

## SECTION 02770

### CONCRETE CURB, CURB AND GUTTER, VALLEY GUTTERS, SIDEWALK, AND DRIVEWAYS

#### PART 1 - Description

The work covered by this section consists of furnishing all equipment, labor, and materials necessary for constructing concrete curb, curb and gutter, valley gutters, sidewalks, and driveways on natural or prepared subgrades and bases, completed in accordance with the following specifications and dimensions shown on the plans.

#### PART 2 – Materials

##### 2.01 Materials

###### A. Portland Cement Concrete

1. Portland Cement Concrete shall conform to the requirements specified under Section 03050 Portland Cement Concrete

###### B. Reinforcing Steel and Fibers

1. Reinforcing steel for concrete reinforcement shall meet the requirements of ASTM A615, Grade 60.
2. Welded wire fabric for concrete reinforcement shall meet the requirement as ASTM A185. Mesh shall be welded plain cold-drawn steel wire fabric.
3. Reinforcing Fibers
  - a. Concrete reinforcing fibers shall be polypropylene collated, fibrillated fibers designed and engineered specifically for use as secondary reinforcement for concrete, shall be three-quarter inch (3/4") (20mm) to one inch (1")(25mm) in length and be manufactured by Fibermesh Company, Forta Corporation, or approved equal.

###### C. Preformed Expansion Joint Material

1. Preformed joint material shall comply with the requirement of ASTM D994, ASTM D1751, or ASTM D1752.

###### D. Leveling Base Course

1. Base course materials, if specified, shall conform to the requirements of sand with less than 10% passing No. 200 sieve.

#### E. Forms

1. Concrete forms shall be wood, steel, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal.
2. Forms shall be coated with a non-staining agent that will not discolor or deface surface of concrete.

#### F. Curing Compound

1. Curing compound shall be poly-alpha-methyl-styrene (PAMS) meeting AASHTO 148 Class B, or engineer approved equivalent.

#### G. Foundation Material

1. Refer to Section 02632 for Foundation Material

#### H. Aggregates

1. Course and fine Aggregates shall meet the requirements of ASTM C33 Article 2. Concrete mix under this Section shall meet one and one half inch (1½") (37.5 mm) sieve size, as specified in Division 300, Section 301.

### **2.03 Subgrade and Base**

#### A. Natural Subgrades.

1. Subgrade shall be cut to the grade to accommodate concrete improvement being specified. The upper eight inches (8") (200mm) of the subgrade shall be compacted to a dry density of at least 95% of maximum dry density as determined by ASTM D698 at a moisture content of  $\pm 2\%$  of optimum. The finished surface of the subgrade shall be smooth, free from surface irregularities, and true to line and grade as established by grade hubs or pins.
  2. Compaction tests shall be performed a minimum of every one hundred fifty feet (150') (45m) of curb walk or side walk, once for each valley gutter, and once for each driveway not part of a section of curb walk being tested. This testing requirement is only applicable for new subdivision construction.
- B. Trenches crossing curbwalk, valley gutters, or other concrete paving within the City right-of-way shall be compacted the full depth of the trench and shall be compacted to a dry density of at least 95% of maximum dry density as determined by ASTM D698 at a moisture content of  $\pm 2\%$  of optimum. This applies to all trenches installed for any purpose. Prepared Subgrades with

## Foundation Material

1. Where spongy, organic, or otherwise unsuitable material is encountered, which, in the opinion of the Engineer is unsuitable for subgrade, such unsuitable material shall be removed to a minimum of twelve inches (12") (300mm) below the four inch (4") (100mm) thick leveling base course, and replaced with foundation material. The Engineer may direct the Contractor to excavate deeper than the specified twelve inches (12") (300mm).
2. All foundation material shall be compacted to 95% of maximum dry density, as determined by ASTM D698 at a moisture content of  $\pm 2\%$  of optimum. Tree roots shall be removed at least one foot (1') (300mm) laterally and twelve inches (12") (300mm) vertically below all prepared subgrades.

## C. Proof Rolling

1. Subgrades shall be proof rolled after compaction testing requirements have been passed and prior to placement of the leveling base course.
2. Proof rolling shall be performed in the presence of the Engineer and a representative of the City Engineer's office.

## D. Leveling Base Course.

1. Just prior to placement of concrete, the four inch (4") (100mm) thick leveling base course shall be accurately graded to conform to the grade of the forms, and sprinkled if necessary until the moisture content is at or near optimum moisture content. Optimum moisture content shall be determined by the Engineer in accordance with ASTM D698. In no case shall concrete be placed on a saturated base or if free water is standing on the base. This paragraph applies in areas where spot concrete improvements are scheduled such as short runs of new curb and gutter and in areas where valley gutters are removed and replaced and or where concrete is placed manually in lieu of machine placement.

## 2.04 Forms

- A. When using forms, they shall be of wood or metal, straight, free from warp, and of sufficient strength when staked to resist the pressure of the concrete without springing, and the upper edge shall form a true line. Outside forms for the curbside shall be of a depth equal to the full depth of the sidewalk, and the inside forms shall be of the depth of the gutter and shall be so designed as to permit secure fastening to the outside form. All forms shall be cleaned thoroughly and greased or oiled before concrete is placed against them. Forms that have become worn, bent, or broken shall not be used. Forms shall be securely set true to line and grade.
- B. On short radii curves, steel plates, which can be readily formed to the desired radii, shall be used. Face forms, if used, shall be preshaped to the proper radii. Care shall be exercised to insure the maintenance of the required cross-section around the entire radius.

- C. The Contractor shall provide an approved metal straight edge, ten feet (10') (3m) in length for use in checking the alignment of the forms prior to placing the concrete and also to check the concrete surface during the finishing operation. Forms and the final product shall not deviate more than one-quarter inch (1/4") (6.25mm) from a straight edge ten feet (10') (250mm) in length and shall be sloped to achieve complete drainage without "bird baths."
- D. Forms shall remain in place at least twelve (12) hours after concrete has been placed against them or for a longer period if so directed by the Engineer. Crowbars or other heavy tools shall not be used against green concrete in removing the forms. Forms shall be well cleaned before reoiling and reuse.
- E. Screed guide templates shall be pulled prior to the concrete taking initial set. In those cases where initial set takes place prior to pulling of the templates, the joint shall be sealed with an asphaltic sealing compound approved by the Engineer.

## **2.05 Protection**

- A. Protect fresh concrete from deleterious effects of weather and from traffic until adequately cured.
- B. Concrete shall not be placed on frozen subgrade or when weather is stormy, dusty, or otherwise inclement to the point that it precludes good workmanship. Air temperature shall be a minimum of 40° F (4°C) and rising when the pour is started. Adequate measures shall be employed to protect the concrete from freezing for a period of at least seventy-two (72) hours after it is poured.

## **2.06 Joint Construction**

### **A. Expansion Joints**

- 1. All expansion joints shall be constructed straight, plumb, and shall extend through the full width and depth of the section. Expansion joint material shall be flush with the finished surface to three-quarters inch (3/4") (20 mm) below the finished surface. Edges adjacent to expansion joint material shall be tooled.
- 2. Expansion joints shall be constructed at the intersection with any existing curbwalk or curb and gutter, at the tangent point of curb radii, at alley returns, adjacent to inlet structures and at intermediate intervals of not more than sixty feet (60') (18m) or at such lesser spacing as may be determined by the Engineer.

### **B. Contraction Joints**

- 1. Transverse weakened-plane contraction joints shall be constructed at right angles to the curb line at intervals of ten feet (10') (3.1m). Joint depth shall average at least one-fourth (1/4) of the cross-section of the concrete.
- 2. Contraction joints may be sawed, hand formed, or made by one-eighth inch (1/8") (3mm)

thick division plates in the formwork. Sawing shall be done early after the concrete has set to prevent the formation of uncontrolled cracking. The joints may be hand formed either by 1) using a narrow or triangular jointing tool or a thin metal blade to impress a plane of weakness into the plastic concrete; or, 2) inserting one-eighth inch (1/8") (3mm) thick steel strips into the plastic concrete temporarily. Steel strips shall be withdrawn before final finishing of the concrete.

3. After removal of templates and finishing, contraction joints shall be reopened with a mason's trowel to a depth of one-fourth (1/4) the thickness of the section, the line of cut coinciding with and extending into the joint formed by the template. The joints shall be finished with a jointer.

#### C. Construction Joints

1. At end of day's run, or in case of an interruption which would result in cold joint, construction joints shall be made at right angles to the longitudinal axis of the curbwalk and shall be located at the regular five foot (5') (1.5m) spacing designated for contraction joints unless otherwise specifically permitted by the Engineer. In no case shall any length of curbwalk be less than five feet (5') (1.5m) between joints.
2. Construction joints shall be formed by use of a bulkhead or divider which shall be removed before continuing with the next run. Edges of construction joints shall be edge tooled to form a recess for sealing compound.

### **2.07 Concrete Placement**

A. Concrete shall be placed either by an approved slipform/extrusion machine, by the formed method, or by a combination of these methods. Concrete shall not be placed until base courses and forms have been checked for depth and alignment. The method used shall adequately vibrate and compact the concrete to achieve a homogeneous dense concrete free from honeycomb and pockets of segregated aggregate.

#### B. Machine Placement

1. The slipform/extrusion machine approved shall be so designed as to place, spread, consolidate, screed, and finish the concrete in one complete pass in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogeneous concrete section.
2. The machine shall shape, vibrate, and/or extrude the concrete for the full width and depth of the concrete section being placed. It shall be operated with as nearly a continuous forward movement as possible.
3. All operations of mixing, delivery, and spreading concrete shall be so coordinated as to provide uniform progress, with stopping and starting of the machine held to a minimum.

#### C. Formed Method

1. Construct forms to the shape, lines, grades, and dimensions called for in the Drawings. Set wood or steel forms securely in place, true to line and grade. Forms shall be braced to prevent change of shape or movement in any direction resulting from the weight of the concrete during placement. Tops of forms shall not depart from grade line more than one-fourth inch (1/4") (6.25mm) when checked with a ten-foot (10') (3m) straightedge. Alignment of straight sections shall not vary more than one-fourth inch (1/4") (6.25mm) in ten feet (10') (3m).

## **2.08 Finishing**

- A. Finishing shall be done with a metal screed or mule designed to give proper shape to the section as detailed. Particular care shall be used to finish the gutter flow line to a true, uniform grade that will drain completely without "bird baths". The back of the curbwalk and toe of the gutter shall be edge tooled. Traffic surfaces shall be broom finished at 90° to the direction of traffic. All honeycombed areas or small defects shall be patched with 1:2 mix mortar.
- B. After stripping forms, exposed concrete surfaces shall be finished smooth and even by means of a moist wood float or a moist brick.
- C. Sides of concrete exposed by the removal of forms shall be protected immediately to provide continuance of curing and preventing injury to the edge and the underlying subgrade. After the forms have been removed, suitable fill material shall be placed along the edge of the walk and tamped by either hand or mechanical tampers to a density at least equal to that of the adjacent ground. The finish grade and section shall be as indicated on the drawings and to the satisfaction of the Engineer.
- D. Protection And Repairs
  1. Protection: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
  2. Maintain concrete with minimum moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
  3. Random Cracks in Pavement Slabs on Grade: When cracks occur within 2 feet (0.61 meters) of expansion or construction joints, remove and repair, otherwise grout with epoxy adhesive grout. Use saw cuts and dowels in all cut planes.
  4. Random Cracks in Curb and Gutter: When concrete cracks larger than hairline cracks appear in curb and gutter and are the width of a penny standing on edge, Engineer shall direct Contractor to remove and replace concrete curb and gutter sections. Sections to be replaced shall be a minimum of five feet in length. When cracks are hairline in width, repair with epoxy adhesive grout.

## **2.09 Curing**

- A. Concrete shall be sprayed uniformly with curing compound immediately after finishing of the surface and before the set of the concrete has taken place. Curing compound shall be applied at the manufacturer's recommended rate.
- B. Curing compound shall also be applied immediately to the exposed concrete once forms have been removed.
- C. See section 2.02 F for approved curing compounds.

## **2.05 Jointing New and Existing Curb Sections**

Where the new concrete sections will join existing concrete sections with a different cross-section, five foot (5') (1.5m) long minimum transition section shall be constructed.

## **2.11 Fiber Reinforced Concrete**

- A. Where specified or approved by the Engineer, provide polypropylene fibers added to the concrete mix to control shrinkage cracks.
- B. Polypropylene fibers shall be added at the rate of three pounds (3#) (1.4 kg) of fiber per cubic yard of concrete. Fibers shall be added to the concrete in accordance with the manufacturer's recommendations.

## **2.13 Cutting and Patching of Asphalt Paving.**

- A. When curb cuts, or other concrete structures are installed adjacent to existing asphaltic concrete paving, the asphalt paving shall be saw cut parallel to and a minimum of eighteen inches (18") (450mm) away from the edge of the concrete.
- B. The excavation between the concrete and the asphalt paving shall be backfilled with a minimum of two and one-half inches (2.5 inches) of asphalt over a specified base course. Base course and asphaltic concrete paving shall comply with City of Lakeland standard specification.
- C. Where the existing pavement and base course sections exceed the minimums specified above, the replacement thickness shall match the existing.

**END OF SECTION**

**SECTION 02835**  
**SEEDING AND LAWN RESTORATION**

**PART 1 - DESCRIPTION**

**1.01 General**

The work covered in this article includes the furnishing of all materials, labor, tools and equipment for seeding and lawn restoration as described in the specifications.

**PART 2 - MATERIALS**

**2.01 Materials**

**A. Type A – Native Seed**

1. Priority should be given to native species in any mixture due to the level of damage that non-native species are currently exhibiting within the City as noted by the Natural Resources Inventory. Suggested native seed mixes are shown below but can be modified to include a variety of native warm season grasses and native forbs. Suggested native warm season grasses include:
  - (a) Big bluestem (*Andropogon gerardii*)
  - (b) Little bluestem (*Schizachyrium scoparium*)
  - (c) Indiangrass (*Sorghastrum nutans*)
  - (d) Broomsedge bluestem (*Andropogon virginicus*)
  - (e) Sideoats grama (*Bouteloua curtipendula*)
  - (f) Switchgrass (*Panicum virgatum*)
  - (g) Eastern gamagrass (*Tripsacum dactyloides*)
  
2. Any native warm season grass mixture should contain no more than 30% of one species. Native forbs may be included in the seed mixture including but not limited to:
  - (a) partridge pea (*Chamaecrista fasciculata*)
  - (b) Illinois bundleflower (*Desmanthus illinoensis*)
  - (c) roundhead lespedeza (*Lespedeza capitata*)
  - (d) perennial sunflowers (*Helianthus salicifolius*)
  - (e) purple prairieclover (*Dalea purpurea* var. *purpurea*)
  - (f) purple coneflower (*Echinacea purpurea*)
  - (g) Tennessee Coneflower (*Echinacea tennesseensis*)
  - (h) black-eyed susan (*Rudbeckia hirta*)
  - (i) blazing star (*Liatris spicata* / *Liatris squarrulosa*)
  - (j) lance-leaved coreopsis (*Coreopsis lanceolata*)
  - (k) joe pyeweed (*Eupatorium purpureum* var. *purpureum*)
  - (l) evening primrose (*Oenothera biennis*)



- (m) New England aster (*Symphyotrichum novae-angliae*)
- (n) Indian blanket (*Gaillardia pulchella* var. *pulchella*)

Suggested Type A Seed Mixes With Planting Dates

Native Grass Mixture	Little Bluestem Indian Grass Side Oats Grama Big Bluestem Switchgrass (native) ( <i>Panicum virgatum</i> )	April 1 – June 30
Southeast Native Mixture	Indiangrass Little Bluestem Switchgrass Big Bluestem Lovegrass (Native only)	March 1 – June 15
Songbird Native Grass /Wildflower Mixture (Useful near conservation easements or natural areas for establishment of wildlife habitat)	Side Oats Grama Little Bluestem Indian Blanket Lance-leaved Coreopsis Purple Coneflower Goldenrod Joe Pyeweed Evening Primrose New England Aster Black-Eyed Susan	April 1 – June 15  August 15 – October 15
Wetland Mixture	Red Top (Native only) Virginia Wild Rye Fox Sedge Woolgrass Soft Rush Lurid Sedge Joe Pyeweed	March 15 – June 15  August 15 – October 15
Native Rough Mixture (Fescue mix may not be appropriate in all locations due to invasive nature)	Hard Fescue Little Bluestem Chewings Fescue Blue Fescue	March 15 - June 1 August 15 – Octobe

3. Some of the above mixtures may not be appropriate near natural areas due to the inclusion of non-natives and plants that are invasive by nature. Mowing should only be done in late October and late February to early March. Other forms of maintenance (that closely resemble natural disturbance) may be needed to exclude undesirables and to further promote the growth and spread of the native grasses.
4. Type A seed mix should be sown at approximate rates of 4-8 pounds pure live seed (PLS) per acre. Seed purity should be no less than 50% PLS.

B. Type B – Lawn Seed

1. Bermuda, Zoysia, and Fescue shall be used in areas where frequent mowing occurs. An established mowing schedule shall be in place in order to prevent species from becoming invasive.

- C. Grass seed mixtures under brand names may be acceptable if they approach the above specifications and if accepted by the City Engineer. All seed types shall meet the requirements of the Tennessee Department of Agriculture and no Below Standard seed will be accepted. Grass seed furnished under these specifications shall be packed in new bags or bags that are sound and not mended. The vendor shall furnish the Engineer a certified laboratory report from an accredited commercial seed laboratory or from a State seed laboratory showing the analysis of the seed to be furnished.

D. Tackifiers

1. Tackifiers shall be a synthetic polyacrylamide tackifier. The tackifier shall water soluble and anionic in nature. Cationic tackifiers shall not be permitted. Organic tackifiers such as starch based compounds may be substituted upon approval of the engineer.

E. Mulch

1. Hay or straw mulch materials shall be air dried and reasonable free of noxious weeds and weed seeds or other materials detrimental to plant growth. Hay shall be stalks of approved grasses, sedges or legumes seasoned before bailing or loading. Straw shall be stalks of rye, oats, wheat, or other approved grain crops. Both hay and straw shall be suitable for spreading with standard mulch blower equipment.
2. Wood fiber mulch shall be in accordance with Section 02925.

**PART 3 - EXECUTION**

**3.01 Restoration of Lawn and Grassed Areas.**

- A. Any sod which is disturbed during the project or its appurtenances shall be replaced with similar sod including necessary topsoil, by the Contractor.
1. Top soil shall be replaced to a thickness equal to that removed up to a maximum of six inches (6") (150mm). No sod or seed shall be laid on less than four inches (4") (100mm) of topsoil. Topsoil shall be light friable loam containing a liberal amount of humus and shall be free from heavy clay, coarse sand, stones, plants, roots, sticks, and other foreign materials.

2. Sod shall be rolled within 24 hours after its placement with a roller that leaves the sod smooth and the joints properly closed. The new sod shall be trimmed neatly to match old sod, curbs, and walks. In all sod areas, the Contractor shall be responsible for ensuring adequate moisture until the new sod has properly established itself.
- B. In other areas, the Contractor shall reseed as specified in the City's Standard Specifications.
1. In general, Type A seeding shall be used in undeveloped areas having a "native" grass vegetation. After the disturbed area has been backfilled as specified, the Contractor shall place four inches (4") inches (100mm) of topsoil over the disturbed area, prior to Type A, seeding. The area to be seeded shall be made smooth and uniform and shall conform with the finished grade. Type B seeding shall be used in developed areas where the disturbed vegetation would not be classified as sod. For temporary seeding of disturbed areas, Type A seed shall be used.
  2. The seedbed, if not loose, shall be loosened to a depth of from 1 to 2 inches (25-50mm) below finished grade. Seeds and fertilizers can be sown with standard agricultural drills, or other approved methods. Grass seeds may be sown broadcast or with a special seeder attachment on agricultural drills, but shall not be covered with more than ½-inch (12mm) of soil, whether drilled or raked in. If not covered by the drill, all uncovered seed shall, immediately after sowing, be slightly raked or harrowed to cover the seed. No seed shall be broadcast during high wind.
  3. Seeding shall be done in accordance with the manufacturers recommendation and approved of by the City Engineer. During other periods, the time of sowing shall be determined by the Engineer, whose decisions will be based on the moisture content of the soil and weather conditions.

### **3.02 Fertilization, Mulching and Tackifier**

- A. Fertilizer shall be applied in accordance to the soils analysis recommendation. Cellulose hydromulch shall be applied according to manufacturer's recommendation.

### **3.03 Warranty**

- A. Weed control in planted areas shall be the responsibility of the Contractor. Watering schedules of City-owned property shall be the responsibility of the Contractor during the warranty period.

**END OF SECTION**

## SECTION 03050

### PORTLAND CEMENT CONCRETE

#### Part 1-Description.

The work covered in this section includes the classification, materials, proportioning of materials, equipment, mixing requirements, and testing for Portland Cement Concrete to be used for curbs, curb and gutter, and sidewalks, streets, bridges, and miscellaneous structures.

#### Part 2 - Materials

2.01. Classes of Portland Cement Concrete. Portland cement concrete used for construction of the various items specified elsewhere in these Specifications shall be classified by usage as follows:

A. Class A.

Class A concrete shall be used as specified for such items as directed by the Engineer and other uses as noted in the Special Provisions.

B. Class AS.

Class AS concrete shall be used for storm and sanitary structures, concrete curb, curb and gutter, valley gutters, sidewalks, ditch paving, and similar structures unless otherwise noted in the Special Provisions.

C. Class B.

Class B concrete shall be used for roadway base, soil cement, and pavement.

D. Class C.

Class C concrete shall be used as specified for such items as concrete cradles, encasements, embankment slope paving at bridge abutments, and other low strength applications.

E. Class P.

Class P concrete shall be used for cast-in-place box culverts and precast and precast-prestressed concrete structures or structural members. High-early-strength concrete shall be as specified in Specification Section 03050 Paragraph 6.05.

2.02 Materials.

A. Portland Cement.

1. Type I or Type I-SM cement shall be used unless otherwise specified. Different types of cement shall not be mixed. Portland Cement shall conform to all requirements of the "Standard Specifications for Portland Cement," AASHTO M 85. M. Specification C 150 for Class Type I, except that for high early strength concrete, Type III cement may be used.

B. Fine Aggregate.

1. Fine aggregate for concrete shall consist of sand and shall conform to the following ASSHTO M6 with the following exceptions.

i. General Composition. Concrete sand shall be composed of clean (washed), hard, durable, uncoated grains, free from injurious amounts of clay, dust, soft flaky particles, loam, shale, alkali, organic matter, or other deleterious matter. Fine aggregate shall not contain appreciable materials which have unsatisfactory expansive properties when combined with Portland Cement and water.

ii. Sieve Analysis. Fine aggregate shall be graded within the following limits:

Sieve	% Passing by Weight	
	Min.	Max.
3/8" (9.5mm)	100	---
No. 4 (4.75mm)	95	100
No. 8 (2.36mm)	80	100
No. 16 (1.18mm)	50	90
No. 50 (330um)	5-30	
No. 100 (150um)	0	10
No. 200 (75um)	0	3

Deleterious Substances. The fine aggregate shall not contain more than the following maximum amounts of deleterious substances:

	<u>Max. % of Weight</u>
Clay lumps.	0.5
Coal, lignite, or shale.	0.5
Material passing the No. 200 Sieve.	3.0
Other deleterious substances such as Shale, alkali, mica, coated/grains soft and flaky particles.	3.0

If the fine aggregate is manufactured from limestone or dolomite and if the material finer than the No. 200 sieve consists of dust of fracture, essentially free from clay or shale, this limit may be increased from 3% to 5%

iv. Organic Impurities. Fine aggregate subjected to the colorimetric test as per ASTM C40 for organic impurities and producing a color darker than the standard shall be rejected unless it passes the mortar strength test as specified herein, Organic Impurities ASTM C40.

C. Coarse Aggregate. Coarse aggregate for concrete shall consist of crushed stone or gravel or crushed or uncrushed gravel and shall conform to the following requirements:

1. Coarse aggregate for Class A, Class B, or Class C concrete shall be furnished in two sizes: Size No. 4 and Size No. 67 as shown hereinafter in the attached Table Coarse Aggregate Gradation Table.
2. The two sizes shall be manufactured, within the specified limits, to produce Size No. 467 when combined in the proper proportions at the batching plant. If the supplier provides a proper stockpile to prevent segregation, then a combined Size No. 467 can be used in lieu of blending Size No. 4 and Size No. 67.
3. Coarse aggregate for Class AS concrete shall be Size No. 57. Only limestone coarse aggregate will be used for Class AS concrete; gravel coarse aggregate will not be permitted.
4. Coarse aggregate for Class P concrete shall be size No. 57 or Size No. 67 as may be specified or directed. Only limestone coarse aggregate shall be used for Class P concrete; gravel coarse aggregate will not be permitted.
5. Coarse aggregate for concrete curbing placed by machine extrusion methods shall be Size No. 57 or Size No. 67.
6. The coarse aggregates shall otherwise conform to the requirements of AASHTO M 80 and ASTM C 33 with the following exceptions and stipulations:

a. Deleterious Substances. The coarse aggregate shall not contain more than the following maximum amounts of deleterious substances:

	<u>Max. % of Weight</u>
Clay lumps	0.25
Material passing No. 200 sieve	1.0
Coal or Lignite	1.0
Other deleterious substances such as friable, thin, elongated, or laminated pieces	10.00
Other Local deleterious substances	1.00
Soft or nondurable fragments (fragments which Are structurally weak such as shale, soft Sandstone, limonite concretions, gypsum, Weathered schist, or cemented gravel.	3.0

7. The sum of the above, excepting thin or elongated pieces, shall not exceed 5% by weight.
8. Soundness. When subjected to 5 cycles of the soundness test, as set forth in ASTM C 88, the loss in weight of coarse aggregate weighted in accordance with the grading of a sample complying with the grading requirements specified, shall not exceed nine (9) percent for sodium sulfate.
9. Abrasion. The coarse aggregate shall not have an abrasive loss greater than 40% as determined by AASHTO T96.

10. In the case of crushed aggregate, if all the material finer than the 200 mesh sieve consists of the dust of fracture essentially free of clay or shale, Item 4, Maximum Per Cent by Weight, may be increased to 1.5.

**COARSE AGGREGATE GRADATION TABLE**  
Amounts Finer than Each Lab. Sieve (Sq. Opening), %By Weight

SIZE NO.	2"	1-1/2"	1"	3/4"	1/2"	3/8"	NO. 4	NO. 8
4	100	90-100	20-55	0-15	-----	0-5	----	----
467	100	95-100	-----	35-70	-----	10-30	0-5	----
57	-----	100	95-100	----	25-60	----	0-10	0-5
67	----	----	100	90-- 100	----	20-55	0-10	0-5

- D. Water for Concrete. The water shall be clean and free from objectionable amounts of oil, acid, alkali, organic matter, or other deleterious materials and shall not be used until the source of supply has been approved. If at any time the water from an approved source becomes of unsatisfactory quality or insufficient quantity, the Contractor will be required to provide satisfactory water from another source. Water of questionable quality shall be subject to the acceptance criteria of Table I, as specified in ASHTO T26.
- E. Air-Entraining Admixture. The Contractor shall use a regular Portland Cement with the addition of an air-entraining admixture meeting requirements of AASHTO M 154. Air-entraining admixtures to be used in air-entrained concrete shall be Darex AEA, Neutralized Vinsol Resin, and Protex, or any other air-entraining agent meeting the approval of the Engineer. Air-entraining admixtures shall contain no chlorides. The air-entraining characteristics of the admixture, in suitable proportions in combination with Portland Cement, fine aggregate and water, within the limits of the proportion specified, shall be such that the resulting concrete will have a satisfactory workability, and the total air content shall be as provided below in the following table.

Nominal Max Size of Coarse Aggregate	Total Air Content Percentage by Volume Concrete
3/8 inch	6 to 10
1/2 inch	5 to 9
3/4 inch	4 to 8
1 inch	3 1/2 to 6 1/2
1 1/2 inch	3 to 6
2 inch	2 1/2 to 5 1/2
3 inch	1 1/2 to 4 1/2

- F. Chemical Admixtures. Chemical admixtures shall conform to ASTM C494, except TYPE C accelerating admixtures shall contain no chlorides, shall be non-toxic after thirty (30) days, and shall be compatible with air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations.
- G. Pozzolan Admixture. Pozzolan admixture shall conform to the requirements of ASTM C311 and ASTM C618-85 (including Table IA) for either Class C or Class F. Class C fly ash may be used as a replacement for Portland cement if approved in writing by the Owner. The maximum amount of cement being replaced by fly ash shall not exceed 15 percent. When a specific air content has been required and fly ash is being used, the air content shall be tested on each truck load of concrete at the batch plant and the tested value shall be indicated on the ticket.
- H. Fiber-Reinforced Concrete shall conform to ASTM C1116 material requirements and classifications. Concrete containing fibers (steel, glass fibers, or synthetic fibers) shall conform to the manufacturers addition rate and shall be included in the mix design approved by the Engineer. Glass Fiber and synthetic fiber reinforced concrete shall not be used to replace structural reinforcement, and shall be added at the batch plant.

### **PART 3 – Execution**

#### **3.01 Sampling and Testing and Storage of Materials.**

- A. Cement. Cement may be accepted on the basis of mill tests and the manufacturer's certification of compliance with the specifications, provided the cement is the product of a mill with a record for production of high quality cement. Certificates of compliance shall be furnished the Engineer by the Contractor, for each lot of cement furnished prior to use of cement in the work. This requirement is applicable to cement for job-mixed, ready-mixed, or transit-mixed concrete. Cement proposed for use where no certificate of compliance is furnished, or where, in the opinion of the Engineer, the cement furnished under certificate of compliance may have become damaged in transit or deteriorated because of age or improper storage, will be sampled at the mixing site and tested for conformance to the specifications.
1. Cement will be approved for use if it satisfactorily passes the fineness, soundness, and time of set test requirements specified, provided the general run of materials has been



satisfactorily meeting the 28-day strength requirements. Any approved cement failing to pass the 28-day strength requirements, if unused, shall be rejected. If, in the judgement of the Engineer, it is considered necessary, other lots of shipments from the same mill may be held for the results of tests before being used.

2. If cement is supplied from a new source or from a source of unknown quality, it may be held for the results of strength test before being approved.
- B. Fine and Coarse Aggregate. At least two (2) weeks in advance of the beginning of concrete work the Contractor shall submit to an approved materials testing laboratory approximately five hundred pound (500#) (225kg) samples of each concrete aggregate proposed for use unless otherwise waived by the Engineer in writing. All tests which are necessary to determine the compliance of the concrete materials with these specifications shall be performed on these samples. These samples shall also be used by the laboratory as the basis for a concrete mix design. The results of all tests and the concrete mix design shall be submitted to and approved by the City Engineer prior to the start of any concrete work. Standards shall conform to the latest applicable codes. The sampling and testing shall conform to the following standard procedures:
- C. Cement. The Contractor shall provide adequate protection for the cement against dampness. No cement shall be used that has become caked or lumpy. Accepted cement which has been held in storage more than 90 days after shipment from the mill shall be retested, and if failing to meet the requirements specified herein shall be rejected.
1. Accepted cement which has been stored in approved sealed bins at the mill for not more than six (6) months may be used without further testing unless a retest is specifically requested by the Engineer.
- D. Aggregate. Aggregates shall be handled and stored in separate piles at the site in such manner as to avoid a separation of the coarse and fine particles and contamination by foreign materials. Sites for stockpiles shall be prepared and maintained in such a manner as to prevent the mixing of deleterious materials with the aggregate. The Contractor shall deposit material in stockpiles at the batching plant site until the moisture content becomes uniform. Stockpiles shall be built in layers not to exceed three feet (3') (1m) in height, and each layer shall be completed before beginning the next one.
1. Coning or building up stockpiles by depositing the materials in one place will not be permitted. The storing of aggregates in stockpiles, or otherwise, upon the subgrade or shoulders will not be permitted.

### **3.02 Concrete Mixture Requirements.**

- A. The concrete shall meet the following requirements as outlined in the Concrete Classification Table attached to the end of this Section.

1. If it is found impossible to produce concrete having the required air content with the materials and mixing procedures that are being used, the Contractor shall make such changes in the materials or mixing procedures, or both, as may be necessary to insure full compliance with the requirements of air content in the concrete.
2. The total weight of aggregates per sack of cement and the relative proportions of coarse and fine aggregate shall be determined by yield tests made during the progress of the work. The Engineer may, at his discretion, adjust the laboratory mix design to obtain the proper yield, and consistency of concrete.
3. The Contractor shall receive written permission from the Engineer prior to adding Pozzolan admixture to Portland Cement Concrete.
4. Any combination of aggregates which requires the use of more than six and one-half gallons (6.5g) (25l) of water per sack of cement to produce a workable mixture, with the brand of cement used will be considered as being unsatisfactory, and all such combinations of aggregate will be rejected.
5. Concrete shall be uniformly plastic, cohesive, and workable. Workable concrete is defined as concrete which can be placed without honeycomb and without voids in the surface. Workability shall be obtained without producing a condition such that free water appears on the surface when finished. The consistency of the mixture shall be that required for the specified conditions and methods of placement; however, the previously determined maximum water cement ratio shall not be exceeded.

### **3.03 Proportioning of Materials.**

All materials shall be separately and accurately measured by weight, and each batch shall be uniform. The coarse and fine aggregates shall be weighed separately. A sack of cement shall weigh ninety-four pounds (94#) (43kg). When bulk cement is used, ninety-four pounds (94#) (43kg) shall be considered as one sack. The Contractor shall furnish and use approved weighing devices, which, in operation, will give the exact quantity of materials required for the class of concrete. When the cement is in contact with the aggregate, it shall not remain more than forty-five (45) minutes before being deposited into the mixer.

### **3.04 Measurement of Aggregate.**

- A. Where sack cement is used, the quantities of aggregate for each batch shall be exactly sufficient for one or more sacks of cement. No batch requiring a fraction of a sack of cement will be permitted. All measurements shall be by weight, upon approved weighing scales and shall be such as will insure separate and uniform proportions. Scales shall be of either beam or springless dial types, and shall be suitable for supporting the hopper or hoppers. They shall be set accurately in substantial mountings which will insure a permanent spacing of the knife edges under all conditions of loading and use. They shall be so designed and maintained that they will at all times be accurate to within one-half (1/2) of one (1) percent throughout the

entire weight range. Clearance shall be provided between the scale parts and the hopper or the bin structure to prevent displacement of the scale parts due to vibrations, accumulations, or any other cause. The value of the minimum gradations on any scale shall not be greater than five pounds (5#) (2.3kg). The weighing beam or dial shall be so placed that it will be in full view of the operator during the operation of the gate which delivers the material to the hopper. Scales shall be protected from air currents that may affect the accuracy of weighing.

- B. Separate hoppers shall be provided for weighing fine and coarse aggregate. They shall be of suitable size and tight enough to hold the aggregate without leakage, and shall be supported entirely upon the scales. Suitable provisions shall be made for removal of overload from the hopper by the operator while he operates the bin gates.
- C. The Contractor shall provide a sufficient number of fifty-pound (50#) (23kg) standard test weights for calibrating the weighing equipment.
- D. The volume of concrete mixed per batch shall not exceed the manufacturer's guaranteed capacity of the mixer.
- E. When the aggregates are delivered to the mixer in trucks, each batch shall be in a separate compartment of the capacity required by the Engineer. Suitable covers shall be provided for the batch compartments of the trucks to protect the cement from the wind. All trucks, truck bodies, bulkheads, and compartments used in proportioning and transporting to the mixer of concrete materials shall be so designed and operated to insure the charging of the mixer, batch by batch, with the proper amounts of each material without overspillage, intermixing of batches or wastage. Any units which, in the opinion of the Engineer, do not operate satisfactorily, shall be removed from the work until properly rebuilt and corrected.

### **3.05 Mixing Concrete.**

- A. Consistency. The quantity of water to be used shall be determined by the Engineer and shall not be varied without his consent. The Contractor shall furnish and use with the mixer an approved adjustable, water measuring device which will prevent excess water flowing into the mixer, in order that the consistency may be under positive control and that all batches may be of the same consistency.
  - 1. In general, the minimum amount of water shall be used which will produce the required workability. The mortar shall cling to the coarse aggregate and shall show no free water when removed from the mixer.
- B. Mixer. The mixing machine used shall be of an approved type known as a batch mixer, and of a design having a suitable device attached for automatically measuring the proper amount of water accurate to one percent (1%) and for automatically timing each batch of concrete so that all materials will be mixed together for the minimum time required. Such device shall be easily regulated and controlled to meet the variable conditions encountered. If the time device becomes broken or fails to operate, the Contractor will be permitted to continue the balance of the day without the timing device while the same is being repaired, provided that

each batch of concrete is mixed two (2) minutes.

1. The normal mixing time for each batch shall be one (1) minute, and the measuring of this period shall begin after all the materials are in the drum. During this mixing period, the drum shall revolve at the speed for which the mixer is designed, but shall make not less than fourteen (14) nor more than twenty (20) revolutions per minute.
2. No materials for a batch of concrete shall be placed in the drum of the mixer until all of the previous batch has been discharged therefrom. The discharge of water into the drum shall commence with the flow of the aggregates, but shall not be started before the entrance into the drum of part of the aggregates. The discharge of all of the mixing water for any batch shall be completed within ten (10) seconds after all of the aggregates are in the drum. The inside of the drum shall be kept free from hardened concrete.
3. The use of mixers having a chute delivery will not be permitted except by permission of the Engineer. In all such cases the arrangement of chutes, baffle plates, etc., shall be such as will insure the placing of fresh concrete without segregation.
4. Ready-mixed concrete from a central mixing plant delivered at the work ready for use, will be permitted, provided the mixture is transported to the job site in an agitating truck having the concrete contained in a revolving drum and provided there is no segregation of the mixture at the point of placing. Ready-mixed concrete from a central batching plant and mixed in transit will be permitted; however, the mixing and transporting equipment will be subject to the special approval of the Engineer. Any ready-mixed concrete shall comply with all of the requirements of these specifications.
5. The time elapsing from the time the water is added to the mix until the concrete is deposited in place at the site of the Work shall not exceed 30 minutes when hauled in non-agitating trucks, not 60 minutes when hauled in truck mixers or truck agitators. In addition, the total revolutions at mixing speed shall not be less than 70 nor more than 100. When truck mixers are used on hauls in excess of 1 hour, the cement shall be added at the site of the work. The concrete must be of workable consistency when placed. No mixer which has a capacity of less than a two-sack batch shall be used.
  - i. Hand mixing will not be permitted except with the permission of the Engineer and then only in very small quantities or in case of an emergency.
6. Retempering concrete by adding water or by other means will not be permitted; however, a portion of the mixing water may be withheld from transit mixers and added at the work site provided the delivery ticket indicates the amount withheld. The batch shall be mixed for 30 revolutions at mixing speed after adding the water. Water cannot be added to a partial load of concrete mix. Concrete that is not within the specified slump limits at time of placement shall not be used.
7. In using air-entraining admixtures, the mixer shall be equipped with a suitable automatic

dispensing device which will proportion the air entraining admixture accurately to each batch of concrete. The device shall be calibrated and adjusted to deliver to each batch of concrete the quantity of admixture required to produce the specified air content in the concrete.

8. The manufacturer of the concrete shall furnish to the purchaser with each batch of concrete before unloading at the site, a delivery ticket. The purchaser shall provide the Engineer with one (1) copy of each delivery ticket.

### **3.06 Forms.**

- A. Forms shall be made of wood or metal. Forms shall be provided with adequate devices for secure setting so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. The top and face of forms shall be cleaned and oiled prior to the placing of concrete.

### **3.07 Placing Concrete.**

- A. The concrete shall be unloaded into an approved spreading device, or deposited on the base, and spread in such a manner as to prevent segregation of the materials. As deposited, the mixture shall be placed where it will require as little rehandling as possible. No concrete shall be placed on frozen grade.
- B. Necessary hand spreading shall be done with shovels or other approved tools. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated in earthen or other foreign substances.
- C. Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies, by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than 5 seconds in any one location.

### **3.08 Protection.**

- A. It shall be the responsibility of the Contractor to protect from damage all freshly poured concrete regardless of the location or type of structure for a minimum period of seven (7) days or for such longer period as the Engineer may direct. Any concrete which is damaged shall be repaired to the satisfaction of the Engineer prior to acceptance of the completed work.

### **3.09 Quality Control Testing.**

- A. The Owner or Consultant will employ a testing laboratory to perform test and submit test reports. Test reports will be reported in writing to Consultant, Owner, and Contractor as soon as possible upon completion of tests.

1. Compressive Strength Tests. Concrete test cylinders will be made by a qualified technician from a certified material testing laboratory.
2. The cylinders shall be made and tested in accordance with ASTM C39.
2. Tests may be required for each day's run or according to the following schedule:

<u>Total Cubic Yards of Concrete Placed (m<sup>3</sup>)</u>	<u>Minimum Number of Tests* (3 cylinders each)</u>
0 – 100(0-75)	One for 7 days, two at 28 days
100 – 1000 (75 -750)	One for each 50 cu. Yds. (38m <sup>3</sup> )
1000 – 2000 (750 – 1500)	One for each 125 cu. Yds. (100m <sup>3</sup> )
2000 and Over (1500)	One for each 175 cu. Yds. (125 m <sup>3</sup> ) One for each 250 cu. Yds. (200 m <sup>3</sup> )

\*One test per pour minimum.

- iii. Results of all tests shall be furnished to the Engineer as soon as they are available.
2. Slump. Slump test shall be conducted in accordance with ASTM C172. A test shall be performed for each day's pour of each type of concrete and for each set of compressive strength test.
2. Air Content. Air content shall be tested in accordance with ASTM C143 or ASTM C231. Air content test shall be performed for each set of compressive strength tests of each type of air-entrained concrete.

### CONCRETE CLASSIFICATION TABLE

Class of Concrete	Min. 28 day Compressive Strength (psi)	Slump in Inches	Min Cement--Sacks//CY (3)		Min Cement--#/CY (3)		Net Water Max. Gal/CY (3)		Net Water Max-#/CY (3)	
			Gravel Course Aggregate	Limestone Course Aggregate	Gravel Course Aggregate	Limestone Course Aggregate	Gravel Course Aggregate	Limestone Course Aggregate	Gravel Course Aggregate	Limestone Course Aggregate
A	3000	3-5	6.0	5.5	564	517	36	33	300	275
AS	4000	3-5	(2)	6.2	(2)	583	(2)	37.2	(2)	310
B	3500(1)	1-2.5	6.2	5.8	583	545	34.1	31.9	284	266
C	2500	2-4	5.0	4.5	470	423	34	30.6	283	255
P	5000	1-3	(2)	7.0	(2)	658	(2)	35	(2)	292

Notes:

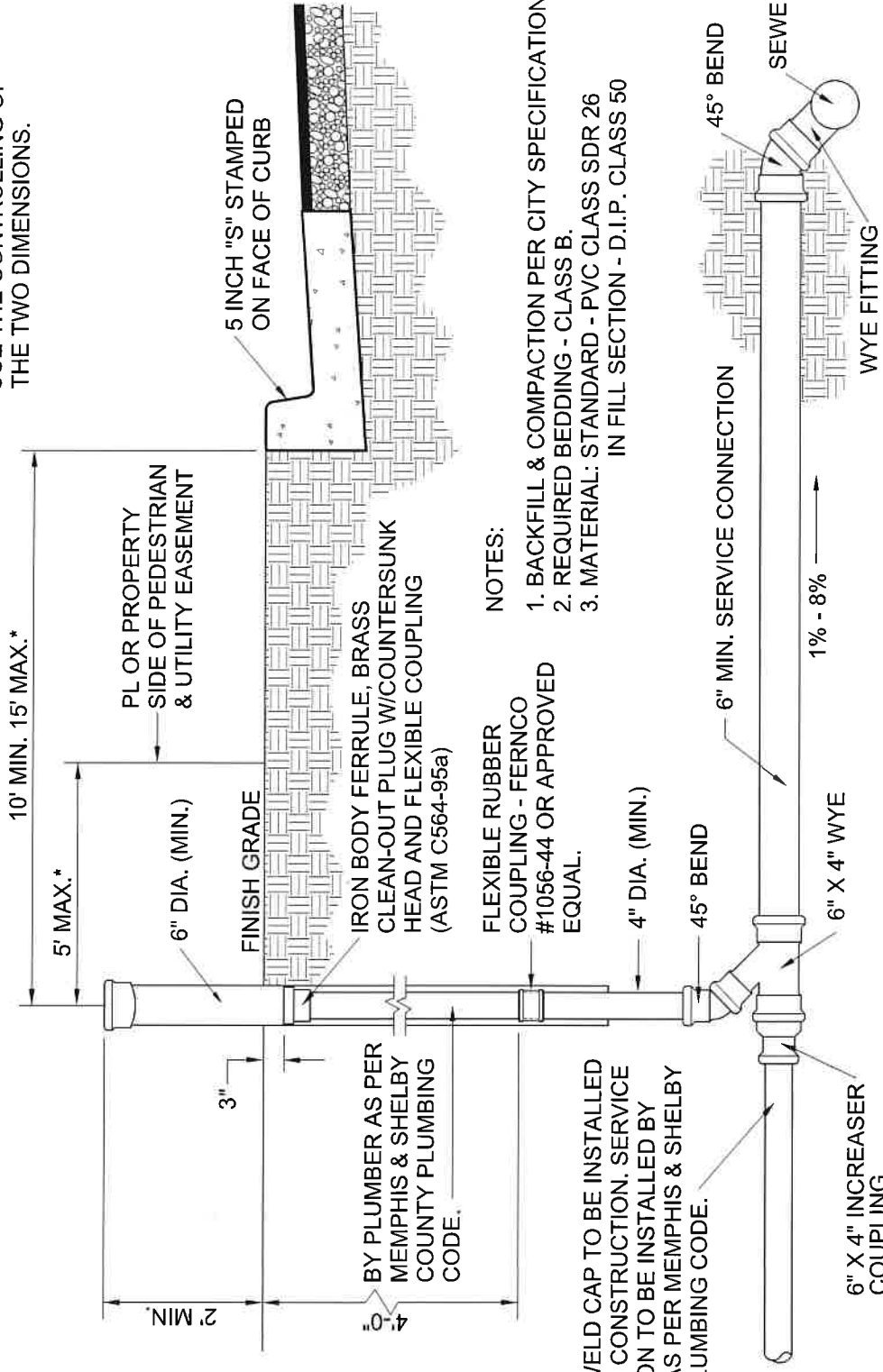
- (1) Minimum compressive strength at 14 days. Minimum flexural strength at 14 days of 550 psi per AASHTO T 22
- (2) Gravel Coarse Aggregate not permitted.
- (3) Tabulated values are for Type I cement conforming to the requirement of AASHTO M 85 only.

**END OF SECTION**

# **APPENDIX A**



\* USE THE CONTROLLING OF THE TWO DIMENSIONS.



PL OR PROPERTY SIDE OF PEDESTRIAN & UTILITY EASEMENT

5 INCH "S" STAMPED ON FACE OF CURB

6" DIA. (MIN.)

FINISH GRADE

IRON BODY FERRULE, BRASS CLEAN-OUT PLUG W/COUNTERSUNK HEAD AND FLEXIBLE COUPLING (ASTM C564-95a)

NOTES:  
 FLEXIBLE RUBBER COUPLING - FERSCO #1056-44 OR APPROVED EQUAL.

1. BACKFILL & COMPACTION PER CITY SPECIFICATIONS.  
 2. REQUIRED BEDDING - CLASS B.  
 3. MATERIAL: STANDARD - PVC CLASS SDR 26  
 IN FILL SECTION - D.I.P. CLASS 50

BY PLUMBER AS PER MEMPHIS & SHELBY COUNTY PLUMBING CODE.

SOLVENT WELD CAP TO BE INSTALLED AT TIME OF CONSTRUCTION. SERVICE CONNECTION TO BE INSTALLED BY PLUMBER AS PER MEMPHIS & SHELBY COUNTY PLUMBING CODE.

45° BEND

6" MIN. SERVICE CONNECTION

1% - 8%

6" X 4" WYE

6" X 4" INCREASER COUPLING

SEWER MAIN

WYE FITTING

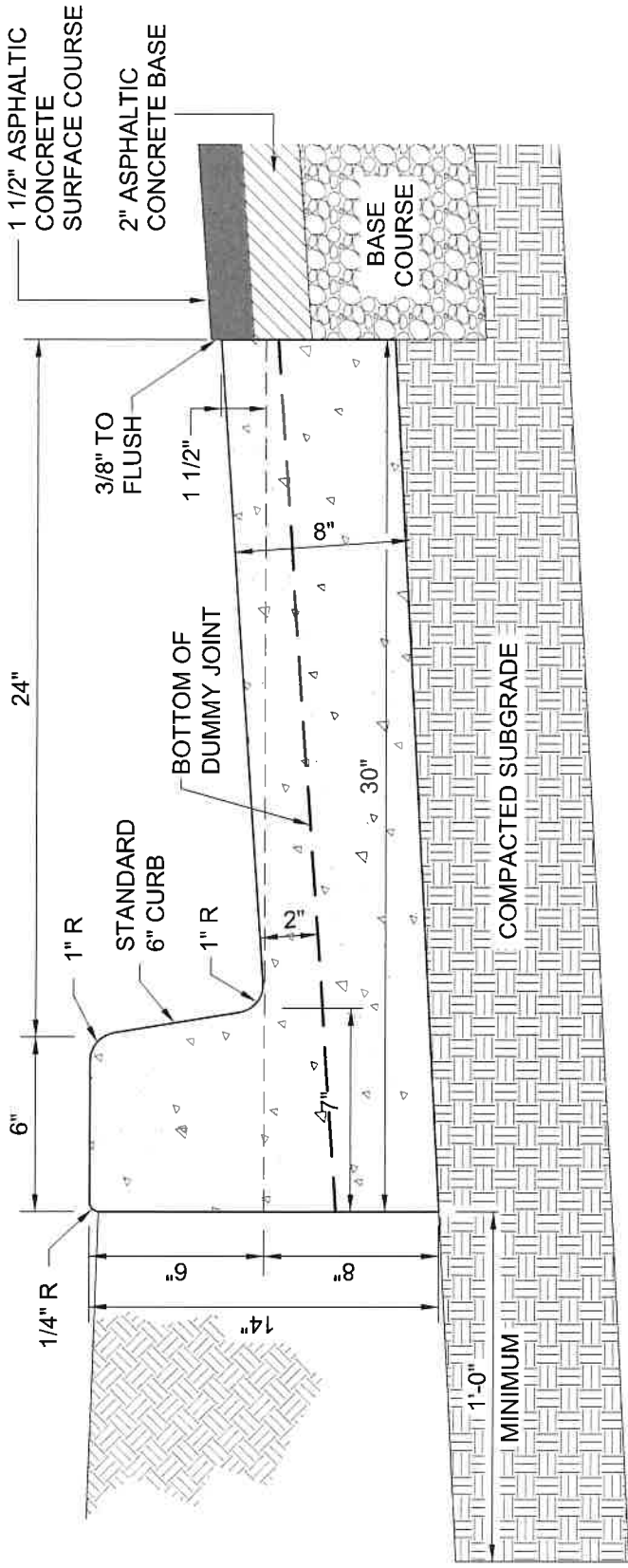
# SANITARY SEWER SERVICE CONNECTION

NOT TO SCALE

CITY OF LAKELAND  
 ENGINEERING DIVISION

## SANITARY SEWER SERVICE CONNECTION

REV.	DESCRIPTION	DATE
1	ORIGINAL ISSUE	8/2008



**CONSTRUCTION NOTES:**

1. PRECUT EXPANSION JOINT MATERIAL WILL BE USED IN ALL EXPANSION JOINTS.
2. DUMMY JOINTS WILL BE INSTALLED AT 10' MAXIMUM INTERVALS.
3. EXPANSION JOINTS WILL BE INSTALLED AT 40' O.C. MAX.
4. EXPANSION JOINTS WILL BE INSTALLED AT ENDS OF RADII.
5. EXPANSION JOINTS WILL BE LOCATED ADJACENT TO INLET STRUCTURES.
6. CONCRETE WILL BE CLASS "AS" CONCRETE, 4000 PSI.
7. SEE DETAIL FOR EXPANSION JOINTS.

*CITY OF LAKELAND  
ENGINEERING DIVISION*

**6-30 CURB  
AND GUTTER**

NOT TO SCALE

**6-30 CURB  
AND GUTTER**

REV.	DESCRIPTION	DATE
1	ORIGINAL ISSUE	8/2008

# TYPICAL PAVEMENT REPAIR DETAIL

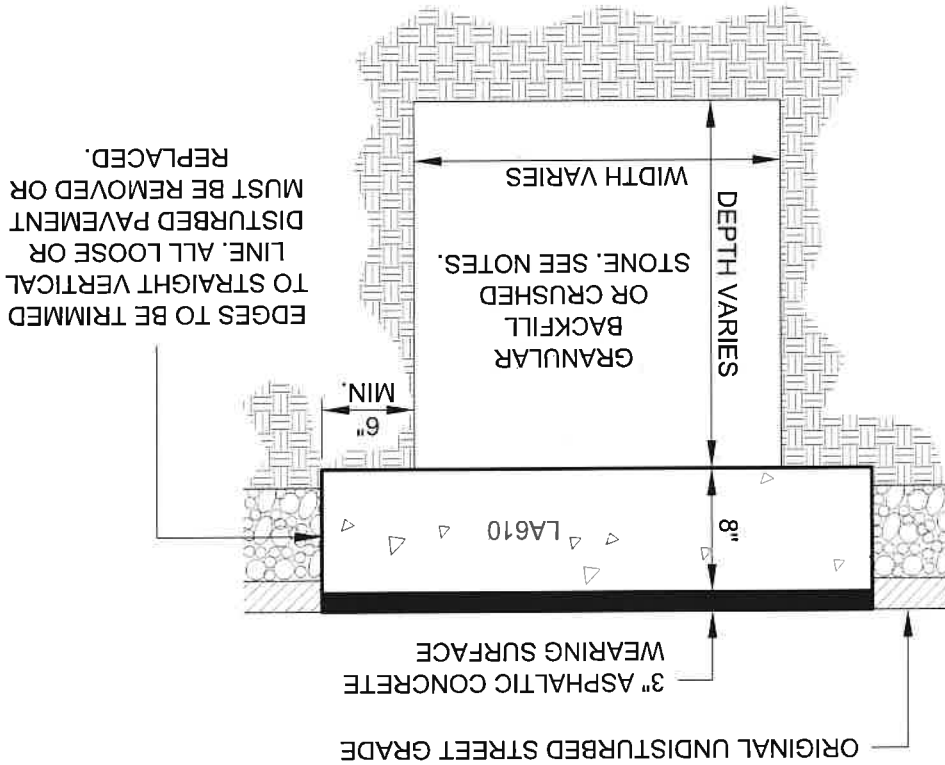
NOT TO SCALE

## TYPICAL PAVEMENT REPAIR DETAIL

CITY OF LAKELAND  
ENGINEERING DIVISION

REV.	DESCRIPTION	DATE
2	LA610 ADDED	1/2011
1	ORIGINAL ISSUE	8/2008

- NOTES:
1. SAND MAY BE USED AS BACKFILL MATERIAL IN TRENCHES 6' DEEP OR LESS.
  2. ANY TRENCH GREATER THAN 6' IN DEPTH SHALL BE REQUIRED TO BE BACKFILLED WITH CR610 CRUSHED STONE OR AS DIRECTED BY THE CITY ENGINEER.
  3. GRANULAR BACKFILL MATERIAL SHALL BE COMPACTED TO 95% MAXIMUM DRY DENSITY.



<b>CITY OF LAKELAND</b>		
<b>ENGINEERING DIVISION</b>		
<b>CLASS B BEDDING</b>		
REV.	DESCRIPTION	DATE
1	ORIGINAL ISSUE	8/2008
2	MIN. DIM./PAY LIMITS	1/2011

# CLASS B BEDDING

NOT TO SCALE

