



STANDARD CONSTRUCTION SPECIFICATIONS

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Department of Public Works
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STANDARD SPECIFICATIONS INDEX

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. A-1

GRADING UNDER BASE COURSE

Scope.

The Contractor shall furnish all labor, materials, tools, and equipment necessary to complete all operations in connection with the excavation, compacting, and grading for all areas under base course, and the subsidiary items of work herein specified.

General.

"Grading Under Base Course" shall consist of performing all excavation, regardless of the nature of the materials encountered. It shall include all borrowing, filling, grading, hauling, wetting, rolling, and other operations necessary to construct the roadway subgrade and specified subsidiary items to the lines, grades, and cross-sections shown on the drawings and in these specifications.

Equipment.

All plans, equipment, tools and machines used in the performance of the work shall be subject to the approval of the Engineer, and shall be maintained in satisfactory working condition at all times.

(a) Power Rollers. The rollers shall be self-propelled, three-wheel or tandem types, weighing not less than 8 tons. The three-wheel rollers shall have a minimum weight of 300 pounds per inch width of rear wheel.

(b) Tamping Rollers (Sheepsfoot Type) shall consist of one or more units. Each unit shall consist of a watertight cylindrical drum not less than 48 inches in length, surmounted by metal studs with tamping feet projecting not less than 7 inches from the surface of the drum, and spaced not less than 6 nor more than 10 inches, measured diagonally from center to center. The tamping feet shall be an approved type suitable for compacting subgrade material. Each unit shall be equipped with a suitable device for cleaning the tamping feet. The rolling units of multiple type tamping rollers shall be pivoted on the main frame in a manner which will permit the units to adapt themselves to uneven ground surfaces and to rotate independently. When fully loaded, the roller shall produce at least 300 pounds per square inch on the combined areas of the tamping feet in contact with the ground.

(c) Blade Graders shall have a wheel base of not less than 15 feet, a blade of not less than 10 feet, and shall be self-propelled.

(d) Rubber-Tired Rollers shall consist of two axles on which are mounted not less than 9 pneumatic-tired wheels in such a manner that the rear group of tires will not follow the tracks of the forward group. The axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. The tires shall be uniformly inflated. The rollers shall be weighted as directed by the Engineer. The tractor or other towing equipment shall also be pneumatic-tired.

(e) Excavating Equipment shall be of a type and size suitable to perform the necessary excavation.

(f) Sprinkling Equipment shall consist of tank trucks, pressure distributors, or other equipment designed to apply water uniformly and at controlled quantities to variable widths of surface.

(g) Disks shall be of the tandem type.

(h) Plows shall be of the multiple-furrow type, and shall be so designed that the depth of furrow can be accurately controlled.

(i) Hauling Equipment shall consist of pneumatic-tired vehicles having dump bodies suitable for dumping materials in windrows or in layers on the subgrade.

(j) Tampers. Hand tampers shall weigh not less than 50 pounds and shall have a face area of not more than 100 square inches. Mechanical tampers shall be of an approved type.

(k) Miscellaneous Equipment. Scarifiers, tractors, springtooth or spiketooth harrows, and other equipment shall be of approved types, suitable for constructing the subgrade.

Method of Construction.

(a) Cut Areas. Cut in previously untraveled roadways shall be loosened by plowing, scarifying, or other means, to a depth of at least 6 inches below the final subgrade elevation, and all large stones, large lumps of earth, roots and vegetation, and trash and rubbish, removed and disposed of as directed by the Engineer. The loosened material shall be brought to as finely a divided condition as the material will permit. The loosened material shall be wetted or aerated as necessary, mixed to a uniform consistency, and the upper 6 inches of subgrade shaped and compacted to at least 90% of maximum density at optimum moisture content. Cut in traveled roadways need not be scarified, but shall be shaped and compacted to at least 90% of maximum density at optimum moisture content.

(b) Fill Areas. Areas to receive fill on previously untraveled roadways shall be prepared by scarifying the area to a depth of at least 6 inches below the existing grade, removing and disposing of all vegetation and unsuitable material as directed by the Engineer, and compacting to at least 90% of maximum density at optimum moisture content. Areas to receive fill on previously traveled roadways need not be scarified but shall be shaped and compacted to at least 90% of maximum density at optimum moisture content.

(c) Unforeseen Areas of Soft or Unsuitable Material. Areas in which soft or unsuitable material are encountered shall be excavated to a depth directed by the Engineer and filled with suitable material compacted to at least 90% of density at optimum moisture content.

(d) Water Courses. Where the work herein contemplated intercepts or affects any stream, ditch, drain or culvert, the Contractor, where required shall arrange to keep the same open and in suitable condition for its purpose.

(e) Protection. Newly graded areas shall be protected from the action of the elements, and any settlement or washing that may occur from that or any other cause shall be repaired, and grades reestablished to the required elevations and slopes.

Compaction Control.

The Engineer will make all field tests to determine whether the specified compactions are being obtained. The determination of maximum density and optimum moisture of native soils will be based on AASHTO Method T99-38 for "Compaction and Density of Soils". Any areas of inadequate compaction shall be corrected by the Contractor immediately.

Load Testing.

After subgrade has been brought to grade and compacted, the entire surface shall be tested with load testing equipment (15 cubic yard carryall, pneumatic-tired, fully loaded) to determine that there are no soft, weak spots or other deficiencies that might result in pavement failures.

Any soft, weak or spongy areas shall be corrected by the Contractor by replacing material and compacting until the entire subgrade successfully supports the above stated load.

An eight ton or heavier tandem roller shall be used after load testing to take out any irregularities left by the load testing equipment.

Work Tolerance. The subgrade surface shall not vary more than 0.05 foot from the established elevation and approved cross section as shown on the plans. Any deviation in excess of this amount shall be corrected by the Contractor by loosening, or adding or removing material, reshaping, wetting, and compacting as directed by the Engineer.

Subsidiary Items of Construction.

(a) "Grading Area Back of Improvement" and "Parkway Grading". These items, if either or both are applicable to this contract, shall proceed simultaneously with the "Grading Under Base Course" and shall be in such a stage of completion when the "Grading Under Base Course" is completed that there will be no chance of earth being mixed with the base course from further work on "Grading Area Back of Improvement" and/or "Parkway Grading". If, in the opinion of the Engineer, the "Grading Area Back of Improvement" and/or "Parkway Grading" is not in an advanced enough stage to insure the above stated condition, the laying of base course shall not begin until "Grading Area Back of Improvement" and/or "Parkway Grading" are in a condition which will insure that with further work done on these items no earth or other undesirable materials will be mixed into the base course. In the event the Engineer delays the laying of base course for this reason, no additional time shall be granted to the Contractor for the completion of this contract. Refer to "GRADING AREA BACK OF IMPROVEMENT" and/or "PARKWAY GRADING" in these specifications for requirements of each item, as applicable.

If the Contractor engages in other work outside of this contract but located within the boundaries of the subject area, all of the requirements applicable to the timely completion of "Grading Area Back of Improvement" and/or "Parkway Grading" shall be applicable to this work also.

(b) Clearing and Grubbing. This work shall include all clearing of all brush, trees under 6" diameter, stumps, roots, rubbish, debris, and other objectionable matter from the area to be improved prior to construction. Also, included shall be the removal of all corrugated metal pipe, concrete pipe, irrigation and drainage structures, fences which can be removed and disposed of, existing asphaltic pavement, and any other obstruction to the consideration which is not specifically mentioned under a separate pay item for removal. No objectionable materials from clearing or grubbing operations will be allowed in fills. All objectionable material shall be properly disposed of outside the boundary of the district or burned in a location and in a manner approved by the Engineer.

Care shall be taken by the Contractor not to injure any shrubbery, vines, plants, grasses, or other vegetation growing outside the actual limits of the improvement.

(c) Adjusting Valve Boxes in Earth Areas. In earth areas the top of the valve box shall be adjusted to one (1) inch above the finished grade.

(d) Traffic Signs. It shall be the responsibility of the Contractor to preserve, maintain and relocate when necessary all of the existing traffic signs during the progress of the work.

(e) Mail Boxes. All mail boxes mounted within the right-of-way limits shall be relocated adjacent to the curb, unless otherwise directed by the Engineer.

Measurement and Payment.

(a) Grading. This item will be measured by the square yard for all areas under base course. All items of work listed in "Subsidiary Items for Construction" shall not be measured for payment.

(b) Removal and Replacement of Unsuitable Material. This item will be measured by the cubic yard and shall include the complete removal of the undesirable subgrade from the job site and the replacement, compaction, and grading of select fill material. Only that unsuitable material authorization by the field engineer for removal and replacement is eligible for payment.

(c) Payment for this item will be included in the contract price for "Grading Under Base Course" which shall be full compensation for all labor, tools, equipment, excavation, hauling and other expenses incurred in the satisfactory completion of the work specified.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. A-1a

GRADING

Scope.

The Contractor shall furnish all labor, materials, tools, and equipment necessary to complete all operations in connection with the excavation, compacting, and grading for all areas, and the subsidiary items of work herein specified.

General.

"Grading" shall consist of performing all excavation, regardless of the nature of the materials encountered. It shall include all borrowing, filling, grading, hauling, wetting, rolling, and other operations necessary to construct the roadway subgrade and specified subsidiary items to the lines, grades, and cross-sections shown on the drawings and in these specifications.

Equipment.

All plans, equipment, tools and machines used in the performance of the work shall be subject to the approval of the Engineer, and shall be maintained in satisfactory working condition at all times.

(a) Power Rollers. The rollers shall be self-propelled, three-wheel or tandem types, weighing not less than 8 tons. The three-wheel rollers shall have a minimum weight of 300 pounds per inch width of rear wheel.

(b) Tamping Rollers (Sheepsfoot Type) shall consist of one or more units. Each unit shall consist of a watertight cylindrical drum not less than 48 inches in length, surmounted by metal studs with tamping feet projecting not less than 7 inches from the surface of the drum, and spaced not less than 6 nor more than 10 inches, measured diagonally from center to center. The tamping feet shall be an approved type suitable for compacting subgrade material. Each unit shall be equipped with a suitable device for cleaning the tamping feet. The rolling units of multiple type tamping rollers shall be pivoted on the main frame in a manner which will permit the units to adapt themselves to uneven ground surfaces and to rotate independently. When fully loaded, the roller shall produce at least 300 pounds per square inch on the combined areas of the tamping feet in contact with the ground.

(c) Blade Graders shall have a wheel base of not less than 15 feet, a blade of not less than 10 feet, and shall be self-propelled.

(d) Rubber-Tired Roller shall consist of two axles on which are mounted not less than 9 pneumatic-tired wheels in such a manner that the rear group of tires will not follow in the tracks of the forward group. The axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. The tires shall be uniformly inflated. The rollers shall be weighted as directed by the Engineer. The tractor or other towing equipment shall also be pneumatic-tired.

(e) Excavating Equipment shall be of a type and size suitable to perform the necessary excavation.

(f) Sprinkling Equipment shall consist of tank trucks, pressure distributors, or other equipment designed to apply water uniformly and at controlled quantities to variable widths of surface.

(g) Disks shall be of the tandem type.

(h) Plows shall be of the multiple-furrow type, and shall be so designed that the depth of the furrow can be accurately controlled.

(i) Hauling Equipment shall consist of pneumatic-tired vehicles having dump bodies suitable for dumping materials in windrows or in layers on the subgrade.

(j) Tampers. Hand tampers shall weigh not less than 50 pounds and shall have a face area of not more than 100 square inches. Mechanical tampers shall be of an approved type.

(k) Miscellaneous Equipment. Scarifiers, tractors, springtooth or spiketooth harrows, and other equipment shall be of approved types, suitable for constructing the subgrade.

Method of Construction.

(a) Cut Areas. Cut in previously untraveled roadways shall be loosened by plowing, scarifying, or other means, to a depth of at least 6 inches below the final subgrade elevation, and all large stones, large lumps of earth, roots and vegetation, and trash and rubbish, removed and disposed of as directed by the Engineer. The loosened material shall be brought to as finely a divided condition as the material will permit. The loosened material shall be wetted or aerated as necessary, mixed to a uniform consistency, and the upper 6 inches of subgrade shaped and compacted to at least 90% of maximum density at optimum moisture content. Cut in traveled roadways need not be scarified, but shall be shaped and compacted to at least 90% of maximum density at optimum moisture content.

(b) Fill Areas. Areas to receive fill on previously untraveled roadways shall be prepared by scarifying the area to a depth of at least 6 inches below the existing grade, removing and disposing of all vegetation and unsuitable material as directed by the Engineer, and compacting to at least 90% of maximum density at optimum moisture content. Fill shall be constructed in layers, each layer not exceeding 6 inches in compacted depth. Suitable material of the proper moisture content shall be spread in layers of the proper thickness and each layer shaped and compacted through its full depth to at least 90% of maximum density at optimum moisture content. Areas to receive fill on previously traveled roadways need not be scarified but shall be shaped and compacted to at least 90% of maximum density at optimum moisture content.

(c) Unforeseen Areas of Soft or Unsuitable Material. Areas in which soft or unsuitable materials are encountered shall be excavated to a depth directed by the Engineer and filled with suitable material compacted to at least 90% of density at optimum moisture content.

(d) Water Courses. Where the work herein contemplated intercepts or affects any stream, ditch, drain or culvert, the Contractor, where required, shall arrange to keep the same open and in suitable condition for its purpose.

(e) Protection. Newly graded areas shall be protected from the action of the elements, and any settlement or washing that may occur from that or any elevations and slopes.

Compaction Control.

The Engineer will make all field tests to determine whether the specified compactions are being obtained. The determination of maximum density and optimum moisture of native soils will be based on AASHTO Method T99-38 for "Compaction and Density of Soils". Any areas of inadequate compaction shall be corrected by the Contractor immediately.

Load Testing.

After subgrade has been brought to grade and compacted, the entire surface shall be tested with load testing equipment (15 cubic yard carryall, pneumatic-tired, fully loaded) to determine that there are not soft, weak spots or other deficiencies that might result in pavement failures.

Any soft, weak or spongy areas shall be corrected by the Contractor by replacing materials and compacting until the entire subgrade successfully supports the above stated load.

An eight ton or heavier tandem roller shall be used after load testing to take out any irregularities left by the load testing equipment.

Work Tolerance.

The subgrade surface shall not vary more than 0.05 foot from the established elevation and approved cross-section as shown on the plans. Any deviation in excess of this amount shall be corrected by the Contractor by loosening, or adding or removing materials, reshaping, wetting, and compacting as directed by the Engineer.

Subsidiary Items of Construction.

(a) "Grading Area Back of Improvement" and "Parkway Grading". These items, if either or both are applicable to this contract, shall proceed simultaneously with the "Grading Operation" and shall be in such a stage of completion when the "Grading Operation" is completed that there will be no chance of earth being mixed with the base course from further work on "Grading Area Back of Improvement" and/or "Parkway Grading". If, in the opinion of the Engineer, the "Grading Area Back of Improvement" and/or "Parkway Grading" is not in an advanced enough stage to insure the above stated condition, the laying of base course shall not begin until "Grading Area Back of Improvement" and/or "Parkway Grading" are in a condition which will insure that with further work done on these items no earth or other undesirable materials will be mixed into the base course. In the event the Engineer delays the laying of base course for this reason, no additional time shall be granted to the Contractor for the completion of this contract. Refer to "GRADING AREA BACK OF IMPROVEMENT" and/or "PARKWAY GRADING" in these specifications for requirements of each item, as applicable.

If the Contractor engages in other work outside of this contract but located within the boundaries of the subject areas, all of the requirements applicable to the timely completion of "Grading Area Back of Improvement" and/or "Parkway Grading" shall be applicable to this work also.

(b) Clearing and Grubbing. This work shall include all clearing of all brush, trees under 6" diameter, stumps, roots, rubbish, debris, and other objectionable matter from the area to be improved prior to construction. Also, included shall be the removal of all corrugated metal pipe, concrete pipe, irrigation and drainage structures, fences which can be removed and disposed of, existing asphaltic pavement, and any other obstruction to the consideration which is not specifically mentioned under a separate pay item for removal. No objectionable materials from clearing or grubbing operations will be allowed in fills. All objectionable material shall be properly disposed of outside the boundary of the district or burned in a location and in manner approved by the Engineer.

Care shall be taken by the Contractor not to injure any shrubbery, vines, plants, grasses, or other vegetation growing outside the actual limits of the improvement.

(c) Adjusting Valve Boxes in Earth Areas. In earth areas the top of the valve box shall be adjusted to one (1) inch above the finished grade.

(d) Traffic Signs. It shall be the responsibility of the Contractor to preserve, maintain and relocate when necessary all of the existing traffic signs during the progress of the work.

(e) Mail Boxes. All mail boxes mounted within the right-of-way limits shall be relocated adjacent to the curb, unless otherwise directed by the Engineer.

Measurement and Payment.

(a) Grading. This item will be measured by the square yard for all areas. All items of work listed in "Subsidiary Items of Construction" shall not be measured for payment.

(b) Removal and Replacement of Unsuitable Material. This item will be measured by the cubic yard and shall include the complete removal of the undesirable subgrade from the job site and the replacement, compaction, and grading of select fill material. Only that unsuitable material authorization by the field engineer for removal and replacement is eligible for payment.

(c) Payment for this item will be included in the contract price for "Grading" which shall be full compensation for all labor, tools, equipment, excavation, hauling and other expenses incurred in the satisfactory completion of the work specified.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. A-2

GRADING AREA BACK OF IMPROVEMENT

Scope.

The Contractor shall furnish all labor, materials and equipment necessary to complete all operations in connection with grading the area back of the improvement. See detail drawing "Area Designations for Grading" of these specifications.

Definition of the Word "Improvement".

The word "Improvement" in this section of these specifications shall be understood to mean either walk or curb whichever is the closest to the property line.

Definition of the Word "Area".

The word "Area" in this section of these specifications shall be understood to mean that area beginning at the back edge of the improvement and extending toward the property line as far as is necessary to comply with the specific instructions located in the "Description of Work" in this section of these specifications.

General.

Grading Area Back of Improvement shall include all excavating, filling, borrowing, trimming, shaping, sloping, removing undesirable material of whatever nature encountered, and all other work necessary to bring the specified area back of the improvement to the required grade and cross-section.

Description of Work.

- (a) General. The Contractor shall finish grade the area back of any improvement, whether existing or new, where through the execution of this contract he has disturbed the natural ground.
- (b) Replacement. In the case where a section of the existing improvement has been replaced with new improvement, the Contractor shall grade the area back of the new improvement so as to make it conform to the type of grading existing on either side of the replacement.
- (c) New Improvement. (See Standard Details "Grading Area Back of Improvement"). In the case where a new improvement is constructed in a location where no improvement previously existed, the Contractor shall grade the area back of the new improvement as follows:

- (1) For sections of improvement adjoining irrigated land the Contractor shall construct a border along the back of the improvement adequate in size to prevent water escaping across said improvement.
- (2) For sections of improvement crossing driveway entrances the Contractor shall grade the area back of the improvement in such a manner as to insure the safe and comfortable passage of vehicles across said area. It shall be the Contractor's responsibility to construct driveway entrances in such a way as to insure that no water will escape from the gutter into the yard through the driveway entrance.

(A) Where existing paved, graveled or otherwise surfaced driveways are crossed by the improvement or are in anyway disturbed through the construction of the improvement, the area between the undisturbed portion of the driveway and the back of the improvement shall be paved or resurfaced with the same type of material as exists on the rest of the driveway and shall be equal to or better in quality.

- (3) For sections of improvement adjoining neither driveways or irrigated land, the Contractor shall construct a slope from the top of the back of the improvement to the natural ground not to be steeper than a 3 to 1 slope.

(d) Exemption. In the case where an existing improvement has not been disturbed and the ground back of the existing improvement has not been disturbed by the Contractor then the Contractor shall have no obligation under this contract to regrade such areas.

Measurement and Payment.

(a) Measurement. This item will not be measured for payment.

(b) Payment for this item will be included in the contract price for "Grading Under Base Course" which shall be full compensation for all labor, tools, equipment, excavation, hauling and other expenses incurred in the satisfactory completion of the work specified under "GRADING AREA BACK OF IMPROVEMENT".

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. A-2a

GRADING AREA BACK OF IMPROVEMENT

Scope.

The Contractor shall furnish all labor, materials and equipment necessary to complete all operations in connection with grading the area back of the improvement. See detail drawing areas.

Definition of the Word "Improvement".

The word "Improvement" in this section of these specifications shall be understood to mean concrete block retaining wall or chain link fence.

Definition of the Word "Area".

The word "Area" in this section of these specifications shall be understood to mean that area beginning at the edge of the existing pavement and extending toward the "Improvement" as far as is necessary to comply with the specific instructions located on the detailed drawings.

General.

Grading Area Back of Improvement shall include all excavating, filling, borrowing, trimming, shaping, sloping, removing undesirable material of whatever nature encountered, and all other work necessary to bring the specified area back of the improvement to the required grade and cross-section.

Description of Work.

(a) General. The Contractor shall finish grade the area back of any improvement, whether existing or new, where through the execution of this contract he has disturbed the natural ground.

(b) Replacement. In the case where a section of the existing improvement has been replaced with new improvement, the Contractor shall grade the area back of the new improvement so as to make it conform to the type of grading existing on either side of the replacement.

(c) New Improvement. In the case where a new improvement is constructed in a location where no improvement previously existed, the Contractor shall grade the area back of the new improvement as follows:

- (1) For sections of improvement adjoining irrigated land the Contractor shall construct a border along the back of the improvement adequate in size to prevent water escaping across said improvement.
 - (2) For sections of improvement crossing driveway entrances the Contractor shall grade the area back of the improvement in such a manner as to insure the safe and comfortable passage of vehicles across said area. It shall be the Contractor's responsibility to construct driveway entrances in such a way so as to insure that no water will escape from the gutter into the yard through the driveway entrance.
 - (A) Where existing paved, graveled or otherwise surfaced driveways are crossed by the improvement or are in any way disturbed through the construction of the improvement, the area between the undisturbed portion of the driveway and the back of the improvement shall be paved or resurfaced with the same type of material as exists on the rest of the driveway and shall be equal to or better in quality.
- (d) Exemption. In the case where an existing improvement has not been disturbed and the ground back of the existing improvement has not been disturbed by the Contractor , then the Contractor shall have no obligation under this Contract to regrade such areas.

Measurement and Payment.

- (a) Measurement. This item will be measured by the cubic yard complete in place.
- (b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract unit price per cubic yard for "Imported Sand Fill", which price shall constitute full compensation for all labor, materials, equipment, compaction, and incidentals necessary to complete the work as shown on the plans and specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. A-3

GRADER DITCHES

Scope.

The Contractor shall furnish all material, labor and equipment necessary to construct grader ditches and any specified graded areas pertinent to the grader ditches in accordance with the plans and specifications of this contract.

Description.

Grader ditches and specified graded areas shall be constructed to the lines and grades and at the locations designated on the plans.

Measurement and Payment.

(a) Measurement. This item will be paid for by the linear foot of grader ditch completed and accepted. All graded areas designated on the plans shall not be measured for payment.

(b) Payment. The amount of linear feet of grader ditch, measured as provided above, shall be paid for at the contract price for "Grader Ditches" which price shall be full compensation for all labor, equipment, tools, grading the areas specified on the plans, and other expenditures necessary to complete the work in accordance with the plans and these specifications.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. B-1

AGGREGATE BASE COURSE

Scope.

The Contractor shall furnish all materials, labor, and equipment and perform all work necessary to construct the aggregate base course of the thickness and to the lines and grades shown on the drawings, and as specified herein.

General.

The aggregate base course shall consist of the aggregate hereinafter specified, and include the furnishing, hauling, depositing and spreading, processing, compacting, load testing and fine grading as specified herein on a prepared subgrade.

Materials.

(a) Aggregates. The aggregate shall consist of gravel, crushed or uncrushed, crushed stone, sand-gravel, sand silt, or other approved materials having similar characteristics. The aggregate shall be free from lumps or balls of clay, or other objectionable matter, and shall be durable and sound. The portion of the material retained on a No. 4 sieve shall be known as coarse aggregate, and the materials passing a No. 4 sieve shall be known as a binder material.

(b) Coarse Aggregate conforming to the requirements specified above shall have a percentage of wear not to exceed 50 after 500 revolutions, as determined by AASHTO Standard Method T-96.

(c) Binder Material shall consist of sand, silt, or other finely divided mineral matter, obtained from sources approved by the Engineer, or naturally combined with the coarse aggregate. It shall be free from vegetable or other objectionable matter. The binder material, either naturally combined with the coarse aggregate or separately obtained and mixed therewith, shall be of such character that the composite material will conform to the gradation and other requirements specified. Care shall be taken to insure that the kind of material which is contained in that fraction passing the No. 200 sieve is not of a nature which will expand excessively when wet.

(d) Gradation. The composite mixture of coarse aggregate and binder material, processed as hereinafter specified, shall conform to the gradation shown in the following table:

CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. B-1

<u>Sieve Designation</u>	<u>Percentages by Weight Passing Square Mesh Sieves</u>
1-1/8"	100
3/4"	70 - 100
3/8"	50 - 75
No. 4	35 - 60
No. 10	25 - 50
No. 40	10 - 30
No. 200	3 - 12

The fraction of the material passing the No. 200 sieve shall be less than one-half that of the fraction passing the No. 40 sieve. That portion of the binder material passing the No. 40 sieve shall have a liquid limit of not more than 25 and a plasticity index of not more than 5 as determined by AASHTO Standard Method T-89 and T-91 respectively.

(e) Sampling and Testing. Samples of aggregate base course shall be taken by the Contractor at the locations and in the manner directed by the Engineer. The Contractor shall deliver said samples to an approved testing laboratory to determine the gradation in accordance with the requirements of AASHTO Standard Method T-27. At least two (2) copies of the test report shall be mailed directly to the Engineer.

If, in the opinion of the Engineer, there is a question as to the character of the fraction passing the No. 200 sieve, he shall have the right to ask for an appropriate qualitative analysis of said material at the Contractor's expense.

The number of tests required by the Engineer shall not exceed one (1) for each 1,000 tons of aggregate base course required.

The Contractor shall bear all expenses incurred in making the above stated tests including the laboratory fees. Compensation for this expenditure shall be included in the price bid for the item to which the work applies.

Equipment.

(a) General. All plant, equipment, tools, and machines used in the performance of the work covered by this section shall be subject to the approval of the Engineer, and shall be maintained in satisfactory working condition at all times.

(b) Power Rollers. The rollers shall be self-propelled, threewheel or tandem types, weighing not less than 8 tons. The threewheel rollers shall have a minimum weight of 300 pounds per inch width of rear wheel.

(c) Tamping Rollers (Sheepsfoot Type) shall consist of one or more units. Each unit shall consist of a watertight cylindrical drum not less than 48 inches in length, surmounted by metal studs with tamping feet projecting not less than 7 inches from the surface of the drum, and spaced not less than 6 nor more than 10 inches, measured diagonally from center to center. The tamping feet shall be an approved type suitable for compacting aggregate base courses. Each unit shall be equipped with a suitable device for cleaning the tamping feet. The rolling units of multiple type tamping rollers shall be pivoted on the main frame in a manner which will permit the units to adapt themselves to uneven ground surfaces and to rotate independently. When fully loaded, the roller shall produce at least 300 pounds per square inch on the combined areas of the tamping feet in contact with the ground.

(d) Blade Graders shall have a wheel base of not less than 15 feet, a blade of not less than 10 feet, and shall be self-propelled.

(e) Rubber-Tired Rollers shall consist of two axles on which are mounted not less than 9 pneumatic-tired wheels in such a manner that the rear group of tires will not follow in the tracks of the forward group. The axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. The tires shall be uniformly inflated. The rollers shall be weighted as directed by the Engineer. The tractor or other towing equipment shall also be pneumatic-tired.

(f) Traveling Mixing Plants shall be so designed and constructed that they will pick up the windrowed aggregate without damaging the subgrade or leaving any portion of the windrow on the subgrade. Machines shall be mounted on pneumatic-tired wheels or smooth-tread crawler type tracks of such width that, when the plant is fully loaded, they will not cut or damage the subgrade. The equipment for proportioning the aggregates and water shall accurately measure the specified amounts of the materials while the machine is in operation. Each plant shall be capable of producing a uniform mixture without loss of the aggregate and shall have a capacity of not less than 100 tons of mixed material per hour.

(g) Stationary Mixing Plants shall be so designed that they will accurately proportion and thoroughly mix the aggregate, binder material and water. Each plant shall be equipped with weighing and measuring devices for proportioning on a weight basis or by volume based on weight, and shall have a capacity of not less than 100 tons of mixed material per hour.

(h) Sprinkling Equipment shall consist of tank trucks, pressure distributors, or other equipment designed to apply water uniformly and at controlled quantities to variable widths of surface.

(i) Disks shall be of the tandem type, and shall be constructed so as to prevent any cutting of the subgrade during mixing operations.

(j) Plows shall be of the multiple-furrow type, and shall be so designed that the depth of furrow can be accurately controlled.

(k) Hauling Equipment shall consist of pneumatic-tired vehicles having dump bodies suitable for dumping materials in windrows or in layers on the subgrade.

(l) Tampers. Hand tampers shall weigh not less than 50 pounds and shall have a face area of not more than 100 square inches. Mechanical tampers shall be of an approved type.

(m) Miscellaneous Equipment. Scarifiers, tractors, springtooth or spiketooth harrows, windrow equalizers, spreaders, and other equipment shall be of approved types, suitable for constructing aggregate base courses.

Weather Limitations.

Aggregate base courses shall not be constructed when the atmospheric temperature is below 35 degrees F. When the temperature falls below 35 degrees F., it shall be the responsibility of the Contractor to protect all areas of completed base course against any detrimental effects, by methods approved by the Engineer. Any areas of completed base course that are damaged by freezing, shall be reconditioned, reshaped and recompacted by the Contractor in conformance with the requirements of this specification without additional cost to the Owner.

Preparation of Subgrade.

Prior to constructing the aggregate base course, the previously constructed subgrade shall be cleaned of all foreign substances. The subgrade will be inspected by the Engineer for conformance to the requirements specified in "EXCAVATION".

Grade Control.

Intermediate grade control shall be established by the Contractor by means of grade stakes placed in lines parallel to the center line of the area to be paved, and spaced so that string lines may be stretched between the stakes.

Placing and Mixing of Materials.

The materials shall be mixed and placed as follows:

(a) Stationary-Plant Method. The aggregates, binder material, and water shall be proportioned and mixed in an approved stationary mixing plant. The binder material and aggregate shall be weighed or proportioned by volume, based on weight, so as to produce the gradation and other requirements specified hereinbefore. Any adjustments of the percentages of materials to be used that are found necessary in order to keep the finished mixture within the specified gradation and moisture content, shall be made by the Contractor when so directed by the Engineer. Water shall be measured by weight or by means of an accurate volumetric measuring device. The aggregate, binder material, and water shall be mixed until all the materials are uniformly distributed throughout the mass. The mixing time may be ordered increased by the Engineer without additional cost to the Owner when this is found to be necessary in order to produce a uniform and satisfactory mixture. The finished mixture shall be hauled to the area to be paved in approved pneumatic-tired vehicles. The material shall be deposited and spread in a uniform layer to the required contour and grades and to such loose depth that when compacted to the density required the layer will be of the thickness indicated on the drawings. The

material shall be spread uniformly on the prepared subgrade from moving vehicles or spreader boxes, then leveled to the required contour and grades with blade graders. Portions of the layer which become segregated in spreading shall be removed and replaced with satisfactory mixture or shall be remixed as directed by the Engineer.

(b) Traveling Plant Method. The aggregate and binder material shall be hauled to the area to be paved in approved pneumatic-tired vehicles. The aggregate and binder material of the gradation required shall be placed in windrows of such cross-section, and proportions that, when picked up, mixed and redeposited in windrows on the subgrade the finished mixture will conform to the gradation and other requirements specified herein. The size of the windrow of combined materials shall not exceed the rated capacity of the traveling plant, and shall be approved by the Engineer. Water in quantities designated or approved by the Engineer shall be added to the materials at the time of mixing. The materials shall be uniformly mixed by the traveling plant and deposited on the subgrade in windrows of uniform cross-section. The windrowed mixed material shall then be spread in a layer of uniform thickness, and leveled to the required contour and grades by means of blade graders. Any portions of the layer which become segregated in spreading shall be removed and replaced with a satisfactory mixture, or shall be remixed as directed by the Engineer.

(c) Road-Mix Method. The aggregates and binder material shall be hauled to the area to be paved in approved pneumatic-tired vehicles. The aggregate shall be placed in a layer of uniform thickness on the subgrade without segregation of sizes, followed by placing thereon a uniform layer of binder material to such loose depth and proportions that, when mixed together and compacted, the finished layer will conform to the gradation and other requirements specified hereinbefore, and to the compacted thickness indicated on the drawings. The materials shall be spread from spreader boxes or moving vehicles equipped to distribute the materials in layers of uniform thickness. The layers shall be mixed with blade graders, harrows, disks, or other approved equipment, in such manner as not to disturb or mix material from the underlying subgrade into the layer. Initial mixing shall continue until the mixture is uniform throughout, adding water to the extent necessary to prevent segregation during mixing operations, as approved by the Engineer. Any areas of segregated material shall be corrected by the addition of binder material or aggregates as required, followed by thorough remixing until approved by the Engineer. Additional water in such amounts as are required shall be applied during mixing by the sprinkling equipment specified, and the mixing shall continue until the water is uniformly distributed throughout the mixture as determined by the Engineer, following which the approved mixture shall be leveled to the required contour and grades with blade graders. When approved by the Engineer, the aggregate and binder material may be placed on the subgrade, in windrows of such cross-section proportions that, when mixed and compacted, the layer will conform to the thickness shown on the drawings. The windrowed material shall then be mixed and spread as specified above in a layer of uniform thickness. Prior to compaction, samples of the finished mixture will be tested by the Engineer for compliance with the gradation and other requirements specified. When directed by the Engineer, binder material or aggregate, or both, in such amounts as required, shall be added to the mixture, followed by thorough remixing until approved by the Engineer.

(d) Layer Thickness. When the thickness of the base course, as shown on the drawings, is more than 6 inches, the base course shall be constructed in layers, each layer not exceeding 6 inches in compacted thickness, and the construction procedures herein specified shall apply similarly to each layer.

Shaping and Compacting.

The mixed materials shall be approved by the Engineer prior to spreading and compacting. Immediately following the mixing, the finished mixture shall be uniformly spread in a layer and additional water added, if required, as directed by the Engineer. The loose thickness of the layer to be rolled shall be such that the required compaction will be obtained with the rolling equipment to be used. The layer shall then be bladed, shaped, and smoothed to the grades or levels required, and rolled with tamping rollers, power rollers, or rubber-tired rollers, or by combinations thereof, as approved by the Engineer. Rolling shall continue until the layer is thoroughly compacted through the full depth. The surface of the layer shall be finished by blading and rolling with a power roller and rubber-tired rollers. In all places not accessible to the rolling equipment, the mixtures shall be compacted with tamping equipment specified hereinbefore. Blading, rolling, and tamping shall continue until the surface is smooth and free from waves and inequalities. If at any time the mixture is excessively moistened by rain, it shall be aerated by means of blade graders, harrows, or other approved equipment, until the moisture content of the mixture is satisfactory to the Engineer, and the surface then recompacted and finished as specified above.

Unsupported Edges of Base Course.

Earth or other approved material shall be placed along the unsupported edges of the base course in such quantity as will compact to the thickness of the course being constructed, allowing in each operation at least one-foot width of shoulder to be rolled and compacted simultaneously with the rolling and compacting of the base course, as approved by the Engineer.

Load Test.

After the aggregate base course has been brought to grade and compacted the entire surface shall be tested with load testing equipment (15 cubic yard carryall, pneumatic-tired, fully loaded) to determine that there are no areas which have been insufficiently compacted.

An eight ton or heavier tandem roller and a rubber-tired roller shall be used after load testing to take out any irregularities left by the testing equipment.

Smoothness Test.

The surface shall not show any deviations in excess of 3/8 inch when tested with a 10-foot straightedge applied parallel with the centerline of the area to be paved. Any deviation in excess of this amount shall be corrected by the Contractor by loosening, adding or removing material, reshaping, watering, and compacting as directed by the Engineer.

Compaction Control.

During the progress of work a testing laboratory approved by the Engineer shall make density tests of compacted aggregate base course in accordance with ASTM D 1556 (or other approved field density tests, including the use of properly calibrated nuclear testing devices). The determination of maximum density and optimum moisture shall be determined in accordance with ASTM D 698, method D at Contractor's expenses. Aggregate Base material shall be compacted, full depth, to a minimum of one hundred (100%) percent of maximum density. Any areas of inadequate compaction shall be corrected by the contractor immediately.

Maintenance.

The finished base course shall be maintained by the Contractor in a condition satisfactory to the Engineer until the asphaltic concrete surfacing is placed.

Measurement and Payment.

(a) Measurement. This item will be measured by the square yard complete in place.

(b) Payment. No separate payment will be made for Aggregate Base Course; all cost in connection therewith shall be included in the contract price bid for the item to which the work applies.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. C-1

ASPHALTIC CONCRETE PAVEMENT

Scope.

The Contractor shall furnish all plant, labor, equipment and materials, and shall perform all operations in connection with the construction of hotmix asphaltic concrete pavement, complete, in strict accordance with the drawings and specifications.

General.

Asphaltic concrete binder and surface courses shall consist of fine and coarse mineral aggregate and mineral filler uniformly mixed with hot paving asphalt, placed and compacted on the aggregate base course.

Aggregate.

(a) General. Aggregates shall consist of crushed stone, crushed gravel, screenings, sand, and mineral filler conforming to the requirements specified below. The portion of these materials retained on the No. 10 sieve shall be known as coarse aggregate; the portion passing the No. 10 sieve and retained on the No. 200 sieve shall be known as fine aggregate; and the portion passing the No. 200 sieve shall be known as mineral filler. Mineral aggregate shall have a plasticity index of not more than 5 as determined by AASHTO Standard Method T-91.

(b) Coarse Aggregate shall consist of the following:

(1) Crushed Stone shall consist of clean, sound, durable fragments, free from an excess of flat, elongated, soft or disintegrated pieces, dust, dirt, or other objectionable matter, and shall have percentage of wear not to exceed 50 after 500 revolutions, as determined by AASHTO Standard Method T-96.

(2) Crushed Gravel shall be sound, durable, free from adherent coatings of clay, dirt, dust, or other objectionable matter, and shall have a percentage of wear not to exceed 50 after 500 revolutions, as determined by AASHTO Standard Method T-96. Crushed gravel shall contain at least 70 percent by weight of crushed pieces having one or more fractured surfaces.

(c) Fine Aggregate shall conform to the requirements of AASHTO Standard Specification M-29. Fine aggregate or combinations of fine aggregate which do not conform to the gradation table in paragraph 3 of AASHTO Standard may be used, provided the finished mixture conforms to the gradations specified hereinafter.

(d) Mineral Filler shall conform to the requirements of AASHTO Standard Specification M-17.

(e) Swell Test for Bituminized Aggregate. When tested in accordance with the requirements of AASHTO Standard Method T-101, bituminized aggregate shall not swell more than 1.5 percent.

(f) Stripping Tests for Aggregates. The fine or coarse aggregate, or composite mixture, shall show no detrimental amount of stripping when tested as follows: A test sample consisting of the aggregate and bitumen to be used in the paving mixture shall be mixed at the temperature specified herein. The sample shall then be spread in a loose, thin layer and allowed to air-season for 24 hours before testing. A portion of the sample, not over 1/2 the capacity of the jar, shall be placed in a glass jar and completely covered with distilled water. The jar shall be fitted with a tight screw cap and allowed to stand for a period of 24 hours. The jar shall be vigorously shaken for a period of 15 minutes, and the sample of the mixture shall then be examined for stripping. If stripping occurs, the aggregate shall be rejected or an approved method of treating shall be specified to change the material from a hydrophilic to hydrophobic state as directed by the Engineer.

(g) Responsibilities in Sampling and Testing Aggregate concerning all the tests described above in subheadings (a), (b), (c), (d), (e), and (f) under "Aggregate". The Contractor's sole responsibility shall be that of furnishing suitable sized samples at his own expense for whatever tests the Engineer feels are necessary. The Engineer will bear the actual expense of performing the desired tests. Concerning subheading (h) "Gradation Analysis" however, the Contractor shall bear the whole expense of the required tests as described below.

(h) Gradation Analysis. The sources from which the aggregates are to be obtained shall be selected in advance of the time when the materials will be required in the work, and samples of the size required shall be delivered by the Contractor to an approved testing laboratory to determine the gradation in accordance with the requirements of AASHTO Standard Method T-11 and T-27. At least two (2) copies of the test report shall be mailed directly to the Engineer. The gradation of the aggregate shall conform to the requirements specified hereinafter under "Composition of Mixture". The number of gradation tests required by the Engineer shall not exceed two (2), one for the aggregate used in each course of bituminous pavement. The Contractor shall bear all expenses incurred in making the above stated gradation tests including the laboratory fees. Full compensation for this expenditure shall be included in the price bid for "Asphaltic Concrete Pavement". Unless otherwise directed by the Engineer, AASHTO Standard Method T-2 shall be used for sampling fine and coarse aggregates, and AASHTO Standard Method T-127, paragraph 3, 4, and 5, shall be used for sampling mineral filler. Sampling will be observed and supervised by the Engineer, when deemed necessary. Only those materials that have been demonstrated by service tests as satisfactory for the intended work will be acceptable.

Paving Asphalt.

(a) General. Asphalt shall be paving grade asphalt conforming to section 711 of Maricopa Association of Governments (MAG) Specifications. And shall be grade AR-4000. The asphalt cement shall be applied at a temperature between 275° and 325 °F.

(b) Percentage of Paving Asphalt, by weight, to be used in asphaltic mixtures shall be within the limits contained in the gradation tables specified hereinafter.

(c) Certificate of Test. The Contractor shall furnish the Engineer with a certificate of test from the manufacturer of the asphalt cement for each car of asphalt used in the work.

Composition of Mixture.

(a) General. The mineral aggregate for the surface course and for the binder course shall be of such size that the percentage composition, by weight, as determined by laboratory screens, will conform to one of the gradations specified below, for surface course and binder course respectively. The percentage of bituminous material, by weight, to be used for preparing the bituminous mixture shall be within the limits contained in the table, as directed by the Engineer. Gradation of the aggregate shall be determined by the Contractor as specified hereinbefore under "Sampling and Testing Aggregate".

(b) Gradation

Asphalt-Mixture Surface Course (Seal)

Bituminous Mixture	Sieve Designation (Square Openings)	Percentage by Weight (Passing)
Aggregate	1/2"	100
	3/8"	100
	No. 4	65 - 85
	No. 10	45 - 65
	No. 40	15 - 40
	No. 100	4 - 23
	No. 200	3 - 10
Asphalt Cement Percentage *		5 - 7

Asphalt-Mixture Binder Course (Base)

Bituminous Mixture	Sieve Designation (Square Openings)	Percentage by Weight (Passing)
Aggregate	1 - 1/4"	100
	1"	80 - 100
	3/4"	70 - 100
	1/2"	60 - 80
	3/8"	42 - 72
	No. 4	40 - 60
	No. 10	35 - 53
	No. 40	12 - 25
	No. 100	3 - 14
	No. 200	3 - 10
Asphalt Cement Percentage *		3.5 - 4.5

* The upper limit may be raised when absorptive aggregates are used.

The above gradations represent the extreme limits which shall determine suitability of aggregate for use from all sources or supply. The aggregate as finally selected for use in the work shall have a gradation within the limits designated in the table and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but shall be uniformly graded from coarse to fine. The table is based on aggregates of uniform specific gravity and the percentages passing the various sieves are subject to appropriate correction by the Engineer when aggregates of varying specific gravities are used. The plasticity index for any of the above gradations shall not be greater than 5 as determined by AASHTO Standard Method T-91.

(c) Job-Mix Formula. The Contractor shall submit a written job-mix formula to the Engineer, for approval, at least 10 days before placing any bituminous mixture. The job-mix formula shall indicate the definite percentage of each sieve fraction, the percentage of asphalt, and the temperature of the completed mixture as it is discharged from the mixer. The Contractor shall make all changes in the job-mix formula ordered by the Engineer, within the limits of the above gradation tables, without adjustment in the contract prices. All bituminous mixture used in the work shall conform to the approved job-mix formula with the following tolerances:

Aggregate passing No. 4 sieve or larger	4 percent plus or minus
Aggregate passing No. 10, 40, and 80 sieves	3 percent plus or minus
Aggregate passing No. 200 sieve	1.5 percent plus or minus
Asphalt	0.3 percent plus or minus
Temperature of mixing	25 degrees F. plus or minus

Mixing Plant.

Mixing plant shall be designed, coordinated, and operated so as to produce a mixture within the job-mix formula. The plant may be either a weight batch type or a volumetric-proportioning, continuous-mixing type, provided the equipment has demonstrated that it is suitable for producing finished mixtures complying with the job-mix formula specified herein. Any plant used for the preparation of bituminous mixtures shall conform to all the requirements specified in subparagraph (a) on page 5, except that the scale requirements shall apply only where weight proportioning is used, and in addition, any batch mixing plant and continuous mixing plants shall conform to the special requirements specified in subparagraph (b) or (c) on page 5, whichever is applicable.

(a) Requirements for All Plants.

(1) Plant Scales. Scales for any weigh box or hopper shall be of standard make and design, either of the beam or springless dial type, sensitive to 1/2 of one percent of the load that may be required. When of the beam type, there shall be a separate beam for each size aggregate, with a single telltale actuated for each separate beam and a tare beam for balancing the hopper. Standard test weights shall be provided for checking the accuracy of the

plant scales. All weighing equipment shall be tested and sealed by a representative of the State Inspector of Weights and Measures.

(2) Equipment for Preparation of Bituminous Material. Tanks for storage of bituminous material shall be capable of heating the material under effective and positive control, at all times, to the temperature requirements specified herein. Heating shall be accomplished by steam coils, electricity, or other means that will allow no direct flame to come in contact with heating tank. The circulating system for the bituminous material shall be of adequate size to insure proper and continuous circulation between storage tank and mixer during the entire operating period. All pipe lines and fittings shall be steam-jacketed or otherwise properly insulated to prevent heat loss. The storage tank capacity shall be sufficient for at least a one-day run.

(3) Feeder for Dryer. The plant shall be provided with an accurate mechanical means for uniformly feeding the mineral aggregate into the dryer so that a uniform production and uniform temperature will be secured.

(4) Dryer. A rotary dryer of any satisfactory design for drying and heating the mineral aggregate shall be provided. The dryer shall be capable of drying and heating the mineral aggregate to the temperature requirements set forth in the specifications.

(5) Screens. Plant screens capable of screening all aggregates to the specified sizes and proportions and having normal capacities in excess of the full capacity of the mixer shall be provided.

(6) Bins. The plant shall include storage bins of sufficient capacity to supply the mixer when it is operating at full capacity. The bins shall be divided into at least 3 compartments arranged to insure separate and adequate storage of appropriate fractions of the aggregate. Each compartment shall be provided with an overflow pipe of such size and at such location as to prevent any backing up of the material into other bins. Adequate dry storage shall be provided for mineral filler, and provision shall be made for accurately weighing or proportioning the mineral filler to the mixtures.

(7) Bituminous Control Unit. Satisfactory means shall be provided to obtain the proper amount of bituminous material in the mix within the tolerances specified by the job-mix formula, either by weighing, metering, or volumetric measurements. Suitable means shall be provided, either by steam-jacketing or other methods of insulation, for maintaining the specified temperature of the bituminous material in the pipe lines, meters, weigh buckets, spray buckets, spray bars, and other containers or flow lines.

(8) Thermometric Equipment. An armored thermometer with a range from 200 degrees to 400 degrees F. shall be fixed in the bituminous feed line at a suitable location near the discharge valve at the mixer unit. The plant shall be further equipped with an approved dial-scale, mercury-actuated thermometer, and electric pyrometer, or other approved thermometric instrument, so placed at the

discharge chute of the dryer as to register automatically or indicate the temperature of the heated aggregate.

(9) Control of Mixing Time. The plant shall be equipped with positive means to govern the time of mixing and to maintain it constant, unless otherwise directed by the Engineer. The time of mixing shall be considered as the interval between the time the bituminous material is spread on the aggregate and the time the same aggregate leaves the mixing unit for continuous mixing plants and the total of dry - and wet - mixing time for batch plants.

(10) Dust Collectors. When plants are located in any vicinity where dust may be objectionable, the plant shall be equipped with dust collectors. Provision shall be made to waste the material so collected or to return it uniformly to the mixture, as the Engineer may direct.

(11) Safety Requirements. All belts, gears, chains, pulleys, projecting set screws, keys and other rotating parts shall be properly guarded when exposed to hazardous contact. Adequate and safe stairways to the mixer platform and safe ladders or other means shall be provided for accessibility to all plant operations. All equipment and exposed steam or other lines carrying high temperatures, so located as to endanger personnel or create a fire hazard, shall be properly guarded or covered with a suitable type of insulation.

(b) Special Requirements for Batch Mixing Plants.

(1) Weight Box or Hopper. The equipment shall include means for accurately weighing each bin size of aggregate in a weigh box or hopper suspended on scales, ample in size to hold a full batch without hand raking or running over. The weigh box or hopper shall be supported on fulcrums and or adjustment. The gates on both the bins and hoppers shall be so constructed as to prevent leakage of aggregate when closed.

(2) Asphalt Bucket. When an asphalt bucket is used for weighing the bituminous material, it shall have sufficient capacity to hold not less than 15 percent of the rated capacity of the mixer. It shall be steam-jacketed or equipped with properly insulated electric heating units and shall be suspended on dial or beam scales equipped with a telltale so the tare weight of the bucket will be shown for each weighing and the net weight of bituminous material measured accurately to within one percent above or below the weight required. The bucket shall be so arranged that the heated bituminous material will be delivered in a thin, uniform sheet or in multiple streams the full width of the mixer, except in the case of a mixer where the bituminous material is sprayed.

(3) Mixer Unit for Batch Method. The plant shall include a batch mixer of an approved twin pugmill type, and shall be capable of producing a uniform mixture within the job-mix tolerance specified. The pugmill shall be heated by use of either steam jackets, hot-oil jackets, or thermostatically controlled

electrical strip heaters or other suitable electrical heating devices, of an approved type. The batch capacity of the mixer shall have an accurate time lock to control the operation of the complete mixing cycle by locking the weigh-box gate after charging the mixer until the closing of the mixer gate at the completion of the cycle. The time lock shall lock the asphalt bucket throughout the dry-mixing period and shall lock the mixer gate throughout the dry- and wet- mixing periods. The dry-mixing period is defined as the interval of time between the opening of the weigh-box gate and the application of the bituminous material; the wet-mixing period is the interval between the application of the bituminous material and the opening of the mixer gate. The control of the timing shall be flexible and capable of being set at intervals of not more than 5 seconds throughout cycles up to 3 minutes. A mechanical batch counter shall be installed as part of the timing devices and shall be so designed as to register only the actuation of the bituminous-bucket release and to preclude the register of any dry batches or the register of any material through the operation of pulling bins. If not enclosed, the mixer box shall be equipped with an adjustable hood to prevent loss of mineral filler by dispersion. The clearance of the pugmill blades from all fixed parts shall not exceed 3/4 inch.

(c) Special Requirements for Continuous Mixing Plants.

(1) Gradation Control Unit. The plant shall include a means for accurately proportioning each bin size of aggregate either by weighing or by volumetric measurement. When gradation control is by volume, the unit shall include a feeder mounted under the compartment bins. Each bins shall have an accurately controlled individual gate to form an orifice for volumetrically measuring the material drawn from each respective bin compartment. The orifice shall be rectangular, approximately 8 inches by 9 inches, with one dimension made adjustable by positive mechanical means provided with a lock. Indicators shall be provided on each gate to show the gate opening in inches.

(2) Weight Calibration of Aggregate Feed. The plant shall include a means for calibration of gate openings by means of weight test samples. The materials fed out of the bins through the individual orifices shall be bypassed to a suitable test box, each compartment material confined to a separate box section. The plant shall be equipped to handle conveniently such test samples weighing up to 800 pounds and to weigh them on accurate platform scales. Mechanical means shall be provided to accurately proportion the mineral filler to the mixing unit.

(3) Synchronization of Aggregate and Bitumen Feed. Satisfactory means shall be provided to afford positive interlocking control between the flow of aggregate from the bins and the flow of bitumen from the meter or other proportioning source. This control shall be accomplished by interlocking mechanical means or any positive method subject to control by the Engineer.

(4) Mixer Unit for Continuous Method. The plant shall include a continuous mixer of an approved twin-pugmill type, and shall be capable of producing a uniform mixture within the job-mix tolerances specified. The pugmill shall be heated by use of either steam jackets, hot-oil jackets, or thermostatically controlled electrical strip heaters or other suitable electrical heating devices, of an approved type. The paddles shall be of a type adjustable for angular position of the shafts and reversible to retard the flow of the mix. The mixer shall carry a manufacturer's plate giving the net volumetric contents of the mixer at the several heights inscribed on a permanent gage and also giving the rate of feed of aggregate per minute at plant operating speed. Unless otherwise required, determination of mixing time shall be by weight method under the following formulas, except that the mixing time shall be not less than 35 seconds. The weights for the job shall be determined by tests made by the Engineer.

$$\text{Mixing time in seconds} = \frac{\text{Pugmill dead capacity in pounds}}{\text{Pugmill output in pounds per second}}$$

Equipment.

All equipment, tools, and machines used in the performance of the work shall be subject to the approval of the Engineer and shall be maintained in a satisfactory working condition at all times.

(a) Bituminous Spreaders. The spreaders shall be self-propelled type, equipped with hoppers, distributing screws, adjustable screens, and equalizing devices, capable of spreading hot bituminous mixtures without tearing, shoving, or gouging and of producing a finished surface of specified evenness. Spreaders shall be designed to operate forward at variable speeds and in reverse traveling speeds of not less than 100 feet per minute. The use of approved spreaders operating on fixed side forms will be permitted.

(b) Power Rollers. The roller shall be self-propelled, three-wheel or tandem types, weighing not less than 8 tons. The three-wheel rollers shall have a minimum weight of 300 pounds per inch width of rear wheel. The wheels shall be equipped with adjustable scrapers, water tanks, and sprinkling apparatus, which shall be used to keep the wheels wet for the purpose of preventing the bituminous mixture from sticking to the wheels. The roller shall be otherwise suitable for rolling hot-mix pavements and shall be capable of reversing without backlash.

(c) Rubber-Tired Rollers shall consist of two axles on which are mounted not less than 9 pneumatic-tired wheels in such a manner that the rear group of tires will not follow in the tracks of the forward group. The axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. The tires shall be uniformly inflated. The rollers shall be weighted as directed by the Engineer. The tractor or other towing equipment shall also be pneumatic-tired.

(d) Power Blowers and Power Brooms. Blowers and brooms shall be of the power type and shall be suitable for cleaning the surface to be paved.

(e) Small Tools shall consist of rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, wheel-mounted wagons for heating small tools, wood sandals and stilt sandals of standard type, and other small tools as may be required. Sufficient number of small tools shall be available at all times to efficiently construct the bituminous pavements.

Weather Limitations.

Bituminous courses shall be constructed only when the base course is dry, and when the weather is not rainy. Such courses shall not be constructed when the atmospheric temperature is below 40 degrees F., unless otherwise directed by the Engineer.

Reconditioning of Base Course and Binder Course.

The previously constructed base course and binder course shall be conditioned as specified below; and in all cases, prior to laying a bituminous course, the underlying surface shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, and hand brooms as directed by the Engineer. Any ruts or soft, yielding spots that may appear in the base course or the binder course, any areas having inadequate compaction, and any deviations of the surface from the requirements specified for the underlying course shall be corrected at the Contractor's expense by loosening the affected area, removing unsatisfactory material and adding approved material where required, reshaping, and recompacting to line and grade and to the specified density requirements as directed by the Engineer.

Grade Control.

Intermediate grade control shall be established by the Contractor by means of grade stakes placed in lines parallel to the centerline of the area to be paved, and spaced so that string lines may be stretched between the stakes.

Mixing.

The bituminous mixture shall be produced in an approved plant as specified hereinbefore.

(a) Preparation of Mineral Aggregates. In all cases the fine and coarse aggregate shall be piled in separate piles. Each pile shall be fed to the drier by a separate mechanical feeder in a manner approved by the Engineer, so as to produce a bituminous mixture within the tolerances specified for the job-mix formula. When two or more fine aggregates or two or more coarse aggregates of varying gradations are used, the fine aggregates and the coarse aggregates shall be thoroughly premixed separately by methods satisfactory to the Engineer prior to being placed in the separated piles described above. The aggregate shall be heated and thoroughly dried before entering the bins. The temperature of the aggregate, determined as it enters the mixer, shall be such that the temperature of the finished mixture will be within the tolerances specified

by the job-mix formula. The heated and dried aggregates shall be screened and conveyed to separate bins ready for mixing with the bituminous material. The aggregate shall be separated into the sizes designated or approved by the Engineer. Adequate dry storage shall be provided for mineral filler.

(b) Preparation of Bituminous Mixture. The aggregate, prepared as specified hereinbefore, and dry mineral filler shall be accurately weighed or measured and conveyed into the mixer in the proportionate amounts of each aggregate size required to meet the job-mix formula. The required amount of asphalt for each batch, or calibrated amount of asphalt for continuous mixing, shall be introduced into the mixer. In batch mixing after the aggregate and mineral filler have been introduced into the mixer and mixed for not less than 15 seconds, the bituminous material shall be added and mixing continued for a period of not less than 20 seconds and as much longer as may be required to obtain a homogenous mixture. When a continuous mixer is employed, the mixing time shall be as specified hereinbefore. In no case shall the aggregate be introduced into the mixture at a temperature more than 25 degrees F. above the temperature of the asphalt. The temperature of the bituminous material at the time of mixing shall not exceed 325 degrees F. The temperature of the aggregate and mineral filler in the mixer shall not exceed 350 degrees F. when the asphalt is added. The temperatures of both the aggregate and asphalt at the time of mixing shall be as determined by the Engineer. The volume of the aggregate's mineral filler, and bituminous material shall not be so great as to extend above the tips of the mixer blades when the blades are in a vertical position. All overheated and carbonized mixtures, or mixtures which foam or show indication of moisture, will be rejected by the Engineer. When moisture is detected in the finished mixture, all aggregates in the bins shall be removed and placed in their respective stock piles.

Transportation of Bituminous Mixture.

The bituminous mixture shall be transported from the paving plant to the site in trucks having tight, clean, smooth beds which have been oiled with a MINIMUM AMOUNT of approved thin oil to prevent adhesion of the mixture to the truck bodies, and yet will not allow a breakdown of the bituminous mixture. After each oiling the truck body shall be raised to the highest limit of the hoist and allow all excess oil to drain out. Each load shall be covered with canvas or other suitable material of ample size to protect it from the weather and to prevent the loss of heat. Deliveries shall be made so that spreading and rolling of all the mixture prepared for a day's run can be completed during daylight, unless artificial light satisfactory to the Engineer is provided. The mixture shall be delivered to the area to be paved in such manner that the temperature at the time of dumping into the spreader will not be less than that hereinafter specified. Any loads wet excessively by rain will be rejected by the Engineer. Hauling over freshly laid material will not be permitted.

Placing.

Prior to laying the binder or surface course, the underlying course shall be cleaned of all foreign or objectionable matter with power blowers, power brooms, or hand brooms as directed by the Engineer. The range or

temperature of the mixtures, when dumped into the mechanical spreader shall be as determined by the Engineer. Asphalt mixtures which have temperatures of less than 225 degrees F. when dumped into the mechanical spreader, will be rejected. The mechanical spreader shall be adjusted and the speed regulated so that the surface of the course will be smooth and of such depth that, when compacted, it will conform to the cross section, grade, and contour shown on the drawing. Unless otherwise directed by the Engineer, the placing shall begin along the side of areas to be paved on a crowned section and on the high side of a section with a one-way slope. The 6-inch strip adjacent to the area on which additional materials is to be laid shall not be rolled until such additional material is placed, except when the work is to be discontinued. After the first strip has been placed and rolled, the second strip and succeeding strips shall be placed, and rolling shall be extended to include the 6 inches of the first strip not previously rolled. The succeeding strips shall be placed while the unrolled 6-inch section of the adjoining strip is hot and in a readily compactible condition. The length of any strip to be laid before placing the succeeding strip shall be as determined by the Engineer. No joint shall be over the joint in the underlying course. The joints in courses should be offset or staggered at least six (6) inches. Placing of the mixture shall be as continuous as possible. When directed by the Engineer, the laying of the binder course shall be discontinued until the overlying surface course is laid. A sufficient number of experienced shovelers and rakers shall follow the spreading machine, adding hot mixture and raking the mixture as required to produce a course that, when completed, will conform to all requirements specified herein. The areas where the use of machine spreading is impracticable, the mixture may be spread by hand. The mixture shall be dumped on approved dump boards outside the area to be paved. The mixture shall be distributed into place from the dump boards by means of hot shovels and then spread with hot rakes, in a uniformly loose layer of such thickness that, when compacted, it will conform to the required grade and thickness. The loads shall not be dumped any faster than they can be properly handled by the shovelers and rakers. Rakers not equipped with stilt sandals shall not be permitted to stand in the hot mixture while raking the course. Contact surfaces of previously constructed pavements, curbs, manholes, and similar structures shall be painted with a thin coat of hot bituminous material prior to placing the bituminous mixture.

Compaction of Mixture.

Compaction shall be effected by the three-wheel rollers, tandem rollers and rubber-tired rollers specified hereinbefore. Rolling of the mixture shall begin as soon after placing as the mixture will bear the roller without undue displacement. Delays in rolling freshly spread mixture will not be tolerated. Rolling shall start longitudinally at the extreme sides of the lanes and proceed toward the center of the pavement, overlapping on successive trips by at least one-half the width of the rear wheel of the roller. Alternate trips of the roller shall be of slightly different lengths. The initial longitudinal rolling shall be effected by the use of three-wheel rollers. Tests for conformity with the specified crown, grade, and smoothness shall be made by the Contractor under the supervision of the Engineer immediately after initial compression. Before continuing the rolling, any variations shall be corrected by removing or adding materials as directed by the Engineer. The course shall also be subjected to diagonal

rolling using the power rollers specified herein, crossing the lines of the first rolling while the mixture is hot and in a compactible condition. The speed of the roller shall not exceed 3 miles per hour and shall at all times be slow enough to avoid displacement of the hot mixture. Any displacement of the mixture occurring as the result of reversing the direction of the roller, or from any other cause, shall be corrected at once by the use of rakes and fresh mixture applied or mixture removed as required. After rolling with the power rollers the pavement shall be thoroughly compacted by rolling with the rubber-tired rollers to a density of at least ninety-five (95) percent of the theoretical minimum density. Rolling shall continue until no tire marks show and until the surface is completely healed over. During rolling, the wheels of the rollers shall be moistened to prevent adhesion of the mixture to the wheels, but an excess of water will not be permitted. The rollers shall be operated by competent and experienced roller men. The minimum number of rollers to be furnished by the Contractor shall consist of one three-wheel roller or tandem roller and a rubber-tired roller, conforming to the requirements specified hereinbefore, for each spreading machine in operation on the job. The Contractor shall furnish additional 8-ton rollers if it is found that the required compaction is not obtained by the operation of the minimum number of rollers specified. In all places not accessible to the rollers, the mixture shall be thoroughly compacted with hot hand tampers. Hand tampers shall weigh not less than 25 pounds and shall have a tamping face of not more than 50 square inches. Skin patching of an area that has been rolled will not be permitted. Any mixture that becomes mixed with foreign material or in any way defective shall be removed, replaced with fresh mixture, and compacted to the density of the surrounding area. The roller shall pass over the unprotected edge of the course only when the laying of the course is to be discontinued for such length of time as to permit the mixture to become cold. The Contractor shall provide competent workmen who are capable of performing all work incidental to the correction of all pavement irregularities.

Joints.

(a) General. All joints shall present the same texture density, and smoothness as other sections of the course. The joints between old and new pavements or between successive days' work shall be carefully made in such manner as to insure a continuous bond between old and new sections of the course. All contact surfaces of previously constructed pavements shall be painted with a thin, uniform coat of hot bituminous material just before the fresh mixture is placed.

(b) Transverse. The roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the course is to be discontinued. Except when a canvas-rope joint cloth or a wood header is used, the edge of the previously laid course shall be cut back to expose an even, vertical surface for the full thickness of the course. Wood headers, if used, shall be of the same thickness as the course being laid and shall be secured firmly in place to prevent "rocking" or other movement under the action of the rollers. The fresh mixture shall be raked against the joints, thoroughly tamped with hot tampers, and smoothed with hot smoothers, followed by rolling.

(c) Longitudinal. When the edges of the longitudinal joints are irregular, honeycombed, or poorly compacted, all unsatisfactory sections of joint shall be cut back to expose an even, vertical surface for the full

thickness of the course. Where required, fresh mixture shall be raked against the joint, thoroughly tamped with hot tampers, and smoothed with hot smoothers, followed by rolling.

Edges of Pavement.

(a) Free Edges of Pavement. Pavements that do not have concrete gutters or curbs on the edges shall have thickened edges to prevent raveling (see standard detail) and earth or other approved material placed along the edges of the course in such quantity as will compact to the thickness of the course being constructed; allowing at least one foot of the width of the shoulder to be rolled and compacted simultaneously with the rolling and compacting of the course as approved by the Engineer. Prior to placing the earth or other approved material along the edges, the course, when necessary, shall be trimmed neatly to line.

(b) Edges Bounded by Concrete or Old Asphalt. The edges of the new asphalt pavement shall be finished to an elevation which is 3/8 inch above the elevation of the concrete or old asphalt adjoining it.

Protection of Pavement.

After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until it has cooled and hardened, and in no case less than 6 hours.

Smoothness Tests.

The finished surface shall not vary more than 1/4 inch when tested with a 10-foot straightedge applied parallel with the centerline of the paved area. Measurements for conformity with the specified crown elevations and cross section will also be made by the Engineer immediately after initial compaction, and any variation shall be corrected by removing or adding materials and continuing the rolling. After the completion of final rolling, the smoothness of the course shall again be checked and the irregularities that exceed the specified tolerance or that retain water on the surface shall be corrected by removing the defective work and replacing with new material as directed by the Engineer at no additional cost to the Owner.

Inspection of Plant and Equipment.

The Engineer shall have access at all times to all parts of the paving plant for checking the adequacy of the equipment in use, inspecting the operation of the plant, verifying weights, proportions, and character of materials, and checking temperatures being maintained in the preparation of the mixtures.

Payment.

No separate payment will be made for Asphaltic Concrete Pavement; all cost in connection therewith shall be included in the contract price bid for the item to which the work applies.

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CITY OF YUMA, ARIZONA
 STANDARD SPECIFICATION NO. C-2

ASPHALTIC CONCRETE PAVEMENT
 (SINGLE COURSE)

All items under this Section are as listed under Standard Specification No. C-1 "Asphaltic Concrete Pavement" except those listed below:

General.

Asphaltic concrete shall consist of mineral aggregate and earth filler uniformly mixed with 85-100 penetration paving asphalt placed and compacted on the aggregate base course.

Asphaltic concrete mixtures shall be hot-mixed in a mixing plant and laid hot in accordance with the requirements of these Specifications.

Paving Asphalt.

(a) Sampling and Testing Paving Asphalt. All sampling, unless otherwise specified, will be done in accordance with AASHTO Standard Method T-40. The Contractor shall furnish the Engineer with the manufacturer's test report for each car of asphalt used in the work.

Bituminous Mixture.

(a) Composition of Mixture. The mineral aggregate for asphaltic concrete mixture shall be of such grading that the respective percentages by weight as determined by laboratory sieves will conform to one of the gradations set forth hereinafter, and shall consist of material having a plasticity index not greater than 5 as determined by AASHTO Standard Method T-91.

Sieve Size	Percent Passing Sieve, Square Openings
3/4 Inch	100
1/2 Inch	75 - 95
3/8 Inch	65 - 85
No. 4	47 - 67
No. 10	33 - 53
No. 40	17 - 30
No. 100	6 - 17
No. 200	3 - 12
(Percent by weight 85 - 100 penetration asphalt to be added to aggregate)	4 - 6
Mixing Temperature	275° - 325 °F

Placing.

(a) General. Asphaltic courses shall be constructed only when the surface is dry, when atmospheric temperature is above 40 °F. and when the weather is not rainy.

The mixture shall be dumped in an approved mechanical spreader as specified. The speed of the mechanical spreader shall be so regulated and adjusted that when compacted the surface of the course will be smooth and the depth required to conform to the indicated cross-section, grade and contour required. The mixture shall be placed in strips of a minimum width of ten (10) feet. The portion of the strip 6 inches in width and adjacent to the area on which the future material is to be laid shall not be rolled until such material has been placed. After the strip has been compacted, the second strip shall be placed and rolling shall be extended to include the six (6) inches of the first width not previously compacted. In areas where the use of machine spreading is impractical, the mixture may be spread by hand. The mixture shall be dumped on dump boards outside the area to be spread. The mixture shall be distributed into place by means of hot shovels and spread with hot rakes in a loose layer of such thickness that, when compacted, it will conform to the required grade and thickness. Contact surfaces of previously constructed pavements shall be painted with a thin uniform coat of bituminous cement or cut-back asphalt just before the mixture is placed.

Measurement and Payment.

(a) Measurement. This item will be measured by the square yard, complete in place.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract unit price per square yard for "Asphaltic Concrete Pavement (Single Course)", which price shall constitute full compensation for all labor, materials, equipment, compaction, and incidentals necessary to complete the work, as shown on the plans and as specified herein.

CITY OF YUMA
STANDARD SPECIFICATION NO. C-2a

PAVEMENT REINFORCING FABRIC

Scope

The Contractor shall furnish all labor, materials, tools, and equipment necessary to complete all operations in connection with the placing of a pavement reinforcing fabric onto an existing asphalt pavement surface.

General

The work shall include placing a pavement reinforcing fabric into an asphalt tack coat with a minimum of wrinkles at the locations indicated on the plans.

Materials

a) Pavement Reinforcing Fabric (PRF) The fabric shall be 100 percent non-woven needle-punched polypropylene pavement reinforcing fabric which conforms to the following properties when tested in accordance with ASTM D1682-64, grab method. Fabric shall be retained in waterproof opaque packaged wrapping until immediate placement. The fabric shall meet the following requirements:

Elongation at Break, Warp Direction	65% (minimum)
Elongation at Break, Fill Direction	55% (minimum)
Mullen Burst Strength, psi	140 lbs (minimum)
Weight, oz/sq. yd.	4.0 (minimum)
Asphalt retention by Fabric	0.20 GSY Residual (minimum)
Tensile strength, either direction	90 lbs (minimum)

Equipment

a) Mechanical laydown equipment must be capable of handling full rolls of fabric and shall be capable of laying the fabric smoothly without excessive wrinkles and/or folds.

b) Rubber-tired rollers shall consist of two axles on which are mounted not less than 9 pneumatic-tired wheels in such a manner that the rear group of tires will not follow in the tracks of the forward group. The axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. The tires shall be uniformly inflated. The rollers shall be weighted as directed by the Engineer. The tractor or other towing equipment shall also be pneumatic-tired. Turning movements should be gradual and kept to a minimum to avoid movement or damage to the membrane.

Preparation of Existing Paved Surface

General

- a) All existing paved surfaces to be overlaid shall be cleaned of all dirt, water, vegetation and all other objectionable material, using power brooms and blowers, supplemented by hand brooms where necessary. Holes, cracks and depressions in the existing surface shall be filled in with asphaltic concrete surface course, in accordance with the requirements specified in Standard Specification C-1 "Asphaltic Concrete Pavement", and compacted to existing surface grade.
- b) Broken portions of existing pavement in a loose condition and underlying base material shall be removed and the resulting areas shall be filled in with a 5-inch aggregate base course, 2" asphaltic concrete single course and compacted to existing surface grade in accordance with the requirements specified in Standard Specifications B-1 "Aggregate Base Course" and C-1 "Asphaltic Concrete Pavement".
- c) Tack Coat. The prepared existing paved surface shall be approved by the Engineer before application of the tack coat and any areas not satisfactorily prepared shall be reworked to the satisfaction of the engineer.

Fabric Placement

Placement of (PRF) shall be made only under the following conditions:

- a) The ambient air temperature is above 40 degrees F. and rising.
- b) The pavement from surface to 2 inches below surface is absolutely dry and the pavement temperature is above 40 degrees F. and rising.
- c) The wind conditions are such that a satisfactory placement of the fabric can be achieved. The surface area to receive the fabric shall be sprayed with pavement type asphalt cement tack coat AC-20 (AR-4000) at a rate of 0.22-0.28 gallons per square yard. The exact rate of application will be determined by the Engineer. The asphalt shall be sprayed with a suitable metered truck. The temperature of the asphalt tack coat during spraying must be in the range of 290 degrees F. to 325 degrees F. The minimum width of asphalt application will be the fabric width plus 4 inches. Asphalt tack coat shall be applied not farther in advance of fabric so as to maintain sufficient asphalt temperature for fabric adherence to existing pavement.

The fabric shall be placed by approved mechanized equipment onto the asphalt tack coat with a minimum of wrinkles prior to the tack coat cooling substantially enough that the fabric will adhere to it. If fabric folds or wrinkles of 1/2 inch in height or greater exists, the fabric shall be slit and allowed to lay flat in the direction of paving. Use brooming or pneumatic rolling on all areas to maximize fabric contact with the pavement surface.

The fabric shall overlap from 3-4 inches at all joints except as otherwise shown. No joints shall be lapped with more than two layers of fabric. Transverse joints shall be shingled in the direction of the paving to prevent edge pick-up by the paving machine. As directed by the Engineer, additional sealant of about 0.20 GSY should be applied to fabric joints. Any fabric that is damaged after it has been placed is the responsibility of the contractor and shall be removed and replaced prior to the resurfacing operation.

Paving Operation: The paving operation shall closely follow the fabric placement in accordance with the requirements specified in Standard Specification C-4 "Asphaltic Concrete Overlay". In the event that the binder bleeds through the fabric before the hot-mix is placed and traffic over the area is desired by the Contractor, it will be necessary to blot the binder by spreading hot-mix on those areas so affected to prevent pick-up by traffic driving on the fabric. The temperature of the hot-mix shall never exceed 325 degrees F. A minimum compacted thickness of 1 inch is required for the pavement overlay.

Traffic Control

Traffic of all types shall be kept off the fabric until the hot-mix is placed, except for times when it is necessary that hauling equipment and pilot cars must travel on the fabric. The speed for all hauling equipment and pilot cars shall not exceed 15 miles per hour.

Supervision by Manufacturer's Representative: The manufacturer of the PRF shall be on the project to work with the contractor's personnel and to provide the necessary technical assistance to insure the satisfactory placement of the fabric. The representative shall not leave the project until the Engineer is satisfied that the Contractor has a full understanding of what is required to satisfactorily place the fabric, and not less than 2,000 square yards have been satisfactorily placed.

Measurement and Payment

a) Measurement. Pavement reinforcing fabric will be measured by the square yard, complete in place.

b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Pavement Reinforcing Fabric", which price shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. C-3

EMULSIFIED ASPHALT TACK COAT

Scope.

The Contractor shall furnish all labor, materials, and equipment perform all operations in connection with the application of a bituminous tack coat on an existing pavement.

Bituminous Material used for the tack coat shall conform to the following requirements:

(a) Emulsified Asphalt shall comply with the requirements of AASHTO Specification M-140, Type SS-1h.

(b) Test Report. The manufacturer's "Report of Laboratory Test" shall be furnished the Engineer for all emulsified asphalt to be used in the work prior to its being used by the Contractor.

Construction Methods.

(a) Weather Limitations. The tack coat shall be applied only when the existing surface is dry, when the atmospheric temperature is above 60 °F., and when existing weather conditions are favorable, at the direction of the Engineer.

(b) Preparation of Surface. Immediately before applying the tack coat the surface shall be cleaned of all objectionable material, using power brooms and blowers, supplemented by hand brooms where necessary.

(c) Quantities to be Applied. Bituminous material for the tack coat shall be applied in quantities of not less than 0.1 gallon nor more than 0.25 gallon per square yard. The exact quantity shall be determined by the Engineer to meet field conditions.

Equipment.

All equipment, tools, and machines, used in the performance of the work required by this section of the specifications shall be subject to the approval of the Engineer and shall be maintained in satisfactory working condition at all times.

(a) Bituminous Distributor. The distributor shall have pneumatic tires of such width and number that the load produced on the base surface shall not exceed 650 pounds per inch of tire width. It shall be so designed and equipped as to distribute the bituminous material uniformly on variable widths of surface at readily determined and controlled rates ranging from 0.05 to 2.0 gallons per square yard, with a pressure range of from 25 to 75 pounds per square inch, and with an allowable variation from any specified rate not exceeding 5 percent. Distributor equipment shall include an independently operated bitumen pump, tachometer, pressure gages, volume measuring devices, and a hose attachment suitable for applying bituminous material to spots missed by the distributor. The distributor shall be equipped for circulation and agitation of the bituminous

material.

(b) Power Brooms and Power Blowers. Blowers and brooms shall be of the power type, and shall be suitable for cleaning the surfaces to which the tack coat is to be applied.

Measurement and Payment.

(a) Measurement shall be by the ton of material used in the accepted work, corrected to tons at 60 F.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price bid for "Emulsified Asphalt Tack Coat" and shall constitute full compensation for all labor, material, equipment and incidentals necessary to complete the work as shown on the drawings and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. C-4

ASPHALTIC CONCRETE OVERLAY

Scope.

The Contractor shall furnish all labor, materials, equipment and perform all operations in connection with the construction of an asphaltic concrete overlay pavement on existing paved surface, complete, in strict accordance with the drawings and specifications.

General.

Asphaltic concrete overlay shall consist of fine and coarse mineral aggregate and mineral filler uniformly mixed with hot paving asphalt, placed and compacted on the previously prepared existing paved surface. The existing paved surface shall receive a tack coat prior to the placement of the overlay course.

Materials.

(a) The asphaltic concrete overlay shall consist of asphaltic concrete surface course and shall be in accordance with the applicable requirements specified in "ASPHALTIC CONCRETE PAVEMENT".

(b) The tack coat shall conform to the requirements specified in "EMULSIFIED ASPHALT TACK COAT".

Preparation of Existing Paved Surface.

(a) General. All existing paved surfaces to be overlaid shall be cleaned of all objectionable material, using power brooms and blowers, supplemented by hand brooms where necessary. Holes and depressions in the existing surface shall be filled in with asphaltic concrete binder course, in accordance with the requirements specified in "ASPHALTIC CONCRETE PAVEMENT", and compacted to existing surface grade.

(b) Broken Portions of existing pavement in a loose condition and underlying base material shall be removed and the resulting areas shall be filled in with a 5-inch aggregate base course, 1 1/2-inch asphaltic concrete binder course and compacted to existing surface grade in accordance with the requirements specified in "AGGREGATE BASE COURSE" and "ASPHALTIC CONCRETE PAVEMENT".

(c) Tack Coat. The prepared existing paved surface shall be approved by the Engineer before application of the tack coat and any areas not satisfactorily prepared shall be reworked to the satisfaction of the Engineer.

Placement of the Asphaltic Concrete Overlay.

After the prepared existing paved surface has been approved and tack coat has been placed, the asphaltic concrete overlay course shall be placed and compacted to the required thickness as indicated on the drawings.

Measurement and Payment.

(a) Measurement.

(1) Asphaltic concrete overlay will be measured by the square yard, complete in place.

(2) Preparation of existing paved surface will be measured by the square yard, complete.

(3) Tack coat will be measured and paid for as specified in "EMULSIFIED ASPHALT TACK COAT".

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the applicable contract price for "3/4-Inch Asphaltic Concrete Surface Course Overlay" and "Preparation of Existing Paved Surfaces For Overlay", which prices shall be full compensation for furnishing all labor, materials, including asphalt cement, tools, equipment, and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. C-4a

ASPHALTIC CONCRETE OVERLAY

OPEN GRADED MIX

Scope.

The Contractor shall furnish all labor, materials, equipment and perform all operations in connection with the construction of an asphaltic concrete overlay pavement on existing paved surface, complete in strict accordance with the drawings and specifications.

General.

Asphaltic concrete overlay shall consist of fine and coarse mineral aggregate and mineral filler uniformly mixed with hot paving asphalt, placed and compacted on the previously prepared existing paved surface. The existing paved surface shall receive a tack coat prior to the placement of the overlay course.

Materials.

(a) The asphalt concrete overlay shall consist of asphaltic course surface course and shall be in accordance with the applicable requirements specified in "ASPHALTIC CONCRETE PAVEMENT", except as follows:

- (1) Aggregate. At least 90% of the aggregate shall have at least one mechanically fractured face.
- (2) Gradation.

Asphalt-Mixture Overlay Course (Open Graded Mix)

Bituminous Mixture	Sieve Designation (Square Openings)	Percent by Weight (Passing)
Aggregate	1/2"	100
	3/8"	90 - 100
	No. 4	30 - 50
	No. 8	15 - 32
	No. 200	0 - 3
Asphalt Cement Percent		5 to 6%

(3) Mixing Temperature. A temperature of 225 °F to 250 °F shall be used and must be accurately controlled.

(4) The roller should be kept up close to the paver so that material does not have a chance to cool before being rolled.

- (b) The tack coat shall conform to the requirements specified in "EMULSIFIED ASPHALT TACK COAT".

Preparation of Existing Paved Surface.

(a) General. All existing paved surfaces to be overlaid shall be cleaned of all objectionable material, using power brooms and blower, supplemented by hand brooms where necessary. Holes and depressions in the existing surface shall be filled in with asphaltic concrete binder course, in accordance with the requirements specified in "ASPHALTIC CONCRETE PAVEMENT", and compacted to existing surface grade.

(b) Broken Portions of existing pavement in a loose condition and underlying base material shall be removed and the resulting areas shall be filled in with a 4-inch aggregate base course, 1 1/2-inch asphaltic concrete binder course and compacted to existing surface grade in accordance with the requirements specified in "AGGREGATE BASE COURSE" and "ASPHALTIC CONCRETE PAVEMENT".

(c) Tack Coat. The prepared existing paved surface shall be approved by the Engineer before application of the tack coat and any areas not satisfactorily prepared shall be reworked to the satisfaction of the Engineer.

Placement of the Asphaltic Concrete Overlay.

After the prepared existing paved surface has been approved and tack coat has been placed, the asphaltic concrete overlay course shall be placed and compacted to the required thickness as indicated on the drawings.

Measurement and Payment.

- (a) Measurement.

- (1) Asphaltic concrete overlay will be measured by the square yard, complete in place.

- (2) Tack coat will be measured and paid for as specified in "EMULSIFIED ASPHALT TACK COAT". (diluted)

- (b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the applicable contract price for "1 inch Asphaltic Concrete Overlay Course", which prices shall be full compensation for furnishing all labor, materials, including asphalt cement, tools, equipment, and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. D-1

PORTLAND CEMENT CONCRETE

Scope.

This is a general specification, which applies to all Portland Cement Concrete work performed under the contract.

Description.

Portland Cement Concrete shall consist of an intimate mixture of Portland Cement, fine aggregate, coarse aggregate and water. Admixtures will not be used unless approved by the Engineer.

Classification.

Concrete shall be Class "A" for structures and Class "B" for pavement, curb, gutter and sidewalk, unless otherwise designated on the plans.

Materials.

(a) Cement. Portland cement shall conform to the requirements of ASTM C-150, Type II, "low-alkali", with fly ash unless otherwise approved by the Engineer.

(b) Water for mixing shall be clean, fresh, and free from injurious amounts of oil, acid, alkali, or organic matter.

(c) Fine Aggregate shall be washed concrete sand of hard, strong, durable, and uncoated particles, and shall comply with the requirements of AASHTO Standard Specification M-6.

Fine aggregate shall be subject to approval. The grading shall conform to the grading shown in the above-mentioned standard specification.

(d) Coarse Aggregate shall be washed gravel or crushed stone consisting of hard, tough, durable particles, free from adherent coating. It shall contain no vegetable matter or soft, friable, thin, or elongated particles in quantities considered deleterious. Aggregate which has been disintegrated or weathered badly under exposure conditions similar to those which will be encountered by the work under consideration shall not be used. When crushed stone is used, the crusher shall be equipped with a screening system which will entirely separate the dust from the stone and convey it to a separate bin.

The substances designated shall not be present in excess of the following amounts:

Soft fragments	5%
Clay lumps	1/4%
Material removed by decantation	1%

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Course aggregate shall be subject to approval.

(e) Aggregate Grading Requirements. The grading for coarse aggregate shall conform to Table No. 1 as outlined in AASHTO Standard Specification M-30.

Proportioning.

(a) Basis. All concrete materials shall be proportioned by weight so as to produce a workable mixture in which the water content will not exceed the maximum specified.

(b) Measurement. One (1) 94-pound bag of cement will be considered as one (1) cubic foot in volume, and one (1) gallon of water as 8.33 pounds.

In calculating the total water content in any mix, the amount of moisture carried on the surface of the aggregate shall be included. In all cases, however, the amount of water to be used shall be the minimum necessary to produce a plastic mixture of the strength specified and of the desired density, uniformity and workability. In general, the consistency of any mix shall be that required for the specific placing conditions and methods of placement, and ordinarily the slump shall be between two inches and four inches, as established by the Engineer, when tested in accordance with AASHTO Standard Method T-119.

The total volume of aggregate to be used in each cubic yard of concrete shall be that necessary to produce a dense mixture of the required workability and strength.

(c) Table of Mix and Compressive Strength Requirements for Concrete.

Class	Maximum Water Content (Gallons per sack)	Cement Content (Sacks per Cu. Yd.)	Minimum Compressive Strength (Lbs. per square inch)	
			7 Days	28 Days
Structural "A"		6.5	5.8 - 6.2	1800 3000
Paving, Curb & Gutter & Sidewalk "B" Thrustblock		6.5	5.5 - 6.0	1500 2500
Backfill around Pipes - Concrete Pipe Encasement C		8.0	4.5 - 5.0	1300 2000

Control of the Quality of Portland Cement Concrete.

(a) Mix Design and Trial Batch. It shall be the Contractor's responsibility to have a mix designed and trial batch made according to these specifications by an approved laboratory. Two (2) concrete test cylinders shall be made in accordance with the requirements of AASHTO Standard Method T-23 and shall be cured and tested in accordance with the requirements of AASHTO Standard Method T-22 by said laboratory. Both cylinders shall be tested after 7 days curing. At least two (2) copies of the mix design and the compressive strength at 7 days shall be sent directly to the Engineer for approval before any concrete work can commence. If the compressive strength is lower than that required by these specifications for the strength of the class of concrete tested, the mix must be redesigned and the compressive strength determined in accordance with the procedure stated above.

The Contractor shall bear all expenses incurred in following the above procedure including the laboratory fees. Full compensation for this expenditure shall be included in the prices bid for the various Portland Cement Concrete items.

(b) Concrete Test Cylinders. The Engineer shall take representative samples of the concrete being placed to be used for making concrete test cylinders. Three (3) 7, 14, 28 day test cylinders shall be made from each representative sample, one cylinder to be tested after 7 days and the other to be tested after 28 days.

The Contractor shall furnish concrete for the test cylinders as requested by the Engineer. The Contractor shall furnish all the necessary equipment for making and transporting the test cylinders and shall bear all expenses incurred in handling and testing the test cylinders.

The concrete pour represented by the test cylinders may be approved by the Engineer on the basis of the 7 day test results in which case the corresponding 28 day test cylinder will not be tested. However, the Engineer reserves the right to approve or disapprove concrete pours based on the 28-day test regardless of the 7 day test result.

Concrete pours represented by 28-day test cylinders that did not achieve the minimum allowed compressive strength required by these specifications when tested shall be removed and replaced at the Contractor's expense.

(c) Mix Control. The exact proportions by weight of all materials entering into the concrete shall be changed as directed by the Engineer whenever necessary to obtain the specified strength and/or the required density, uniformity, and workability.

Mixing and Placing.

(a) Mixing Equipment shall be of the stationary plant or truckmixer type. Adequate equipment and facilities shall be provided for accurate measurement and control of all materials, and for readily changing the proportions of material. The minimum time for mixing each batch after all

materials are in the mixer shall be 1-1/2 minutes.

(b) Placing. Concrete shall be placed before initial set has occurred, and in no event after it has contained its water content for more than 45 minutes. All concrete shall be placed upon clean, damp surfaces free from running water. Concrete shall not be placed in water nor shall water be allowed to rise over freshly placed concrete until the concrete has obtained its final set. All concrete shall be deposited in approximately horizontal layers, and the concreting shall be carried on as a continuous operation, as far as practicable, until the placing in the section is completed. Concrete shall be spaded and/or internally vibrated during pouring operation to avoid honeycombs. Concrete shall not be placed when the ambient atmospheric temperature is below 35 degrees F. nor when concrete is likely to be subjected to freezing temperature before final set has occurred.

Curing and Protection.

(a) Protection. All concrete and grout work shall be properly protected by the Contractor. The work shall be protected from the elements, flowing water and defacement of any nature during the building operations. It shall be the Contractor's responsibility to correct any damages or defaced work throughout the execution of this contract.

(b) Membrane Curing.

(1) Membrane curing compound shall conform to the requirements of AASHTO Standard Specification M-148, clear or translucent containing fugitive dye.

(2) Field Performance. Acceptance for continued use will be based on satisfactory field performance under the conditions encountered on this project.

(3) Delivery. Each shipment of material shall be delivered to the job in the original containers.

(4) Application.

a. General. Curing compounds shall be agitated thoroughly by mechanical means during use, and shall be sprayed uniformly, in a single coat, by approved power-driven or other approved spraying equipment, on all concrete surfaces, at a rate not to exceed two hundred (200) square feet per gallon.

b. Unformed Surfaces. Upon completion of the specified or indicated finishing work and after the disappearance of free surface moisture, the exposed concrete surface shall be immediately coated with the curing compound as specified herein.

c. Formed Surfaces. The forms while in place shall be wet at all times to prevent opening at the joints and consequent rapid evaporation of moisture from the concrete. Immediately after the removal of forms and prior to the application of the curing compound, the concrete shall be moistened with water to the point where it will not readily absorb more moisture. After the wet

glaze has disappeared and there is an approach to surface dryness, the exposed concrete surface shall be completely coated with the curing compound as

specified above. If any of the curing compound is spilled or splashed on a surface for which the curing compound is prohibited, it shall be removed by sandblasting, wire brushing, or other means approved by the Engineer.

d. Time of Application. Application shall be made immediately following the final finishing operation. If a delay in application should occur which permits the concrete surface to dry, the surface of the concrete shall be thoroughly moistened with water immediately prior to the application of the compound. If, in the opinion of the Engineer, discontinuities or pinholes exist, a second coat shall be applied immediately to the affected areas.

(5) Protection of Treated Surfaces. Concrete surfaces to which membrane-curing compounds have been applied shall be kept free from all foot and vehicular traffic or other sources of abrasion for a period of seven (7) days after application of the curing treatment.

Payment.

No separate payment will be made for Portland Cement Concrete; all costs in connection therewith shall be included in the contract price bid for the item to which the work applies.

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STANDARD SPECIFICATION NO. D-10

ROLL TYPE CURB AND GUTTER

Scope.

The Contractor shall furnish all labor, materials and equipment necessary to construct roll type curb and gutter, as indicated on the drawings and as specified herein.

General.

The work shall include excavation and embankment, preparation of subgrade, placing and finishing of concrete, curing, and backfilling. This work shall conform to the requirements of "Roll Type Curb and Gutter" Standard Detail No. D-1 in these Specifications.

Materials.

Concrete shall be in accordance with the applicable requirements of "PORTLAND CEMENT CONCRETE". The concrete shall be Class "B".

Subgrade.

The subgrade shall be constructed true to grade and cross-section, as shown on the drawings. It shall be thoroughly watered and rolled or hand tamped until hard and solid before placing the concrete. All adobe or soft and spongy material shall be removed to a depth of not less than 6 inches below subgrade elevation, and the resulting space filled with earth, sand, or gravel of a quality that will compact when moistened. This material shall then be watered thoroughly and rolled or tamped until a firm and solid subgrade is secured. The completed subgrade shall be tested for grade and cross-section by means of a template extending the full depth of the curb and gutter and supported between the side forms. The subgrade and forms shall be thoroughly watered in advance of placing concrete.

Forms.

All forms shall have a smooth, straight upper edge and shall have a depth equal to the full depth of the concrete. Any warped, broken, excessively battered, or otherwise undesirable forms shall be removed from the site of the project when directed by the Engineer.

Only steel forms shall be used on straightedged pours. For curb returns and other short radius curves, steel plate or 1/4 inch plywood benders may be used, held rigidly in place with steel stakes, spreaders, and tie wires. Care shall be taken to insure that all spreaders and tie wires are removed before the initial set takes place. If plywood forms are used they shall be smooth, free from splits, knot holes and other surface defects. If steel plate forms are used, they shall be smooth, clean, and not excessively bent.

Curb and gutter sections on streets with longitudinal grades greater than 4 percent shall be keyed.

Form Oil.

A light application of form oil shall be sprayed on all forms used. Care shall be taken to insure that the forms are clean before spraying and that the entire face of the form is covered with the oil.

Expansion Joints.

Expansion joints shall be installed at the ends of all returns, at intervals not exceeding 16 feet, and where indicated on the Standard Details. The joints shall consist of 1/2-inch thick preformed fillers conforming to the requirements of A.A.S.H.T.O. Standard Specification M-33.

The expansion joints shall be vertical, straight, and at right angles to the longitudinal axis of the curb. The expansion joint filler shall be shaped to the full cross-section of the curb and gutter, allowing the top to be approximately 1/4 of an inch below the surface of the adjoining concrete, which shall be tooled with a 1/4-inch radius-edging tool. All concrete on the top of the expansion joint filler shall be removed. Bituminous premolded expansion joint material shall be of the dimensions specified and shall be of asphaltic or tar composition.

Placing Concrete.

The concrete shall be placed in the forms in layers. Each layer shall be tamped and spaded until the mortar entirely covers its surface. Every care shall be exercised in the spading along the faces of all forms and around all expansion joint fillers so as to insure a surface free from voids and honeycomb.

Finishing.

The troweling and floating operation shall begin immediately after the concrete is placed. The Contractor shall have a sufficient crew of finishers and helpers and shall so regulate the pour that this provision is observed at all times during the work.

The edge of the gutter and the top of the curb shall be edged with the proper edging tool, floated and finished with a steel trowel until it is true to grade and section. These surfaces shall then be brushed with a fine hairbrush with strokes perpendicular to the longitudinal axis of the curb. All visible surfaces and edges of the finished curb and gutter shall be uniform in color, shape, and appearance. The finished curb shall be true and be of uniform width, free from humps, sags, or other irregularities. When a straightedge 10 feet long is laid on the top or face of the curb or on the surface of gutter, the surface shall not vary more than 1/8 inch from the edge of the straightedge, except at grade changes or curves.

Markings in Gutters.

The Contractor shall stamp his name on all work done by him, not less than 3 times in every block, once at each corner property line, and once in the center of the block. The letters shall not be less than 3/4 of an inch in height, of proportionate width and shall be sunk into the surface not less

than 1/4 of an inch.

Curing.

Immediately after the surface of the curbs and gutters is finished the concrete shall be cured in accordance with the requirements of "PORTLAND CEMENT CONCRETE", using membrane curing compound.

Backfilling.

Immediately after forms are removed, the Contractor shall fill in behind the curb with good clean soil, free from rocks, and compact in 6-inch layers until the top of the curb is reached. Finish grading shall conform to the requirements of "PARKWAY GRADING" or "GRADING AREA BACK OF IMPROVEMENT", as applicable.

Measurement and Payment.

(a) Measurement. This item will be measured by the linear foot. The work will be measured separately for roll type curb and gutter.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Roll Type Curb and Gutter" complete in place, which price shall constitute full compensation for the excavation, backfill, and preparation of subgrade; for finishing and curing; and for all joints, materials, equipment, labor and incidentals necessary to complete the work in accordance with the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. D-11

CONCRETE PARKWAY PAVERS

Scope.

The Contractor shall furnish all materials, labor, and equipment to perform all work necessary to construct the concrete brick paver areas to the thickness and grades indicated on the drawings, and as specified herein.

General.

The work shall include excavation or embankment to prepare the subgrade, placing and compacting a layer of coarse sand and setting of precast bricks.

Materials.

Bricks shall be made of Portland Cement Concrete Class "A" as described in Specification D-1. Color pigment shall be iron oxide similar or equal to Mobay Bayferrox (120N rustic red). Contractor shall prepare a 3 cubic yard sample batch and cast example bricks for owner approval of materials and workmanship.

Subgrade Preparation.

The subgrade shall be constructed true to grade and cross-section as shown on the plans. It shall be thoroughly compacted to 95% density. Subgrade shall be watered in advance of placing coarse sand layer.

Coarse Sand Layer.

Sand shall consist of gravel, crushed or uncrushed, crushed stone, sand-gravel, sand silt, or other approved materials having similar characteristics. Sand shall be free from lumps or balls of clay and all other objectionable matter. Material gradation will be limited to 97-100% by weight passing a No. 10 sieve, 0-20% passing a No. 200 sieve with a maximum PI of 5.

Measurement and Payment.

- (a) Measurement. This item will be measured by the square foot completed and accepted in place.
- (b) Payment. The amount of completed and accepted work will be paid for at the contract price for "Concrete Parkway Pavers". Price shall include full compensation for furnishing all labor, materials, tools, equipment, and other incidental items necessary to complete the work as shown on the plans.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. D-2

STRUCTURAL CONCRETE

(A) Structural Concrete shall consist of furnishing all materials and constructing structures of the forms, shapes and dimensions shown on the Plans or as directed, using Portland Cement Concrete, in accordance with the details shown on the Plans and these specifications.

(B) Wood. All lumber used for forms shall be free from defects affecting the accuracy of shape, strength, rigidity, watertightness and smoothness of the surface. All lumber for forms above ground shall be plywood. All forms boards shall be securely fastened to the studding so that cupping cannot occur. Chamfer strips shall be of selected materials dressed to true line and uniform dimensions. The interior surfaces of all forms in contact with concrete surfaces which will be exposed in the finished work shall be smooth and even. No uneven or offset joints or single boards projecting so that their impressions are left in the concrete shall be allowed. Forms, as practicable, shall be so constructed that the formmarks will conform to the general lines of the structure. In general, grain of the lumber and direction of side joints shall be horizontal on wide faces and walls and vertical on narrow faces. If varying widths of panels are used, the wider panels shall be placed on the bottom and the narrower ones near the top. Panel end joints shall be staggered not less than three feet. Spreaders made of wood shall not be left in the concrete.

(C) Removal of Forms. In the determination of the time for removal of forms, considerations shall be given to the location and character of the structure, the weather and other conditions influencing the setting of the concrete and the materials used in the concrete.

The following period of time, between placement of concrete and removal of forms, shall be used as a guide:

Floor Slabs	7 - 14 days
Walls	6 - 24 hours

No forms shall be removed without approval.

(D) General Requirements. No concrete shall be placed in a foundation until the extent of excavation and the character of bearing material have been approved and no concrete shall be placed in any structure until the placement of reinforcing and the adequacy of the forms have been approved.

Concrete in shallow or thin sections shall be deposited in one continuous operation.

When required, concrete between expansion joints, as shown on the plans, shall be placed in one continuous operation.

Concrete shall be placed in horizontal layers not over 24 inches in depth, in forms. It will be so deposited that there will be a minimum of segregation. Dropping the concrete more than five feet without the use of approved pipes or tubes, depositing large quantities at any point and running or working it

along the forms or any other practice tending to cause segregation of the ingredients will not be allowed. Concrete shall be consolidated by vibration and tamping.

Care shall be taken to fill every part of the forms, to work the coarser aggregate back from the face and to force the concrete under and around the reinforcement without displacing it.

(E) Vibrating Concrete. All concrete in structures shall be consolidated by means of approved vibrators together with any other equipment necessary to perform the work as specified herein.

The minimum frequency of the vibrators shall be 4,500 vibration cycles per minute.

The vibrators shall be placed in the concrete and shall not be attached to the forms or reinforcing steel, nor shall they be allowed to vibrate against them.

Vibration shall be applied at the point of deposit and in the area of the freshly deposited concrete. The vibrator shall be inserted in and withdrawn from the concrete slowly. The vibration shall be of sufficient duration and intensity to compact the concrete thoroughly within 15 minutes after it has been deposited in the forms. Vibration shall not be continued at any one point to the extent that localized areas of grout are formed.

Application of vibrators shall be at points uniformly spaced and not farther apart than twice the radius over which the vibrator is visibly effective.

The Contractor shall provide sufficient apparatus to insure uninterrupted and continuous vibration of concrete in compliance with this specification.

General Requirements.

Immediately after the removal of forms all concrete surfaces shall be finished in accordance with the requirements specified herein.

If rock pockets or honeycombs are of such an extent and character as to affect materially the strength of the structure and to endanger the steel reinforcement, the Engineer may declare the concrete defective and require the removal and replacement of that portion of the structure affected at the expense of the contractor.

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

Finishing Green Concrete.

Class I Finish - All bolts, wires and rods shall be clipped and recessed. All holes, honeycombs, rock pockets and other surface imperfections shall be cleaned out, thoroughly moistened and carefully patched with mortar. Mortar shall be composed of one part of cement and two parts of fine sand. A

portion of the required cement for mortar shall be white as required to match the surrounding concrete.

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

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

General Requirements:

Careful attention shall be given by the contractor to the proper curing of all concrete.

Immediately after completion of machine or hand finishing of fresh concrete, the surface shall be given a curing treatment.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. D-3

REINFORCING STEEL

Scope.

The Contractor shall furnish all material, labor and equipment and perform all work necessary to properly fabricate and install reinforcing steel as designated on the plans and in these specifications. This is a general specification and shall apply to all reinforcing steel used under this contract.

Acceptable Type of Reinforcement.

(a) Reinforcing Steel for Concrete Structures shall conform to the requirements of the American Society for Testing Materials Specification A-15. Deformations shall conform to A.S.T.M. Specification A-305.

(b) Reinforcing Steel for Concrete Pavement shall conform to the requirements of either A.S.T.M. Specification A-15 or A-16. Deformations shall conform to A.S.T.M. Specification A-305.

(c) Mesh Reinforcing for concrete slabs shall conform to the requirements of the A.S.T.M. Specification A-185.

Reinforcing Steel.

(a) General. Reinforcement, fabricated to shapes and dimensions shown, shall be placed where indicated on the drawings. Before being placed, reinforcement shall be thoroughly cleaned of excessive rust, mill scale, coating, ice, or anything else that would reduce or destroy the bond. Reinforcement reduced in section shall not be used. Following any substantial delay in the work, previously placed reinforcement left for future bonding shall be inspected and cleaned. Reinforcement shall not be bent or straightened in a manner injurious to the material. Bars with kinks or bends not shown on the drawings shall not be placed. The heating of reinforcement for bending or straightening will be permitted only if the entire operation is approved by the Engineer. In slabs, reinforcement shall not be spliced at points of maximum stress. At points where bars lap or splice, including distribution steel, a wire-tied minimum lap or 40 bar diameters shall be provided unless otherwise shown. Splices in adjacent bars shall be staggered.

(b) Design. Unless otherwise indicated on the drawings, the details of reinforcing steel shall conform to the ACI Building Code ACI 318.

(c) Shop Drawings. Shop detail and placing drawings for all reinforcing steel shall be furnished and approved before proceeding with fabrication.

(d) Supports. With the exception of temperature reinforcement which shall be tied to main steel at approximately 24 inches on center, reinforcement shall be accurately placed and securely tied at all intersections and spliced with 19-gage black annealed wire, and shall be securely held in position during the placing of concrete by spacers, chairs, or other approved supports. Wire-tie ends shall point away from the form. Slabs on grade and footing reinforcement bars or mesh shall be supported on precast concrete blocks, spaced at intervals required by size of reinforcement used, to keep reinforcement the minimum height specified above the underside of slab or footing.

Measurement.

This item will not be measured for payment.

Payment.

Payment for reinforcing steel shall be included in the price bid for the item in which the reinforcing steel is located, and shall be full compensation for all labor, materials, equipment, hauling, cleaning and other expenses necessary to complete the work as shown on the plans and as herein specified.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. D-4

VERTICAL TYPE CURB AND GUTTER

Scope.

The Contractor shall furnish all labor, materials and equipment necessary to construct vertical type curb and gutter as indicated on the drawings and as specified herein.

General.

The work shall include excavation and embankment, preparation of subgrade, placing and finishing of concrete, curing, and backfilling. This work shall conform to the requirements of "Vertical Type Curb and Gutter" Standard Detail No. D-4 in these Specifications.

Materials.

Concrete shall be in accordance with the applicable requirements of "PORTLAND CEMENT CONCRETE" in these Specifications. The concrete shall be Class "B".

Subgrade.

The subgrade shall be constructed true to grade and cross-section, as shown on the drawings. It shall be thoroughly watered and rolled or hand tamped until hard and solid before placing the concrete. All adobe or soft and spongy material shall be removed to a depth of not less than 6 inches below subgrade elevation, and the resulting space filled with earth, sand, or gravel of a quality that will compact when moistened. This material shall then be watered thoroughly and rolled or tamped until a firm and solid subgrade is secured. The completed subgrade shall be tested for grade and cross-section by means of a template extending the full depth of the curb and gutter and supported between the side forms. The subgrade and forms shall be thoroughly watered in advance of placing concrete.

Forms.

All forms shall have a smooth, straight upper edge and shall have a depth equal to the full depth of the concrete. Any warped, broken, excessively battered, or otherwise undesirable forms shall be removed from the site of the project when directed by the Engineer. Only steel forms shall be used on straight edged pours. For curb returns and other short radius curves, steel plate or 1/4 inch plywood benders may be used, held rigidly in place with steel stakes, spreaders, and tie wires. Care shall be taken to insure that all spreaders and tie wires are removed before the initial set takes place. If plywood forms are used they shall be smooth, free from splits, knot holes and other surface defects. If steel plate forms are used, they shall be smooth, clean, and not excessively bent.

In no event shall any form be removed while the concrete is sufficiently plastic to slump upon removal of the form. No back of curb forms shall be removed in less than twelve (12) hours after the finishing has been completed.

Curb and gutter sections on streets with longitudinal grades greater than 4

percent shall be keyed.

Form Oil.

A light application of form oil shall be sprayed on all forms used. Care shall be taken to insure that the forms are clean before spraying and that the entire face is covered with oil.

Expansion Joints.

Expansion joints shall be installed at the ends of all returns, at intervals not exceeding 16 feet, and where indicated on the Standard Details. The joints shall consist of 1/2 inch thick preformed fillers conforming to the requirements of A.A.S.H.T.O. Standard Specification M-33. Bituminous premolded expansion joint material shall be of the dimensions specified and shall be of asphaltic or tar composition.

The expansion joints shall be vertical, straight, and at right angles to the longitudinal axis of the curb. The expansion joint fillers shall be shaped to the full cross-section of the curb and gutter, allowing the top to be approximately 1/4-inch below the surface of the adjoining concrete, which shall be tooled with 1/4-inch radius edging tool. All concrete on the top of the expansion joint filler shall be removed.

Placing Concrete.

The concrete shall be placed in the forms in layers. Each layer shall be tamped and spaded until the mortar entirely covers its surface. Every care shall be exercised in the spading along the faces of all forms and around all expansion joint fillers so as to insure a surface free from voids and honeycomb.

Finishing.

The troweling and floating operation shall begin immediately after the concrete is placed. The Contractor shall have a sufficient crew of finishers and helpers and shall so regulate the rate of pour that this provision is observed at all times during the work.

The edge of the gutter shall be edged with the proper edging tool, troweled smooth, and finished with a fine hair brush with strokes parallel to the line of the curb. The face and top of the curb shall have all form marks and blemishes troweled out and shall be finished smooth with a street trowel. All visible surfaces and edges of the finished curb and gutter shall be uniform in color, shape and appearance. The face of the finished curb shall be true and straight, and the top surface of curbs and gutters shall be of uniform width, free from humps, sags, or other irregularities. When a straightedge 10 feet long is laid on the top or face of the curb or on the surface of the gutter, the surface shall not vary more than 1/8 inch from the edge of the straightedge, except at grade changes or curves.

Markings in Gutter.

The Contractor shall stamp his name on all work done by him, not less than 3 times in every block, once at each corner property line, and once in the center of the block. The letters shall not be less than 3/4 of an inch in height, of proportionate width and shall be sunk into the surface not less than 1/4 of an inch.

Curing.

Immediately after the surface of the curbs and gutters is finished, the concrete shall be cured in accordance with the requirements of "PORTLAND CEMENT CONCRETE" in these specifications, using membrane curing compound.

Backfilling.

Immediately after forms are removed, the Contractor shall fill in behind the curb with good clean soil, free from rocks, and compact in 6 inch layers until the top of the curb is reached. Finish grading shall conform to the requirements of "PARKWAY GRADING" or "GRADING AREA BACK OF IMPROVEMENT", as applicable.

Measurement and Payment.

(a) Measurement. This item will be measured by the linear foot. The work will be measured separately for "6" Vertical Type Curb and Gutter".

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "6" Vertical Type Curb and Gutter" complete in place, which price shall constitute full compensation for the excavation, backfill, and preparation of subgrade; for finishing and curing; and for all joints, materials, equipment, labor and incidentals necessary to complete the work in accordance with the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. D-5

PORTLAND CEMENT CONCRETE SIDEWALK

Scope.

The Contractor shall furnish all labor, materials and equipment and perform all work necessary to construct the Portland Cement Concrete sidewalks, of the thickness and to the lines and grades indicated on the drawings, and as specified herein.

General.

The work shall include excavation and embankment, preparation of subgrade, placing and finishing of concrete, curing, and backfilling. The sidewalks shall be 4-inches thick unless otherwise noted on the plans. The work shall conform to the requirements of "Sidewalks" , Standard Detail No. 30 in these specifications.

Materials.

Concrete shall be in accordance with the requirements of "PORTLAND CEMENT CONCRETE" in these specifications. The concrete shall be Class "B".

Subgrade Preparation.

The subgrade shall be constructed true to grade and cross-section, as shown on the drawings. It shall be thoroughly watered and rolled or hand tamped until hard and solid before placing the concrete. All adobe or soft and spongy material shall be removed to a depth of not less than 3 inches below subgrade elevation, and the resulting space filled with earth, sand or gravel of a quality that will compact when moistened. This material shall then be watered thoroughly and rolled or tamped until a firm and solid foundation is secured.

The completed subgrade shall be tested for grade and cross-section by means of a template extending the full depth of the sidewalk and supported between the side forms. The subgrade and forms shall be thoroughly watered in advance of placing concrete.

Forms.

Only steel forms shall be used on straight edged pours and shall be straight, with a true, smooth upper edge and a depth equal to the full depth of the finished sidewalk. They shall be set with the upper edge true to line and grade and shall be held rigidly in place by stakes placed on the outside of the forms and set flush with the top of the form.

For walk returns and other short radius curves, steel plate or 1/4-inch plywood benders may be used, held rigidly in place with steel stakes. If plywood forms are used they shall be smooth, free from splits, knot holes and have a depth of at least the full depth of the concrete which they are to form. If steel plate forms are used they shall be smooth, clean and not

excessively bent. They shall have a straight upper edge which is not excessively battered and shall be at least the full depth of the concrete which they are to form. Any undesirable forms shall be removed from the site of the project at the request of the Engineer.

No walk forms shall be removed in less than 12 hours after the finishing has been completed.

Form Oil.

A light application of form oil shall be sprayed on all forms used for this work. Care shall be taken to insure that the forms are clean before spraying and the entire face of the form is covered.

Construction.

After the concrete for the sidewalk has been placed between the side forms, a strike-off, guided by the side forms, shall be used to bring the surface to the proper section to be compacted. The concrete shall then be tamped with a tamper consisting of wire mesh having square openings of not less than 1/8 inch nor more than 1/4 inch in size.

The surface shall then be finished to grade and cross-section with a wooden float. After floating, the surface shall be troweled smooth and edged with appropriate edging tools.

The surface of sidewalks shall be marked every 4 feet, the marking to be done with a tool which will leave the corners rounded and a depth of mark not less than 1/2 of an inch.

The surface shall then be given a final finish with a hair push broom, lightly drawn over the surface transverse to the line of traffic.

When a 10-foot straightedge is placed in the sidewalk, the surface shall not vary more than 1/8-inch from the edge of the straightedge, except at grade changes, and the finished surface shall be free from blemishes.

Expansion Joints.

Expansion joints shall be installed at intervals not exceeding 16 feet and at the junction of the sidewalk with the curb and gutter. Expansion joints shall be formed at the time of pouring by placing premolded expansion joint strips 1/2 inch thick and fastening them firmly in place so that there will be no movement during the pouring operation.

An edger shall be used along each side of the strip. The joints shall be vertical, plumb, and at right angles to the centerline of the street.

Bituminous premolded expansion joint material shall be of the dimensions specified and shall be of asphaltic or tar composition conforming to the requirements of AASHTO Standard Specification M-33.

Markings on Sidewalk.

The Contractor shall stamp his name on all work done by him, not less than 3 times in every block, one at each corner property line, and once in the center of the block. The letters shall not be less than 3/4 inch in height, of proportionate width and shall be sunk into the surface not less than 1/4 inch.

Curing.

Immediately after the surface of the sidewalk is finished, the concrete shall be cured in accordance with the requirements of the "PORTLAND CEMENT CONCRETE" section in these specifications, using membrane curing compound.

Measurement and Payment.

(a) Measurement. This item will be measured by the square foot.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "PORTLAND CEMENT CONCRETE SIDEWALKS", or "6" - INCH PORTLAND CEMENT CONCRETE SIDEWALKS", whichever shall apply, which price shall constitute full compensation for excavation, backfill, preparation of subgrade, forming, finishing, curing, labor, materials, equipment, and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. D-6

PORTLAND CEMENT CONCRETE DRIVEWAYS

Scope.

The Contractor shall furnish all material, labor, equipment and perform all work necessary to construct Portland Cement Concrete driveways as shown on the drawings and as specified herein.

Definitions.

(a) "Driveway Entrance" shall be understood to mean that portion of the driveway which meets a depressed curb and is warped up for at least 4 feet in order to control drainage. A "Driveway Entrance" shall always accompany a depressed curb section.

(b) "Driveway Extension" shall be understood to mean that portion of the driveway which extends from the back of a "Driveway Entrance", Roll Type Curb and Gutter, or Sidewalk, to the property line or existing paved driveway. It shall lie in a plane and be constructed only at the request of the individual owning the driveway concerned.

(c) "Driveway" shall be understood to include either or both "Driveway Entrance" and "Driveway Extension", according to the desire of the property owner involved.

General.

The work shall include excavation and embankment, preparation of subgrade, placing and finishing concrete, curing and backfilling. The work shall conform to the requirements of "DRIVEWAY ENTRANCE" Standard Nos. 27 or 28 on the Plans.

It shall be the Contractor's responsibility to contact each property owner regarding the location of his individual "Driveway" and to establish whether or not said owner desires a "Driveway Extension" to his property line or existing paved driveway.

Materials.

Concrete shall be in accordance with the applicable requirements of "PORTLAND CEMENT CONCRETE" of these Specifications. The concrete shall be Class "B".

Subgrade.

The subgrade shall be constructed true to grade and cross-section, as shown on the drawings. It shall be thoroughly watered and rolled or hand tamped until hard and solid before placing the concrete. All adobe or soft and spongy material shall be removed to a depth of not less than 6 inches below subgrade elevation, and the resulting space filled with earth, sand, or gravel of a quality that will compact when moistened. This material shall then be watered thoroughly and compacted by rolling or tamping to at least eighty-five (85) percent of the theoretical maximum density. The subgrade and forms shall be thoroughly watered in advance of placing concrete.

Forms.

All forms shall have a smooth, straight upper edge and shall have a depth equal to the full depth of the concrete. Any warped, broken, excessively battered or otherwise undesirable forms shall be removed from the site of the project when directed by the Engineer.

Either steel or wood forms may be used, held rigidly in place with steel stakes. If wood forms are used they shall be smooth, free from splits, knotholes and other surface defects. If steel plate forms are used, they shall be smooth, clean, and not excessively bent. No driveway forms shall be removed in less than twelve (12) hours after the finishing has been completed.

Form Oil.

A light application of form oil shall be sprayed on all forms used. Care shall be taken to insure that the forms are clean before spraying and that the entire face of the form is covered with the oil.

Expansion Joints.

Expansion joints shall be installed at the ends of all returns at intervals not exceeding 20 feet, and where indicated on the Standard Details. The joints shall consist of 1/2 inch thick preformed fillers conforming to the requirements of A.A.S.H.T.O. Standard Specification M-33. Bituminous premolded expansion joint material shall be of the dimensions specified and shall be asphaltic or tar composition.

The expansion joints shall be vertical, straight, and at right angles to the longitudinal axis of the curb. The expansion joint fillers shall be shaped to the full cross-section of the driveways, allowing the top to be approximately 1/4-inch below the surface of the adjoining concrete, which shall be tooled with a 1/4-inch radius edging tool. All concrete on the top of the expansion joint filler shall be removed.

Placing Concrete.

The concrete shall be placed in the forms in layers. The top layer shall be tamped and spaded until the mortar entirely covers its surface. Every care shall be exercised in the spading along the faces of all forms so as to insure the surface free from voids and honeycomb.

Finishing.

The troweling and floating operation shall begin immediately after the concrete is placed. The Contractor shall have a sufficient crew of finishers and helpers and shall so regulate the rate of pour that this provision is observed at all times during the work.

The surface of the driveway entrance shall be edged with the proper edging tools, floated and finished with a steel trowel. The surface shall then be brushed with fine hair brush with strokes parallel to the line of the curb. All visible surfaces and edges of the finished driveway entrance shall be uniform in color, shape and appearance.

Curing. Immediately after the surface of the driveway is finished, the concrete shall be cured in accordance with the requirements of "PORTLAND CEMENT CONCRETE" in these Specifications, using membrane curing compound.

Backfilling.

Immediately after forms are removed, the contractor shall backfill around the edges of the driveway with clean soil, free from rocks, and compact in layers until the top of the driveway is reached. Finished grading shall conform to the requirements of "PARKWAY GRADING" or "GRADING AREA BACK OF IMPROVEMENT", as applicable.

Measurement and Payment.

(a) Measurement. This item will be measured by the square foot.

(b) Payment. The amount of completed and accepted work measured, as provided above, will be paid for at the contract price for "4-inch, or 6-inch Portland Cement Concrete Driveways" whichever shall apply, which price shall be full compensation for excavation, backfill, preparation of subgrade, finishing, curing, labor, materials, equipment and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. D-7

PORTLAND CEMENT CONCRETE VALLEY ENTRANCES

Scope.

The Contractor shall furnish all material, labor, equipment and perform all work necessary to construct Portland Cement Concrete alley entrances as shown on the drawings and as specified herein.

General.

The work shall include excavation and embankment, preparation of subgrade, placing and finishing concrete, curing and backfilling. The work shall conform to the requirements of "ALLEY ENTRANCES" Standard Detail No. D-7 in these Specifications.

Materials.

Concrete shall be in accordance with the applicable requirements of "PORTLAND CEMENT CONCRETE" in these Specifications. The concrete shall be Class B.

Subgrade.

The subgrade shall be constructed true to grade and cross-section, as shown on the drawings. It shall be thoroughly watered and rolled or hand tamped until hard and solid before placing the concrete. All adobe or soft and spongy material shall be removed to a depth of not less than 6 inches below subgrade elevation, and the resulting space filled with earth, sand, or gravel of a quality that will compact when moistened. This material shall then be watered thoroughly and compacted by rolling or tamping to at least eighty-five (85) percent of the theoretical maximum density. The subgrade and forms shall be thoroughly watered in advance of placing concrete.

Forms.

All forms shall have a smooth, straight upper edge and shall have a depth equal to the full depth of the concrete. Any warped, broken, excessively battered, or otherwise undesirable forms shall be removed from the site of the project when directed by the Engineer.

Either steel or wood forms may be used, held rigidly in place with steel stakes. If wood forms are used they shall be smooth, free from splits, knotholes and other surface defects. If steel forms are used, they shall be smooth, clean, and not excessively bent. No alley entrance forms shall be removed in less than twelve (12) hours after the finishing has been completed.

Form Oil.

A light application of form oil shall be sprayed on all forms used. Care shall be taken to insure that the forms are clean before spraying and that the entire face of the form is covered with the oil.

Expansion Joints.

Expansion joints shall be installed at the ends of all returns at intervals not exceeding 20 feet, and where indicated on the Standard Details. The joints shall consist of 1/2 inch thick preformed fillers conforming to the requirements of A.A.S.H.T.O. Standard Specification M-33. Bituminous premolded expansion joint material shall be of the dimensions specified and shall be of asphaltic or tar composition.

The expansion joints shall be vertical, straight, and at right angles to the longitudinal axis of the curb. The expansion joint fillers shall be shaped to the full cross-section of the alley entrance, allowing the top to be approximately 1/4-inch below the surface of the adjoining concrete, which shall be tooled with a 1/4-inch radius edging tool. All concrete on the top of the expansion joint filler shall be removed.

Placing Concrete.

The concrete shall be placed in the forms in layers. The top layer shall be tamped and spaded until the mortar entirely covers its surface. Every care shall be exercised in the spading along the faces of all forms so as to insure that the surface will be free from voids and honeycomb.

Finishing.

The troweling and floating operation shall begin immediately after the concrete is placed. The Contractor shall have a sufficient crew of finishers and helpers and shall so regulate the rate of pour that this provision is observed at all times during the work.

The surface of the alley entrance shall be edged with the proper edging tool, floated and finished with a steel trowel. The surface shall then be brushed with a fine hairbrush with strokes parallel to the line of the curb. All visible surfaces and edges of the finished alley entrance shall be uniform in color, shape, and appearance.

Curing.

Immediately after the surface of the alley entrance is finished, the concrete shall be cured in accordance with the requirements of "PORTLAND CEMENT CONCRETE" of these Specifications, using membrane-curing compound.

Backfilling.

Immediately after the forms are removed, the Contractor shall backfill around the edges of the alley entrance with clean soil, free from rocks, and compact in layers until the top of the driveway is reached. Finish grading shall conform to the requirements of "PARKWAY GRADING" or "GRADING AREA BACK OF IMPROVEMENT", as applicable.

Measurement and Payment.

(a) Measurement. This item will be measured by the square foot.

(b) Payment. The amount of completed and accepted work measured, as provided above, will be paid for at the contract price for "6" Portland Cement Concrete Alley Entrances", which price shall be full compensation for excavation, backfill, preparation of subgrade, finishing, curing, labor, materials, equipment and incidentals necessary to the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. D-8

PORTLAND CEMENT CONCRETE VALLEY GUTTER AND APRONS

Scope.

The Contractor shall furnish all labor, materials and equipment necessary to construct the valley gutter and aprons to the thickness, lines and grades indicated on the drawings and as specified herein.

General.

The work shall include placing, finishing and curing of concrete and installation of reinforcing steel as shown on the drawings and Standard Details.

Materials.

Concrete materials shall be in accordance with the applicable requirements of "PORTLAND CEMENT CONCRETE", as addressed elsewhere within these Specifications. The Concrete shall be Class "B".

Forms.

All forms shall have a smooth, straight upper edge and shall have a minimum depth equal to that of the depth of the concrete to be placed. Any warped, broken, excessively battered or otherwise undesirable forms shall be removed from the project.

Only steel forms shall be used on straight edged concrete placements. Care shall be taken to insure that all spreaders and tie wires are removed prior to the initial set of the concrete. Steel plate forms shall be smooth, clean and free from excessive deformations.

Form removal shall not be initiated prior to twenty-four (24) hours after finishing of the concrete has been completed, unless permitted by the Engineer.

Form Oil.

A light application of form oil shall be placed on all forms used to contain the concrete placement. Care shall be exercised to insure that all forms are cleaned prior to oil application and that the full surface is coated.

Expansion Joints.

Expansion joints shall be established as shown on the Standard Detail, appended hereinafter. The joints shall consist of one-half (1/2) inch thick preformed fillers conforming to the requirements of AASHTO Standard Specification M-33. Bituminous premolded expansion joint material shall be of the dimension specified and shall be of asphaltic or tar composition.

The expansion joints shall be vertical, straight and at right angles to the longitudinal axis of the gutters, unless shown otherwise on the Standard Detail. Expansion joint fillers shall be shaped to the full cross-section of the adjacent concrete, with the top of the filler approximately one-quarter (1/4) inch below the surface of the adjacent concrete. Concrete abutting the filler shall be tooled with an edger having a one-quarter (1/4) inch radius. All concrete shall be cleaned from the top of the expansion joint filler.

Placing Concrete.

Concrete shall be placed within forty-five (45) minutes of batching. All concrete shall be placed upon a clean, damp surface that is free from standing water. Concrete shall not be placed in water nor shall water be allowed to rise over freshly placed concrete until the concrete has reached its final set. All concrete shall be deposited in approximately horizontal layers and the concrete placement shall be carried out as a continuous operation, as far as is practical, until the placing of a section is completed. Concrete shall not be placed when the ambient atmospheric temperature is below 35 F, nor when it is likely that the concrete will be subjected to freezing temperatures before final set has occurred.

Finishing.

Trowelling and floating operations shall begin immediately after placement of the concrete. The Contractor shall provide sufficient personnel to man the placement and finishing activities and shall regulate the rate of placement such that placement does not outstrip the finishing activity.

The edges of the valley gutter and aprons shall be edged using a proper edging tool, trowelled smooth and finished with a fine-haired brush or broom, using strokes parallel to the line of flow of the valley gutters and adjacent vertical curb. All visible surfaces and edges of the finished product shall be uniform in color, shape and appearance. The top surface of the valley gutter and aprons shall be free from humps, sags and other irregularities. When a ten (10) foot long straightedge is placed along or parallel to the longitudinal axis of the valley gutter surface, the surface shall not vary more than one-eighth (1/8) inch from the edge of the straightedge, except at grade changes or curves.

Markings in Gutters.

The Contractor shall stamp his name on all work completed under his auspices. The letters shall not be less than three-quarters (3/4) inch in height, or proportionate width and shall be depressed into the surface not less than one-quarter (1/4) inch.

Curing.

Immediately after the surface of the valley gutter and aprons is finished, the Contractor shall cure the concrete in accordance with the requirements of "PORTLAND CEMENT CONCRETE" of these Specifications, using a membrane curing compound.

Measurement and Payment.

(a) Measurement. This item will be measured by the square foot and shall be exclusive of that surface measured and paid for under various types of curb/curb and gutter.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the Contract price for "Portland Cement Concrete Valley Gutters and Aprons" complete in place, which price shall constitute full compensation for all placement, finishing and curing activities and shall include all materials, labor, equipment and incidentals necessary to complete the work in accordance with the plans as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. D-9

SINGLE CURB

Scope.

The Contractor shall furnish all labor, material and equipment necessary to construct single curb, as indicated on the drawings and as specified herein.

General.

The work shall include excavation and embankment, preparation of subgrade, placing and finishing of concrete, curing and backfilling. The work shall conform to the requirements of "Single Curb" Standard Detail No. D-9 in these Specifications.

Materials.

Concrete shall be in accordance with the applicable requirements of "PORTLAND CEMENT CONCRETE". The concrete shall be Class "B".

Subgrade.

The subgrade shall be constructed true to grade and cross-section, as shown on the drawings. It shall be thoroughly watered and rolled or hand tamped until hard and solid before placing the concrete. All adobe or soft spongy material shall be removed to a depth of not less than 6 inches below subgrade elevation, and the resulting space filled with earth, sand, or gravel of a quality that will compact when moistened. This material shall then be secured. The subgrade and forms shall be thoroughly watered in advance of placing concrete.

Forms.

All forms shall have a smooth, straight edge and shall have a depth equal to the full depth of the concrete. Any warped, broken, excessively battered, or otherwise undesirable forms shall be removed from the site of the project when directed by the Engineer.

Only steel forms shall be used on straight edged pours. For curb returns and other short radius curves, steel plate or 1/4-inch plywood benders may be used, held rigidly in place with steel stakes, spreaders, and tie wires. Care shall be taken to insure that all spreaders and tie wires are removed before the initial set takes place. If plywood forms are used they shall be smooth, free from splits, knot holes and other surface defects. If steel plate forms are used, they shall be smooth, clean, and not excessively bent.

Curb and gutter sections on streets with longitudinal grades greater than 4% shall be keyed.

Form Oil.

A light application of form oil shall be sprayed on all forms used. Care shall be taken to insure that the forms are clean before spraying and the entire face of the form is covered with the oil.

Expansion Joints.

Expansion joints shall be installed at the ends of all returns at intervals not exceeding 16 feet, and where indicated on the Standard Details. The joints shall consist of 1/2 inch thick preformed fillers conforming to the requirements of A.A.S.H.T.O. Standard Specification M-33. Bituminous premolded expansion joint material shall be of the dimensions specified and shall be of asphaltic or tar composition.

The expansion joints shall be vertical, straight, and at right angles to the longitudinal axis of the curb. The expansion joint fillers shall be shaped to the full cross-section of the curb, allowing the top to be approximately 1/4-inch below the surface of the adjoining concrete, which shall be tooled with a 1/4-inch radius edging tool. All concrete on the top of the expansion joint filler shall be removed.

Placing Concrete.

The concrete shall be placed in the forms in layers. Each layer shall be tamped and spaded until the mortar entirely covers its surface. Every care shall be exercised in the spading along the faces of all forms and around all expansion joint fillers so as to insure a surface free from voids and honeycomb.

Finishing.

The troweling and floating operation shall begin immediately after the concrete is placed. The Contractor shall have a sufficient crew of finishers and helpers and shall so regulate the rate of pour that this provision is observed at all times during the work.

The face and top of the curb shall be edged with the proper edging tool and floated and finished with a smooth wood float until it is true to grade and section and uniform in texture. Immediately after removing the front curb form, the face of the curb shall be worked with a wood float until all blemishes, form marks, and tool marks have been removed. The surface of the top and face shall, while still wet, be lightly brushed. All visible surfaces and edges of the finished curb shall be uniform in color, shape, and appearance. The face of the finished curb shall be true and straight, and the top surface of curbs and gutters shall be of uniform width, free from humps, sags, or other irregularities. When a straightedge 10 feet long is laid on the top or face of the curb or on the surface of gutters, the surface shall not vary more than 1/8 inch from the edge of the straightedge, except at grade changes or curves.

Curing.

Immediately after the surface of the curb is finished, the concrete shall be cured in accordance with the requirements of "PORTLAND CEMENT CONCRETE", using membrane-curing compound.

Backfilling.

Immediately after forms are removed, the Contractor shall fill in behind the curb with good clean soil, free from rocks, and compact in 6-inch layers until the top of the curb is reached. Finished grading shall conform to the requirements of "PARKWAY GRADING" or "GRADING AREA BACK OF IMPROVEMENT", as applicable.

Measurement and Payment.

(a) Measurement. This item will be measured by the linear foot.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Single Curb", which price shall constitute full compensation for the excavation, backfill, and preparation of subgrade; for finishing and curing; and for all joints, materials, equipment, labor and incidentals necessary to complete the work in accordance with the plans and as specified.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-1

EXCAVATION

General.

Excavation shall include the loosening, removing, loading, transporting, depositing, and compacting in final location all materials, wet and dry, necessary to be removed for purposes of construction; the furnishing, placing, and removing of all sheeting and bracing; all pumping and drainage of excavation; the supporting of structures above and below the ground; the handling of all water encountered in the excavations; all backfilling around structures and backfilling of all trenches and pits; and all other incidental work as shown on the Plans and as specified.

All excavation removed shall be disposed of under and around the structures, as shown on the Plans and as specified herein, or shall be wasted or disposed of as directed by the Engineer.

Character of Material.

The Contractor must satisfy himself regarding the character and amount of loam, clay, sand, quicksand, gravel, hardpan, rock, water, and all other material to be encountered and work to be performed.

Clearing and Grubbing.

The site of all excavation, embankments, and fills shall be first cleared of buildings, fences, lumber, walls, stumps, brush, weeds and rubbish, trees, and loose boulders, which shall be removed or disposed of.

Trenches and Tunneling.

The Contractor shall make all necessary excavations to construct the work shown on the Plans.

Unless otherwise specifically noted on the Plans, the pipe shall be laid in open trenches.

If the bottom of the excavation is found to consist of rock or any material that by reason of its hardness cannot be excavated to give a uniform bearing surface, said rock or other material shall be removed for at least 3 inches below the bottom of the pipe and be refilled to grade with sand or sand and gravel thoroughly tamped into place, at the Contractor's expense for all labor and material.

The use of trenching and backfilling machinery will be allowed.

Width and Depth of Trench.

The minimum width of trench for vitrified clay pipe or reinforced concrete pipe shall be not less than the nominal inside diameter of the pipe plus 15 inches, but in no case shall it be less than 24 inches. The maximum width of trench for pipes 24 inches and less shall be the outside diameter of the pipe (barrel) plus 18 inches. For pipe over 24 inches in diameter up to and including pipe 36 inches in diameter, the maximum trench width shall be the outside diameter of the pipe (barrel) plus 24 inches.

If any trench, through neglect of the Contractor, be excavated below the bottom grade as required by the Plans, it shall be refilled to grade with sand or sand and gravel thoroughly compacted in place, at the Contractor's expense for all labor and materials.

Length of Trench.

The trench shall be opened not more than 500 feet in advance of the pipe laying, or construction, nor left unfilled more than 500 feet in the rear thereof, unless permitted or ordered by the Engineer.

Shoring.

Where necessary, all trenches and other excavations shall be properly sheeted and braced, to furnish acceptable working conditions. The bracing shall be so arranged as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength. Any damage to structures occurring through settlements, water or earth pressures, slides, caves, or other causes, due to failure or lack of sheeting or bracing, or improper bracing, or through negligence or fault of the Contractor in any other manner shall be repaired by the Contractor at his own expense.

Unauthorized Excavation.

Wherever the excavation is carried beyond or below the lines and grades given by the Engineer, the Contractor shall, at his own expense, refill all such excavated space with such material and in such manner as may be directed in order to insure the stability of the various structures.

Blasting.

The Engineer shall have the right to limit the use of explosives and/or to order discontinuance of the use of any methods in this connection, which, in his opinion, endanger any part of existing structures or public or private property of any character. No blasting will be allowed except by special permission, in writing, from the Engineer.

Removal of Water.

The Contractor shall at all times during construction provide and maintain ample means and devices with which to promptly remove and properly dispose of all water entering the excavations or other parts of the work.

The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property. No water shall be drained into work built or under construction unless the consent of the Engineer is first obtained.

Water shall be disposed of in such a manner as not to be a menace to the public health.

Disposal of Material.

Material excavated shall be disposed of in backfilling, making fills, and grading around the work as may be directed and to the lines and grades given by the Engineer.

Material excavated in streets and roadways shall be laid alongside of the trench, and kept trimmed up so as to cause as little inconvenience as possible to public travel. Free access must be provided to private drives and traffic on cross streets. Means shall be provided whereby storm and waste water can flow uninterruptedly.

No surplus material shall be dumped on private property unless written permission is furnished the Owner, signed by the owner of the property.

Backfilling.

All lumber, rubbish, and braces shall be carefully removed from excavations unless ordered left in place by the Engineer. Unless otherwise specified, all excavations shall then be backfilled up to the original surface of the ground or to such grades as shall be directed. The backfilling shall be done in such a manner as to prevent future subsidence of the area excavation.

All backfilling of trenches shall be done in such a manner as not to disturb the pipe, conduit, or other structure. In all cases the backfilling around the pipe shall be carried up to a point 12 inches above the top of the pipe and backfilling around gravity piping shall be carried up to a point on the pipe equal to $\frac{3}{4}$ diameter of the pipe with clean sand free from stones or clumps, the maximum size allowable in this section will pass through a No. 4 sieve (3/16-inch screen). This section while being place shall be compacted By hand or mechanical tampers in 4-inch lifts to insure good lateral support. Until the backfill material reaches a density of 95 percent of its maximum density. Each lift shall be compacted satisfactory before an additional lift is added. The first 4-inch shall be worked underneath the pipe, couplings, fittings and valve with proper tools to insure a complete and continuous bearing surface free of voids. It shall be the responsibility of the Contractor to use clean sand material from that which has been excavated or to import a material that will meet the requirements of clean sand as defined

above. The rest of the trench shall be backfilled with material similar to Select Sand in 15-inch maximum so that the soil reaches 95 percent of its maximum density.

Sheeting shall in all cases be removed, except where expressly authorized by the Engineer. Where sheeting is drawn, all cavities remaining in or adjoining the trench shall be solidly filled. Where sheeting is left in place, all cavities behind such sheeting shall be so solidly filled.

Excess material shall be rounded up in a neat mound over the trench or removed as directed by the Engineer.

Compaction.

Where noted in this Specification or shown on the Plans that the soil shall be compacted to a certain percentage of its maximum density, the method used to check this maximum density is determined by A.A.S.H.T.O. Method T-99.

Care of Existing Structures and Trees.

All existing power and telephone poles and lines, trees, fences, water, gas, telephone, or other pipes of conduits, embankments, or other structures in the vicinity of the work shall be supported and protected from injury by the Contractor, during the construction and until the completion of the work. The Contractor shall be liable for all damages done to such structures, as provided above, and shall save and keep the Owner harmless from any liability or expense for injuries, damages, or repairs to same.

Fills and Embankments.

The Contractor shall make all fills and embankments as shown on the Plans and as required for the proper completion of the work. Embankments and fills shall be built of the materials removed from the excavation, so far as possible, arranging them in the most suitable manner.

Restoring Surfaces and Utilities.

(a) Streets and Alleys. That portion of all streets, alleys, roads, and driveways where the surface is removed, broken into, or damaged by the installation of this improvement shall be resurfaced with the same type of material that was removed from the surface. Where sewer lines are constructed under existing curb and/or curb and gutter, the Contractor will be allowed to tunnel under these curbs and/or curb and gutters provided that they are not allowed to settle.

(b) Utilities. All utilities of whatever nature, which are broken into or damaged by the installation of this improvement, shall be properly reconstructed of the same kind of material as used in the original.

All existing water, gas, irrigation, telephone, sewer services, and mains shown on the Plans have been plotted as accurately as possible from records available. No guarantee as to their true location will be made. The Contractor shall exercise the greatest care to protect such services and mains regardless of their nature. The Contractor shall repair any damage to such

existing obstructions and no claim shall be made for such work.

At locations where a new sewer line will cross under irrigation distribution and waste ditches, any work interfering with the use of these ditches must be arranged for with the Yuma Valley Water Users Association and scheduled to meet their requirements.

All ditch sections disturbed by the sewer trenching operations shall be restored to their original shape, cross section and grade.

Measurement.

This item will not be measured for payment.

Payment.

Payment for this item will be included in the contract price for the various sizes and types of pipe, which price shall be full compensation for excavation, backfilling and flooding trench with water; for water; for shoring; and for all labor, materials, equipment and incidentals necessary to complete the work as shown on the Plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-10

CORRUGATED METAL PIPE (SLOTTED)

Scope.

The Contractor shall furnish all labor, materials and equipment necessary for installing slotted corrugated metal pipes at the locations and in accordance with the details shown on the Plans.

General.

The work shall include excavation and preparation of subgrade, concrete encasement and anchor stakes. Corrugated metal pipe shall be of the metal thickness, sizes, dimensions, shapes and type as shown on the plans. Galvanized pipe shall be handled carefully to preserve the spelter coating. All pipes which show defects due to negligence or rough handling on the part of the Contractor shall be replaced or repaired at the direction of the City Engineer.

Installation.

Corrugated metal pipe shall be installed in reasonable close conformity to the lines, grades and dimensions established or shown on the plans.

The width of any trench in which the pipe is placed shall be sufficient to permit thorough tamping of the backfill under the haunches and around the pipe. The pipe shall be firmly and uniformly bedded in the trench with the separate sections firmly jointed together and with outside laps of circumferential joints point up stream and with longitudinal laps on the sides. Any metal in joints which is not thoroughly protected by galvanizing shall be painted with one coat of approved protective paint.

Where there is limited head room, as is usually the case when arch type corrugated metal pipes are installed, the bolts on the connecting bands shall be so arranged that the tops of the bolts shall be in line with or below the top of the pipe.

Pipes shall be helically corrugated with welded seams.

The maximum allowable deflection of the final placement of the pipes, along the longitudinal axis, shall not exceed 1/8 of an inch per 10 feet of pipe length.

A watertight joint shall be provided by placing a joint sealant between the coupling band and the periphery of the pipe section ends.

The Joint Sealant Material Shall:

1. Be an extruded strip or bead compounded from a non-drying, nontoxic, synthetic resin base with butyl rubber and inorganic extenders and be 100 percent solid material with no shrinkage.
2. Be furnished in 5/8" x 1" strips or 1" diameter beads on 1" wide release paper and wound into rolls.
3. Have sufficient adhesion so the strip or bead will adhere to galvanized steel and be soft enough to allow cold flow when compressed during connection of the pipe sections.
4. Not flow or sag at temperatures up to 180 degrees F. nor become brittle, crack or lose adhesion at temperatures down to -30 degrees F.
5. Contain no migrating components that could leach out nor produce any chemical reaction with galvanized steel.

An alternative joint sealant or sealing method that will provide a watertight joint may be used provided the alternative sealant is approved by the Engineer.

The slot shall be covered with roofing paper or other approved covering, during backfilling operations to prevent infiltration of material into the pipe.

Before placing asphaltic concrete or Portland cement concrete adjacent to the pipes, the timbers shall be securely fastened together and placed in the slot as shown on the Plans. The Contractor shall prevent bonding of the asphaltic concrete or the Portland cement concrete to the timber by any method acceptable to the Engineer. The timbers shall remain in place until final clean-up operations are completed at which time the timbers shall be removed and satisfactorily disposed of.

Measurement and Payment.

Payment for this work will be made at the contract unit price Linear foot, which prices shall be full compensation for the items complete, including excavation, backfilling and grouting, as described and specified herein and on the plans.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-11

EMBANKMENT SPILLWAYS, EMBANKMENT DOWNDRAINS, INLETS AND OUTLETS

Scope.

The Contractor shall furnish all labor, materials and equipment necessary for construction of embankment spillways, embankment downdrains, inlets and outlets at the location and in accordance with the details shown on the plans and specifications.

General.

Embankment Spillways. Embankment Spillways shall consist of furnishing all materials and constructing spillways in or on embankment slopes and connections to inlets and outlets, using concrete or metal, including excavation, backfill, anchorages, reinforcement and other incidental items, all in accordance with the details shown on the plans and these specifications.

Embankment Downdrains. Embankment Downdrains shall consist of furnishing all materials and constructing downdrains of metal pipe or other metal downdrains in or on embankment slopes, and connections to inlets and outlets, including excavation, backfill, anchorages, reinforcement and other incidental items, all in accordance with the details shown on the plans and these specifications.

Where called for on the plans, metal inlet tanks and stubs shall be included in Inlets.

Outlets. Outlets shall consist of furnishing all materials and constructing Outlets for Embankment spillways and Downdrains, using metal or concrete and shall include excavation, backfill, anchorages, reinforcement and other incidental items, all in accordance with the details shown on the plans and these specifications.

Where called for on the plans, headwalls and aprons, except for riprap aprons, shall be included in Outlets.

Reinforcement. Materials furnished for reinforcing steel bars of mesh shall conform to the requirements of City of Yuma, Standard Specification D-3 Reinforcing Steel.

Metal. All metal parts shall be handled carefully to avoid damage to the metal or any protective coating on the metal, such as galvanizing or bituminous coating.

Shop fabrication and field construction of metal spillways, downdrains and outlets shall be in conformity with acceptable standards of workmanship and such that all component metal parts and incidental items shall be properly fitted, aligned and assembled or constructed, to form the completed structures which shall be firmly bedded and backfilled, anchored and tied, with

individual sections rigidly connected and properly aligned, all in reasonable close conformity to the details shown on the plans and these specifications. When the Engineer determines that either the method used or the workmanship employed in making any connection between individual sections of pipe or of the other metal downdrains does not produce a reasonable watertight joint, the contractor shall furnish a bituminous mastic or other similar material approved by the Engineer and shall apply this material where the sections are joined in a manner that will result in a reasonably watertight joint.

Method of Measurement.

Embankment Spillways and Downdrains. Embankment Spillways and Downdrains will be measured by the linear foot. Measurement will be made along the slope at the centerline of the spillway and along the metal downdrain parallel to the centerline of the pipe or metal downdrain for Downdrains, in accordance with the details shown on the plans.

Inlets and Outlets. Inlet and Outlets will be measured as a unit for each Inlet and Outlet, of the type specified.

Basis of Payment.

The accepted quantities of Embankment Spillways, Embankment Downdrains, Inlets and Outlets, measured as provided above will be paid for at the contract unit prices, complete in place.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Embankment Spillways	Linear Foot
Embankment Downdrains	Linear Foot
Inlet	Each
Outlet	Each

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-1a

DEWATERING

General.

Dewatering shall include the removal, transporting and disposal of natural ground water necessary for purposes of constructing underground items of work such as water or sewer mains, storm sewer lines, irrigation headwalls and all related appurtenances.

Character of Ground Water.

The Contractor must satisfy himself regarding the character and amount of water to be encountered during the work.

Removal of Water.

The Contractor shall at all times during excavation for open trenches maintain ample means and devices which remove and dispose ground water entering any open trench. Ground water shall be removed to a depth 12" below any man-made material set into such excavation.

Disposal of Water.

The Contractor shall dispose of discharge water in a suitable manner without damage to adjacent properties. Existing sanitary sewers and irrigation canals cannot be used for disposal.

Measurement.

This item will be measured by the linear foot along the length of horizontal suction header pipe up to the pump intake.

Payment.

The amount of accepted work will be paid for at the contract price for "Dewatering".

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-2

PIPE AND PIPE LAYING

General.

Storm sewer pipe shall be either reinforced concrete pipe, vitrified clay pipe, or PVC.

Sanitary sewer pipe shall be vitrified clay pipe, or PVC.

Reinforced Concrete Pipe.

(a) Quality. Pipe over 12 inches in diameter shall be reinforced concrete pipe and shall be manufactured and tested in accordance with ASTM Standard Specifications for Reinforced Concrete Culvert Pipe C76, Class III, except where noted on the Plans. Pipe 12 inches in diameter and under shall be manufactured and tested in accordance with ASTM C14, Table II.

(b) Pipe Construction. The pipe shall be of the internal diameters as indicated on the Plans.

Each laying length of pipe shall have tongue and grooved ends perpendicular to the longitudinal axis of the barrel. The tongue and grooved ends shall be so shaped that the pipe will be self-centering and so formed as to leave a recess or joint on the inside of the pipe.

(c) Pipe Handling. Each day's run of pipe shall be marked and stored in the manufacturer's yard so that the pipe made on any particular day may be easily identified. Each section of pipe shall be plainly marked with the date of manufacture, the amount of steel of D-load, and the minor axis of the reinforcing cage if an elliptical cage is used.

All pipe shall be manufactured, handled, loaded, and shipped in such a manner that they will be delivered, undamaged, in sound condition, and conforming in all respects to these Specifications.

Vitrified Clay Pipe.

(a) Quality. Vitrified clay pipe shall be best quality, durable, sound, well burned throughout its length, and shall give a clear metallic ring when struck with a hammer while standing on end. It shall be extra strength pipe in accordance with the standards for Clay Pipe Institute (California) as set forth in Materials Section of Vitrified Clay Pipe, Engineering Handbook (1961), except that the laying lengths of the pipe may be longer than those shown in the Handbook; or it shall be extra strength pipe in accordance with ASTM C200 or C278. Either specification shall be modified by the requirements below.

(b) Shape. All pipes shall be bell and spigot with sockets true, circular, and concentric with the bore of the pipe. All sockets must be of sufficient diameter to receive to the full depth the spigot end of the next following pipe or special, without any chipping and also to leave an annular space as specified under DIMENSIONS.

CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-2

All pipes shall have peripheral corrugations on the inside of the socket for its entire depth, and also on the outside of the spigot end for the corresponding length.

(c) Lengths. The length of all sizes of straight pipe, exclusive of socket, shall be not less than 3 feet. Y and T branches shall be not less than 2 feet in length. Shorter or cut lengths shall be used only where necessary to make closure.

(d) Dimensions. The minimum dimensions of vitrified clay pipe shall be not less than those allowed under the specifications for extra strength pipe of the Clay Pipe Institute (California) or ASTM C200 or C278, except as noted.

(e) Imperfections. The following imperfections in a pipe or special will be considered injurious and cause for rejection; or if 10 percent of the load is imperfect for any of the following reasons, the whole load is subject to rejection.

(1) A single crack in the shell of the pipe extending through the entire thickness, regardless of the length of such crack. A single crack which extends through 1/5 of the shell thickness and is over 3 inches long. Any surface fire crack which is more than 1/16 inch wide at its widest point.

(2) Lumps, blisters, pits, or flakes on the interior surface of a pipe or special.

(3) When the bore or socket of the pipe varies from a true circle by more than 3 percent for pipe under 24 inches in diameter, or by more than 1-1/2 percent for pipe 24 inches and over in diameter.

(4) When a pipe or special, designed to be straight, exhibits a deviation from a straight line of either more than 1/2 inch in the total length or more than 1/8 inch per lineal foot. The deviation shall be measured from a straightedge at a point midway between the ends of the pipe.

(5) Any piece broken from the spigot end of the pipe or fitting, or a piece broken from the bell end if the fracture extends into the body of the pipe, or is longer than 1/3 of the diameter of the pipe.

(6) Any pipe which does not give a clear metallic ring when struck with a hammer while standing on end shall be cause for rejection.

(7) Any pipe which is not completely fired or vitrified throughout the length or thickness of the pipe.

PVC Pipe.

(a) Quality. Gravity PVC sewer pipe shall be best quality manufactured and tested in accordance with ASTM Standard Specifications. Pipe sizes up to 15" shall meet or exceed ASTM D-3034 SDR35.

(b) Pipe Construction. Pipe shall be of the diameters as indicated on the plans. Pipe and all fittings shall be homogenous throughout and free of any visible defects.

(c) Pipe Handling. All pipe shall be handled and shipped according to manufacturers' guidelines. Acceptable pipe shall be delivered undamaged in sound condition and conforming to these specifications.

Reinforced Concrete Pipe Storm Sewer Pipe Laying.

(a) Pipe Laying. Pipe shall be laid on an unyielding foundation with a uniform bearing under the full length of the barrel of the pipe. The first section of pipe laid shall be firmly placed in the center of the trench. All adjustments to line and grade shall be made by scraping away or filling under the body of the pipe. Space shall be provided, scraped out with the trowel, under and immediately in front of the tongue end of the last pipe laid.

The tongue end of the last section of pipe laid shall then be thoroughly washed and cleaned with a wet brush; the groove end of the next section of pipe to be laid shall be next thoroughly wet and filled with laying mortar while standing in a vertical position. Sufficient laying mortar shall be placed on the ground under the tongue end of the last section of pipe laid so that the banding mortar which shall be placed around the joint after the pipes have been abutted together will connect with this mortar and make a continuous band around the joint.

The ends or shoulders of each pipe shall abut against the next adjacent pipe in such a manner that there will be no unevenness of any kind along the bottom half of the interior of the pipe. The interior surface of the joint shall be brushed smooth and surplus mortar be removed with the aid of a long handled brush.

The pipe shall be placed true to alignment and grade before the joints are made and brushed. If a slight adjustment is necessary after making the joint, then both the internal and external surfaces of the joint shall be again brushed. Several sections of pipe shall be laid and the joints made as above described before the external bands are applied.

The application of external bands shall follow the laying closely, never being more than 5 lengths of pipe behind the laying. The external surface of the pipe at the joint shall be thoroughly cleaned with a wire brush and be wetted to insure proper bond of the banding mortar with the concrete of the pipe. The mortar shall be pressed by hand over and into the joint. Particular care shall be exercised to make a thorough union between the bank and the mortar which was placed under the joint before the pipe sections were abutted together. The bank shall be not less than 3/8 inch in thickness and shall be approximately 4 inches in width, overlapping the abutting ends of the pipe sections approximately 2 inches. The edges of the band shall adhere to the pipe surface to prevent peeling and shall be finished in a workmanlike manner with trowel or brush.

Joints in pipe 16 inches in diameter and under shall be neatly wiped on the inside. Joints in pipe 18 inches in diameter and over shall be wiped and carefully pointed.

(b) Curing and Protection of Joints. All completed joints shall be immediately protected from the air and sun by an initial covering of fine, moist earth or sand approximately 6 inches to 12 inches above the top of the pipeline depending on temperature. Extreme care should be taken in placing such earth around the pipe to avoid injury to the freshly applied bands. At the close of each day's work, and at such other times when pipe is not being laid, all openings in ends of the pipeline shall be covered with sacks and moist earth or sand to prevent drying out of the joint mortar by circulation of air within the line.

Gravity PVC Sewer Pipe Laying.

(a) Pipe Laying. All pipe shall be laid true to grade and alignment as indicated on the plans. Foundation shall be unyielding and provide a uniform bearing the full length of pipe.

(b) Trench Width. Width of trench at top of pipe must be wide enough to allow proper placement and compaction of all backfill materials.

Vitrified Clay Pipe Storm Sewer Pipe Laying.

(a) Pipe Laying. All pipe shall be laid without a break upgrade from structure to structure, with socket ends of the pipe upgrade. Pipe shall be laid on an unyielding foundation with uniform bearing under the full length of the barrel of the pipe. Suitable excavations shall be made to receive the bells of the pipe. The pipe shall be carefully laid true to grade and line. All adjustments to line and grade and not by wedging or blocking up the bell.

The spigot end of the pipe shall be centered in the bell with a gasket of dry loose hemp so placed as to prevent any of the cement mortar material pushing through into the pipe and leaving a clear space of not less than 1-3/4 inches between the gasket and the outer end of the socket. The ends or shoulders of each pipe shall abut against the next adjacent pipes in such a manner that there will be no unevenness of any kind along the bottom half of the interior of the pipe. Prior to the placing of the cement mortar, the annular space in the joint between the exterior of the spigot and the interior of the bell shall be thoroughly cleaned.

(b) Curing and Protection of Joints. All completed joints shall be immediately protected from the air and sun by an initial covering of fine moist earth or sand approximately 6 inches to 12 inches above the top of the pipeline depending on temperature. Extreme care should be taken in placing such earth around the pipe to avoid injury to the freshly applied bands. At the close of each day's work, and at such other times when pipe is not being laid, all openings in ends of the pipeline shall be covered with sacks and moist earth or sand to prevent drying out of the joint mortar by circulation of air within the line.

Whenever work ceases or when the end of a pipeline remains unjointed to an existing pipe or structure, it shall be closed by a cap or stopper of concrete tightly sealed in place.

Pipe Laying Conditions for Both Types of Storm Sewer Pipe.

(a) Mortar. All mortar shall be newly mixed and shall be composed of 1 cubic foot of cement and 2 cubic feet of fine aggregate as previously specified, except that all fine aggregate shall pass a 1/8-inch square opening sieve. No mortar that has begun to set shall be used and no retempering will be allowed.

Admixtures may be used not exceeding the following percentages by volume of cement: hydrated lime, 5 percent; fire clay, diatomaceous earth, or other inert material, 10 percent. Quicklime may be used in place of hydrated lime providing care is used to see that the lime is completely slaked before the mortar is used.

Mortar shall be placed in the annular space, tamped in place and struck off at a 45-degree angle between the bell and spigot.

Joints in pipe 16 inches in diameter and under shall be neatly wiped on the inside. Joints in pipe 18 inches in diameter and over shall be wiped and carefully pointed.

(b) Openings in Pipeline. All openings cut into the reinforced concrete pipe or vitrified clay pipeline for outlets and branch connections shall be full size, within 1 inch of the inside diameter of the connecting pipe or fitting. Such openings shall be cut in the pipe either before or after the pipes are laid at the Contractor's option. After the pipes are laid, the cuts shall not be made until the joint mortar is thoroughly cured.

All connections shall be cut to fit closely and shall be strongly cemented to the line with banding mortar. Where possible, both the inside and outside of the joint shall be brushed smooth.

Whenever work ceases or when the end of a pipeline remains unjoined to an existing pipe or structure, it shall be closed by a cap or stopper of concrete tightly sealed in place.

Vitrified Clay Pipe Sanitary Sewer Pipe Laying.

(a) Joints. Dry hemp or Sealite caulking yarn can be used on the joint to be packed in the opening between the spigot and ball to aid in keeping the invert of the pipes true. Jointing compound shall be either CPI-2 by Pacific Coast Clay Products Institute, or JC-60 by Atlas Mineral Products Company. These joint compounds shall be poured in accordance with the specifications and recommendations of their manufacturers. Premolded joints may be used if approved by the Superintendent of Streets. If premold joints are used, no hemp or dry packing will be required.

(b) Pipe Laying. All pipe shall be laid without a break upgrade from structure to structure, with socket ends of the pipe upgrade. Pipe shall be laid on an unyielding foundation with uniform boaring under the full length of the barrel of the pipe. Suitable excavations shall be made to receive the bells of the pipe. The pipe shall be carefully laid true to grade and line. All adjustments to line and grade must be made by scraping away or filling in under the body of the pipe, and not by wedging or blocking up the bell.

The spigot end of the pipe shall be centered in the bell with a gasket of dry loose hemp or Sealite caulking yarn so placed as to prevent any of the jointing material flowing through into the pipe and leaving a clear space of not less than 1-3/4 inches between the gasket and the outer end of the socket. The ends or shoulders of each pipe shall abut against the next adjacent pipes in such a manner that there will be no unevenness of any kind along the bottom half of the interior of the pipe. Prior to the placing of the jointing material, the annular space in the joint between the exterior of the spigot and the interior of the bell shall be thoroughly cleaned.

The joint shall then be filled with CPI-2 or JC-60. The runner shall not be removed until at least 15 minutes after the joint has been poured. No joints shall be poured until the gaskets of the next two pipes in advance are properly inserted. Alternate sections may be run on the bank. Where joints are run on the bank by standing pipes in a vertical position, a runner will not be required, but the pipes shall be carefully centered. After joints have been poured in this manner, the pipe shall not be moved for 30 minutes thereafter.

Walking on or disturbing the pipe in any manner after the joints have been made will not be permitted.

At the close of each day's work and at such other times when pipe is not being laid, the end of the pipe shall be closed with a close fitting stopper.

Whenever the work ceases or when a pipeline remains unjointed to an existing pipe or structure, it shall be closed by a cap or stopper of vitrified clay tightly sealed into place.

(c) Stoppers. Vitrified clay stoppers 3/4 inch thick, snugly fitting the bells, shall be caulked into the end bells of all branches that are left unconnected.

Testing.

Each section of sewer, between two successive structures, shall be tested by closing the lower end of the sewer to be tested and the inlet sewer into the upper structure with stoppers and filling the pipe and structure with water to a point 4 feet above the invert of the sewer in the upper structure. Allowable leakage will be computed by the formula.

Vitrified Clay Pipe or Reinforced Concrete Pipe.

The leakage per 100 feet of length, as determined during the last 2 hours of a 24-hour test, must not exceed 1 gallon per hour per inch of inner diameter of the pipe.

PVC Pipe.

Leakage per 100 feet must not exceed .04 gallon per hour per inch of diameter.

In making this hydrostatic test, the water in the pipe and standpipe shall be maintained at or above the 4.0 level as noted above for a period of at least 2 hours. Any individual leaks showing up during this 2-hour period shall be repaired.

If the leakage, as shown by the test, is greater than allowed by the formula, the pipe shall be overhauled, and, if necessary, re-laid until the joints shall hold satisfactorily under the test. If the leakage is less than that allowed, the Contractor shall stop any individual leaks that are observed.

If, in the construction of a section of the sewer between structures, excessive ground water is encountered, the test for leakage described above shall not be used, but instead the end of the sewer at the upper structure shall be closed sufficiently to prevent the entrance of water and pumping of ground water shall be discontinued for at least 3 days, after which the section shall be tested for infiltration. The infiltration shall not exceed 0.2 gallon per minute per inch of diameter per 1000 feet of main sewer being tested. (The length of house connections entering the section shall not be included.) Where any infiltration in excess of this amount is discovered before completion and acceptance of the sewer, the sewer shall be immediately uncovered and the amount of infiltration reduced to a quantity within the specified amount before the sewer is accepted. Should, however, the infiltration be less than the specified amount, the Contractor shall stop any individual leaks that are observed.

All tests shall be completed before street or trench is resurfaced.

The above hydrostatic tests do not apply to the catch basin leads.

All labor, tools, materials, appliances, and bulkheads required for making the tests shall be supplied by the Contractor.

Cleaning.

All sewer lines shall be left in a clean condition. All debris, rubbish, or materials of any sort shall be removed prior to the testing and checked again before the final acceptance.

Measurement.

This item will be measured by the linear foot for the various sizes and types of pipe involved, measured along the center line of the pipe in place, from end of pipe to end of pipe or from center of structure to end of pipe, with no reduction for length through the structure.

Payment.

The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for the various sizes and types of pipe, which price shall be full compensation for connections to existing pipe or structures; for furnishing materials and pipe; for excavation, backfilling, compaction; for water; for shoring; and for all labor, materials, equipment and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-3

MANHOLES

General.

Manholes of brick masonry units shall be constructed along the sewer lines at points indicated on the Plans.

Masonry Units.

Brick masonry units shall conform to the requirements of the ASTM Standard Specifications for Brick Masonry Units for Construction of Catch Basins and Manholes, ASTM C-32, Grade MA except maximum water absorption by 5 hours boiling, in percent, average of 5 brick, 18 percent; and any individual brick, 20 percent; also that the minimum compressive strength (brick flat wise) the average of 5 brick shall be 4,500 pounds per square inch, and individual brick shall not be less than 3,000 pounds per square inch. They shall be uniform in quality and shall be culled or sorted before installing in the work.

Mortar.

All brick work for manholes shall be laid in mortar composed of not less than 1 part Portland Cement to 3 parts sand by volume with an allowable addition of lime putty or hydrated lime not to exceed 10 percent by volume of the cement content.

Cement shall be Portland Cement, Type II, in accordance with ASTM C150, and shall contain not more than 0.6 percent total alkali. Sand shall be clean masonry sand in accordance with ASTM C144.

The mortar shall be well mixed and used immediately after mixing and before it has taken its initial set. No mortar that has partially hardened shall be retempered or used in any way.

Concrete.

Class A concrete shall be 3,000 concrete, Class C concrete shall be 2,000-pound concrete. Both classes shall be as specified under CONCRETE.

Frames and Covers.

Manhole frames and covers shall be constructed as shown on Standard Detail E-5 F & C of these Specifications.

All castings shall be of first-class gray iron, tough, and of even grain. The castings shall be dipped in asphalt at not less than 200 degrees F. after they have been thoroughly cleaned.

After castings have seasoned sufficiently so that there will be no further distortion due to temperature changes, the cover and ring seat shall be

machined so that the entire area of the seat will be in contact with the cover in any position of the cover on the seat.

The tops of the cover and frames shall be flush, and there shall be 1/8-inch clearance all around between frame and cover.

The top surface of each cover shall be cast with a studded pattern including the letter S. Letter and studs shall be raised 5/16 inch. The letter shall be not less than 2-1/2 inches high. Each cover shall be provided with not less than two 3/4-inch diameter ventilating holes.

Steps.

Steps for masonry manholes shall be made of cast iron, similar and equal to Alhambra Foundry Company No. A-3340 or Clow National Foundry No. F-3650. Steps shall be placed at intervals of 16 inches; the lower step shall be not more than 24 inches from the bottom of the manhole or other structure, and the upper step shall be placed under the manhole ring as indicated on the Plans.

Manhole Construction.

(a) General. Manholes of brick with concrete bottoms, each with cast iron ring and cover and iron steps, all in conformity with the Plans, shall be built along the line of the sewer at the points indicated on the Plans.

(b) Manhole Bases. Manhole bases shall be constructed of concrete to the dimensions indicated on the Drawings. Projecting ends of the sewer and pipe stubs shall be adequately supported to prevent displacement from line or grade during the construction of the base. All manholes shall have the invert shaped as indicated on the Plans to provide an adequate channel between the inlet and outlet pipes. The entire surface of the manhole invert including channel and shelves shall be steel troweled to a smooth, dense surface.

(c) Inverts. It is intended that all inverts of junction manholes be shaped while the manholes are under construction. The Contractor shall have the choice of continuing the pipe through the manhole, building the invert and later breaking out the pipe above the midpoint of the pipe, in which case he will be required to patch and smooth up with cement mortar the broken edges of the pipe; or he may stop the pipes at the inside faces of the manhole and construct the invert to the shape and sizes of pipe as detailed. All inverts shall follow the grades of pipe entering the manholes.

Where laterals enter manholes located over a large trunk or main sewer at an elevation above the main invert shelf, an invert shall be shaped above, at, or below the crown of the main sewer.

All grades through manholes shall conform to the grade of the pipe entering and leaving the manhole. No drops in elevation within the manholes will be required.

(d) Manhole Shaft Construction. The walls of the manholes shall be brought to such an elevation that the cast iron ring and cover when set thereon will conform to the grade of the street or to the grade given by the Engineer. The joints in the walls of the manhole shall be completely filled

CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-3

with mortar. The outside of the brick manholes shall be plastered with a layer of mortar 1/2 inch thick and given a smooth brushed finish. All surfaces to be so plastered shall be well dampened before mortar is applied. All brickwork shall be well bonded. Mortar shall be as specified under MORTAR. For brick manhole, 4-inch brick arch shall be turned over each pipe 12 inches in diameter and under entering the manhole. An 8-inch brick arch shall be turned over each pipe over 12 inches in diameter entering the manhole.

Measurement.

Each manhole shall be measured as a unit for payment.

Payment.

Payment for completed and accepted manholes, measured as provided above, will be paid for at the contract price for "Manholes" and shall be full compensation for excavation, backfilling, hauling, labor, materials, equipment and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-4

CATCH BASINS

General.

Catch basins of cast in place reinforced concrete shall be constructed along the sewer line at points indicated on the Plans or as directed by the Engineer. The inlet gutter grade shall be as shown on the Plans or as established by the Engineer.

Material.

Concrete shall conform to Class A concrete as specified herein in these Specifications.

Castings shall conform to CASTINGS as specified herein in the Specifications.

Reinforcing steel shall conform to REINFORCING STEEL as specified herein in these Specifications.

Excavation.

Excavation for structure shall be made to the lines and elevations shown on the Plans. All footings shall be firm and solid. The walls of catch basins may be poured directly against the earth, provided a satisfactory excavation is made true to the lines as shown on the Drawings. In any event, the back form shall be carried to a depth of at least 1 foot below the finished ground line.

Finishing.

The top of all walls around the inlets shall receive a smooth trowel finish, and the edges be neatly rounded.

Catch basins to have troweled inverts to eliminate water from standing in bottom.

Curing shall conform with CONCRETE as specified herein in these Specifications.

Measurement.

Each catch basin shall be measured as a unit for payment.

Payment.

Payment for completed and accepted catch basin, measured as provided above will be paid for at the contract price for "Catch Basins" and shall be full compensation for excavation, backfilling, hauling, labor, materials, equipment and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-5

CASTINGS

General.

The castings for manhole frame and cover, manhole steps, and inlet grates shall conform to the details shown on the Plans and in these Specifications.

Castings.

All castings shall be tough, gray iron, free from cracks, holes, swells and cold shuts, and be of workmanlike finish, and shall conform to the Standard Details and with the ASTM Specifications Designation A48, Class 40. The quality shall be such that a blow from a hammer will produce an indentation on a rectangular edge of the casting without flaking the metal. Before leaving the foundry, all castings shall be thoroughly cleaned and before set in place, shall be subjected to a hammer inspection. The bearing faces of manhole frame and cover shall be machined so that the cover will lie flat in any position in the ring and have uniform bearing throughout the entire circumference. The castings shall be dipped in asphalt at not less than 200 degrees F. after they have been thoroughly cleaned.

Measurement.

These items will not be measured for payment.

Payment.

Payment for all castings shall be included in the price bid for the item in which the casting is located and shall be full compensation for labor, materials, equipment, and incidentals necessary to complete the work as shown on the plans and as herein specified.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-6

PAVEMENT REPLACEMENT

General.

That portion of all streets, where the surface is removed, broken into, or damaged by the installation of this improvement shall be resurfaced and specified herein and in accordance with the typical details shown on the plans.

Backfill.

Trench shall be backfilled in accordance with EXCAVATION.

Aggregate Base Course.

Aggregate Base Course of the depth specified on the plans shall be placed in accordance with AGGREGATE BASE COURSE.

Asphalt Pavement.

Asphalt concrete of the depth specified on the plans shall be placed in accordance with ASPHALTIC CONCRETE PAVEMENT (SINGLE COURSE).

Measurement.

This item will be measured for payment by the square yard of pavement replaced.

Payment.

The amount of completed work, measured as provided above, will be paid for at the contract price for "Remove and Replace Existing A.C. Pavement", which price shall be full compensation fro all labor, materials, tools, hauling, compacting, backfilling and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-7

RIPRAP

Description.

Riprap shall consist of broken pieces of concrete used to protect against scour. Riprap shall be plain concrete pieces or grouted in place as shown; where the riprap is shown grouted in place the concrete grout shall first be poured and the pieces of riprap laid in this grout.

Materials.

Concrete riprap shall be sound. From 50 to 60 percent of the riprap shall be "two man" size having a volume of 1-1/2 cubic feet or more and the remaining 40 to 50 percent shall range in size from 1-1/2 cubic feet to pieces weighing not less than 10 pounds. Where grouted riprap is specified, the pieces of concrete shall be first wetted and reasonably clean before being placed.

Grout.

Grout for grouted riprap shall be composed by volume of one part Portland cement, four parts of fine aggregate and one-fifth part hydrated lime. To these mixed materials, sufficient water shall be added to provide a mixture that will flow readily. The lime shall be considered as an addition to and not as replacing any cement. Grout that has been mixed more than 1 hour shall not be used. Retempering of grout will not be permitted.

Cement-Water, Fine Aggregate, and Lime.

Cement and water shall conform to the requirements for these materials as herein specified under CONCRETE. Fine aggregate for grout shall conform to the grading requirements of A.A.S.H.O. M-45. Hydrated lime shall meet the requirements of ASTM C207, Type N.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-8

EXISTING HOUSE CONNECTIONS

Where indicated on the Plans or directed by the Engineer, existing vitrified clay pipe house connections shall be dug up and relaid to new grades. Work shall be done in such a manner as to maintain the flow of sewage without interruption which will cause undue backing up in the house connection.

Salvage pipe may be used if in sound condition and meeting the specifications herein specified under VITRIFIED CLAY PIPE, all subject to approval by the Engineer. Where relaying the pipe of the existing house connection is necessary, the Engineer will approve this first and order the work done; the method of so doing shall meet the Engineer's approval.

Where vitrified clay pipe house connections are over and clear of the storm sewer pipe, said service shall be maintained during construction. After the storm sewer construction, the backfill material under the house connection shall be compacted to 95 percent of its maximum density, 3 feet on each side of the centerline of the house connection.

The house connection shall be in a reinforced concrete encasement. This encasement shall be extended into the side walls of the trench for 18 inches to give it support as detailed on the Plans.

If a house connection is relaid under the storm sewer, a small amount of concrete shall be poured around the house connection pipe where the storm sewer pipe crosses over the house connection.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. E-9

CLEANUP

Upon the completion of types of work, and before final acceptance, the Contractor shall clean the streets, alleys, easements and all ground occupied or used by him in connection with the work, of all rubbish, excess or unused material, false work, and equipment. All work shall be backfilled and the surrounding ground leveled to protect the work and to leave the street or alley in a finished, neat, and presentable condition.

No payment shall be made for any item in CLEANUP. The cost of this work shall be included in other items of work for which payment is provided.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. F-2

REMOVE AND REPLACE EXISTING FENCES

Scope.

The Contractor shall furnish all labor, materials and equipment necessary to remove and replace fences within the street rights-of-way where necessary to clear construction.

General.

It shall be the Contractor's responsibility to contact all property owners, who have fences that must be moved to clear for construction, at least 15 days prior to any construction in that area. If the property owners do not remove the fences, the Contractor shall do so in accordance with the requirements of this specification.

Materials.

Existing materials are to be reused where not damaged in the process of removal. The Contractor is to furnish any additional material necessary.

Construction.

The Contractor shall remove existing fencing and posts in such manner as to prevent damage and shall reconstruct fences at the locations specified by the Engineer. When completed the fences shall be in proper alignment with the post plumb and all wire taut where used and shall be in all respects equal in serviceability to the original fence.

Measurement and Payment.

- (a) Measurement. This item will be measured by the linear foot of fence, in place before removal, for all fences necessary to be removed and relocated to clear the construction area.
- (b) Payment. The amount of completed and accepted work measured as provided above will be paid for at the contract price for "Remove and Replace Existing Fences" which payment shall be full compensation for removal and replacing all fences, and for all labor, materials, tools, equipment and incidentals necessary to complete the work as shown on the plans and specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. F-3a

REMOVE EXISTING CONCRETE CURB AND GUTTER

Scope.

The Contractor shall furnish all labor, tools, and equipment and perform all work necessary to remove and dispose of the existing concrete curb and gutter shown on the plans to be removed.

General.

Existing concrete curb and gutter indicated on the plans to be removed, shall be removed by the Contractor and disposed of by him outside the area of work.

If new curb and gutter or paving is to be placed in the location where the removed curb and gutter has been, the subgrade for the new curb and gutter shall be compacted to at least 95% of maximum density at optimum moisture content. If no new construction is to be placed in the location where the removed curb and gutter has been, then the area shall be backfilled and graded in accordance with "PARKWAY GRADING" or "GRADING BACK OF IMPROVEMENT" in these specifications.

Measurement and Payment.

(a) Measurement. This item will be measured by the lineal foot of curb and gutter removed.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Removal of Existing Concrete Curb and Gutter", which price shall include full compensation for all labor, material, tools, hauling, compacting, backfilling and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION No. F-3b

REMOVE EXISTING CONCRETE SINGLE CURB

Scope.

The Contractor shall furnish all labor, tools, and equipment and perform all work necessary to remove and dispose of the existing concrete single curb shown on the plans to be removed.

General.

Existing concrete single curb indicated on the plans to be removed, shall be removed by the Contractor and disposed of by him outside the area of work. If new curb and gutter or paving is to be placed in the location where the removed single curb has been, the subgrade for the new curb and gutter shall be compacted to at least 90% of maximum density at optimum moisture content. If no new construction is to be placed in the location where the removed single curb has been, then the area shall be backfilled and graded in accordance with "PARKWAY GRADING" or "GRADING BACK OF IMPROVEMENT" in these specifications.

Measurement and Payment.

(a) Measurement. This item will be measured by the lineal foot of single curb removed.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Removal of Existing Concrete Single Curb", which price shall include full compensation for all labor, material, tools, hauling, compacting, backfilling and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION No. F-4

REMOVE EXISTING CONCRETE SIDEWALK OR DRIVEWAY

Scope.

The Contractor shall furnish all labor, tools, and equipment and perform all work necessary to remove and dispose of the existing concrete sidewalk shown on the plans to be removed.

General.

Existing concrete sidewalk indicated on the plans to be removed, shall be removed by the Contractor and disposed of by him outside the area of work. If new sidewalk is to be placed in the location where the removed sidewalk has been, the subgrade for the new sidewalk shall be compacted to at least 85% of maximum density at optimum moisture content. If no new construction is to be placed in the location where the removed sidewalk has been, then the area shall be backfilled and graded in accordance with "PARKWAY GRADING" or "GRADING BACK OF IMPROVEMENT" in these specifications.

Measurement and Payment.

(a) Measurement. This item will be measured by the square foot of sidewalk removed.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Removal of Existing Concrete Sidewalk or Driveway", which price shall be full compensation for all labor, material, tools, hauling, compacting, backfilling and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION No. F-4a

REMOVE EXISTING CONCRETE DRIVEWAY (S)

Scope.

The Contractor shall furnish all labor, tools, and equipment and perform all work necessary to remove and dispose of the existing concrete Driveways shown on the plans to be removed.

General.

Existing concrete Driveways indicated on the plans to be removed, shall be removed by the Contractor and disposed of by him outside the area of work at the place acceptable to the Engineer.

New Concrete Sidewalk and Vertical Curb and Gutter is to be placed in the location where the removed Driveways has been, the subgrade for the new work shall be compacted to at least 95% of maximum density at optimum moisture content.

The remaining area shall be backfilled and graded in accordance with "PARKWAY GRADING" in these specifications.

Vertical Curb and Gutter shall match the grade and alignment of that existing.

New sidewalk shall match existing.

Measurement and Payment.

(a) Measurement. This item will be measured as indicated below.

1. Driveway, measured by the square foot removed.
2. Sidewalk, measured by the square foot installed.
3. Vertical Curb and Gutter, measured by the lineal foot installed.
4. Parkway grading, incidental no pay item.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Removal of Existing Concrete Driveway(s)", which shall be full compensation for all labor, material, tools, hauling, compacting, backfilling and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION No. F-5

REMOVE OF CONCRETE PIPE

Scope.

The Contractor shall furnish all labor, tools, and equipment and perform all work necessary to remove and dispose of the existing concrete pipe shown on the plans to be removed.

General.

Existing concrete pipe indicated on the plans to be removed, shall be removed by the Contractor and disposed of by him outside the area of work. Where the concrete pipe to be is in a location where new construction is to be placed, the trench left after the removal of said pipe shall be backfilled with compactable native soil in 6-inch lifts and compacted to at least 90% of maximum density at optimum moisture content.

Measurement and Payment.

(a) Measurement. This item will be measured by the lineal foot between center lines of structures exist then the lineal foot measurement shall be made between the actual ends of the pipe.

(b) Payment, For removal f concrete pipe will be made at the contract price per lineal foot of concrete pipe removed, which shall include all costs for removal of pipe; for all labor, material, tools, hauling, excavation, backfill, tools, equipment and other expenses necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION No. F-6

REMOVAL OF CONCRETE PIPE AND CONCRETE HEADWALLS

Scope.

The Contractor shall furnish all labor, tools, and equipment and perform all work necessary to remove and dispose of all concrete headwalls shown on the plans to be removed.

General.

Existing concrete pipe and concrete headwalls, indicated on the plans to be removed, shall be removed by the Contractor and disposed of by him outside the area of work

Measurement and Payment.

(a) Measurement. This item will be measured by the job.

(b) Payment for removal of concrete pipe and concrete headwalls will be made at the contract lump sum price, which shall include all costs for removal of pipe, headwalls, aprons, and encasement; for all labor, hauling, excavation, backfill, tools, equipment and other expenses necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION No. F-7

REMOVAL OF STRUCTURES & OBSTRUCTIONS

Description.

Removal of structures & obstructions shall consist of the removal, wholly or in part, and satisfactory disposal of all structures and obstructions within the limits of said work to be done, which have not been designated to remain. Salvaging designated materials shall be included.

Indicated on the plans that existing structures, pavement, sidewalks, curbs, gutters and others existing improvements are to become an integral part of the planned improvements shall be considered to mean that such designated improvements are to remain even though not specifically noted to remain.

Materials removed and not designated to be salvaged or incorporated into the work shall become the property of the contractor.

General Requirements.

The contractor shall raze, remove and dispose of all structures and obstructions as required including, but not limited to, the following: Building, sheds, slabs, foundations, inlets, catch basins, culverts, headwalls, trash racks, bridges, piers, abutments, retaining walls, irrigation structures, standpipes, manholes, valves, gates, planters, curb, gutters, sidewalks, driveways, feedpens, corrals, cattle guards, trees, stumps, shrubs, and plants.

Hole, cavities, trenches or depressions left by the removal of structures and obstructions shall be backfilled with acceptable material to the grades required.

Blasting or other operations necessary for the removal of an existing structure or obstruction, which may damage new construction, shall be completed prior to placing new construction, shall be completed prior to placing new work.

Removal of Bridges, Culverts and Other Drainage Structures.

Bridges, Culverts, and other drainage structures in use by traffic shall not be removed until satisfactory arrangements have been made to accommodate traffic.

Removal of Pipe.

All pipe to be removed and either salvaged or relaid shall be carefully removed and every precaution taken to avoid breaking or damaging the pipe. The pipe shall be stored when necessary so that there will be loss or damage before relaying. The contractor will be required to replace sections lost from storage or damage by negligence or by the use of improper methods in their removal.

Removal of Concrete Pavement, Sidewalks, Slabs, Curb and Gutter.

The removal of concrete pavement, sidewalks, driveways, miscellaneous slabs, curbs, gutter, etc. shall include the breaking or cutting as necessary for removal and hauling and disposing of all debris.

When a portion of the concrete sidewalk, driveway or slab is to be removed to other than an existing joint, a joint with a minimum depth of one inch shall be sawed so that a neat edge remains after the removal of concrete.

Method of Measurement.

Removal of structures and obstructions will be measured on a lump sum basis except that when the bidding schedule contains specific items under this section on a units basis, measurement will be made by the unit specified in the bidding schedule.

When removal of pipe is specified as an item, the length of pipe removed will be measured by multiplying the number of commercial lengths removed, or fractions thereof, by the nominal laying length, or by measuring parallel to the centerline of the pipe in place, prior to removal, if practicable.

Basis of Payment.

The accepted quantities of removal of structures and obstructions will be paid for at the contract lump sum price, which price shall be full compensation for removing and disposing of the obstructions in accordance with this contract.

Specific obstruction items, including pipe, specified for removal and disposal under unit price pay items will be paid for at contract unit price per unit specified in the proposal, which price shall be full compensation backfill incidental to their removal, the price shall also include salvage of materials removed, their custody, preservation, storage on the right-of-way, and disposal as provided herein.

There will be no separate payment for excavating for removal of structures and obstructions.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. F-8

RELOCATION OF IRRIGATION STRUCTURES

Scope.

The Contractor shall furnish all labor, materials, and equipment for the relocation of irrigation structures.

General.

The work shall consist of relocating the irrigation structures as shown on the drawings and as specified herein. Where new construction is placed in the location of the existing structure the fill material shall be compacted to at least 95% of maximum density at optimum moisture content. If no new construction is to be placed in the location of the existing structure the area shall be backfilled in accordance with "PARKWAY GRADING" or "GRADING AREA BACK OF IMPROVEMENT" in these specifications. Concrete pipe work shall be in accordance with the section entitled "CONCRETE PIPE" of these specifications.

Measurement and Payment.

- (a) Measurement. Measurement shall be by the Job, complete in place.
- (b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Relocation of Irrigation Structures", which price shall be full compensation for all labor, material, equipment, and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. F-9

RELOCATION OF IRRIGATION DITCHES

Scope.

The Contractor shall furnish all labor, materials, tools, and equipment necessary to complete all operations in connection with the relocation of all irrigation ditches as shown on the drawings and as specified herein.

General.

The work shall consist of filling the existing ditches with suitable material, clean and free of any debris and organic material. Where new construction is placed in the location of existing ditch, the fill material shall be compacted to at least 95% of maximum density at optimum moisture content. If no new construction is to be placed in the location of existing ditch, the area shall be backfilled and graded in accordance with "PARKWAY GRADING" or "GRADING AREA BACK OF IMPROVEMENT" in these specifications.

The work also includes the construction of new irrigation ditches at locations and grades as shown on drawings.

Measurement and Payment.

- (a) Measurement. This item will be measured by the linear foot of existing ditch, in place before relocation, for all ditches necessary to be relocated to clear construction area.
- (b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "RELOCATION OF IRRIGATION DITCHES", which price shall be full compensation for all labor, material, tools, hauling, compacting, backfilling and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. G-1

MONUMENT COVERS

Scope.

The Contractor shall furnish all materials, labor, and equipment necessary to install monument covers in accordance with the drawings and as specified herein.

Materials.

(a) Frame and Cover. Cast-iron frames and covers shall conform in all essentials of design to the Standard Detail. The castings shall conform to the requirements of A.S.T.M. Specification A-48.

(b) Concrete. Concrete shall be Class "B" and shall be in accordance with the section entitled "PORTLAND CEMENT CONCRETE" in these specifications.

Construction Methods.

(a) Monuments. When required, straddle points will be set by the Engineer prior to the installation of monument covers by the Contractor.

(b) Disturbing of Monuments. Care shall be taken not to disturb the existing monument during the excavation, forming, placing of concrete, or installation of the cover. Concrete must NOT be placed against any part of the monument proper. The clearance between the concrete footing and the monument, as shown on the Standard Detail, must be maintained.

(c) Where monument covers are set in concrete paving, steps shall be taken to see that the bond between the top of the footing and the paving slab is broken.

(d) Monument covers shall be installed after the asphalt pavement has been placed. A hole shall be cut in the asphalt paving, the monument cover set so that it is flush with the top of the asphalt. Concrete shall then be poured around the cast-iron monument cover and finished level with the asphalt paving.

Measurement and Payment.

(a) Measurement. Each monument cover which has been satisfactorily installed will be measured as a unit for payment.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Monument Covers", which price shall constitute full compensation for furnishing monument covers, work as shown on the drawings and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. G-2

ADJUSTING VALVE BOXES IN PAVED AREAS

Scope.

The Contractor shall furnish all labor, material and equipment necessary to adjust valve boxes, as shown on the drawings and as specified herein.

General.

The work shall include the raising or lowering of existing valve boxes and adjusting the tops of the boxes to the exact grade of the finished surface in paved areas.

Adjusting Valve Boxes.

Where valve boxes are located in streets to be paved with asphaltic concrete, the paving shall be placed over the valve box cover, then the pavement shall be cut out around the box, the box raised to the exact finished grade, then Class "B" Portland cement concrete shall be poured around the cover to a depth and width of six inches. Traffic shall not be allowed to pass over within 2 days after the concrete has been placed.

Measurement and Payment.

(a) Measurement. This item will be measured as the actual number of valve boxes adjusted to grade in paved areas.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Adjusting Valve Boxes in Paved Areas", which price shall be full compensation for all labor, material, and incidentals necessary to complete the work as shown on the drawings and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. G-3

ADJUSTING CLEANOUTS TO GRADE

Scope.

The Contractor shall furnish all labor, material and equipment necessary to adjust cleanout rings and covers, as shown on the drawings and as specified herein.

General.

The work shall include the raising or lowering of cleanout rings and covers to meet finished grade.

Construction.

Where cleanouts are in areas to be paved, the asphalt paving shall be placed over the ring and cover and the pavement shall then be cut and the cleanout ring and cover set to grade. Class "B" Portland cement concrete shall then be poured around the ring and cover to a depth and width of six inches. Traffic shall not be allowed to pass over within 2 days after the concrete has been placed.

Measurement and Payment.

(a) Measurement. Each cleanout satisfactorily adjusted to grade shall be measured as a unit for payment.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Adjusting Cleanouts to Grade", which price shall constitute full compensation for all labor, material, hauling and incidentals necessary to complete the work as shown on the drawings and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. G-4

ADJUSTING MANHOLE RINGS AND COVERS

Scope.

The Contractor shall furnish all labor, material and equipment necessary to adjust manhole rings and covers, as shown on the drawings and as specified herein.

General.

The work shall include the raising or lowering of manhole rings and covers to meet finished grade.

Adjusting Manhole Rings and Covers.

- (a) New Streets. All manholes that are located in areas to be paved with asphaltic concrete shall be adjusted to final grade in the following manner:
1. The existing manhole ring and cover shall be removed and salvaged. All damaged rings and covers shall be replaced at the contractor's expense.
 2. The existing manhole wall (brick, block, etc.) shall be removed to a minimum depth of 3" below subgrade and the existing grout shall be removed from the brick course. All damaged bricks shall be replaced at the contractor's expense.
 3. Dirt and debris shall be cleared and a protective cover shall be placed over the manhole.
 4. The roadway shall be constructed complete. All courses of base material and pavement shall be placed and compacted over manhole as otherwise prescribed in the sections of these specifications entitled "Aggregate Base Course" and "Asphalt Work".
 5. All pavement and courses of material over the manhole shall be neatly cut and removed.
 6. In situations where the distance between the base of the existing manhole and the finished grade elevations of the new pavement is such that the standard brick manhole construction cannot be used, a reinforced concrete structure, subject to the approval of the field engineer, shall be constructed.
 7. Rings and covers shall be set to exact finish pavement grade and firmly anchored to the manhole with cement mortar. Class "B" Portland Cement Concrete to a depth and width of at least 6 inches shall be applied around the ring. No traffic shall be permitted to travel over concrete for 2 days.

8. All base course material in the excavated area shall be replaced in 6" maximum lifts and pneumatically tamped to the stipulated density.

(b) Overlaid Streets. All manholes that are located in areas to be overlaid shall be adjusted to final grade in the following manner:

1. If the ring and cover protrude above existing pavement such as to be an obstacle for the laydown machine, they shall be removed, the manhole covered, and the overlay course applied. If the ring and cover are at or below existing pavement grade, the overlay shall be applied directly over the existing ring and cover.

2. All pavement over the manhole shall be neatly cut and removed.

3. Rings and Covers shall be set to exact pavement grade and firmly anchored to the manhole with cement mortar. Class B Portland Cement Concrete, to a depth and width of at least 6 inches shall applied around the ring. Traffic shall not be permitted to travel over concrete for two days.

Bricks, rings and covers damaged during the raising Operation shall be removed and replaced at the contractor's expense.

Measurement and Payment.

(a) Measurement. Each manhole ring and cover satisfactorily adjusted to grade shall be measured as a unit for payment.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Adjusting Manhole Ring and Covers", which price shall constitute full compensation for all labor, material, hauling and incidentals necessary to complete the work as shown on the drawings and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. G-5

ADJUSTING EXISTING MONUMENT COVERS

Scope.

The Contractor shall furnish all materials, labor and equipment necessary to adjust existing monument covers in accordance with the drawings and as specified herein.

General.

The work shall include the raising or lowering of existing monument covers to meet finished grade.

Adjusting Monument Covers.

The Contractor shall be required to furnish and place additional concrete or remove existing concrete base and place new base as required, and adjust the top of the cover to the exact grade of the pavement. Traffic shall not be allowed to pass over nor paving be laid, within 4 days after the concrete has been placed. Care shall be taken so as not to disturb the existing monument during the excavation, forming, placing concrete, or adjustment to cover. Concrete must not be placed against any part of the monument proper. Where monument covers are located in concrete paving, a premolded expansion joint one half inch in thickness shall be placed around the entire outside surface of the cover, cut to shape, and placed in a neat and workmanlike manner. The paving slab shall not be bonded to the top of the footing.

Measurement and Payment.

- (a) Measurement. Each monument cover which has been satisfactorily adjusted to grade will be measured as a unit for payment.
- (b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Adjusting Existing Monument Covers", which price shall include full compensation for furnishing all materials for excavation and backfill, and for all labor, materials, equipment, tools and incidentals necessary to complete the work as shown on the plans and as specified herein.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. G-6

CONCRETE HEADWALL

Scope.

The Contractor shall furnish all materials, labor, and equipment and perform all work necessary to construct concrete headwalls, as shown on the plans and as specified herein.

General.

The work shall include all excavation for concrete headwalls irrespective of the nature of the material encountered or any necessary changes in depth due to unforeknown underground obstructions. Also, included shall be all compacted backfill and other necessary operations to complete the work to the lines and grades indicated on the drawings and as specified herein.

Material.

Portland cement concrete shall be Class "B" and shall be in accordance with the section entitled "PORTLAND CEMENT CONCRETE" of these specifications. Cement shall be TYPE _____.

Forms.

All forms shall be smooth and shall have a depth equal to the full depth of the concrete. Either wood or steel forms may be used. If wood forms are used, they shall be smooth, free from splits, knot holes and other surface defects. If steel plate forms are used, they shall be smooth, clean, and not excessively bent. In no event shall any form be removed while the concrete is sufficiently plastic to slump upon removal of the forms.

Placing Concrete.

The concrete shall be placed in the forms in layers. Each layer shall be tamped and spaded until the mortar entirely covers its surface. Every care shall be exercised in the spading along the faces of all forms so as to insure a surface free from voids and honeycombs.

Backfilling.

Immediately after forms are removed, the Contractor shall fill in behind the headwalls with good clean soil, free from rocks, and compact in 6-inch layers. Finish grading shall conform to the requirements of the section entitled "GRADING AREA BACK OF IMPROVEMENT", as applicable.

Measurement and Payment.

(a) Measurement. This item will be measured as a unit for each headwall completed in place.

(b) Payment. The amount of completed and accepted work, measured as provided above, will be paid for at the contract price for "Concrete Headwall", which price shall be full compensation for all labor, material, and incidentals necessary to complete the work as shown on the drawings and as specified herein.

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CHAIN LINK FENCE

Scope.

The Contractor shall furnish all labor, materials and equipment necessary to construct a Chain Link Fence as indicated on the drawings and as specified herein.

Materials.

(a) All Components. Iron or steel components shall be hot dipped galvanized after fabrication. All materials shall be new.

(b) Fabric. Fabric shall be 72" in width woven in a 2" mesh of #9 W & M gage copper bearing steel wire. Top and bottom edges shall be twisted and barbed. Minimum tensile strength of wire shall be 90,000 p.s.i. after galvanizing. Fabric shall be galvanized after weaving and shall stand 7 one-minute Immersions under the Pierce Test per ASTM-A-191-38.

(c) Line Posts. Line posts shall be 2" OD pipe, 3.65 lb/L.F.; 2" square, 4.1 lb/L.F.; or 2" H, 4.1 lb/L.F.; set not less than 36" into concrete; spaced not to exceed 10' center to center. No open seam materials will be allowed.

(d) Top Rails. Top rails shall be 1-5/8" OD pipe; 2.27 lb/L.F.; fitted with expansion joints of the outside sleeve type averaging not more than 20' center to center. Sleeves shall make rigid connection but allow expansion and contraction. Top rails to be anchored at terminal posts. Top rails to be continuous for full length of fence passing through fittings on top of line posts.

(e) Terminal Posts. End, corner, terminal or pull posts called terminal posts herein shall be 3" OD, 5.79 lb./L.F.; or 2" square, 5.79 lb/L.F.; shall be set not less than 36" in concrete; shall be used in lieu of line posts at ends of runs, changes in alignment or other points of strain. Terminal posts shall be fitted with bracing between terminal post and first line post. Bracing shall consist of not less than one horizontal 1-5/8" OD, 2.27 lb/L.F. Compression member located mid height of fabric and one diagonal tension member from base of terminal post to end of compression member. Tension member shall be not less than 3/8" in diameter and fitted with a tension take up device. Compression and tension members shall be secured to terminal posts and line posts with suitable fabricated devices to develop the full strength of the members.

(f) Barbed Wire and Barbed Wire Extensions. Posts shall be fitted with an extension device to carry three strands of barbed wire. Extension device shall be at 45 to inside which will extend height of fence one foot except at gates where, if necessary for clearance, extension may be vertical. Top rail shall pass through extensions. Extensions at terminal posts shall be securely fastened to the terminal posts. Each strand of barbed wire shall be made of not less than two strands of 12 W & M gage twisted steel wire. Barbs shall be

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4 point type of 14 W & M gage steel barbs not greater than 4" center to center.

(g) Fabric Bands. Fabric shall be securely attached to posts at not greater than 12" center to center and top rails at not greater than 24" center to center with fabric bands. Fabric bands shall be either aluminum wire or aluminum straps for line posts and top rails and ends shall be twisted around the fabric.

(h) Gate Posts. Gate posts shall be round pipe and shall be not less than the size and weights given below for the gate openings shown.

Single gate up to	5'	3" OD	5.79
Single gate	6' and up to 13'	4" OD	9.11
Single gate	14' and up to 18'	6-5/8" OD	18.97
Single gate	19' and up to 32'	8-5/8" OD	28.55

Square posts of same or greater weights shown above may be substituted for round pipe. Gate posts shall be set into concrete not less than 36" for 3" and 4" OD pipe and 48" for 6-5/8" pipe.

(i) Gate Frames. Gate frames shall be not less than 2" OD, 2.72 lb/L.F.; or 2" square 3.65 lb/L.F. Cantilever sliding gate horizontal member shall not be less than 2" OD. Frames shall be constructed with heavy pressed steel or malleable castings or welding at the joints to produce rigid and weatherproof joints. Bracing and details of construction shall be adequate to provide a rigid non-sagging and non-twisting gate of high quality. Fabric shall be same as fence fabric and shall be securely attached, using methods equal to fence fabric attachment. Welding of fabric to frame will not be permitted. Frames shall have provision for three strands of barbed wire in vertical position.

(j) Latches. Single gates shall have rugged automatically engaging latches. Double gates shall have drop bar type latch for one leaf with automatically engaging latch for other leaf. Drop bar shall be outfitted with suitable casting set in concrete to hold gate leaf in place when drop bar is engaged. Latching devices shall be heavy duty type and shall be lockable with padlock from either side. Heavy duty padlock secured to gate with chain and two keys shall be provided for all gates. Padlocks on job will be keyed alike.

(k) Gate Keepers. Gates shall be equipped with gate keepers to hold gate in open position as indicated on plan.

(l) Hinges. Gates shall be of the swing type and shall be capable of swinging 180 from closed to open position. Hinges shall be rugged heavy duty type.

(m) Concrete for Post Foundations. Posts shall be set in concrete as provided above. Concrete foundation shall be not less than 10" diameter for line posts and 12" for other posts except 6-5/8" posts and 8-5/8" posts which shall be 18". Concrete shall extend not less than 4" below bottom of post and shall be crowned at the top to shed water. Concrete shall be Class "B" concrete.

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(n) Miscellaneous Materials. Other miscellaneous materials required to complete the fencing in a first class manner shall be furnished as required. Miscellaneous materials shall be consistent with the fence and gate materials listed above.

Gate Sizes shall be as follows except when indicated otherwise on plans or specifications.

- Single leaf pedestrian gates shall be 4' in width.
- Single or double leaf vehicular gates across drives or roads shall be 2' greater in total opening width than the total width of the drive or road exclusive of shoulders.
- Single or double leaf vehicular gates in non-road or drive areas shall be 12' in width.

Installation. Install fence and gates in strictly first-class workmanlike manner. Vertical members shall be truly vertical. Alignment shall be true. Fence shall be tight without sags or bulges. Damaged materials shall be removed from the site and replaced with new. Provide men experienced with erection of fence and gates, provide any special tools or equipment required. Concrete work shall be finished with a steel trowel and will be smooth, true and neat.

Fabric shall be placed 2" above grade. Minor irregularities in ground will be corrected to maintain the 2" clearance.

Stretch poles shall be set at a minimum of 500'-0" intervals.

All fence work shall be accomplished in accordance with the suggested standards of the "Chain Link Institute of America", latest edition.

Basis of Payment.

The accepted quantities of Fences and Gates, measured as provided above, will be paid for at the contract unit prices, complete in place.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Chain Link Fence	L.F.
Gate	Each

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. H-1a

CHAIN LINK FENCE

Scope.

The Contractor shall furnish all labor, materials and equipment necessary to construct a Chain Link Fence as indicated on the drawings and as specified herein.

Materials.

(a) All Components. Iron or steel components shall be hot dipped galvanized after fabrication. All materials shall be new.

(b) Fabric. Fabric shall be 48" and 144" in width woven in a 1" mesh of #9 W & M gage copper bearing steel wire. Top and bottom edges shall be twisted and barbed. Minimum tensile strength of wire shall be 90,000 p.s.i. after galvanizing. Fabric shall be galvanized after weaving and shall stand 7 one-minute immersions under the Pierce Test per ASTM-A-191-38.

(c) Line Posts. Line posts for 48" fabric shall be 1-3/8" OD pipe; set not less than 24" into concrete; spaced not to exceed 10' center to center. No open seam materials will be allowed.

(d) Top Rails. Top rails shall be 1-3/8" OD pipe; fitted with expansion joints of the outside sleeve type averaging not more than 20' center to center. Sleeves shall make rigid connection but allow expansion and contraction. Top rails to be anchored at terminal posts. Top rails to be continuous for full length of fence passing through fittings on top of line posts.

(e) Terminal Posts. End, corner, terminal or pull posts called terminal posts herein shall be 3" OD, 5.79 lb./L.F.; shall be set not less than 36" in concrete; shall be used in lieu of line posts at ends of runs, changes in alignment or other points of strain. Terminal posts shall be fitted with bracing between terminal post and first line post. Bracing shall consist of not less than one diagonal tension member from base of terminal post to end of compression member. Tension member shall be not less than 3/8" in diameter and fitted with a tension take up device. Compression and tension members shall be secured to terminal posts and line posts with suitable fabricated devices to develop the full strength of the members.

(f) Fabric Bands. Fabric shall be securely attached to posts at not greater than 12" center to center and top rails at not greater than 24" center to center with fabric bands. Fabric bands shall be either aluminum wire or aluminum straps for line posts and top rails and ends shall be twisted around the fabric.

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(g) Gate Posts. Gate posts shall be round pipe and shall be not less than the size and weights given below for the gate openings shown.

Single gate up to	5'	3" OD	5.79
Single gate	6' and up to 13'	4" OD	9.11
Single gate	14' and up to 18'	6-5/8" OD	18.97
Single gate	19' and up to 32'	8-5/8" OD	28.55

Gate posts shall be set into concrete not less than 36" for 3" and 4" OD pipe and 48" for 6-5/8" pipe.

(h) Hinges. Gates shall be of the swing type and shall be capable of swinging 180" from closed to open position. Hinges shall be rugged heavy duty type.

(i) Concrete for Post Foundations. Posts shall be set in concrete as provided above. Concrete foundation shall be not less than 12" diameter for line posts. Concrete shall extend not less that 6" below bottom of post and shall be crowned at the top to shed water. Concrete shall be Class "B" concrete.

(j) Miscellaneous Materials. Other miscellaneous materials required to complete the fencing in a first class manner shall be furnished as required. Miscellaneous materials shall be consistent with the fence and gate materials listed above.

Installation.

Install fence and gates in strictly first-class workmanlike manner. Vertical members shall be truly vertical. Alignment shall be true. Fence shall be tight without sags or bulges. Damaged materials shall be removed from the site and replaced with new. Provide men experienced with erection of fence and gates, with a steel trowel and will be smooth, true and neat.

Fabric shall be placed 3" above grade. Minor irregularities in ground will be corrected to maintain the 3" clearance.

Stretch poles shall be set at a minimum of 500'-0" intervals.

All fence work shall be accomplished in accordance with the suggested standards of the "Chain Link Institute of America", latest edition.

Basis of Payment.

The accepted quantities of Fences and Gates, measured as provided above, will be paid for at the contract unit prices, complete in place.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Chain Link Fence	L.F.

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CITY OF YUMA, ARIZONA
STANDARD SPECIFICATION NO. P-1

PRESSURE PIPING, VALVES AND HYDRANTS

General.

(a) This specification shall apply to the furnishing and installation of different sizes, types and classes of pressure piping, fittings, valves and hydrants. Only those provisions of this specification referring to the furnishing and/or installation of pressure piping or piping constructed of the materials herein specified which are shown on the plans and/or elsewhere specified in the special provisions are to be considered as contract requirements.

Materials.

(a) All polyvinyl chloride pipe (PVC) 4" or larger shall meet the requirements of AWWA C-900, with a minimum pressure rating of 150 psi.

Plans and Specifications.

(a) All work shall be performed in accordance with the plans and Specifications supplemented by Johns-Manville "Blue Brute Installation Guide" and shall meet the requirements of ASTM D-2774. A copy of the Plans and Specifications and Installation Guide shall be on the job site at all times during construction. The Engineer or his Inspector shall be empowered to stop work if Contractor fails to comply with the dictates of these requirements. Error made as the result of noncompliance will be corrected without added compensation to the Contractor.

(b) Deviations from plans and specifications must first be approved by the Engineering Division as set forth by the Engineering Division with concurrence from the Water Division.

(c) Deviations which require added compensation, when Contractor is under contract to the City of Yuma, will not be authorized unless the extra cost is predetermined as set forth in writing and attested to by an authorized representative of both the Engineering Division and City Administrator, and the Contractor.

Trenching.

(a) The width of trench at pipe level shall fall within the limits as set forth in the Johns-Manville Installation Guide. The depth of trench shall be such as to provide a minimum 42-inch cover over pipe, unless specified otherwise on the plans. In rock excavation, the trench shall be dug 6 inches deeper than normal trench grade and refilled to normal grade with select tamped soil or sand import. A trencher shall not be used for thrust block excavations since all thrust blocks shall bear against undisturbed soil and yet offer a minimum obstruction to other underground structures.

(b) All trenching shall be accomplished with the aid of grade and alignment stakes unless the Engineering Division authorizes otherwise. It shall be the duty of the Contractor to protect and preserve all staking at least until all check measurements have been made. The destruction or removal of stakes by the Contractor may require restaking, the cost of which shall be borne by the Contractor.

(c) Permission for tunnel work may be granted for crossing under crosswalks, driveways or existing utility lines, but such tunnels shall not exceed ten (10) feet in length unless otherwise specified. The length of trench to be opened at one time may be limited when, in the opinion of the City Engineer, such limitation is necessary. Amount of open or unfilled trench shall not exceed 300 lineal feet, unless ordered by the City Engineer and failure to comply with this requirement shall be cause of shutdown of entire project until such backfilling is accomplished.

(d) Prior to trenching or excavating, the Contractor shall explore the area to be excavated in search of underground pipes, cables, or structures. The Contractor is responsible to contact Blue Stake to coordinate with Utility Companies for locating underground pipe, cables or structures necessary to complete the project. Exact locations and depths shall be determined by the Contractor and he shall be held responsible for damages.

Laying Asbestos-Cement Pipe.

(a) Pipe couplings shall not rest on any undisturbed surface of the trench floor. Final bedding for the pipe shall be uniform, compact, and continuous. "Belling" for pipe couplings, to permit laying pipe in direct contact with trench floor, will not be permitted except upon authorization by the Engineering Division.

(b) The "mound" method shall normally be used to support pipe as it is laid in the trench. After laying but before starting to backfill, each section of pipe shall be adjusted at its couplings to eliminate "zigzag" in alignment and "waves" in the profile. The clearance under each coupling shall be at least 2 inches. No coupling shall rest on, or settle down to, original trench bottom and no pipe or coupling shall come in direct contact with rock, concrete, or underground structures.

(c) The radius of curvature of a trench shall determine the maximum length of pipe section that can be used without exceeding the allowable deflection at a coupling. The deflection of any flexible joint shall not exceed that prescribed by manufacturers of the asbestos-cement pipe. The J-M Installation Guide outlines radius of curvature that can be negotiated with pipe sections of various lengths.

(d) Short lengths of pipe shall be used at rigid structures (such as tapping valves) and may be used for making closures or repairs, locating fittings and service outlets more accurately, and negotiating curves without exceeding allowable deflection at couplings.

Laying Asbestos-Cement Pipe.

(a) Pipe couplings shall not rest on any undisturbed surface of the trench floor. Final bedding for the pipe shall be uniform, compact, and continuous. "Belling" for pipe couplings, to permit laying pipe in direct contact with trench floor, will not be permitted except upon authorization by the Engineering Division.

(b) The "mound" method shall normally be used to support pipe as it is laid in the trench. After laying but before starting to backfill, each section of pipe shall be adjusted at its couplings to eliminate "zigzag" in alignment and "waves" in the profile. The clearance under each coupling shall be least 2 inches. No coupling shall rest on, or settle down to, original trench bottom and no pipe or coupling shall come in direct contact with rock, concrete, or underground structures.

(c) The radius of curvature of a trench shall determine the maximum length of pipe section that can be used without exceeding the allowable deflection limits established by the manufacturer. The pipe shall form a true arc, curved uniformly throughout its length with no deflection at the joint.

Valve Box Setting.

(a) Contractor is required to set all valve boxes and adjust to final grade. Lower section of box shall not rest on bonnet of the valve. At time of final inspection, valve boxes shall be plumb centered over valve operating nut, and the interior free of dirt and other debris. When the distance from the top of the valve box exceeds (36") thirty-six inches, an extension to the operating nut shall be furnished and installed. See standard detail, which is available at the Engineering Division Office.

Valve-Fitting Assembly.

(a) Valve fitting assemblies shall be made prior to installing in the trench to facilitate proper cleaning and application of protective coating. All steel or malleable iron surfaces that will come in direct contact with the soil shall be given a protective coating. This coating shall be coal tar primer and coal tar enamel applied in accordance with its companion primer only on bolt-flange assemblies that cannot be made above ground. Protective coatings may be subjected to a high-voltage Holiday Detector test and any detected Holidays shall be corrected to the satisfaction of the Engineering Division. 10-mil polyethylene sheeting may be used as a substitute for protection of fittings.

(b) Assemblies shall be made with new gaskets and new bolts and nuts of the proper size. Bolt heads shall be positioned to insure free movement of the nut after installing concrete thrust blocks.

(c) Ring-Tite grooves in valves and fittings shall be inspected prior to assembly for high spots or abnormal surface roughness that might be conducive to leakage under pressure. Castings shall also be inspected for possible cracks or blowholes in the metal. Cement-mortar linings shall meet the requirements of the AWWA Standard C104.

(d) Asbestos-cement pipe shall be cut with hand pipe cutters which use a cutting edge (do not use wedge-type roller cutters), motor driven saws using abrasive discs, and with hand saws. The ends of cut sections shall be machined smooth and square with the longitudinal axis of the pipe section.

The Polyvinyl Chloride Pipe shall be cut with a fine-toothed hacksaw, handsaw, or a motor driven saw with a steel blade or abrasive disc. The ends of cut sections shall be square with the longitudinal axis of the pipe section.

(e) The Contractor shall furnish and use wood plugs in all open end pipes and fittings which have been installed in a trench and are left unattended. Care shall be exercised to prevent dirt or rodents from entering pipe as it is being laid or as it lays in a trench.

(f) Number 12 gauge, plastic coated, soft copper wire shall be attached to the top side of PVC pipe for its entire length. Retention of the wire to the top side of the pipe shall be accomplished by either a half hitch or a tie at each coupling and near but not in contact with metal fittings or valves in the lines.

Water Mains Near Sewers.

(a) Horizontal Separation. When water pipe and sewers are laid parallel to each other, the horizontal distance between the water pipe and sewer shall be no less than 6 feet. Each line shall be laid in a separate trench or the space in between filled with compacted fill.

(b) Vertical Separation. When a sewer crosses a water pipe at a point at which the sewer is 2 feet or more below the water pipe, no extra protection is required. At all other crossings, the sewer shall be constructed of ductile iron with slip joints with restrainer glands or mechanical joints for a distance of at least 6 feet in each direction from the crossing.

(c) Unusual Conditions. Where conditions prevent the minimum horizontal and vertical separation set forth above, both the water main and sewer should be constructed of mechanical joint ductile iron pipe pressure tested to assure water tightness before backfilling. Where a water main must cross under a sewer a vertical separation of at least 24 inches between the bottom of the sewer and the top of the water main shall be maintained with adequate support provided for the sewer lines to prevent them from settling on and breaking the water main.

(d) Sewer Manholes. No water pipe shall pass through, or come into contact with, any part of a sewer manhole. Special care should be taken to make sewer manholes as nearly watertight as practicable.

Backfilling and Tamping

(a) All backfilling of trenches shall be done in such a manner as not to disturb the pipe, conduit, or other structure. In all cases the backfilling around the pipe shall be carried up to a point 12 inches above the top of the pipe with clean sand free from stones or clumps, the maximum size

allowable in this section will pass through a No. 4 sieve (3/16-inch screen). This section, while being placed shall be compacted by hand or mechanical tampers in 4-inch lifts to insure lateral support, until the backfill material reaches a minimum of 95 percent of its maximum density. Each lift shall be compacted satisfactorily before an additional lift added. The first 4-inch lift shall be worked underneath the pipe, couplings, fittings and valves with proper tools to insure a complete and continuous bearing surface free of voids. It shall be the responsibility of the Contractor to use a clean sand material from that which has been excavated or to import a material that will meet the requirements of clean sand as defined above. The rest of the trench shall be backfilled with material similar to Select Sand in 15-inch maximum (loose material) lift and compacted by an approved method so that the soil reaches 95 percent of its maximum density. The Engineering Division shall approve the backfill and compaction methods prior to construction.

(b) Sheet piling shall in all cases be removed, except where expressly authorized by the Engineer. Where sheet piling is drawn, all cavities remaining in or adjoining the trench shall be solidly filled. Where sheet piling is left in place, all cavities behind such sheet piling shall be solidly filled.

Excess material shall be rounded up in a neat mound over the trench or removed as directed by the Engineer.

(c) Compaction of backfill shall be effected by a method that is in keeping with the dictates of good practice. Water settlement shall not be allowed as method of trench backfill compaction. The use of water that would result in "floating" of the pipe or washing out of backfill from around the pipe is prohibited. The method employed for obtaining compaction is dependent principally upon type of soil used in backfill. Therefore, the method employed must be acceptable to the Engineering and Water Divisions.

Thrust Blocks.

(a) The size of thrust block depends upon water pressure, pipe size, angle or flow diversion, type and condition of soil and type of fitting. No thrust blocks shall provide less than 6 square feet of bearing surface against undisturbed soil and larger in area if necessary to meet soil-bearing capacity.

The minimum size of bearing surface shall be determined at time of construction by the Engineer and verified by the Water Division. Concrete shall be kept behind the bell of fitting and not allowed to enter a Ring-Tite joint. Encase tie-down bars in the concrete so that no metal surface is left exposed.

(b) A thrust block shall be made in one continuous pour of concrete to form a monolithic block. Thrust blocks shall be constructed using 2500 psi, 28 day strength concrete.

(c) All valves 8 inches or larger in size shall be provided with anchor blocks and tie-down bars embedded in the concrete.

Restoring Street Surfaces.

(a) The cutting and restoration of paved surfaces shall be in compliance with the requirements of the controlling agency (State, County, City, Water Division, or private). The Contractor shall supply all paving or patching materials. Contractor shall be held responsible for proper compaction or backfill and any settlement over water trenches within one year after application.

(b) All patches shall be symmetrical in shape (square, rectangular, or circular), smooth surfaced, and blend evenly into the surrounding pavement.

(c) Plant mix patches may be applied in one lift providing the thickness of surrounding pavement does not exceed 2 inches. A binder shall be used on the cut surfaces prior to the application of the hot plant mix.

(d) Concrete patches shall be 8 inches in thickness and extend into the surrounding pavement at least 6 inches beyond the encompassed valve box(es). The surface shall be smooth and blend evenly into the surrounding surfaces. The edges shall be sealed with a bitumastic filler after concrete has set at discretion of Engineer.

Tapping Valves.

(a) Tapping valves mounted on asbestos-cement pipe shall be accomplished by means of split type flanged sleeve as specified in the material list. Before assembling, pipe barrel shall be cleaned thoroughly with a wire brush to provide a smooth, hard surface for the sleeve. Tapping sleeves should be well supported independently of the pipe during the tapping and the support used should be left in place. Thrust blocks shall be used the same as for any other fitting.

(b) Asbestos-cement pipe shall be joined to a tapping valve by "dry packing". Asbestos-cement yard shall be used to center pipe in hub and also to prevent spillage into valve. The length of the first joint shall not exceed a quarter length of asbestos-cement pipe.

(c) Tapping valves mounted on steel mains shall be accomplished by means of a shaped nipple and reinforced welding saddle or approved equal. After completion of all welding and prior to mounting of valve, the shaped nipple shall be coated and lined with two coats of "Koppers" Bitumastic Super Tank Solution of approved equal. The slip-on shall be counter bored to mate with lip on tapping valve.

(d) Steel pipe joined to a tapping valve shall be accomplished in a manner similar to that outlined in paragraph 11b. In addition, a 1/4 inch round steel rod shall be welded to the steel pipe to be inserted in the hub end of the valve for anchor purposes.

Fire Hydrants.

(a) The Contractor shall furnish all labor, materials, and equipment necessary to install fire hydrants complete in place at locations shown on the plans in accordance with the standard details and special provisions. Fire hydrants furnished by the Contractor shall conform to the specifications on file at the City Engineer's office. This shall include any and all modifications to the standard hydrant as received from the Contractor's vendor to bring the hydrant into compliance with agreements called out hereinafter.

(b) All hydrants shall stand plumb, with the 4-1/2" pumper nozzle facing the curb. Hydrants shall be installed with nozzles at least 15 inches above established or proposed finished grade.

(c) If paint is chipped, scuffed, or otherwise damaged during handling and installation, the Contractor shall touch up such spots as may be designated by the Engineering Division representative.

(d) All hydrants must be tested, flushed, and left in good working condition in accordance with the Testing and Sterilizing Section of this specification.

Valves.

(a) The Contractor shall furnish all labor, materials, and equipment necessary to furnish and install valves complete in place at locations shown on the plans in accordance with standard details and special provisions.

Gate Valves.

The specifications shall cover Hub-End by Flange, Ring-tite, and Double Flanged Tapping Gate Valves with non-risings stems. All valves shall have all bronze internal working parts, parallel seating, and solid disc with resilient seating surface or resilient ring seal gland. All valves and tapping valves shall open left, counter clockwise, and a 2" square operating nut.

Wedging Mechanism: By means of a top wedge, bottom wedge and two side spreaders, the disc shall be wedged against the seat at four separate contact points near the outside edge of the disc. The top wedge, the bottom wedge and the two side spreaders shall be free to adjust or adjustable, assuring equal distribution of the seating pressure at the four contacting points. The top wedge nut shall be designed so that the closing pressure applied by the stem will not bind or bend the stem. The wedge mechanism is tapered so that during vertical movement, abrasive action between the disc and the seat rings is eliminated.

Stem: The threads on the bronze stem shall be Acme cut in a most perfect manner. The stem for valves shall be made from Modified Manganese Bronze, A.B. alloy 933.

Material: All iron castings shall be made from a superior quality of iron remelted in a couple. Iron shall be tough and even grain and shall possess a tensile strength of not less than 31,900 pounds per square inch. These castings shall be clean and perfect without blow or sand holes or without defects of any kind. All bronze castings, except the stem, shall have a tensile strength of not less 30,000 pounds per square inch. All stems shall be made from bronze having a tensile strength of not less than 60,000 pounds per square inch.

Painting: All iron parts, after being thoroughly cleaned, shall be painted throughout with two (2) coats of asphaltum varnish.

Pressure Ratings: All valves 12" and under are to be resilient wedge gate valves. The following valves will be accepted:

- Waterous Series 500 Resilient Wedge
- Clow Resilient Wedge
- American Darling 80 CSR Resilient Wedge

Markings: All valves shall have cast integral upon their body, in raised letters the manufacture's name, pressure rating valve size and year of manufacture.

Submittals: The bidder shall submit five sets of certified drawings, showing the principal dimensions, construction details, and materials used for all parts of the valve, along with a certificate showing compliance with these specifications.

Touch-up: If paint is chipped, scuffed, or otherwise damaged during handling and installation, the Contractor shall touch-up such spots as may be designated by the Engineer or his Inspector.

Testing and Sterilizing.

The testing of PVC waterlines shall be undertaken as follows and in descending order of precedence.

1. All visible leaks shall be repaired, regardless of the amount of leakage and regardless of whether the leak develops under test pressure of line pressure.
2. Initial pressure for both pressure test and allowable leakage test shall be a minimum of 150 psi.
3. A pressure test will be deemed successful if it passes the criteria set forth by AWWA C-600, Section 4 (current edition) and that criteria noted above.
4. Should the pressure test be unsuccessful, the Contractor has the option of attempting an allowable leakage test. This test will be deemed successful it passes the criteria set forth in AWWA C-600, Section 4 (current edition) or AWWA M-23 (current edition), whichever is more restrictive, and that criteria noted above.

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(a) Connection to In-Service Mains. All testing is to be accomplished prior to joining the existing supply main to eliminate immeasurable leakage past gate valves during test that would create spurious results and also possible pollution in sterile mains. At no time shall abnormal pressure be imposed on Customers' service lines. Any deviation in testing procedure shall be by written authority and direction of the Water Division.

(b) Sterilization. Any part of a distribution system which has satisfactorily met the requirements of the pressure-leakage test shall be sterilized after it has been joined to inservice mains. Contractor is responsible for furnishing and installing all necessary thrust blocks, pipe, fittings, and valves required to inject the sterilizing solution at points designated by the Water Division and withdraw water and/or solution in order to effect satisfactory results. Tapped couplings or bronze service clamps are to be used for mounting corporation stops on asbestos-cement mains. Sterilization shall be done in accordance with Arizona Department of Health Services Bulletin.

The Contractor will be responsible for chlorination in accordance with AWWA Standard C651-86, latest revision.

(c) Replacement of a pipe section after pressure test and/or sterilization has been completed may require a re-test for pressure-leakage and/or resterilization as directed by the Water Division.

(d) Water required for the testing and flushing activities associated water main construction shall be provided by the Contractor or obtained from existing City of Yuma water mains and appurtenances, at such locations as are arranged between the Contractor and the City of Yuma Water Division. The Contractor shall make all necessary arrangements for securing and transporting such water and shall take such actions in a manner that will produce no harmful drain upon or pressure decrease to the existing City water system.

Water consumed from the existing City water system by the Contractor, for activities other than testing and flushing. Shall be paid for by the Contractor at the standard rate established by the Water Division. All water obtained from the existing City water system shall be metered and a log shall be maintained by the Contractor, noting date, purpose and amount of water consumption. This log shall be provided to the City Water or Engineering Division for review upon request.

Measurement and Payment.

(a) Measurement for Class 150 piping shall be by the lineal foot for the size of pipe shown on the drawings along the "in place" centerline of the pipe through valves, fittings and casings. Bid price to include all excavation, laying pipe, couplings, fittings, thrust blocks, compaction, testing clean-up, vertical curb and gutter removal, sidewalk removal, valley gutter and apron removal, driveway and alley entrance removal, and removal and disposal of existing gate valves and valve box and covers, disconnection of existing water with concrete plug or water tight plug and thrust block, whichever applies, connection of new Class 150 pipe to existing pipes with adaptor, and removal of existing water pipe whether shown on the plans or not, necessary to provide a complete job.

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(b) Measurement for new fire hydrants, fire hydrant replacement, gate valves, tapping sleeves and valves, and new water or fire service line reconnection, new water or fire service line extension shall be measured by the individual items that constitute furnishing a complete project.

(c) Payment. The amount of completed and accepted work measured as provided above, will be paid for at the contract price for the various sizes of Class 150 and for furnishing the various items shown on the proposal schedule necessary to provide a complete job, which price shall include full compensation for all labor, material, tools, compacting, backfilling and incidentals necessary to complete the work as shown on the plans and as specified herein.

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DUCTILE IRON SEWER PIPE

Scope.

The Contractor shall furnish all labor, materials, and equipment and perform all work necessary to properly connect in place, at the locations shown in the Contract Drawings, all piping. Fittings and incidentals for the completion of the installation of the Ductile Iron Sewer Pipe as indicated on the plans and as specified herein.

Materials.

All ductile Iron Pipe shall be manufactured in accordance with the latest specifications ANSI A21.50 "Thickness Design of Ductile-Iron Pipe." All ductile iron pipe shall be Class 50 coated with fusion bonded epoxy in accordance with AWWA C213 on the interior and exterior of pipe.

Trenching and Backfilling.

The trench shall be excavated and backfilled in accordance with "EXCAVATION."

Measurement and Payment.

a) Measurement: Each ductile iron pipeline, which has been satisfactory installed at the location indicated on the plans, will be measured as a unit for payment for the different sizes of pipe shown on the drawings.

b) Payment: The amount of completed and accepted and work, measured as provided above, will be paid for at the contract price for various sizes of "New 8" & 12"

Ductile Iron Sewer Pipe (14 L.F. Minimum each)", which price shall constitute full compensation for furnishing all labor, materials, equipment, hauling, compacting, backfilling, and incidentals necessary to complete the work as shown on the plans and as specified herein.

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