, and external loading conditions designated on the approved plans or in the project specifications.

758.1 (B) is modified to add:
Pipe may be either lined cylinder type or embedded cylinder type. Stress analysis of pipe shall be made using "Olander's" coefficients for a 120 degree bedding angle.

Except as otherwise provided in this Section, fabricated steel plate fittings and specials shall be designed for internal pressure only. The internal pressure design shall be based upon a design stress of 15,000 psi. The minimum steel plate thickness shall be 1/4 inch.

(1) Outlets, where specified on the plans, with an internal diameter of less than one-half the diameter of the mainline pipe shall be installed on prestressed concrete cylinder pipe. Outlets with an internal diameter greater than one-half the diameter of the mainline pipe or thirty-six (36) inches shall be designed and manufactured as a separate fabricated steel plate fitting.

(2) The exterior of fabricated steel plate fittings and specials shall not be mortar coated, but shall be shop painted as provided in this section.

(3) All fabricated steel plate fittings and specials shall be encased in reinforced concrete as shown on the details in the plans.

At mainline valves, where a steel plate section is required to comply with plans and/or attach a companion flange for connection to the valve, the following shall apply to such plate sections:

(a) Design shall limit deflection to the square of the diameter in inches divided by 4,000 for pipe diameters less than sixty (60) inches. For pipe diameter sixty (60) inches and greater, deflection is limited to one and one-half (1-1/2) percent of the diameter.

(b) Unless otherwise specified, plate sections shall not be longer than one (1) foot.

(c) Plate sections shall comply with all other applicable provisions, MAG Specifications, Phoenix supplement to MAG and AWWA Standards and AWWA Manual of Water Supply Practices-M9, second edition, with the following exception. For design, the minimum cement mortar or concrete lining thickness shall be 0.75 inches and the 0.75 inches shall be the maximum thickness allowed for resisting any external loads and shall be so used and shown in any design calculations. External or outside cement mortar coating shall not be considered for the purposes of resisting any external loads.

758.2 Manufacture: is modified to read:

An affidavit of compliance as specified in Section 1.11 of AWWA C-301 and Section 1.11 of C-303 shall be furnished to the Engineer.

Cement used in manufacture of pipe shall conform to ASTM C-150, Type II, low alkali.

No concrete admixture shall be used except as approved in writing by the Engineer.

Liquid membrane-forming compounds shall conform to ASTM C-309, Type I, and shall be of such composition that after drying they will not impart taste or odor to water flowing through the pipe, nor will they contain any toxic materials. The use of such compounds shall be subject to the approval of the Engineer.

Rust inhibitors used for preventing rust on steel surfaces at holdbacks of mortar lining and/or coating shall be quick-drying material with good bonding properties to the steel, and shall be tack-free and smooth within four (4) hours after applying.

All joints shall be the Carnegie Bell and Spigot type with rubber gaskets. The joint rings for spigot ends for rubber gasket joints shall be Carnegie Shape M-3516, M-3818 or M-3836.

Openings, connections and outlets shall be cement mortar lined and concrete coated as detailed on the plans.

758.3 Material Drawings: New Subsection:

The Contractor shall furnish the Engineer with six (6) copies of shop drawings, pipe layout diagrams, manufacturer's catalog data, and detailed information, in sufficient detail to show complete compliance with all specified requirements, covering but not limited to the following items:

Fabricated pipe and specials; design calculations; field closures; reinforcing steel and concrete mix designs.

The manufacturer's complete design calculations shall be submitted to the Engineer for review prior to or with the Joint Detail submittal.

The procedure outlined in American Water Works Association Manual M-9 will be used in determining the length of pipe requiring welded joints. Joint restraints design shall be based on test pressures. Shop drawing submittal shall include calculations showing the length of welded joints, tensile stress to be resisted by, and design of joint welds and pipe longitudinal reinforcement. Minimum design parameters shall be as follows: Soil unit weight is 110 pounds per cubic foot; soil friction coefficient 0.3; height of backfill over pipe - maximum four (4) feet or as shown on plans (if less than four (4) feet). Throat thickness of welds shall be based on an allowable stress of 8,800 pounds per inch per inch of throat thickness using an E60 low-hydrogen electrode. The allowable stress in the steel cylinder shall not exceed 15,000 psi.

Shop Drawings and Line Layout:

(A) The manufacturer's pipeline layout shall be furnished together with standard details for review. The line layout shall show each standard pipe joint and each special joint or fitting by number. Manufacturer's standard details shall be furnished in sufficient details to assure that the detail design of the pipe and specials will comply with the design concept and structural requirements of the project as presented in the Contract Documents. Full details of reinforcement, concrete, cement, mortar, joint dimensions, etc., for the straight pipe, specials and connections shall be furnished. Layout drawings shall show stations and the invert elevations of the pipeline.

(B) Manufacturer's shop drawings shall be furnished for fabrication, inspection and record purposes in accordance with the "General Conditions". The manufactured pipe and specials shall conform to the approved standard details and shall meet all specified requirements unless otherwise approved in writing.

(C) Valves and fittings to be incorporated in the pipeline shall be considered when preparing the pipeline layout.

758.4 Shop Inspection and Tests: New Subsection:

(A) Inspection:

(1) The City and its representatives shall have access to the work wherever it is in preparation or progress, and the Contractor shall provide proper facilities for access and for inspection during the manufacturing process.

(2) Inspection by the City or its representatives, or failure of the City or its representatives to provide inspection, shall not relieve the Contractor of his responsibility to furnish materials and to perform work in accordance with this specification.

(3) Material, fabricated parts, and pipe which are discovered to be defective or which do not conform to the requirements of this specification, will be subject to rejection at any time prior to final acceptance. Rejected material and pipe shall promptly be removed from the site of the work.

(B) Test and Materials:

(1) In advance of manufacture of the pipe, the Contractor shall furnish to the Engineer three (3) copies of the mill test certificate for all steel products incorporated in the pipe. Three (3) copies shall be furnished of mill test reports on each heat from which the steel is rolled.

(2) Methods of Tests for Cement, Mortars and Concrete:

(a) Mortar Lining: The mortar for all mortar lined pipe shall be sampled and molded by the following procedure:

The mortar sample shall be taken directly from the transfer bucket between the mixer and the charging trough which injects the mixed mortar into the spinning pipe. A sufficient amount shall be extracted to make four (4) 6" x 12" cylinders, and shall be placed in a wheelbarrow or other suitable container. The mortar sample material shall then be transported to the location at which the cylinder cans are to remain without moving for the next 24 hours. The mortar shall be thoroughly mixed immediately prior to pouring into the cylinders in order to prevent segregation. After the mortar has been thoroughly mixed, it shall be poured in a continuous stream into the cylinder cans. The cans shall immediately be capped and allowed to remain without disturbing for twenty-four (24) hours.

(b) Mortar Coating: Mortar for all mortar coated pipe shall be sampled by molding four (4) cylinders for compressive tests of the representative material being used to seat the pipe. The mortar sample shall be molded in 6" diameter cylinders in accordance with applicable provisions of ASTM D-558.

(c) Curing of Test Cylinders: The curing of concrete, lining and coating cylinders for the first twenty-four (24) hours shall be the same as that for the pipe, except that the mortar for coating cylinders shall be covered with a piece of damp burlap to retard the drying out or the low moisture content of the mortar coating. At the end of twenty-four (24) hours, the cylinders shall be transported to a moist curing cabinet and cured in accordance with ASTM C-192.

(3) Strength of Cement Mortar Lining, Coating, Concrete and Steel:

(a) Mortar Lining: The average compressive strength, as per Section C below, of cylinders for mortar lining for the several types of pipe shall be as follows:

(i) Semi-Rigid Pipe: Steel pipe and steel cylinder pipe, single wrap, pretensioned, the average compression strength of cylinders shall not be less than 1700 psi at seven days, and 2300 psi at 28 days.

(ii) Rigid Pipe: Steel cylinder pipe prestressed, the average compressive strength of cylinders shall not be less than 3000 psi at seven days, and 4500 psi at 28 days. Steel cylinder pipe, double wrapped shall not be less than 3000 psi at seven days, and 4500 psi at 28 days.

(b) Mortar Coating and Concrete for Prestressed Pipe:

(i) Semi-Rigid Pipe: Steel pipe and steel cylinder pipe, single wrap, pretensioned, the average compression strength of cylinders shall not be less than 3000 psi at seven days, and 4500 psi at 28 days.

(ii) Rigid Pipe: Steel cylinder pipe prestressed, and steel cylinder pipe, double wrap pretensioned, the average compressive strength of cylinders shall not be less than 3000 psi at seven days, and 4500 psi at 28 days.

(c) To conform to these requirements (a and b above), the average of any five (5) consecutive strength tests of the laboratory cured specimens shall be equal to or greater than the specified strength, and no more than 20% of the strength test shall have values less than the specified strength. If any one cylinder falls below 80% of the specified strength at seven days, an extra cylinder from the same batch shall then be broken, and if the strength of this cylinder also falls below 80% of the specified strength, then the entire production represented by these cylinders will not be accepted for use until the results of the twenty-eight day test is known, and if it also falls below 80% of the specified strength, the above non-acceptance will become final. The expense of the required tests of cylinders and mortar shall be the responsibility of the Contractor.

(d) Testing of Steel Pipe Cylinders (Hydrostatic Pressure Test): Each steel pipe cylinder, prior to embedment in cement mortar, or concrete, shall by hydrostatically tested under a water pressure which stressed the steel to a unit stress of at least 22,000 psi after the bell and spigot ends have been welded in place, utilizing companion bell and spigot test heads. While under this stress, the welded seams shall be hammered vigorously at one foot intervals with a one pound sledge hammer, and shall be thoroughly inspected.

All parts of the cylinder showing leakage shall be marked for rewelding. After rewelding, such cylinders shall be subjected to another hydrostatic test as stipulated above. The costs of hydrostatic pressure test shall be at the Contractor's expense.

(e) Testing of Fittings and Specials: The seams in angle pipe, short-radius bends and special fittings shall be welded in two or more passes, and each weld tested for tightness by the air-soap method or by the dye-penetrant method. However, if the fitting is fabricated from cylinders which have been previously tested hydrostatically, no further test is required for seams so tested. Hydrostatic testing of fittings to 150% of the design operating pressure may replace the tests described above. Any defect revealed under any of the alternate test methods shall be rewelded, and the weld tested again. The cost of these tests shall be at the Contractor's expense.

758.5 Marking, Handling and Delivery: New Subsection:

(A) Marking: Identification markings, for each type of water pipe as specified herein, shall be placed on the pipes. These markings shall show the proper location of the pipe or special in the line by reference to layer drawings. All bends shall be marked on the ends with the angle of deflection and the plane through the axis of the pipe. All beveled pipe shall be marked with the amount of the bevel, and the point of maximum bevel shall be marked at the end of the spigot.

(B) Handling and Delivery: All pipe shall be manufactured, handled, loaded, shipped, unloaded and stored at the job site in such a manner as to prevent any damage to the pipe. Any pipe section that becomes damaged shall be repaired as directed by the Engineer if, in his opinion, a satisfactory repair can be made. Otherwise, it shall be replaced with an undamaged section, at the Contractor's expense. Lifting from the inside of the pipe will not be permitted.

SECTION 760

COATING CORRUGATED METAL PIPE AND ARCHES

760.2 MATERIALS: all the following paragraphs:

The types of CMP that will be allowed in the City of Phoenix are “Aluminized, Type 2” & “Type F-Concrete lined as listed in AASHTO M-190.

Type F Pipe - Concrete Lined Pipe: The pipe shall be uniformly coated on the outside as required for Type A pipe. The entire inside shall be lined with Portland cement concrete. The lining shall be plant applied, in a manner approved by the Engineer, such that a homogeneous, non-segregated concrete lining with mechanical trowel finish is produced. The lining shall have a minimum thickness of 1/8 inch above the crest of the corrugation.

Portland cement used shall be in accordance with MAG Section 725 and, in no case, be less than 564 pounds per cubic yard of cement. Sand shall be as per Section 701 and the size and gradation shall be as specified for Portland cement concrete.

SECTION 787

GRAY IRON CASTING

Subsection 787.3 Manhole Frame and Cover Sets: add the following paragraphs:

ASTM A-48 Class 35, gray cast iron manhole frames and covers are approved for use on City projects. The weights of the 30-inch frame and cover castings shall be a minimum of 219 pounds for the frame and 207 pounds for the cover. The weights of the 24-inch frame and cover castings shall be a minimum of 170 pounds for the frame and 180 pounds for the cover. The Contractor shall provide manufacturer's certification that the product meets the required H-20 traffic loading.

MAG Standard Detail 424 (2411 and 3011 Manhole Frame and Cover) shall be modified to include a 3/4 inch diameter hole near the center of both the 24-inch and the 30-inch sanitary manhole covers.

The casting shall be tested in accordance with the method and procedure that is outlined in AASHTO M306 Section 7.0, proof load testing. The casting shall be tested on a suitable and calibrated load testing machine and the casting shall hold a 40,000-pound proof load for one minute without experiencing any cracks or detrimental permanent deformation. Any added costs for testing are assumed by the manufacturer.

A foundry certification shall be furnished to the Owner stating that the samples have been tested, inspected, and are in accordance with these specifications.

SECTION 795

LANDSCAPE MATERIAL

Section 795 Landscape Material: Delete this section in its entirety and substitute the following:

795.1 GENERAL: Material used for landscaping purposes shall be in conformance with this section.

795.2 TOPSOIL:

Topsoil shall be a fertile, friable soil, obtained from well-drained arable land, and shall be free from nut grass, refuse, roots, heavy clay, clods, weed seed or any other material toxic to plant growth. At least 10 days prior to delivery of topsoil to the site, the Contractor shall furnish the Engineer, at no additional cost, with a soil sample from each source for analysis and tests.

Soil tests will be accomplished by an approved independent soil testing laboratory capable of doing the appropriate horticultural soil test. The results of the test will determine the acceptability of the soil. The testing laboratory may suggest ways to amend the soil to make it suitable to grow plants. The Contractor may be directed by the Engineer to provide the amendments at no additional cost.

To be acceptable, the ph factor shall not exceed 8.0 or be lower than 5.5, soluble salts shall not exceed 1500 PPM, the plasticity index shall be in the range of 3 and 10 inclusive, and it shall contain between 1 and 2%, by dry weight, organic matter either natural or added.

Gradation shall be as follows:

TABLE 795-1

SIEVE SIZE	PERCENT PASSING
1/2"	100
No. 4	90-100
No. 10	70-100
No. 200	15-70

795.3 SOIL AMENDMENTS AND CONDITIONERS:

795.3.1 Chemical Conditioners: Fertilizing material shall comply with the applicable requirements of the State Agricultural Code. Fertilizing material shall be packaged, first grade, commercial quality products identified as to source, type of material, weight and manufacturer's analysis. It shall not contain toxic ingredients or fillers in quantities harmful to human life, animals, or plants. Material which has become caked or otherwise damaged shall not be used.

Fertilizing material for plants shall be similar to the product "Super Start" or approved equal, with the following additive ingredients (% by weight): 3% Nitrogen, 10% Sulfur, 4% Iron, 1% Zinc, 0.08% Manganese, and 0.13% Viterra. All fertilizing material shall be in 40 pound packages with additive ingredient derived from:

1. Nitrogen from Urea Formaldehyde and M.A.P.
2. Sulfur from Potassium Sulfate
3. Iron from Sequestrene 138 Iron
4. Zinc from Sequestrene Zinc
5. Manganese from Sequestrene Manganese
6. Viterra from a synthetic, superabsorbent co-polymer.

Slow Release Fertilizer Plant Tablets: Shall be Agriform 21 gram tablets or equal with 20-10-5 analysis.

Fertilizing Material for lawn areas or used in revegetation shall be a commercially approved brand or a mixture of standard commercial forms to meet the requirements recommended by horticultural test results.

Slow Release Nitrogen: Shall be Methylene urea (38-0-0) or equivalent. It is use to extend nitrogen availability over time on sites where long term nitrogen availability is a limiting factor.

795.3.2 Organic Soil Amendments:

General Soil Conditioner: Compost shall be naturally organic, free of weeds and weed seeds, and contain no plant growth inhibiting factors. This material shall be tested and meet the following minimum requirements.

Germination Rate (full strength extract).....85% minimum
Maturity Index (full strength extract).....50% minimum
Conductivity EC mmhos/cm.....less than 8
Exchangeable Sodium Percentage .....less than 15
Carbon/Nitrogen Ratio .....less than 20:1
Total Nitrogen (not added).....0.5% minimum
pH range of extract .....5.5 – 8.0

When cow manure is used as a soil conditioner in turf areas, it shall be the product of yard fed cattle, free of weed seeds, straw or any other inert material and aged at least 3 months. This manure shall have been processed by grinding and screening and shall be treated with a non-toxic agent so as to be hydrophilic.

Plant Conditioner: Shall consist of a ground or processed wood product derived from redwood, ground or shredded fir, redwood or ponderosa bark. It shall have a nitrogen content of 1%, a ph not exceeding 7.5% and organic matter not less than 85%. Mulch gradation shall be treated with a non-toxic agent so as to be hydrophilic. Cow Manure shall not be used as organic mulch in plant backfill mixes.

Bone Meal: Commercial grade product uniform in composition.

Sand: Shall be brown washed natural mortar sand passing at least a #7 screen, free of weeds, organic material, stones, deleterious materials, non-toxic to plant and human life and usable for backfill mixtures.

Hydromulch shall be packaged in units containing current labels, with the manufacturer's name, the net weight, and certification that the material meets the forgoing requirements. The mulch shall be dyed green to aid in the visual metering application. The dye shall be biodegradable and not inhibit plant growth.

(A) 100% Wood Cellulose Fiber Hydromulch: Shall be shall be used as mulch when hydroseeding turf grass.

Moisture content.....10.0% + 3.0%
Organic Matter (Wood Cellulose Fiber).....99.3% + 0.2%
Ash content .....0.7% + 0.5%
pH.....4.9 + 0.5%
Water Holding Capacity .....10 : 1

(B) Cellulose Fiber Hydromulch: Shall be used as mulch when hydroseeding native seed. Cellulose fiber mulch shall consist of at least 70% specially prepared virgin wood cellulose fiber which has been thermo-mechanically processed for specific use as hydromulch. It shall contain no growth inhibiting factors. It shall have the following properties:

Wood Cellulose Fiber .....70% (minimum)
Recycled Cellulose Fiber .....30% (maximum)
Ash Content .....0.8% + 0.3% (maximum)
pH.....4.5 + 1.0
Water Holding Capacity ratio; water: fiber 10:1

Upon application, the mulch material shall form a blotter-like mat covering the ground. This mat shall have the characteristics of moisture absorption and percolation and shall cover and hold seed in contact with the soil.

Tackifier: Used in hydroseeding shall consist of a free-flowing, noncorrosive powder produced from the natural plant gum of Plantago insularis (Desert Indianwheat), applied in a slurry with water and wood fiber. The powder shall possess the following properties:

Protein content.....1.6 + 0.2 %
Ash content .....2.7 + 0.2%
Fiber .....4.0 + 0.4%
pH 1% solution.....6.5 –8.0 %

The material used for mulch tackifier shall not contain any mineral filler, recycled cellulose fiber, clays, or other substance which may inhibit germination or growth of plants.

Activated Charcoal: Agricultural grade powdered activated charcoal is used in the hydromulching slurry to boost seed germination during cold weather as a soil colorant.

Granular humus based soil conditioner used in hydromulching operations shall be tested and meet the following:

Total humus .....50% minimum
Total humic acid.....15% minimum

Liquid humic acid soil based conditioner used in hydromulching operations shall be tested and meet the following:

Total humic acid.....6% minimum

795.4 SEEDS:

795.4.1 Native Seeds: Shall be certified to scientific name, lot number or other identification, origin of the seed, purity of the seeds as a percentage of pure live seed by weight, germination percentage and percentage of firm ungerminated seeds, name and address of person who labeled or offers seed for sale.

Pure Live Seed (PLS) percentage = (% germination + % ungerminated firm seed) x (% purity). The seed rate specified is pounds of Pure Live Seed.

795.4.2 Turf seed shall be fresh clean seeds, pre-mixed to the specified proportion. They shall be delivered to the site in original, unopened containers bearing the dealer's name guaranteed analysis and germination percentage. They shall have a certification or a stamp or a release accomplished by an agricultural commission.

795.5 PLANTS:

Plants shall be nursery grown or plantation grown stock conforming to ANSI 260-1 and shall be of the varieties specified in the plant list bearing botanical name listed. Plants shall meet the standards established by the Arizona Nursery Association Grower's Committee recommended specifications.

Planting stock shall be well broached and well formed, sound, vigorous, healthy and free from disease, sun-scald, windburn, abrasion and harmful insects or insect eggs and shall have healthy, normal and unbroken root system which is neither root or pot-bound and are free of kinked or girdling roots. Plants shall have been grown under climate conditions similar to those at the project site.

795.6 SOD:

The sod shall be Midiron Bermuda if not specified on the plans and meet State standards to insure high quality and freedom from noxious weeds.

Sod shall be machine cut at a uniform soil thickness of 1/2 inch (plus or minus 1/4 inch), at time of cutting. Measurement excludes top growth and thatch.

Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 30% of the section.

Sod shall be free from disease, nematodes, and soil born insects.

795.7 MISCELLANEOUS MATERIAL:

795.7.1 Lumber: Lumber in contact with the earth shall be redwood heartwood, sized according to the drawing. When unit bid items that include headers or lumber are included in the proposal sheets, the unit prices quoted shall be per linear foot.

795.7.2 Clean fill: Clean fill shall be soil free of weeds, boulders, clods, heavy clay, aggregate base, asphalt or concrete or other deleterious material.

795.7.3 River Run Rock: Rock shall be clean, hard, durable, uniform in quality, free from seams and coatings, rounded and water-worn. The gradation shall be as specified and approved by the Engineer.

PHOENIX SUPPLEMENTAL STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION

City of Phoenix

2009

2009 CITY OF PHOENIX SUPPLEMENT TO THE MAG UNIFORM STANDARD, SPECIFICATIONS AND DETAILS

The ***2009 edition*** of the City of Phoenix Supplements to the Maricopa Association of Governments (MAG) Uniform Standard Specifications and Details will become effective ***January 1, 2009***. The 2009 edition will supersede ***all previous*** editions.

All construction contracts advertised and all permits issued on or after ***January 1, 2009*** will be governed by these ***2009*** Supplements.

For more information, or a copy of this publication in an alternate format, contact Street Transportation Department at 602-262-6284 (Voice) and 602-256-4286 (TTY).