

**CITY
OF
MURFREESBORO**

MURFREESBORO, TENNESSEE

**STREET DESIGN
SPECIFICATIONS**

**AS ADOPTED BY
MURFREESBORO PLANNING
COMMISSION
JULY 22, 2009**

**STREET DESIGN SPECIFICATIONS
MURFREESBORO PLANNING COMMISSION
(Effective date to be added later)**

**Street Design Specifications
Adopted by
Murfreesboro Planning Commission**

TABLE OF CONTENTS

	PAGE
1. Street and Drainage Design Standards	1
1.1. Purpose	1
1.2. Design Specifications	1
1.3. Authority	1
1.4. Modifications	1
1.5. Relationship to Other Documents	2
1.6. Reference Standards	2
1.7. Abbreviations	2
1.8. Definitions	3
1.9. Inspection and Acceptance of Work	5
2. Design Specifications	5
2.1. General	5
2.2. Functional Street Classifications	5
2.3. Private Streets	6
2.4. Planned Developments	6
2.5. Right-of-Way	6
2.6. Street Cross Sections	6
2.7. Easements	7
2.8. Design Criteria	7
2.8.1. Design Speed	7
2.8.2. Design Vehicle	8
2.8.3. Maximum and Minimum Grades	8
2.8.4. Design Traffic Volume	8
2.8.5. Design Level of Service	8
2.8.6. Horizontal and Vertical Alignment	9
2.8.7. Sight Distance	10
2.9. Intersections	11
2.9.1. Intersection Angle	11
2.9.2. Offset Intersections	11
2.9.3. Intersection Radii	12
2.10. Emergency Access and Access for Service Vehicles	12
2.11. Street Elements	12
2.11.1. Pavement Type	12

2.11.2.	Curbs and Gutters	13
2.11.3.	Shoulder	13
2.11.4.	Sidewalks and Ramps	13
2.11.5.	Sidewalk Encroachments and Obstructions	13
2.12.	Drainage	14
2.12.1.	General	14
2.12.2.	Subdivision Requirements	14
2.12.3.	Major and Minor Drainage Systems	14
2.12.4.	Analysis Methods	15
2.12.5.	Drainage and Hydrology Calculation	15
2.12.6.	Curb and Grate Inlets	15
2.12.7.	Storm Sewer Drainage System	15
2.12.8.	Culverts (Cross Drains)	16
2.12.9.	Pipe Materials	16
2.12.10.	Open Channels	16
2.13.	Driveways	17
2.14.	Bicycle Facilities	18
2.14.1.	Bike Lanes	18
2.14.2.	Bicycle Shared Street	18
2.15.	Traffic Control Devices	18
2.15.1.	General	18
2.15.2.	Traffic Signal Warrants	18
2.15.3.	Pedestrians	19
2.15.4.	Traffic Signal Timing	19
2.16.	Lighting	19
2.17.	Utilities	19
2.18.	Street Landscape Design	20
2.19.	Temporary Traffic Control	20
3.	Technical Specifications	20
3.1.	General	20
3.2.	Utility Coordination	20
3.2.1.	Responsibility	20
3.2.2.	Location	21
3.3.	Excavation, Fills, and Embankments	21
3.3.1.	Excavation	21
3.3.2.	Fill Requirements	21
3.3.3.	Geotextile Fabrics	21
3.3.4.	Subgrade Preparation	21
3.4.	Crushed Stone Base (Mineral Aggregate Base)	22
3.4.1.	General	22
3.4.2.	Construction Requirements	22
3.5.	Bituminous Plant Mix Base Course	23
3.5.1.	General	23
3.5.2.	Construction Requirements	23

3.6.	Bituminous Plant Mix Binder Course	23
3.6.1.	General	23
3.6.2.	Construction Requirements	23
3.7.	Bituminous Plant Mix Surface Course	24
3.7.1.	General	24
3.7.2.	Construction Requirements	24
3.8.	Flexible Pavement Testing Requirements	24
3.9.	Surface and Thickness Tolerance	25
3.10.	Bituminous Prime Coat	25
3.10.1.	General	25
3.10.2.	Construction Requirements	25
3.11.	Bituminous Tack Coat	25
3.11.1.	General	25
3.11.2.	Construction Requirements	25
3.12.	Pavement Construction	25
3.12.1.	Subgrade Preparation	26
3.12.2.	Subgrade Inspection	26
3.12.3.	Dust Control	26
3.12.4.	Crushed Stone Base Installation	26
3.12.5.	Crushed Stone Base Inspection	27
3.12.6.	Bituminous Prime Coat	27
3.12.7.	Bituminous Plant Mix Installation	27
3.12.8.	Bituminous Plant Mix Inspection	28
3.13.	Trench Excavation in Existing Streets	28
3.13.1.	Trench Cuts	28
3.13.2.	Trench Limits	28
3.13.3.	Utility Trenches	28
3.13.4.	Trench Repair	28
3.13.5.	Trench Pavement	28
3.14.	Portland Cement	29
3.15.	Concrete Structures	29
3.15.1.	Composition	29
3.15.2.	General Conditions	29
3.16.	Concrete Sidewalks and Driveways	30
3.16.1.	General	30
3.16.2.	Concrete Strength	30
3.16.3.	General Requirements	30
3.16.4.	Sidewalk Thickness	31
3.16.5.	Construction	31
3.16.6.	Preparation of Subgrade	31
3.16.7.	Expansion Joints	31
3.16.8.	Finish	31
3.16.9.	Curing and Protection	31
3.16.10.	Backfilling	32
3.16.11.	Seasonal Limits	32
3.17.	Handicap Ramps	32

3.18.	Concrete Curb and Gutter	32
3.18.1.	General	32
3.18.2.	Concrete Strength	32
3.18.3.	Construction Requirements	32
3.19.	Stamped Concrete	32
3.19.1.	General	32
3.19.2.	Finish	33
3.19.3.	Color	33
3.20.	Stamped Asphalt	33
3.20.1.	General	33
3.20.2.	Finish	33
3.20.3.	Materials	33
3.20.4.	Construction	34
3.21.	Pipe Culverts and Storm Sewers	34
3.21.1.	Material Requirements	34
3.21.2.	Excavation	35
3.21.3.	Backfilling	35
3.21.4.	Pipe Laying	35
3.21.5.	Pipe Joints	35
3.21.6.	Field Strutting	35
3.21.7.	Concrete and Brick Construction	36
3.21.8.	Existing Sewers	36
3.21.9.	Special Protection	36
3.21.10.	Structures	36
3.22.	Ground Stabilization	37
3.22.1.	Seeding	38
3.22.2.	Soil Preparations	38
3.22.3.	Approach	38
3.22.4.	Maintenance	38
3.22.5.	Limitations	39
3.22.6.	Sod	39

Street Design Specifications

1.0. STREET AND DRAINAGE DESIGN STANDARDS

1.1 PURPOSE

The purpose of these design specifications is to provide adequate standards for the construction of public street and drainage infrastructure that is in the best interest of the health, safety, welfare, aesthetics, convenience and prosperity of the community.

These specifications are intended to apply to new construction as well as to modifications to existing infrastructure under the jurisdiction of the City "City" Planning Commission or City Engineer.

1.2 DESIGN SPECIFICATIONS

These design specifications shall apply to the construction of streets or infrastructure within the jurisdiction of the City Planning Commission or City Engineer. The criteria contained shall be considered as minimum requirements for new developments and may be modified through use of an equivalent or higher standard at the direction of the Murfreesboro Planning Commission or City Engineer.

1.3 AUTHORITY

The City Engineer in conjunction with the City Planning Commission shall make the final decision on any questions or interpretations of these design specifications.

1.4 MODIFICATIONS

The City Engineer may allow changes to these design criteria for individual developments or projects. However, modifications will only be allowed if the City Engineer is satisfied that allowing the changes is in the best interest of the City. Any modifications considered shall be equivalent or higher than these criteria. Requests for consideration of modifications to these design criteria shall be made in writing to the City Engineer. The City Engineer may require an engineering study from the Engineer of Record to justify the modification request. Any requested modifications shall be based on sound engineering principles and practices. The modifications shall not create an unsafe or hazardous condition and shall not negatively impact adjacent properties.

The City Engineer shall periodically review the technical design specifications and shall recommend to the Murfreesboro Planning Commission revisions or updates to the design specifications. The City Engineer may make additional design specifications which may be issued as separate design bulletins or special provisions with approval of the Murfreesboro Planning Commission. The design bulletins or special provisions may

be issued on an interim basis prior to approval by the Murfreesboro Planning Commission.

1.5 RELATIONSHIP TO OTHER DOCUMENTS

These Street Design Specifications are a part of the Subdivision Regulations. All new streets shall be designed to conform to the latest revision of the Murfreesboro Major Thoroughfare Plan.

These specifications shall be considered supportive and complimentary to the Murfreesboro Water & Sewer Procedures and General Design Guidelines, as well as the Murfreesboro Water & Sewer Standard Specifications. If there is a conflict between any of these documents, the specifications issued by the controlling department shall prevail.

1.6 REFERENCE STANDARDS

The following documents or standards are referenced in these specifications (latest edition).

- “A Policy on Geometric Design of Highways and Streets”, “Guidelines for Geometric Design of Very Low-Volume Local Roads (ADT ≤ 400),” and “Roadway Lighting Design Guide”, American Association of State Highway and Transportation Officials (AASHTO);
- “Manual on Uniform Traffic Control Devices for Streets and Highways”, (MUTCD) U.S. Department of Transportation, Federal Highway Administration;
- “Roadway Design Guidelines”, “Standard Roadway and Bridge Drawings”, “Standard Specifications for Road and Bridge Construction”, “Drainage Manual”, “Survey Manual” and “Traffic Design Manual”, Tennessee Department of Transportation;
- “ADA Accessibility Guidelines for Buildings and Facilities”, United States Access Board; and,
- “Murfreesboro Subdivision Regulations”, “Murfreesboro Interim Design Guidelines” and “Murfreesboro Major Thoroughfare Plan”, City.

1.7 ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ASTM	American Society for Testing Materials
CUD	Consolidated Utility District
FHWA	Federal Highway Administration
ITE	Institute of Transportation Engineers
MED	Murfreesboro Electric Department
MTEMC	Middle Tennessee Electric Membership Cooperative
MUTCD	Manual on Uniform Traffic Control Devices

MWSD
NEMA
TDOT

Murfreesboro Water and Sewer Department
National Electrical Manufacturers Association
Tennessee Department of Transportation

1.8 DEFINITIONS

In addition to the definitions contained in the Subdivision Regulations these definitions shall apply to these Street Design Specifications:

Base Course - The layer or layers of specified or selected material of designed thickness placed on a subbase or a subgrade to support a surface course.

Box Culvert - A structure consisting of a single box or multiple boxes, with or without a bottom slab, having a length, measured along the centerline of the roadway, of less than twenty feet between the inside faces of the outside walls.

Bridge - A structure erected over a stream, watercourse, highway, railroad or opening, for carrying traffic, having a length, measured along the centerline of the roadway, of more than twenty feet between the faces of end supports.

City Engineer - The City Engineer or authorized designee for the City.

Culvert (Cross Drain) - A pipe, conduit or similar drainage structure which carries surface or stormwater under or through an embankment or fill, roadway, driveway, or pedestrian walk, or other structure.

Detour - A temporary route for traffic around a closed portion of road.

Equipment - All machinery, apparatus, and tools necessary for the proper construction and acceptable completion of the project, plus the necessary repair parts, tools, and supplies for upkeep and maintenance.

Expansion joint - A bituminous fiber placed between separate slabs of concrete, as on a sidewalk, to prevent cracks when rising temperature causes expansion.

Grass strip - area located between curb and sidewalk to allow for elements such as signs, sign posts, and flagpoles.

Laboratory - Any laboratory approved by the City Engineer.

Materials - Any substance specified to be furnished or proposed for use in the construction of the project and its appurtenances.

Plans - The approved layouts containing profiles, cross sections, standard roadway and structure drawings, working drawings and supplemental drawings,

or exact reproductions thereof, which show the location, character, dimensions, and details of the construction to be performed.

Roadbed - The graded portion of a highway prepared as a foundation for the pavement structure and shoulders.

Roadside - A general term denoting the area adjoining the outer edge of the roadway. Extensive areas between the roadways of a divided highway may also be considered roadside.

Roadside Development - Those items necessary to the complete highway which provide for the preservation of landscape materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching and the placing of other ground covers; such suitable planting and other improvements as may increase the effectiveness and enhance the appearance of the highway.

Shoulder - The portion of the graded width of a highway contiguous with the roadway which has been provided for the accommodation of stopped vehicles, for emergency use, and for the general enhancement of traffic operations and safety. The shoulder may be either paved or unpaved.

Specifications - A general term applied to all directions, provisions, and requirements pertaining to performance of the work.

State - The State of Tennessee.

Storm Sewer Drainage System - A system of, conduits, pipes, grates, inlets or manholes that serves for the collection and removal of roadway storm water runoff.

Subdivision Regulations – *The control of the division of a tract, or tracts, of land by requiring development according to design standards and procedures.*

Subcontractor - Any individual, firm, partnership, or corporation to whom the Contractor sublets any part of the Work under a contract.

Subgrade - The top surface of a roadbed upon which the pavement structure and shoulders are constructed.

Substructure - All of that part of the structure below the bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, together with the backwalls, wingwalls and wing protection railings.

Superstructure - The entire structure except the substructure.

Temporary Construction Easement – An area adjacent to permanent right-of-way or other permanent easement required for use in construction of improvements.

Project - The furnishing of all labor, materials, equipment, and any incidentals necessary to the satisfactory completion of the project, including the carrying out of all duties and obligations imposed by the Contract.

1.9 INSPECTION AND ACCEPTANCE OF WORK

The City Engineer shall inspect and approve construction at each stage for the project. This includes storm drainage system, roadway sub-grade, base stone and asphalt courses. The Contractor shall not proceed to the next stage of construction without the inspection and written approval of the City Engineer.

The City Engineer will generally require that construction materials, including aggregate, asphalt, concrete, and roadway subgrades be tested as outlined in the latest edition of the TDOT “Standard Specifications for Road and Bridge Construction”. If so, a qualified independent testing laboratory approved by the City shall perform any required tests including coring existing pavement to determine its design thicknesses have been met, and the results of the tests shall be submitted to the City Engineer. If the test(s) fail, the developer shall pay for the cost of the testing. If the test(s) do not fail, the City will be responsible for paying the testing fees. Any work not meeting these specifications or any applicable City standard shall be repaired or replaced at no cost to the City.

Final construction inspection for approval and acceptance of streets and drainage systems will not be granted until all work has been completed in accordance with the approved plans and specifications.

2.0 DESIGN SPECIFICATIONS

2.1 GENERAL

These standards and specifications should be considered minimum requirements. Design of streets shall follow the latest editions of the TDOT “Roadway Design Guidelines” and the AASHTO “A Policy on Geometric Design of Highways and Streets” unless otherwise noted. Also, other relevant TDOT, AASHTO, FHWA and ITE design documents should be consulted for guidance. The City Engineer shall make the final decision if any questions or conflicts arise between any of the standards.

TDOT’s “Roadway Design Guidelines” and Standard Drawings may be found on-line at: http://www.tdot.state.tn.us/Chief_Engineer/assistant_engineer_design/design/Des_Resources.htm

2.2 FUNCTIONAL STREET CLASSIFICATIONS

Classifications from the City Subdivision Regulations and Major Thoroughfare Plan shall be used for purposes of planning and/or designing new streets.

2.3 PRIVATE STREETS

Private streets shall be designed and constructed to the same standards as required for public streets.

2.4 PLANNED DEVELOPMENTS

All Planned Developments shall be designed to meet the requirements of the Subdivision Regulations including right-of-way and lane width requirements.

2.5 RIGHT-OF-WAY

The minimum right-of-way widths for new streets shall be as shown in the Subdivision Regulations. In some cases, right-of-way greater than that indicated in Table 2.1 may be required. All street elements shall be placed within the right-of-way.

2.6 STREET CROSS SECTIONS

The required number of lanes and lane widths shall be as shown in Table 2.1. The cross sections shown are typical and should be used for most streets. Dimensions should be considered minimum values. However, the City Engineer may adjust the required cross section for a particular street.

Table 2.1 Typical Street Cross Sections

Street Classification	Description	Travel Lanes	Minimum Right-of-Way	Minimum Median	Minimum Sidewalk Width
Major Arterial	Five Lanes	Five @ 12'	84'		5'
	Four Lane - Median Divided	Four @ 12'	96'	24'	5'
Minor Arterials	Five Lanes	4 @ 11' and 11' Center Turn Lane	80'		5'
	Four Lane - Median Divided	Four @ 11'	90'	22'	5'
	Three Lanes	2 @ 11' and 11' Center Turn Lane	60'		5'
	Two Lane - Median Divided	Two @ 15'	70'	16'	5'
Commercial and Community Collectors	Three Lanes	2 @ 11' and 11' Center Turn Lane	60'		5'
	Two Lanes	Two @ 12'	50'		5'
	Two Lane - Median Divided	Two @ 15'	70'	16'	5'
Residential Collectors and Sub-Collectors	Two Lanes	Two @ 12'	50'		5'
Local Streets	Two Lanes	Two @ 12'	40'		4'
Alleys		One @ 16'	20'		

2.7 EASEMENTS

Easements for utilities and drainage may be required. However, all Street Elements shall be located in the street right-of-way and not placed in easements. Any easement shall be of sufficient width to permit access for maintenance.

In addition to permanent easements, a Temporary Construction Easement may be needed to provide adequate construction area in the construction of a project.

2.8 DESIGN CRITERIA

2.8.1 Design Speed

All streets shall be designed in accordance with the minimum design speeds specified for each street classification as shown in Table 2.2. The selected design speed for new streets must be approved by the City Engineer.

2.8.2 Design Vehicle

All streets shall be designed to accommodate the design vehicle shown in Table 2.2. The minimum turning paths for the required design vehicles shall be accommodated by the proposed street and intersection geometrics.

2.8.3 Maximum and Minimum Grades

The maximum grades for each classification of street shall be as shown in Table 2.2. The minimum grade for all streets shall be 0.5%.

2.8.4 Design Traffic Volume

Traffic volumes are not usually a major factor in determining the geometric design criteria to be used in designing residential streets and subdivisions. However, the volume of traffic expected to use a street is important in determining the geometric design criteria for major streets such as arterial streets and some collector streets. Traffic volume and composition is also important in determining the required pavement thickness for a high volume or industrial street. New arterial and collector streets shall be designed to accommodate projected future traffic volumes. Typically, a design year of 20 years from the anticipated completion date shall be used unless a different period is agreed to by the City Engineer. Projects that involve isolated intersection improvements to the existing street network may use a five year traffic horizon if allowed by the City Engineer.

2.8.5 Design Level of Service

Unless otherwise agreed by the City Engineer, projects will be designed to achieve a Level of Service (LOS) "C" or better. The City Engineer may approve other LOS designations.

Table 2.2 Design Vehicle Requirements

Street Classification	Design Speed	Design Vehicles *	Maximum Street Grade	Minimum Curb Flow Line Grade
Major Arterial	45 mph	WB-50	6%	0.5%
Minor Arterials	40 mph	WB-50	6%	0.5%
Commercial Collectors	35 mph	WB-50	6%	0.5%
Community Collectors	35 mph	WB-50	6%	0.5%
Residential Collectors	30 mph	SU-40/SBus-40	8%	0.5%
Residential Sub-Collectors	30 mph	SU-40/SBus-40	8%	0.5%
Local Streets	30 mph	SU-40/SBus-40	10%	0.5%
Alleys	20 mph	SU-40/SBus-40	10%	0.5%

* Design Vehicle must be able to turn and stay out of other travel lanes for Arterials and Commercial, Community and Residential Collectors. Design Vehicle must be able to turn and stay on pavement surface for Residential Sub-Collectors, Local streets and Alleys.

**WB-50 - Semitrailer combination, wheelbase 50'*

**SU-40 - Single-unit truck, wheelbase 40'*

**SBUS-40 - Single-unit bus, wheelbase 40'*

2.8.6 Horizontal and Vertical Alignment

Horizontal and vertical design parameters for each functional classification of street are shown in Tables 2.3 and 2.4. Broken-back vertical curves and compound vertical curves should be avoided. For high speed arterial streets or for complex geometry, TDOT and AASHTO design standards and procedures shall be used.

Table 2.3 Horizontal Geometry Requirements

Street Classification	Horizontal Geometry *		
	Minimum Centerline Radius (with normal crown)	Minimum Centerline Radius (with superelevation) **	Minimum Tangent Distance Between Curves
Major Arterial	1,040' (for 45 mph)	711' (for 45 mph)	300'
Minor Arterials	765' (for 40 mph)	533' (for 40 mph)	300'
Commercial Collectors	510' (for 35 mph)	375' (for 35 mph)	100'
Community Collectors	510' (for 35 mph)	375' (for 35 mph)	100'
Residential Collectors	335' (for 30 mph)	250' (for 30 mph)	100'
Residential Sub-Collectors	335' (for 30 mph)	250' (for 30 mph)	100'
Local Streets	230' (for 30 mph)		100'
Alleys	75' (for 20 mph)		

* From "A Policy on Geometric Design of Highways and Streets" 2004 edition, AASHTO Exhibit 3-16

** For 0.04 'l'

2.8.7 Sight Distance

Vertical curves shall be designed to provide the minimum stopping sight distance required by the latest edition of "A Policy on Geometric Design of Highways and Streets". Current minimum values are shown in Table 2.4. Where there are sight obstructions on the inside of curves or the inside of the median lane on divided streets, the cross section elements or the alignment may need to be adjusted if removal of the obstruction is not possible to provide adequate sight distance. Any changes must be approved by the City Engineer.

Table 2.4 Stopping Sight Distance*

Street Classification	Crest		Sag	
	Minimum K Value	Stopping Sight Distance	Minimum K Value (for Sag)	Stopping Sight Distance
Major Arterial	61 (for 45 mph)	360 feet	79 (for 45 mph)	360 feet
Minor Arterials	44 (for 40 mph)	305 feet	64 (for 40 mph)	305 feet
Commercial Collectors	29 (for 35 mph)	250 feet	49 (for 35 mph)	250 feet
Community Collectors	29 (for 35 mph)	250 feet	49 (for 35 mph)	250 feet
Residential Collectors	19 (for 30 mph)	200 feet	37 (for 30 mph)	200 feet
Residential Sub-Collectors	19 (for 30 mph)	200 feet	37 (for 30 mph)	200 feet
Local Streets	19 (for 30 mph)	200 feet	37 (for 30 mph)	200 feet
Alleys	7 (for 20 mph)	115 feet	17 (for 20 mph)	115 feet

* From "A Policy on Geometric Design of Highways and Streets" 2004 edition, AASHTO Exhibits 3-72 and 3-75

2.9 INTERSECTIONS

2.9.1 Intersection Angle

Streets shall be laid out so as to intersect as nearly as possible at right angles. The minimum angle of intersection shall be 85 degrees for all street types except local streets without approval of the City Engineer. In no case shall the angle of intersection be less than 80 degrees.

2.9.2 Offset Intersections

Proposed new intersections along one side of an existing street shall be located, wherever possible, directly opposite the existing intersecting street. Offset intersections occur when two T-type intersections are located in relatively close proximity. Street jogs with centerline offsets of less than one hundred fifty (150) feet shall not be permitted along local or collector streets and centerline offsets of less than two hundred (200) feet shall not be permitted along an arterial street.

2.9.3 Intersection Radii

The minimum curb radius of any street intersection a local street shall be twenty-five (25) feet. The complete minimum radius requirements are listed in Table 2.5. The radii shown are minimums and a larger radius may be required. Design Vehicle, as outlined in table 2.2, must be able to turn and not encroach other travel lanes.

Table 2.5 Minimum Intersecting Street Radii *

Street Classification	Intersecting with						
	Major Arterial	Minor Arterials	Commercial Collectors	Community Collectors	Residential Collectors	Residential Sub-Collectors	Local Streets
Major Arterial	50'	50'	50'	40'	30'	30'	30'
Minor Arterials	50'	50'	50'	40'	30'	30'	30'
Commercial Collectors	50'	50'	30'	30'	30'	30'	25'
Community Collectors	40'	40'	30'	30'	30'	30'	25'
Residential Collectors	30'	30'	30'	30'	30'	30'	25'
Residential Sub-Collectors	30'	30'	30'	30'	30'	30'	25'
Local Streets	30'	30'	25'	25'	25'	25'	25'

* These values are minimum, larger radii may be required to accommodate design vehicle shown in Table 2.2.

2.10 EMERGENCY ACCESS AND ACCESS FOR SERVICE VEHICLES

All new streets and intersections shall accommodate safe and efficient movement of emergency vehicles and service vehicles (school buses, solid waste trucks, etc). Turning templates should be used to verify that these vehicles will be adequately accommodated.

2.11 STREET ELEMENTS

2.11.1 Pavement Type

Streets are to be designed with asphaltic concrete pavement on compacted subgrade. Pavement thicknesses shall be as shown in the Standard Drawings unless otherwise required. The dimensions shown for each street classification are based on assumed subgrade support and traffic loadings. Arterial streets and industrial streets often will require a pavement design specific to that street. The City Engineer may require

additional thickness or require a detailed pavement design be performed based on a soil condition analysis and projected traffic loadings.

2.11.2 Curbs and Gutters

All new streets shall be designed with curbs and gutters. The standard curbs to be used on new streets are as follows:

- 4" Rollover Curb and Gutter (4" mountable curb with 12" gutter pan) – to be used on all local streets and all collector streets with residential driveways. This is considered a mountable curb (see detail);
- 6-24 Curb and Gutter (6" curb – 24" wide with 18" gutter pan) – to be used on all arterial and collector streets without residential driveways. This is a vertical and non-mountable curb (see detail);
- Mountable Post Curb – to be used on all medians (see detail);
- Ribbon Curb – to be used on all alleys, public or private (see detail); and,
- Grass Strip – to be used with all curb sections and shall be a minimum 2 feet in width, but in certain situations, will be more (see detail).

2.11.3 Shoulder

The standard new street section shall include a concrete curb. A shoulder may be permitted when tying in to existing cross streets. If permitted, a shoulder shall be the same typical section as the roadway and will be a minimum of two (2) feet in width.

2.11.4 Sidewalks and Ramps

Sidewalks and handicap ramps shall be constructed in all new developments. Sidewalks are required along both sides of all streets except permanent cul-de-sacs and alleys. Sidewalks are only required along one side of a cul-de-sac street and no sidewalks are required on alleys.

The minimum width for new sidewalks shall be four (4) feet for Local streets and five (5) feet for all other streets. All pedestrian facilities provided within a City street right-of-way shall be designed in accordance with the "ADA Accessibility Guidelines for Buildings and Facilities" from the Americans with Disabilities Act (ADA). In all cases, new sidewalks shall provide a minimum clear width of three (3) feet.

Ramps meeting requirements of the "ADA Accessibility Guidelines for Buildings and Facilities" shall be installed at all intersections with sidewalks.

2.11.5 Sidewalk Encroachments and Obstructions

Encroachments such as utility poles, fire hydrants, utility boxes, parking meters, mailboxes, sign posts, signal poles and street furniture shall not be located within the concrete portion of a new standard five (5') foot wide sidewalk, unless approved by the City Engineer. Sidewalks shall be inspected by the City Engineer for obstructions before any concrete is poured. Tree grates, utility covers and manholes may be permitted within a sidewalk provided four (4) feet of unobstructed clearance is provided on one side.

2.12 DRAINAGE

2.12.1 General

Streets shall be designed so that storm water is directed to inlets. Streets shall not be used to collect and convey storm water runoff other than that which falls on the street or on a lot along the street.

2.12.2 Subdivision Requirements

Each lot shall have access to a drainage system. Lots shall be laid out so as to provide positive drainage away from all buildings, and individual lot drainage shall be coordinated with the general storm drainage pattern. Storm water runoff shall be designed so as to avoid concentrated runoff from any lot onto adjacent lots, unless the runoff is in a designed conveyance system. Lots shall be graded to allow the drainage system to perform as designed and avoid damage to critical structures.

2.12.3 Major and Minor Drainage Systems

The major drainage system is the storm drainage system that conveys storm water runoff from a 100-year frequency storm event. The major drainage system usually includes features such as swales, ditches, and major drainage channels. Swales along property lines that convey storm water runoff events in excess of the design event for culverts that convey roadway and cross drainage along property lines are also considered a component of the major drainage system. The major drainage system shall be designed so that water from a 100-year storm event is not allowed to encroach onto critical structures. These critical structures shall be defined as the crawl space, garage, finished floor and HVAC units.

The minor drainage system is the storm drainage system that is typically used for collecting, transporting, and disposing of storm water runoff up to the design capacity of the system. The minor drainage system usually includes features such as curb and gutter, culverts, and open drainage ways.

The drainage plan must also include a method of addressing stormwater quality. Additional information concerning stormwater quality management can be found in the Stormwater Quality Ordinance for the City. However, it is important to note that

addressing stormwater quality is paramount and should be considered an integral part of any drainage system.

2.12.4 Analysis Methods

The Engineer of Record shall determine the appropriate analysis method for determining flows and design of the drainage system for both volume and water quality requirements. The rational method shall be an acceptable method for peak flow estimating for drainage basins of less than one hundred (100) acres. The Engineer of Record should be familiar with the limitations of each of the methods so that appropriate methods are applied. The City Engineer may require a particular method on critical portions of the drainage system.

2.12.5 Drainage and Hydrology Calculation

Drainage and hydrology calculations shall be submitted with the construction plans. The calculations shall include a map detailing the drainage basin and sub-basins, storm event, method for calculating peak runoff, headwater and tailwater conditions (assumed and calculated), methods for sizing channels and culverts, flow depths on channel and channel lining calculation. The City Engineer may require additional calculations.

2.12.6 Curb and Grate Inlets

Curb and grate inlets shall be designed to quickly drain the storm water from the roadway. The storm frequency and spread width shall be in accordance with Table 2.6. Spread shall not be allowed to overtop the curb. The maximum inlet spacing is generally 400 feet unless proven otherwise by computations. Inlets should be located at uphill corners of each street intersection to prevent sheet flow of storm water across the intersections. In addition, inlets shall be flush with curb and pavement surface.

2.12.7 Storm Sewer Drainage System

The storm frequency for storm sewer shall be in accordance with Table 2.6. All storm sewer drainage pipes located within the roadway right-of-way shall be reinforced concrete pipe (RCP). The minimum size diameter for storm sewers is 15 inches. The minimum slope shall be one-half percent (0.5%) or that necessary to create a full-flow velocity of two (2) feet per second "fps".

Table 2.6 Drainage Design Criteria

Street Classification	Inlet Design Frequency	Storm Sewer Design Frequency	Culvert (Cross Drain) Design Frequency	Roadway Freeboard ²	Spread
					Width ³
Arterial	10-yr ¹	10-yr ¹	50-yr Check for 100-yr	50-yr	½ traveled way plus gutter width
Collector	10-yr ¹	10-yr ¹	50-yr Check for 100-yr	50-yr	½ traveled way plus gutter width
Local	10-yr	10-yr	10-yr Check for 25-yr	25-yr	Traveled way plus gutter width

¹ 50-yr for Roadway Sag Sections

² The design high water elevation should be at or below the bottom of the roadway subgrade.

³ Bike lanes and shoulders may be used full width for spread.

2.12.8 Culverts (Cross Drains)

Allowable flow within culverts is subject to inlet control, outlet control, or some combination of the two controls. The storm frequency for culverts shall be in accordance with Table 2.6. The minimum size diameter for storm sewers is 15inch. The minimum slope shall be one-half percent (0.5%) or that necessary to create a full-flow velocity of two (2) fps.

For culverts 24-inch and larger in diameter, culvert data must be shown on the plans. Culvert data shall include Station, Structure (size) Skew, Drainage Area, Design Discharge (cubic feet per second “cfs”), Overtopping Elevation, Allowable Headwater Elevation, Headwater Elevation, Velocity (fps), Inlet Elevation and Outlet Elevation.

All culverts that convey storm water runoff from the road surface, and as cross drains, shall extend to the maximum building envelope of the expected zoning lot. All culverts must have concrete endwalls. Outlet velocities shall be checked and appropriate outlet protection shall be provided. Rip-rap is not allowed at the inlet or outlet ends of culverts for velocity control.

2.12.9 Pipe Materials

All storm sewer drainage culverts and cross-drains located within the roadway right-of-way shall be reinforced concrete pipe (RCP). Sections of culvert located outside of the roadway right-of-way may be of a different material (e.g. high density polyethylene “HDPE”). In no event, shall corrugated metal pipe “CMP” be considered as an appropriate pipe material.

2.12.10 Open Channels

Open Channels shall be designed to the same storm frequency as culverts, except in the case where these channels are considered part of the major drainage system. A minimum 6-inch freeboard for the design storm is required for ditches and open channels that are adjacent to streets and roads. Channels shall be designed with stable side slopes and lining to withstand velocities and shear stress for the design storm event. Vegetative channels shall have a maximum side slope of 3H:1V. Channels with bottom widths greater than 10 feet shall have a minimum bottom cross slope of 12 to 1. Parabolic or trapezoidal channels are preferred while triangular shapes should be avoided. When the depth for the design storm event exceeds three (3) feet in depth, the design engineer shall use an alternate drainage system design.

The lining of any channel shall be checked for both velocity and shear stress. Channel lining may be vegetative, flexible or rigid. Rip-rap shall not be allowed as a channel lining. The Engineer of Record shall refer to Chapter 5 of the TDOT Design Division Drainage Manual for maximum velocities and permissible shear stresses of various channel linings.

2.13 DRIVEWAYS

In order to provide ease and convenience of ingress and egress to private property, the number and location of driveways shall be regulated relative to the development density of the property being served and the amount of lot frontage. The number and location of driveways shall be controlled to provide safety and maintain the efficiency of the traffic flow on public streets.

The maximum number of driveways per lot for arterial and collector streets is shown in Table 2.7. Any change in the number of driveways must be approved by the City Engineer.

However, all driveways shall meet the following:

- No driveway shall be constructed within the radius return of a street intersection.
- No driveway shall be constructed with a corner clearance of less than 25 feet.
- No driveway shall be constructed in a manner which results in the encroachment of a curb return or curb radius beyond the extension of an adjacent property line unless there is joint use with the adjacent property.

Table 2.7 Maximum Number of Driveways Per Lot

Lot Frontage	Maximum Number of Driveways (Arterials and Collectors)
< 100 ft	1
100 ft to 300 ft	2
> 300 ft	3

2.14 BICYCLE FACILITIES

For streets with bicycle facilities, either a separate marked bicycle lane or shared outside lane shall be provided. The location and appropriateness of bicycle lanes will be determined according to the Bicycle Master Plan for the City.

2.14.1 Bike Lanes

A bike lane shall be a minimum of 4' wide and located adjacent to the outside travel lane. Bike lanes are separated from conventional travel lanes with a lane stripe and are identified by pavement markings and signing. Bike lanes carry bike traffic in the same direction as the adjacent motor vehicle traffic.

2.14.2 Bicycle Shared Street

A shared street is a street in which motorists and bicyclists share the same travel lanes. Typically this is accomplished by a wider than normal outside travel lane which is shared by vehicles and bicycles. A 14' outside travel lane is used for a street designated as a bike route without a separate marked bike lane and identified by signing.

2.15 TRAFFIC CONTROL DEVICES

2.15.1 General

All signs, markings, signals and other traffic control devices installed or used shall be designed and located in conformance with the "Manual on Uniform Traffic Control Devices" ("MUTCD").

2.15.2 Traffic Signal Warrants

Proposed traffic signals shall meet one or more warrants from the MUTCD. The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation

of a traffic control signal. An engineering study shall be required for all proposed traffic signal installations in order to justify the signal. The analysis shall be submitted to the City Engineer for review and shall include capacity analysis. The City Engineer may require the study to include an evaluation of the effect of this new signal on existing adjacent signals or on signal progression along corridors. The City Engineer shall make the final decision on any new traffic signal on non-state routes. TDOT shall make decisions on traffic signals on state routes. The City Engineer may have specific requirements for a traffic signal and must approve the design of all traffic signals including but not limited to intersection geometry, supports, displays, phasing, timing and materials.

2.15.3 Pedestrians

In general, all new traffic signals at intersections with sidewalks and/or pedestrian activity shall be designed to accommodate pedestrians. The City Engineer shall have the final determination for locations that may not have pedestrian signals.

2.15.4 Traffic Signal Timing

The MUTCD, the TDOT "Traffic Design Manual" and the ADA "Accessibility Guidelines for Buildings and Facilities" should be used to determine signal timings.

2.16 LIGHTING

Two electric utilities provide service to areas in the City. Portions of the City are served by the Middle Tennessee Electric Membership Cooperative (MTEMC) and portions are served by the Murfreesboro Electric Department (MED). Lighting supports and foundations shall be in accordance with the approved list of manufacturers and standard details of either MTEMC or MED. The Engineer of Record, Developer and/or Contractor shall coordinate with MTEMC or MED for the locations and installation of the proposed lighting supports and foundations.

Roadway lighting design shall be in accordance with the AASHTO "Roadway Lighting Design Guide" and the TDOT "Roadway Design Guidelines" Design Manual. All fixtures, poles, and designs will be reviewed and approved by the power provider.

All lighting fixtures shall be designed or shielded to prevent glare, and to minimize light shining on or negatively affecting neighboring residents. Lighting shall be designed to have the intensities and uniformity ratio consistent with the AASHTO Roadway Lighting Design Guide for the roadway classification under consideration.

2.17 UTILITIES

When a development, addition or change in use requires new or expanded utility services (water/sewer, telephone, natural gas, cable television, electricity, etc.), the

Developer is required to contact the appropriate utility companies and coordinate underground installation of the utilities.

The proposed layout of utilities should be carefully examined by the Engineer of Record, Developer and Contractor to avoid interferences between utilities.

No utility encroachments shall be located in or on a new sidewalk unless approved by the City Engineer. Tree grates, utility covers and manholes may be permitted within a sidewalk provided that four (4) feet of unobstructed clearance is provided on one side.

2.18 STREET LANDSCAPE DESIGN

Street landscaping shall be approved by the City Horticulturist. It shall be installed such that it does not obstruct motorist sight distance and does not inhibit service vehicles. Additional information on landscaping in the City right-of-way and along public streets should be referenced in Section 27 of the Murfreesboro Zoning Ordinance.

2.19 TEMPORARY TRAFFIC CONTROL

Any work within the road right-of-way shall require a temporary traffic control plan for the work zone. The plan shall be prepared in accordance with Part 6 of the "Manual on Uniform Traffic Control Devices (MUTCD)".

3.0 TECHNICAL SPECIFICATIONS

3.1 GENERAL

Street and drainage construction for the City shall meet the technical specifications contained or referenced herein, unless the City Engineer pursuant to Section 1.4 has made additional specifications or modifications.

All references are from the Tennessee Department of Transportation (TDOT) "Standard Specifications for Road and Bridge Construction", latest edition, as amended, unless noted differently. TDOT's "Standard Specifications for Road and Bridge Construction" may be found on-line at:

http://www.tdot.state.tn.us/Chief_Engineer/assistant_engineer_design/design/Des_Resources.htm

Any projects involving state highways shall meet the requirements of the Tennessee Department of Transportation.

3.2 UTILITY COORDINATION

3.2.1 Responsibility

The Contractor and/or Developer is required to contact any affected or impacted utility companies and coordinate the protection, removal, relocation and installation of all utilities as required.

3.2.2 Location

Locating and coordination for the relocation of existing utilities is the responsibility of the Contractor and/or Developer. Some utilities may be located by using the Tennessee One-Call utility location service. However, in addition to using the Tennessee One-Call service, the Contractor and/or Developer should coordinate directly with local utility owners. Existing utilities must be protected at all times and the Contractor and/or Developer shall be responsible for costs due to damage caused to any utility lines.

3.3 EXCAVATION, FILLS AND EMBANKMENTS

3.3.1 Excavation

Excavation and Undercutting shall be done in accordance with Section 203 of the TDOT “Standard Specifications for Road and Bridge Construction”. When unsuitable material or soft organic or plastic clays are encountered in the subgrade, the area shall be undercut and backfilled with suitable material.

3.3.2 Fill Requirements

Embankment material, preparation and placement and lift thickness shall be done in accordance with Section 205 of the TDOT “Standard Specifications for Road and Bridge Construction”. Fill and backfill are to be deposited in loose layers not more than twelve (12) inches thick. Rocks, blocks of concrete and masonry materials, not more than twelve (12) inches maximum dimension, but no debris, may be used for fills if well distributed in the earth and provided further, that such materials shall not be placed against manholes, underground structures, or utilities, or in the top 24 inches of fill below finished grade. No frozen material shall be placed in backfill.

3.3.3 Geotextile Fabrics

The City Engineer may allow the use of geotextile fabrics to strengthen backfill material in undercut areas based on the recommendations of a geotechnical report.

3.3.4 Subgrade Preparation

Preparation of Subgrade shall be done in accordance with Section 207 of the TDOT “Standard Specifications for Road and Bridge Construction”. All traces of utility trenches shall be filled and thoroughly tamped. Spongy and unsuitable material shall be removed and replaced with stable material. All subgrades shall be maintained in satisfactory condition, protected against traffic and properly drained until base is placed.

Any areas where settlement occurs due to shrinkage shall be filled to the required finished grade.

All excavation and embankment areas shall be proof rolled with a minimum 12 cubic yard tandem axle dump truck, fully loaded with soil, or other equipment approved by the City Engineer that will reveal any soft, yielding, or spongy areas. Compaction must meet 95 percent Standard Proctor. Any instability observed shall be corrected during the proof roll, to the satisfaction of the City Engineer by diskings, aerating, recompacting, removing and replacing material. After taking corrective measures, affected areas shall be proof rolled to ensure the stability. The City Engineer may require additional testing as outlined in Section 205 of the TDOT "Standard Specifications for Road and Bridge Construction".

3.4 CRUSHED STONE BASE (MINERAL AGGREGATE BASE)

3.4.1 General

The base stone section of the road shall be constructed with mineral aggregate meeting the requirements of Subsection 903.05 of the TDOT "Standard Specifications for Road and Bridge Construction".

3.4.2 Construction Requirements

All base stone shall be placed and compacted according to Section 303 of the TDOT "Standard Specifications for Road and Bridge Construction".

Prior to installation of the base stone, the Contractor and/or Developer shall have the subgrade inspected by the City Engineer. Proof rolling or testing of subgrade shall be in accordance with subsection 3.3 of these specifications. Should the Contractor begin placement of the base stone prior to obtaining the Certification of Inspection for the subgrade, the City Engineer shall have the right to require the Contractor to expose as many areas as deemed necessary to obtain valid testing of the subgrade. If the subgrade fails, the Contractor shall remove all stone in the failed areas and perform the necessary work to bring these areas into compliance.

Once the Contractor and/or Developer believes there is sufficient stone depth, compaction, and proper adjustment of all castings, the City Engineer shall be notified at least 48 hours (excluding Saturday, Sunday and all City-observed Holidays) in advance of paving. Written notice is preferred and is less likely to result in delay. All castings shall be set to the binder course level.

Testing of the mineral aggregate base for local streets shall be performed by the proof rolling method as described above. Additional testing of aggregate base on Collector and Arterial streets as outlined in Section 303.09 of the TDOT "Standard Specifications for Road and Bridge Construction" may be required by the City Engineer.

Once the base stone and castings have been inspected and approved, the Contractor shall be permitted to begin paving. Should any castings be disturbed prior to paving, it will be the responsibility of the Contractor to make the proper adjustments prior to paving.

3.5 BITUMINOUS PLANT MIX BASE COURSE

3.5.1 General

The Bituminous Plant Mix Base course shall be Grading “A” or “A-S” as shown on the plans or in the Standard Drawings. The base course shall meet the requirements of Section 903 of the TDOT “Standard Specifications for Road and Bridge Construction” unless otherwise approved.

3.5.2 Construction Requirements

The Bituminous Plant Mix Base course shall be installed in accordance with Section 307 and Subsections 407.09 through 407.18 of the TDOT “Standard Specifications for Road and Bridge Construction”.

The Subgrade and mineral aggregate base must have been inspected and approved by the City Engineer prior to placement of the base course.

The City Engineer shall be notified at least 48 hours (excluding Saturday, Sunday and all City-observed Holidays) in advance of paving so that a representative can be available for inspection throughout the placement of asphalt.. Written notice is preferred and is less likely to result in delay.

Weather limitations for the placement of asphaltic concrete courses shall be as indicated in Subsection 407.09 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.6 BITUMINOUS PLANT MIX BINDER COURSE

3.6.1 General

The Bituminous Plant Mix Binder course shall be Grading “BM2” as indicated in the plans or in the Standard Drawings meeting the requirements of Subsection 903.06 of the TDOT “Standard Specifications for Road and Bridge Construction” unless otherwise approved.

3.6.2 Construction Requirements

The binder course shall be installed in accordance with Section 407 of the TDOT “Standard Specifications for Road and Bridge Construction”.

The Bituminous Plant Mix Base course must have been inspected and approved by the City Engineer prior to installation of the binder course(s).

The City Engineer shall be notified at least 48 hours (excluding Saturday, Sunday and all City-observed Holidays) in advance of paving so that a representative can be available for inspection throughout the placement of asphalt.. Written notice is preferred and is less likely to result in delay.

Weather Limitations for the placement of asphaltic concrete courses shall be as indicated in Subsection 407.09 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.7 BITUMINOUS PLANT MIX SURFACE COURSE

3.7.1 General

The Bituminous Plant Mix Surface course shall be Grading “D” or “E” as shown on the plans or in the Standard Drawings. The surface course shall meet the requirements of Subsection 903.11 of the TDOT “Standard Specifications for Road and Bridge Construction” unless otherwise approved.

Installation of the final surface course of asphalt on new streets in a subdivision shall not occur before construction is complete on 70 percent of the lots in a section or phase have been built on unless directed by the City Engineer.

3.7.2 Construction Requirements

The surface course shall be installed in accordance with Section 411 of the TDOT “Standard Specifications for Road and Bridge Construction”.

The Bituminous Plant Mix Base and/or Binder course must have been inspected and approved by the City Engineer and any failed areas corrected prior to installation of the surface course.

The City Engineer shall be notified at least 48 hours (excluding Saturday, Sunday and all City-observed Holidays) in advance of paving so that a representative can be available for inspection throughout the placement of asphalt.. Written notice is preferred and is less likely to result in delay.

Weather limitations for the placement of asphaltic concrete courses shall be as indicated in Subsection 407.09 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.8 FLEXIBLE PAVEMENT TESTING REQUIREMENTS

All pavement installation and repairs shall conform to section 407 of the TDOT “Standard Specification for Road and bridge Construction.”

3.9 SURFACE AND THICKNESS TOLERANCE

The pavement surface must be constructed to a 0.25 inch tolerance. To check the surface tolerance, a 10 feet straight edge shall be placed parallel to the centerline of the pavement and a 10 feet straight edge placed transversely to the centerline of the pavement on any portion of the pavement.

The nominal thickness required (per plan) for the course(s) specified and the total thickness of all hot mix asphalt "HMA" mixture courses shall not vary from the total nominal thickness indicated on the plans by more than 0.25 inch.

3.10 BITUMINOUS PRIME COAT

3.10.1 General

The bituminous materials and aggregate cover material for the Bituminous Prime Coat shall conform to Subsections 904.03 and 903.13 of the TDOT "Standard Specifications for Road and Bridge Construction".

3.10.2 Construction Requirements

Installation of the Bituminous Prime Coat shall conform to Section 402 of the TDOT "Standard Specifications for Road and Bridge Construction".

3.11 BITUMINOUS TACK COAT

3.11.1 General

The bituminous materials and aggregate cover material for the Bituminous Tack Coat shall conform to Subsections 904.03 and 904.01 of the TDOT "Standard Specifications for Road and Bridge Construction".

3.11.2 Construction Requirements

Installation of the Bituminous Tack Coat shall conform to Section 403 of the TDOT "Standard Specifications for Road and Bridge Construction".

3.12 PAVEMENT CONSTRUCTION

3.12.1 Subgrade Preparation

The Subgrade shall be prepared in reasonable close conformity to the lines and grades shown on the plans. Prior to the spreading of any mineral aggregate, the subgrade shall be proof rolled with a fully loaded tandem dump truck (or other approved equipment). Any areas which pump will require undercutting, backfill and compaction. Additional proof rolling shall be performed on all repaired areas.

3.12.2 Subgrade Inspection

A request to inspect and test the Subgrade shall be presented to the City Engineer at least 48 hours in advance (excluding Saturday, Sunday and all City-observed Holidays). Written notice is preferred and is less likely to result in delay. After inspection, any deficiencies shall be noted in the field log and corrected by the Contractor.

3.12.3 Dust Control

The Contractor may be required to address dust control at various stages of construction. The Contractor shall sprinkle the street construction surfaces with water or apply a dust-allaying material when such operations are necessary to prevent a dust nuisance or if directed by the City Engineer.

3.12.4 Crushed Stone Base Installation

The crushed stone base shall be constructed in one or more layers with the compacted thickness being that as shown on the approved plans or the Standard Drawings. If the required compacted depth of the crushed stone base course exceeds six (6) inches, the base shall be constructed in two or more layers of approximate equal thickness.

Except where mechanical aggregate spreading equipment is used to place the mineral aggregate base material, final shaping of each layer prior to compaction shall be accomplished by motor grader. In the event that mechanical spreading equipment fails to shape the base material properly, final shaping shall be done by motor grader or other approved means. Immediately following spreading, the mineral aggregate base material shall be shaped to the required degree of uniformity and smoothness and compacted to the required density prior to any appreciable evaporation of surface moisture. Compaction of each layer shall be continuous until the minimum density requirement is attained.

The thickness of the completed mineral aggregate base shall be in reasonably close conformity to the thickness shown on the approved plans or as called for by the construction standards. The thickness tolerance shall be measured at such frequency as established by the City Engineer by means of test holes or other approved methods.

After completion of the crushed stone base, it shall be maintained, smooth and uniform until covered by the following stage of construction.

All manholes, water line valve boxes, and appurtenances shall be adjusted to the correct elevation. When the stone base is at a proper grade, all casting should be above the finished grade of the base stone.

3.12.5 Crushed Stone Base Inspection

A request to inspect and test the crushed stone base shall be made to the City Engineer at least 48 hours in advance. After inspection, any deficiencies shall be noted in the field log and corrected by the Contractor.

3.12.6 Bituminous Prime Coat

A Bituminous Prime Coat shall be applied uniformly over the surface of the crushed stone base by means of a pressure distributor at an approved uniform rate. The prime coat shall be applied at an approved rate. Any areas containing an excess or deficiency of priming material shall be corrected by the addition of blotter material or bituminous material, as directed by the City Engineer.

The Contractor shall protect all structures and concrete surfaces from the bituminous material during construction. If after the bituminous prime coat has been applied, it fails to penetrate before the time that traffic must use the street, or paving is interrupted overnight, a dry cover material shall be spread at an approved rate to prevent damage to the primed surface. An excess of cover material shall be avoided.

The Contractor shall maintain the prime coat and the surface intact until it has been covered by the following stage of construction. No succeeding stage of construction shall be placed upon the prime coat until it has properly cured.

3.12.7 Bituminous Plant Mix Installation (Base, Binder and Surface Courses)

Bituminous Plant Mix Base, Binder and Surface courses shall be installed to the compacted thicknesses shown on the plans or in the Standard Drawings.

Bituminous mixtures shall be delivered and spread on the roadway in ample time to secure thorough compaction during daylight hours.

Prior to installing the binder and surface courses of asphalt, a Bituminous Tack Coat shall be applied uniformly by means of a pressure distributor at a uniform rate. The tacked surface shall be allowed to dry until it is in a proper condition to receive the next course. Tack coat shall only be applied as far in advance of the paving operations as is necessary to obtain the proper condition of tackiness. The contractor shall protect the tack coat from damage until the next course is placed.

The bituminous plant mix shall be placed upon the approved stone base or asphalt course, spread and struck off to established line, grade and elevation by means of an approved asphalt paving machine. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture shall be taken from the hopper of the spreading machine and shall be distributed into place by means of shovels and spread with rakes and lutes in a uniformly loose layer of such depth as will result in a completed course having the required thickness.

Thickness shall be controlled during the spreading operation by frequent measurements of the freshly spread mixture. Thickness or spread rate shall be within reasonably close conformity with that specified in the plans or in the Standard Drawings.

After the bituminous mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly compacted by means of rollers.

3.12.8 Bituminous Plant Mix Inspection (Base, Binder and Surface Courses)

A request to inspect and test each of the Bituminous Plant Mix courses shall be made to the City Engineer at least 48 hours in advance. After inspection, any deficiencies shall be noted in the field log and corrected by the Contractor.

3.13 TRENCH EXCAVATION IN EXISTING STREETS

3.13.1 Trench Cuts

Trenches cut within the limits of the subgrade shall be excavated to neat lines to minimize disturbance of the surrounding material. All excavation for pipes and utilities shall be performed in accordance with the Section 203 of the TDOT "Standard Specifications for Road and Bridge Construction".

3.13.2 Trench Limits

Trench limits shall be saw-cut into the existing pavement. Excavation width shall be limited to the minimum width required to perform the work and accomplish backfilling.

3.13.3 Utility Trenches

Utility trenches excavated into existing streets shall be backfilled with stone or flowable fill as directed by the City Engineer. If granular stone is used, it shall be placed in layers not to exceed 6 inches at its optimum moisture content and then thoroughly compacted with mechanical tampers. If flowable fill is used, it shall meet the requirements of Subsection 204.06 of the TDOT "Standard Specifications for Road and Bridge Construction".

3.13.4 Trench Repair

Concrete curbs, gutters, driveways, median pavement, and sidewalks shall be restored as required to match existing construction. Damaged sections shall be replaced with complete new sections or squares. Patching of damaged sections is not allowed.

3.13.5 Trench Pavement

Base stone and asphalt paving shall be placed over trench backfill with thicknesses and gradations equal to the existing street pavement section. Each course of base stone and asphalt shall be thoroughly compacted with mechanical tampers.

Where trenches have been opened in any roadway or street that is a part of the State highway system, surfaces shall be restored in accordance with the requirements of the Tennessee Department of Transportation.

3.14 PORTLAND CEMENT CONCRETE (RIGID) PAVEMENT

If Portland Cement Concrete (Rigid) Pavement is indicated on the plans or justified by special circumstances, the concrete pavement materials shall meet the requirements of Subsection 501.02 of the TDOT "Standard Specifications for Road and Bridge Construction".

The construction of the concrete pavement shall be in accordance with Subsections 501.05 to 501.24 of the Standard Specifications. The pavement design shall be based on an analysis of the soil conditions and the projected traffic loadings. The use of Portland Cement Concrete (Rigid) Pavement and its design shall be preapproved by the City Engineer.

3.15 CONCRETE STRUCTURES

3.15.1 Composition

Concrete structures shall be constructed of 4000 pounds per square inch "psi" Concrete, unless otherwise specified. The concrete shall be composed of a mixture of Portland Cement, aggregates, air-entraining agents, water and chemical additives when approved, combined and proportioned as specified.

3.15.2 General Conditions

The Contractor shall examine the drawings and specifications for this portion of the work, and for other work affecting this work, and shall report to the City Engineer any discrepancies found to exist. Before starting the work the Contractor shall check all lines, levels, and previous work.

The Engineer of Record's drawings and schedules shall show the typical dimensions and form of concrete work and sizes and typical arrangement of reinforcing. These drawings must show the general design and extent of the concrete work with the position of columns, slabs, etc., together with the reinforcement. All of these items shall be installed to meet conditions. The drawings are not intended to serve as shop drawings, or to show every item in detail. Before proceeding with the work the Contractor shall submit shop drawings, bar lists, placing plans, special or explanatory details for approval showing method of reinforcement. No fabrication of material shall be

started until such shop drawings have been checked by the Contractor and approved by the City Engineer.

The Contractor shall lay out all concrete work, set lines and establish correct levels and be responsible for the accuracy of same. The Contractor shall see to it that at no time is the concrete structure subject to loading, or overloading, with materials and equipment.

Materials for Portland Cement concrete and reinforcing shall meet the requirements of Subsection 604.02 of the TDOT "Standard Specifications for Road and Bridge Construction".

Sampling and testing cement and aggregates shall be performed by a recognized commercial testing laboratory approved by the City Engineer. Certified test reports and certificates shall be submitted to the City Engineer and to such other agencies or persons as required. Reports or certificates indicating compliance of any shipment of cement, aggregate or admixtures shall be placed in the hands of the City Engineer prior to use of such materials. Where reputable cement and aggregate suppliers maintain regular recognized testing services, certified copies of such tests will be accepted by the City Engineer. However, in any case of doubt as to the accuracy and/or adequacy of such tests, the City Engineer may require that cement and aggregates be tested by a recognized commercial testing laboratory which has been selected by the Contractor and approved by the City Engineer. The testing laboratory shall then test the cement and aggregates and prepare written reports showing the results of such tests on each shipment. The laboratory shall also certify that the materials covered by the report comply in all respects with these Specifications. In general, cement and aggregates shall be tested at the mill but if untested shipments require sampling and testing after arrival at the site of the work, the Contractor shall be fully responsible for delays in the progress of the work due to delays in testing and reporting.

The construction of structures shall be in accordance with Section 604 of the standard specifications.

3.16 CONCRETE SIDEWALKS AND DRIVEWAYS

3.16.1 General

Materials for sidewalks and driveways shall meet the requirements of Subsection 701.02 of the TDOT "Standard Specifications for Road and Bridge Construction".

3.16.2 Concrete Strength

Concrete for sidewalks and driveways shall have minimum 28 day strength of 4,000 psi. Minimum slump shall be one (1) inch and maximum slump shall be three (3) inches, unless otherwise approved.

3.16.3 General Requirements

Sidewalks shall be formed to “turn down” their own thickness at terminal points or ending points. The turn down or extra thickness shall extend for the width of the sidewalk.

At the request of the City Engineer, slight adjustments shall be made by the Contractor in the grades and cross-slopes of walks to connect with existing sidewalks or other work, and/or to improve drainage. Grade stakes not more than 50 feet apart shall be provided for all walk construction. Short vertical curves shall be introduced at all summits and valleys where the algebraic difference in grade equals or exceeds two percent (2%).

3.16.4 Sidewalk Thickness

Sidewalks shall have a minimum thickness of four (4) inches. The surface of concrete walks shall be cut into flags by marking with an edging tool having a radius of 1/4 inch. Flags shall be no longer than the width of the sidewalk.

3.16.5 Construction

Sidewalks shall be of the width and depth as shown on the plans and be constructed in accordance with Section 701 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.16.6 Preparation of Subgrade

All boulders, organic materials, soft clay, spongy material, and any other objectionable material shall be removed and replaced with approved material. The Subgrade shall be properly shaped, rolled and uniformly compacted to conform to the accepted cross-sections and grades.

3.16.7 Expansion Joints

Expansion joints shall be installed in accordance with Subsection 701.06 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.16.8 Finish

Concrete sidewalks and driveways shall be finished in accordance with Subsection 701.09 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.16.9 Curing and Protection

Concrete sidewalks and driveways shall be cured and protected in accordance with Subsection 701.10 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.16.10 Backfilling

Backfill shall be of suitable selected material and shall be placed and tamped until firm and solid. Backfilling shall follow immediately after the concrete forms have been removed.

3.16.11 Seasonal Limits

No concrete shall be poured on a frozen or thawing subgrade or during unfavorable weather conditions, or when the temperature is 38 degrees F. and falling.

3.17 HANDICAP RAMPS

Concrete for ramps shall be 4,000 psi specifications meeting the requirements of Sidewalks in this specification and shall be finished by light broom finish texturing. It shall meet the requirements of Subsection 701.02 of the TDOT "Standard Specifications for Road and Bridge Construction".

Truncated dome surface shall be concrete pavers meeting the requirements of ASTM C-936. Concrete paver units shall have a truncated dome top surface for detectable warning to pedestrians.

3.18 CONCRETE CURB AND GUTTER

3.18.1 General

All concrete materials for concrete curbs and gutters shall be proportioned, mixed, and placed in accordance with section 702 of the TDOT "Standard Specifications for Road and Bridge Construction".

3.18.2 Concrete Strength

Concrete for Curb and Gutter shall have minimum 28 day strength of 4,000 psi. Minimum slump shall be one (1) inch and maximum slump shall be three (3) inches, unless otherwise approved.

3.18.3 Construction Requirements

Construction shall be performed in accordance with Subsection 702-04 through 702.11 of the TDOT "Standard Specifications for Road and Bridge Construction"

3.19 STAMPED CONCRETE

3.19.1 General

In special locations, stamped concrete may be used for marked crosswalks. The use of stamped concrete must be approved by the City Engineer.

3.19.2 Finish

Stamped concrete finishes are to be performed only by Contractors experienced in the stamping process. The proposed pattern, finish and color shall be submitted with related product data to the City Engineer for approval. Prior to construction, a 4' x 4' mock-up sample may be required for review and approval by the City.

3.19.3 Color

Concrete stamped areas may include color of the final surface by applying a colored antiquing release agent just after initial set of the concrete. Concrete may also contain a color additive provided the colorant additive is mixed at the batch plant and the color is completely dispersed in the concrete. After concrete curing, the colored concrete surface shall be sealed with a clear sealer. An alternate method of coloring the concrete surface may be submitted to the City Engineer for approval.

3.20 STAMPED ASPHALT

3.20.1 General

In special locations, stamped asphalt may be used for marked crosswalks. The use of stamped asphalt must be approved by the City Engineer.

3.20.2 Finish

Stamped asphalt finishes are to be performed only by Contractors experienced in the stamping process. The proposed pattern, finish and color shall be submitted with related product data to the City Engineer for approval. Prior to construction, a 4' x 4' mock-up sample may be required for review and approval by the City.

3.20.3 Materials

Color coat shall consist of a cement modified, acrylic polymer and fine aggregate blend that has superior adhesion, flexibility, with abrasion and chemical resistance and good scrubability. As performance requirements vary according to traffic density the Engineer of Record (or representative) will specify the dry mil thickness requirements for each intersection.

A clear sealer which is a high quality, breathable, acrylic polymer designed specifically for use with the approved color coat shall be used.

The colorant for any other than premixed colors shall be a high quality, UV resistant pigment blend designed for compatibility with the surface coating system.

3.20.4 Construction

The Contractor shall follow the latest application procedures as issued by the manufacturer. Patterning shall begin once the asphalt has reached its final density and while there is still sufficient heat in the asphalt to permit imprinting. Alternatively, imprinting can be carried out at a later stage, on existing asphalt, by applying heat to the asphalt surface making the upper portion of the surface pliable enough to accept the imprint of the template. The asphalt pavement must be adequately heat soaked (softened) to a depth of at least ½" (one half inch), without burning the asphalt. The asphalt surface temperature shall not exceed 300°F (150°C). Heating must be discontinued if there is any visible smoke. Regular monitoring of the surface temperature during heating is required to prevent overheating.

When paving around obstacles, such as sign posts, poles, valve boxes or manhole covers the contractor must ensure that compaction takes place in these areas, and that the asphalt is finished off neatly at the obstacle. Finishing by hand may be required.

Patterning shall be achieved using steel rollers and/or vibratory plate compactors to impress the templates into the asphalt surface. The templates shall be pushed fully into the asphalt surface until they are even with the asphalt surface. Patterning shall be a consistent depth throughout the project.

There shall be no gaps in the grout lines, either between two templates that butt up together or between the printed area and a solid edge such as curbing.

The color coat shall be installed by applying four coats of the color coat material to the asphalt surface. Additional coats may be required as directed by the City Engineer. Each application of coating material shall be allowed to dry completely before applying the next layer. The coating application shall be spray applied and broomed to work the material into the asphalt surface. Finished thickness of the color coat shall not be less than 50 mils.

Sealer shall be applied as a seal coat after the final color coat has reached the manufacturer's recommended curing stage. The sealer shall be applied in accordance with the manufacturer's recommendations taking care that all imprinted surfaces are covered and that masking is used to assure that only specified areas are sealed.

The air temperature must be at least 50°F (10°C) and rising for applying the surface coating system. No precipitation shall be expected within the manufacturer's specified drying time. Relative humidity shall be within the limits specified by the coating manufacturer.

3.21 PIPE CULVERTS AND STORM SEWERS

3.21.1 Material Requirements

All materials shall be in accordance with Subsection 607.02 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.21.2 Excavation

Excavation for trenches, manholes and structures shall be performed in accordance with Subsection 607.05 and 611.05 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.21.3 Backfilling

Backfilling shall begin after line construction is completed, inspected and approved by the City Engineer. Backfilling shall be performed in accordance with Subsection 607.09 and 611.05 of the TDOT “Standard Specifications for Road and Bridge Construction”.

At locations beneath or closely adjacent to pavements, road shoulders, or other improvements subject to damage by displacement, backfill shall be tamped and thoroughly compacted in six (6) inch layers (before compaction). In other areas, backfill for the upper portion of the trenches may be placed without tamping but the backfill shall be compacted to a density equivalent to that which will result from spreading by a dozer thereon. The Contractor shall exercise precaution to prevent damage to pipes from the operation of backfilling equipment.

Where trenches have been cut across or along existing pavement, the backfill of such trenches shall be temporarily paved by the Contractor with the placing of crushed stone for the top six (6) inches of backfill. Such temporary pavement shall, be maintained by the Contractor until restoration of permanent pavement or until acceptance of the project.

3.21.4 Pipe Laying

Laying Pipe Culverts and Storm Sewers shall be performed in accordance with Subsection 607.07 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.21.5 Pipe Joints

Joining pipes shall be performed in accordance with Subsection 607.07 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.21.6 Field Strutting

When strutting or vertical elongation is required, it shall be performed in accordance with the details shown on the plans and in accordance with Subsection 607.08 of the TDOT “Standard Specifications for Road and Bridge Construction”

3.21.7 Concrete and Brick Construction

Concrete construction shall be performed in accordance with Subsection 611.06 of the TDOT “Standard Specifications for Road and Bridge Construction”. Brick construction shall be performed in accordance with Subsection 611.08 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.21.8 Existing Sewers

Connections shall be made into existing sewer lines at existing manholes and by construction of new manholes over existing lines. At all points where connections are made either to or from existing lines the Contractor shall secure the required permits from the City, paying all costs and charges connected therewith.

The Contractor shall not interfere with the functioning of existing sewers and shall not allow debris to enter these sewers as a result of the Contractor’s work.

3.21.9 Special Protection

Sheathing and bracing generally should be removed only when the trench below it has become substantially filled, and every precaution shall be taken to prevent any slides of material from the sides of the trench onto or against the top of the sewer.

The Contractor shall pump, bail or otherwise remove any water which may be found or accumulate in the trenches or other excavations, and shall provide all dams, flumes and well points or other works necessary to keep them entirely free from water until the pipe has been laid and the mortar joints and masonry has hardened sufficiently, in the opinion of the City Engineer, to withstand any damaging effect that might be caused by the presence of water.

Should underground conditions be encountered that, in the opinion of the City Engineer, might require special protection, the Contractor shall provide such protection either in the form of sheeting lumber left in place, timber foundations, gravel stabilization of subgrade or rigid concrete foundation as directed by the City Engineer.

3.21.10 Structures: Manholes, Catchbasins, Inlets, and Pipe End Walls

Manholes, catchbasins, inlets and pipe end walls shall be constructed in accordance with Subsection 611.02 of the TDOT “Standard Specifications for Road and Bridge Construction”. Tops of manhole castings shall be at exact finished grades unless otherwise specified. Top of yard drainage openings shall be depressed two (2) inches below finished grades. In circular structures, all brick shall be laid as headers. All joints shall be completely filled with mortar.

Manholes shall be neatly and accurately built of brick and concrete, according to City Standards. Precast concrete manholes shall conform to the latest revision of the

appropriate specifications set forth in Subsection 611.02 of the TDOT “Standard Specifications for Road and Bridge Construction”.

Brick shall be new, Grade Mk Sewer Brick or Grade A Concrete Building Brick. All brick shall be wetted and carefully laid and bedded full in mortar. All brick in each course of circular brick masonry shall be headers, breaking joints for those in adjoining portions with all joints entirely filled with mortar.

Mortar for manholes shall be Portland Cement mortar composed of one part Portland Cement and two parts clean, sharp sand with a mixture of hydrated lime in the amount of ten percent (10%) of the Portland Cement. All measurements shall be by volume.

Brick manholes shall be plastered on the outside with a coating of mortar of not less than one half (1/2) inch in thickness of the same composition used in laying brick to prevent excessive infiltration of water, and on the inside of the manholes the vertical portion of the walls shall be plastered and the sloping section neatly pointed with trowel. The cover shall be sealed water tight to exclude all surface water.

Steps in manholes shall be staggered and spaced not more than eighteen (18) inches vertically, and shall be so arranged that the lowest step shall be no more than two (2) feet above the bench. The top shall be no more than eighteen (18) inches below the manhole cover.

Inverts shall be constructed in accordance with Subsection 611.07 of the TDOT “Standard Specifications for Road and Bridge Construction”.

Cast Iron Rim and Covers matching the standard City Cast Iron Rim and Covers are to be used on all inlets. Casting shall be constructed in accordance with Subsection 611.10 of the TDOT “Standard Specifications for Road and Bridge Construction”.

Castings shall be manufactured true to pattern and component parts shall fit together in a satisfactory manner. They shall be smooth and well cleaned by shotblasting. Circular manhole frames, covers and grates shall be furnished with machined horizontal bearing surfaces unless otherwise specified. All square and rectangular units shall be furnished with an as-cast bearing surface.

Concrete and reinforcing steel for manholes, catch basins, culverts, etc., shall be proportioned, mixed and placed in accordance with Subsection 611.06 of the TDOT “Standard Specifications for Road and Bridge Construction”.

Inlets and outlet pipes shall be constructed in accordance with Subsection 611.09 of the TDOT “Standard Specifications for Road and Bridge Construction”.

3.22 GROUND STABILIZATION

3.22.1 Seeding

Apply to final grading of exposed surfaces or areas where erosion is possible.

Apply to denuded areas, soil stockpiles, dikes, dams, sides of sediment basins and temporary diversions.

3.22.2 Soil Preparations

Final grade shall be tilled or loosened in an approved method before seed or sod application.

Soil should be analyzed for fertilizer and lime requirements.

Apply fertilizer and lime per soil requirements and supply fertilizer at a rate of 5 pounds per 1,000 square feet with commercial grade 10-10-10.

3.22.3 Approach

Apply selected seed at a rate of 4 pounds per 1,000 square feet. Seed should be sown uniformly as soon as preparation of the seedbed has been completed by means of a rotary seed spreader, hydraulic equipment, or other satisfactory means.

Straw mulch or chemical stabilization should be applied especially to seedlings in the fall for winter cover or slopes that exceed 3:1 (H:V).

No seeding shall be done during windy weather or when the ground surface is frozen, wet or otherwise non-tillable.

When mulching, the approved material is straw; it shall be spread evenly over the seeded area at an approximate rate of 100 pounds per 1,000 square feet. (This rate may be varied by the City Engineer depending on the texture and condition of the mulch material and the characteristics of the area seeded.)

The Contractor shall not allow any equipment or material to be placed on any planted area, and shall erect suitable barricades and guards to prevent equipment, labor or the public from traveling on or over any area planted with sod or seed.

3.22.4 Maintenance

Inspect frequently within the first six weeks of planting to see if stands are uniform and dense and to assure that appropriate moisture levels are maintained.

Make provisions to water as needed to penetrate to a depth of 6 inches (15.2 cm).

Check for damage caused by equipment or heavy rains.

Damaged areas should be repaired and fertilized. If the area was originally seeded it should be seeded and mulched. If the area was originally sodded it should be sodded. Tack or tie down mulch or sod as necessary.

3.22.5 Limitations

Uneven seed broadcasting or low application is unacceptable as it can lead to patchy growth and erosion.

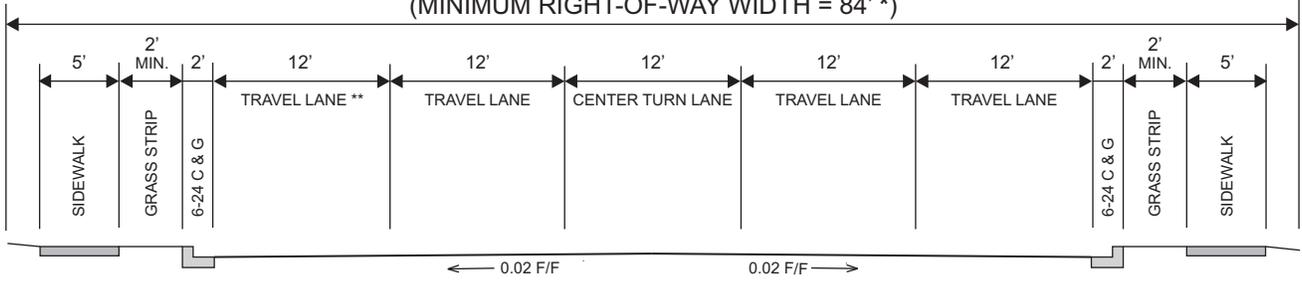
Misapplication of fertilizer or lime is unacceptable as it could lead to pollutant runoff.

3.22.6 Sod

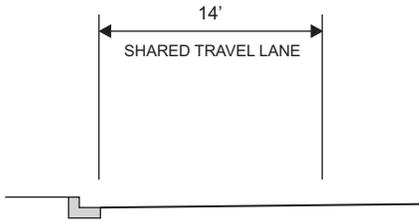
Sod shall be Bermuda Grass or Blended Fescues. Sod shall be set or reset only when the soil is moist and favorable to growth. Setting will be as follows unless permission is granted by the Engineer: 1) Blended Fescues – Anytime weather permits; 2) Bermuda Grass – April 15 through August 14.

On steep slopes sod shall be fastened to the ground with wire staples. Where surface water cannot be diverted from flowing over the face of slopes, install a strip of plastic netting and fasten tight along the crown or top of the slope for extra protection against lifting and undercutting of sod.

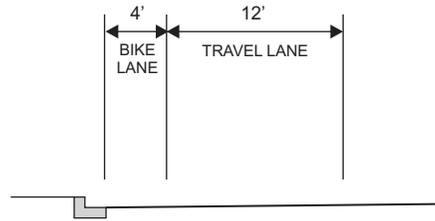
FIVE LANE MAJOR ARTERIAL STREET
(MINIMUM RIGHT-OF-WAY WIDTH = 84' *)



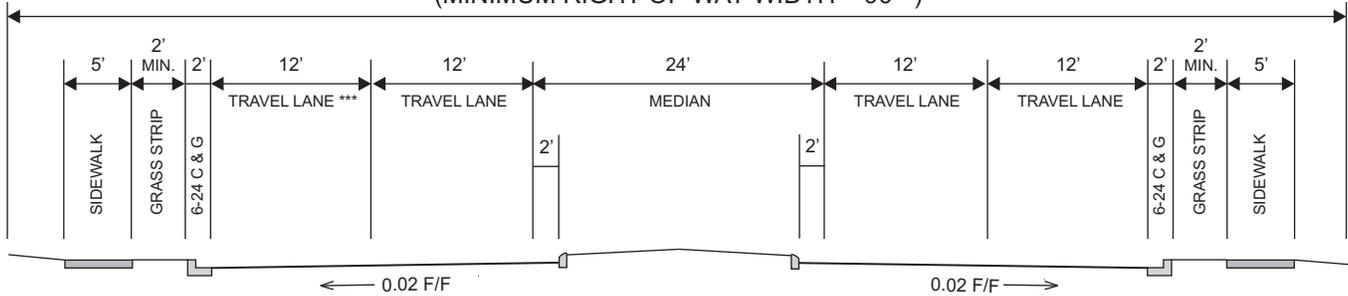
**** SHARED BIKE LANE OPTION**
(MINIMUM ROW 88' *)



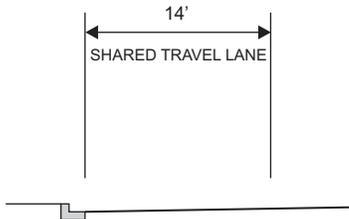
**** SEPARATE BIKE LANE OPTION**
(MINIMUM ROW 92' *)



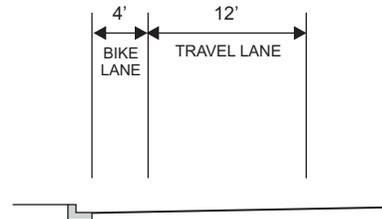
FOUR LANE MEDIAN DIVIDED MAJOR ARTERIAL STREET
(MINIMUM RIGHT-OF-WAY WIDTH = 96' *)



***** SHARED BIKE LANE OPTION**
(MINIMUM ROW 100' *)



***** SEPARATE BIKE LANE OPTION**
(MINIMUM ROW 104' *)



* A UTILITY EASEMENT MAY BE REQUIRED OUTSIDE OF ROW.
DIMENSIONS SHOULD BE CONSIDERED MINIMUMS.
CONSTRUCTION EASEMENTS MAY ALSO BE REQUIRED.

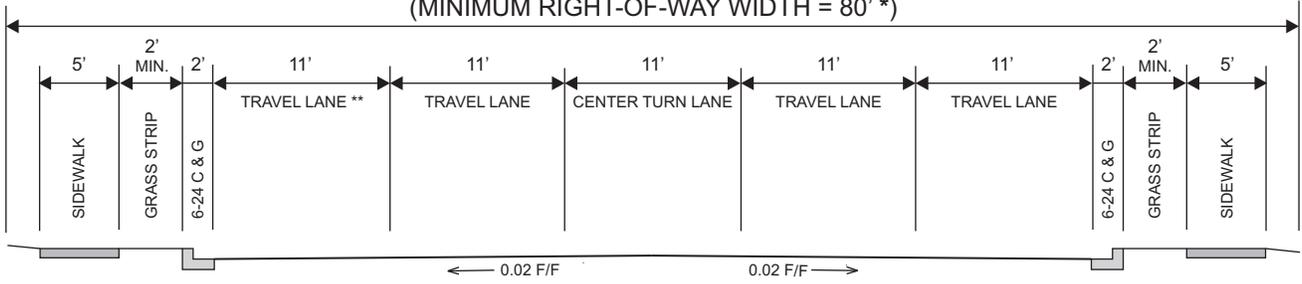
REVISIONS:	DATE:

MAJOR ARTERIAL

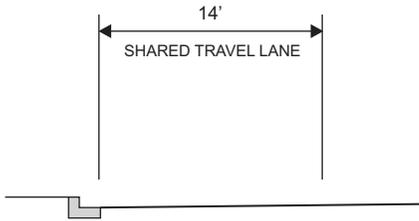
DRAWING NO: **ST-2** DATE: **July 2009**



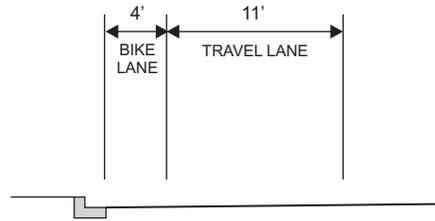
FIVE LANE MINOR ARTERIAL STREET
(MINIMUM RIGHT-OF-WAY WIDTH = 80' *)



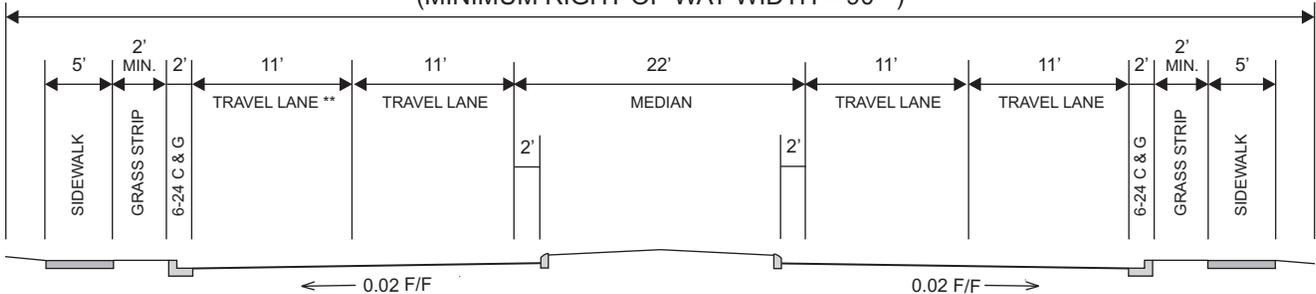
**** SHARED BIKE LANE OPTION**
(MINIMUM ROW 86' *)



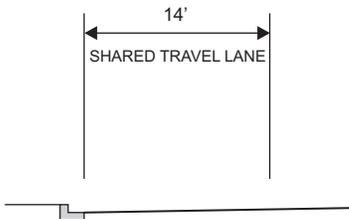
**** SEPARATE BIKE LANE OPTION**
(MINIMUM ROW 88' *)



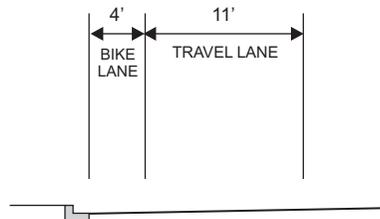
FOUR LANE MEDIAN DIVIDED MINOR ARTERIAL STREET
(MINIMUM RIGHT-OF-WAY WIDTH = 90' *)



**** SHARED BIKE LANE OPTION**
(MINIMUM ROW 96' *)



**** SEPARATE BIKE LANE OPTION**
(MINIMUM ROW 98' *)



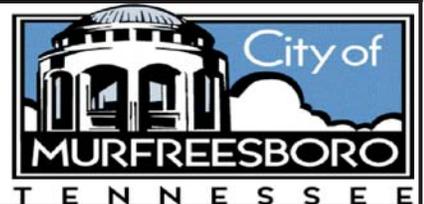
* A UTILITY EASEMENT MAY BE REQUIRED OUTSIDE OF ROW. DIMENSIONS SHOULD BE CONSIDERED MINIMUMS. CONSTRUCTION EASEMENTS MAY ALSO BE REQUIRED.

SEE COMMERCIAL/COMMUNITY COLLECTOR TYPICALS. FOR THREE LANE MINOR ARTERIAL DETAIL AND TWO-LANE MEDIAN MINOR ARTERIAL DETAIL

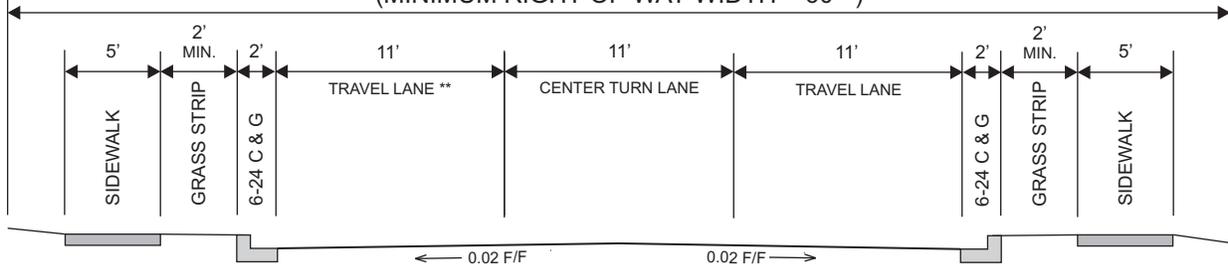
REVISIONS:	DATE:

MINOR ARTERIAL

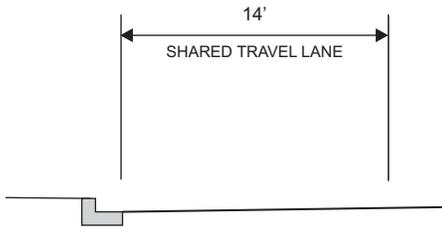
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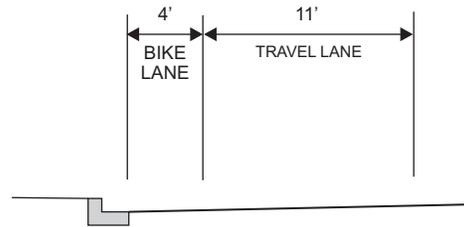
**THREE LANE COMMERCIAL/COMMUNITY COLLECTOR OR MINOR ARTERIAL STREET
(MINIMUM RIGHT-OF-WAY WIDTH = 60' *)**



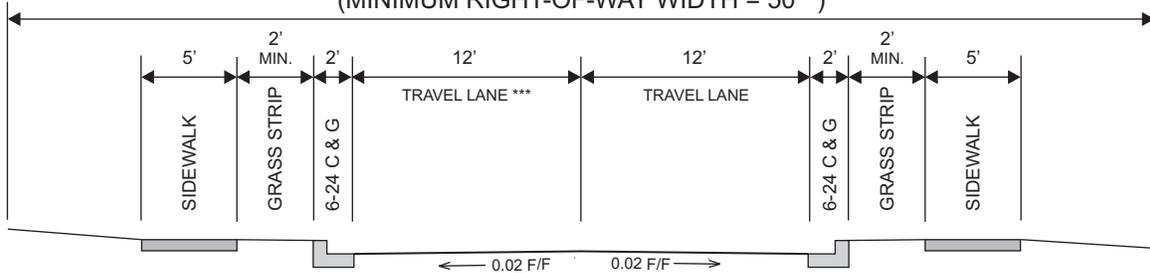
**** SHARED BIKE LANE OPTION
(MINIMUM ROW 66' *)**



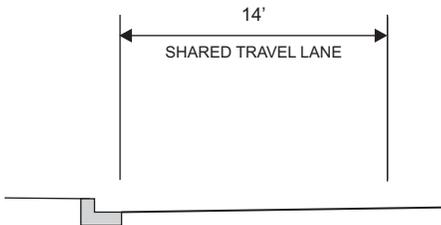
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(MINIMUM ROW 68' *)**



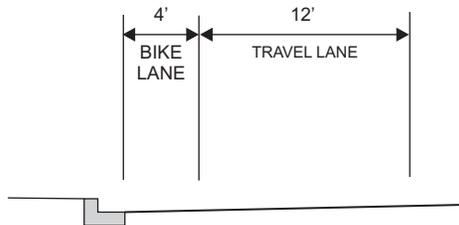
**TWO LANE COMMERCIAL/COMMUNITY COLLECTOR STREET
(MINIMUM RIGHT-OF-WAY WIDTH = 50' *)**



***** SHARED BIKE LANE OPTION
(MINIMUM ROW 54' *)**



***** SEPARATE BIKE LANE OPTION
(MINIMUM ROW 56' *)**

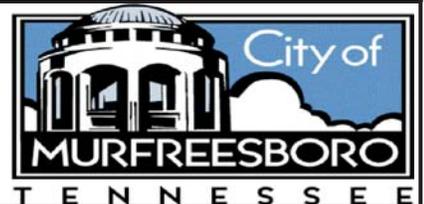


* A UTILITY EASEMENT MAY BE REQUIRED OUTSIDE OF ROW.
DIMENSIONS SHOULD BE CONSIDERED MINIMUMS.
CONSTRUCTION EASEMENTS MAY ALSO BE REQUIRED.

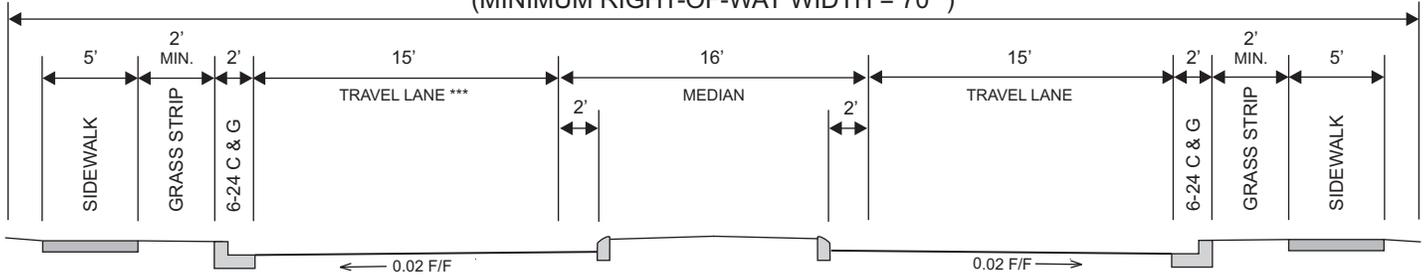
REVISIONS:	DATE:

**COMMERCIAL AND
COMMUNITY COLLECTOR**

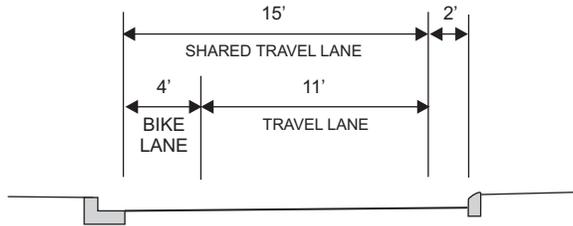
DRAWING NO: **ST-4** DATE: **July 2009**



MEDIAN DIVIDED COMMERCIAL/COMMUNITY COLLECTOR STREET OR MINOR ARTERIAL STREET
(MINIMUM RIGHT-OF-WAY WIDTH = 70 *)



*** SHARED BIKE LANE AND SEPARATE BIKE LANE OPTIONS



* A UTILITY EASEMENT MAY BE REQUIRED OUTSIDE OF ROW.
DIMENSIONS SHOULD BE CONSIDERED MINIMUMS.
CONSTRUCTION EASEMENTS MAY ALSO BE REQUIRED.

REVISIONS:	DATE:

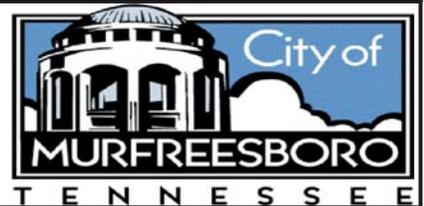
COMMERCIAL AND COMMUNITY COLLECTOR WITH MEDIAN

DRAWING NO:

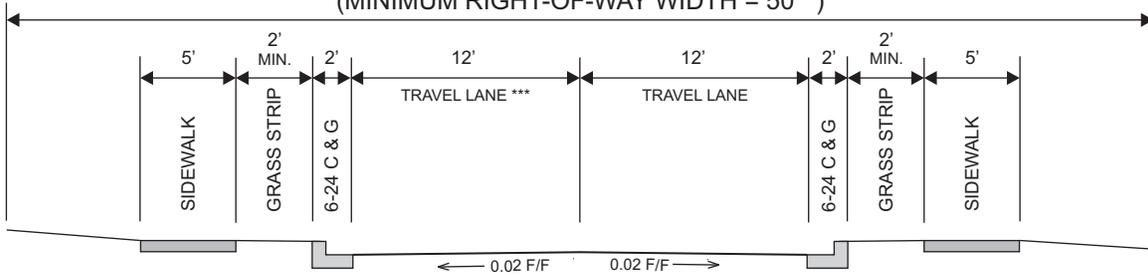
ST-5

DATE:

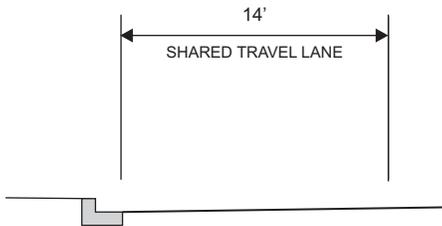
July 2009



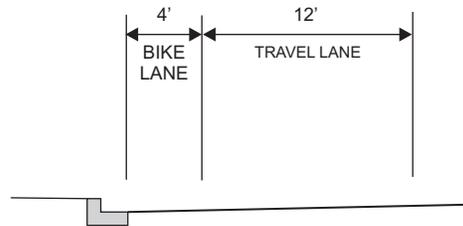
RESIDENTIAL COLLECTOR/RESIDENTIAL SUB-COLLECTOR STREET
(MINIMUM RIGHT-OF-WAY WIDTH = 50' *)



*** SHARED BIKE LANE OPTION
(MINIMUM ROW 54' *)



*** SEPARATE BIKE LANE OPTION
(MINIMUM ROW 56' *)



* A UTILITY EASEMENT MAY BE REQUIRED OUTSIDE OF ROW.
DIMENSIONS SHOULD BE CONSIDERED MINIMUMS.

REVISIONS:	DATE:

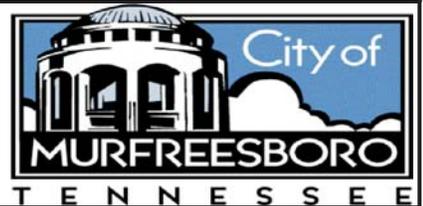
**RESIDENTIAL COLLECTOR AND
RESIDENTIAL SUB-COLLECTOR**

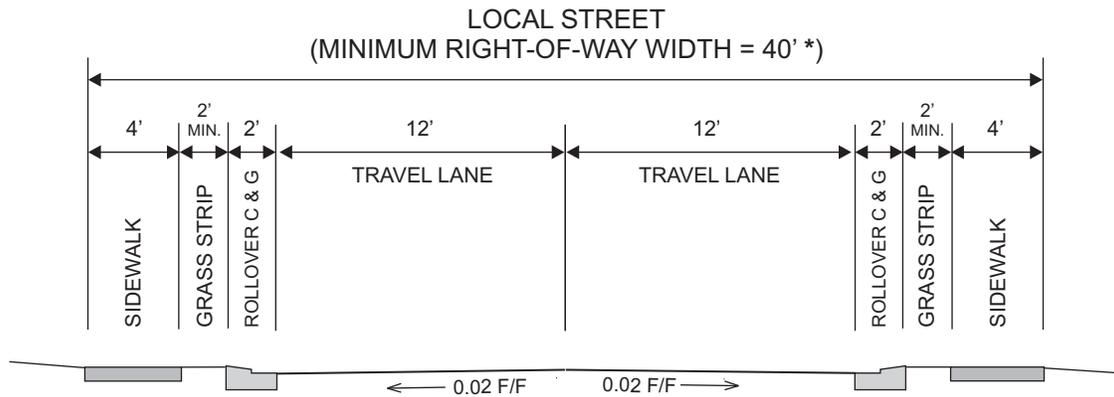
DRAWING NO:

ST-6

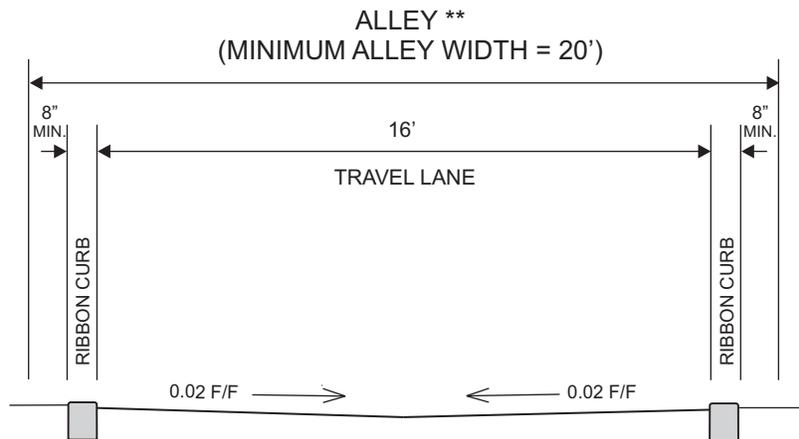
DATE:

July 2009





* A UTILITY EASEMENT WILL BE REQUIRED OUTSIDE OF ROW.
DIMENSIONS SHOULD BE CONSIDERED MINIMUMS.

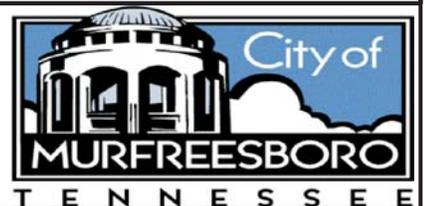


** ALLEYS SHALL BE PRIVATE

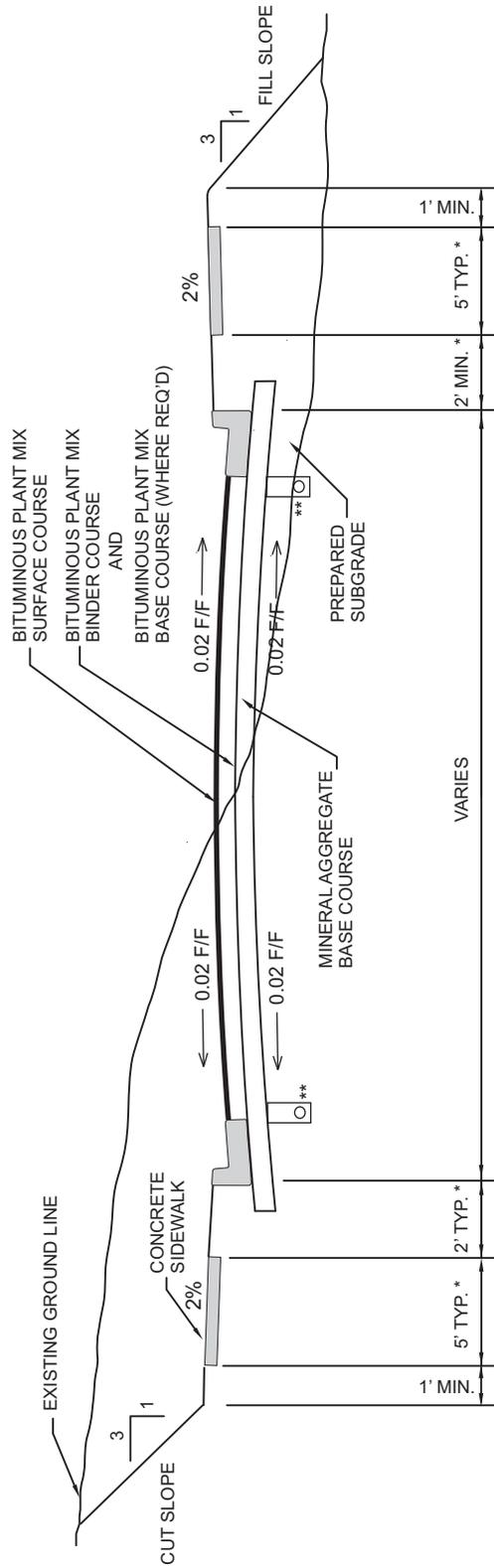
REVISIONS:	DATE:

LOCAL STREET AND ALLEY

DRAWING NO: **ST-7** DATE: **July 2009**



TYPICAL SECTION



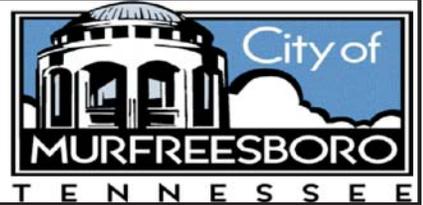
* 4' SIDEWALK AND 2' GRASS STRIP ON LOCAL STREETS.

** UNDERDRAINS MAY BE REQUIRED ON CUT AND FILL SECTIONS.

REVISIONS:	DATE:

TYPICAL STREET SECTION

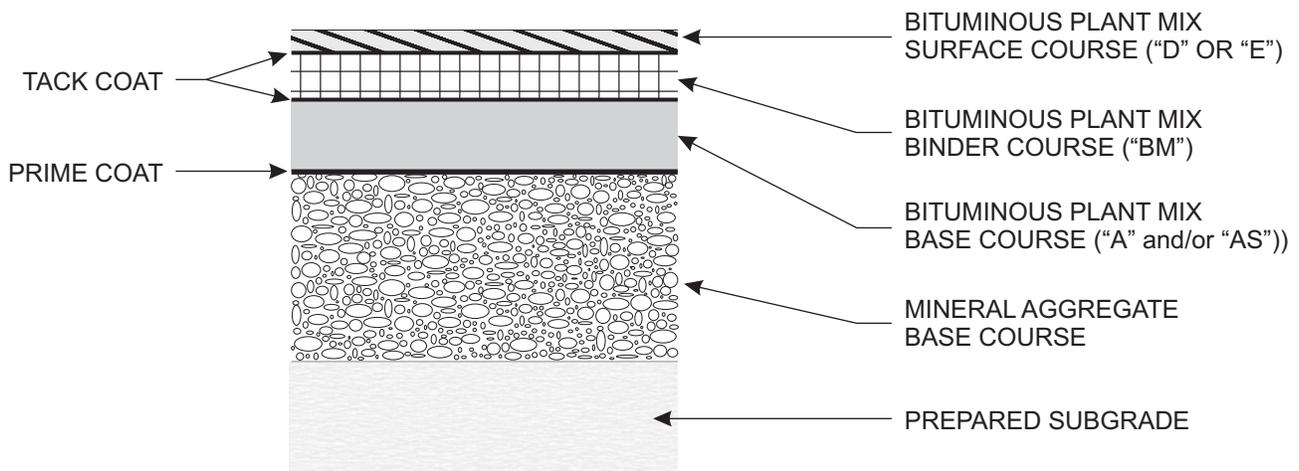
DRAWING NO: **ST-8** DATE: **July 2009**



COMBINATION ASPHALT CONCRETE AND AGGREGATE BASE (MINIMUM REQUIRED THICKNESS *)

CLASSIFICATION	MINERAL AGGREGATE BASE COURSE	ASPHALT PAVEMENT					TOTAL THICKNESS
		BASE/BINDER			SURFACE COURSE		
		"AS"	"A"	"BM"	"D"	"E"	
RESIDENTIAL COLLECTORS, SUB-COLLECTORS AND LOCAL STREETS	6"	-	-	2.5"	-	1.5"	10"
COMMUNITY COLLECTORS AND COMMERCIAL COLLECTORS	8"	-	3"	2"	1.5"	-	14.5"
MAJOR ARTERIALS AND MINOR ARTERIALS	8"	3"	3"	2"	1.5"	-	17.5"

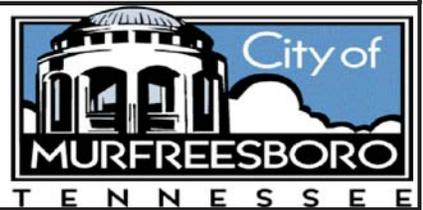
* THE CITY ENGINEER MAY REQUIRE PERFORMANCE GRADE ASPHALT BASED ON PROJECTED TRAFFIC LOADINGS. ADDITIONAL THICKNESS OR A DETAILED PAVEMENT DESIGN BASED ON A GEOTECHNICAL ANALYSIS MAY ALSO BE REQUIRED.

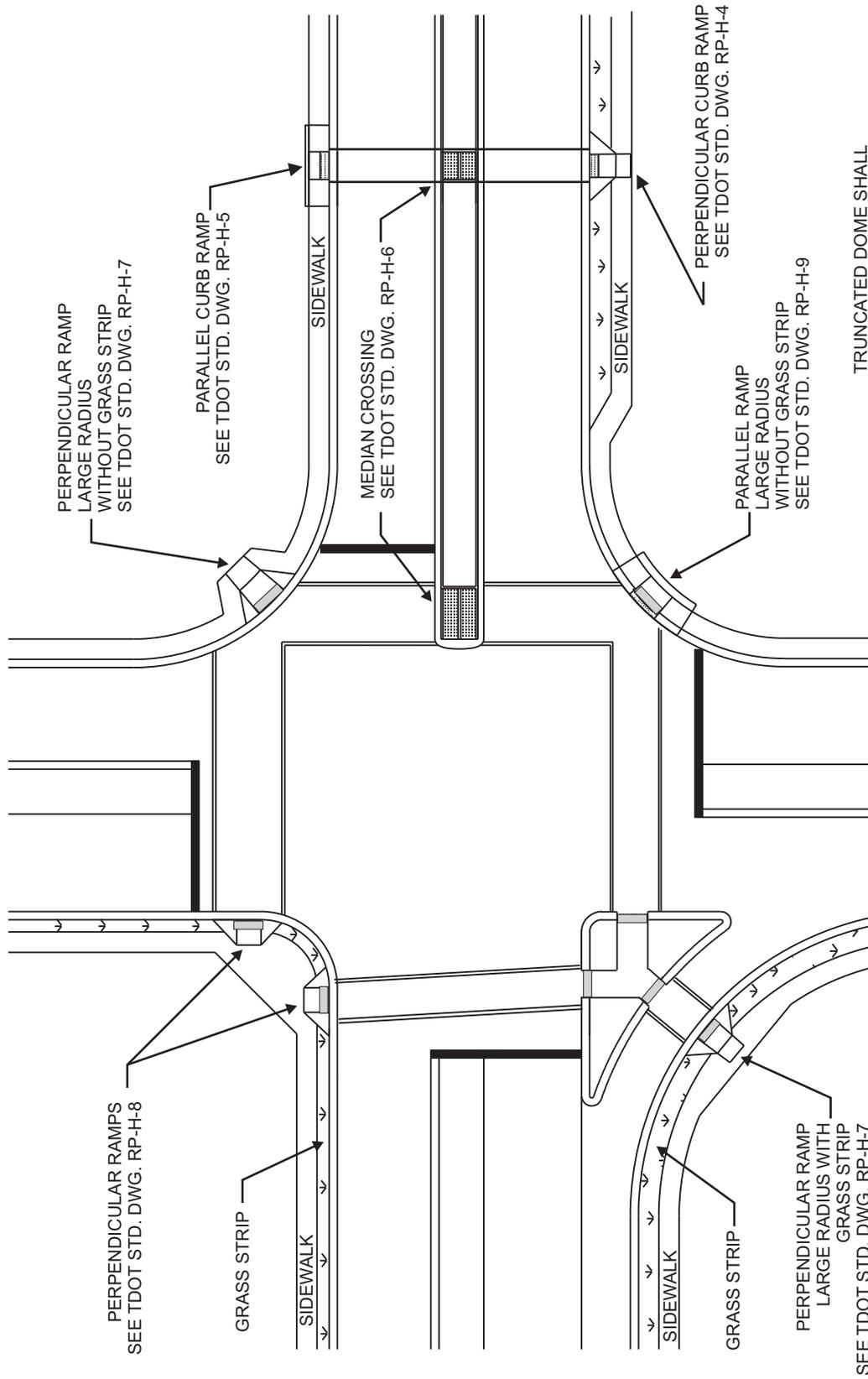


TYPICAL PAVEMENT THICKNESS

<small>REVISIONS:</small>	<small>DATE:</small>

<small>DRAWING NO:</small> ST-9	<small>DATE:</small> July 2009
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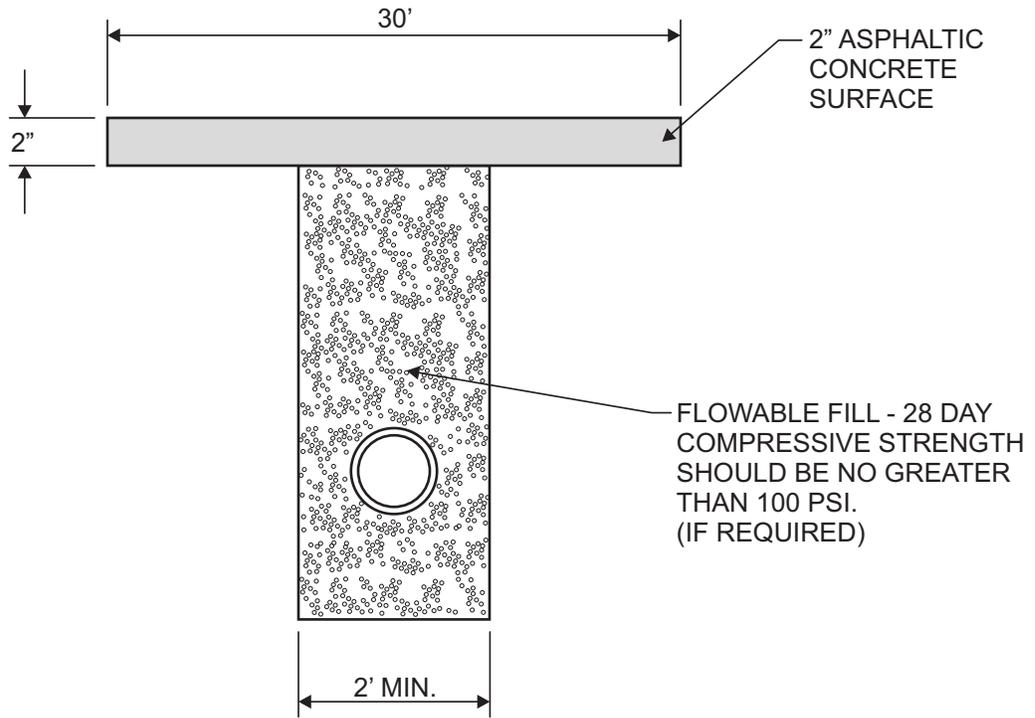


REVISIONS:	DATE:

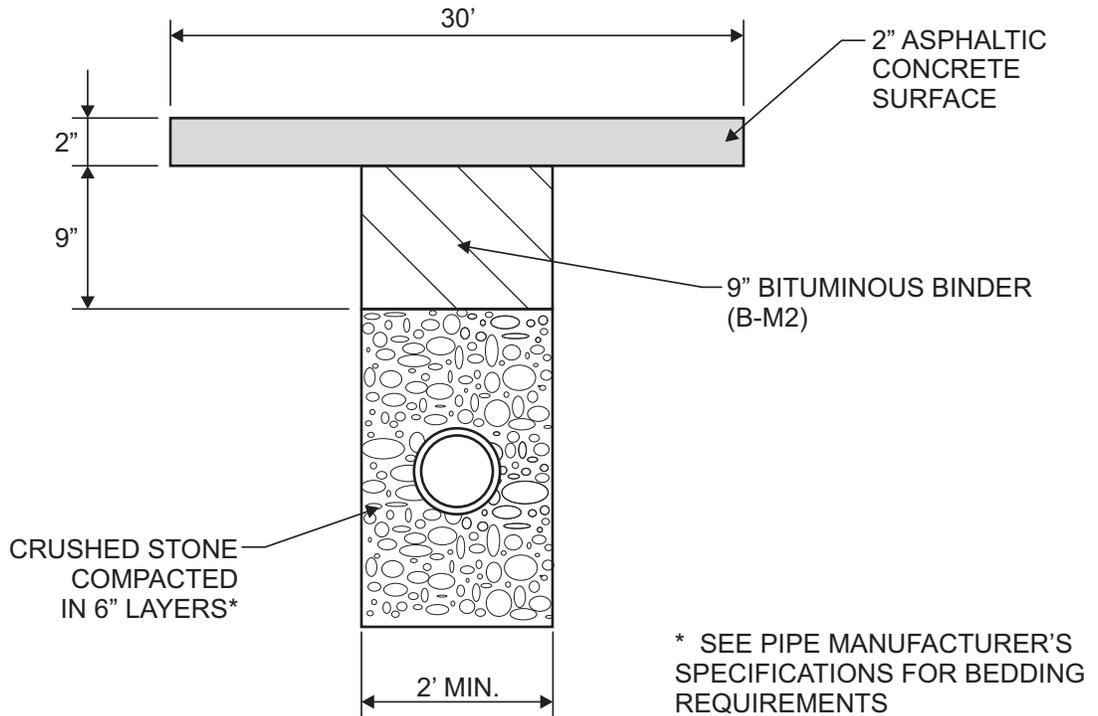
HANDICAP RAMP LAYOUT

DRAWING NO: **ST-10** DATE: **July 2009**





**ASPHALTIC SURFACE
(FLOWABLE FILL)**

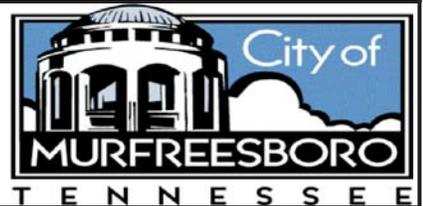


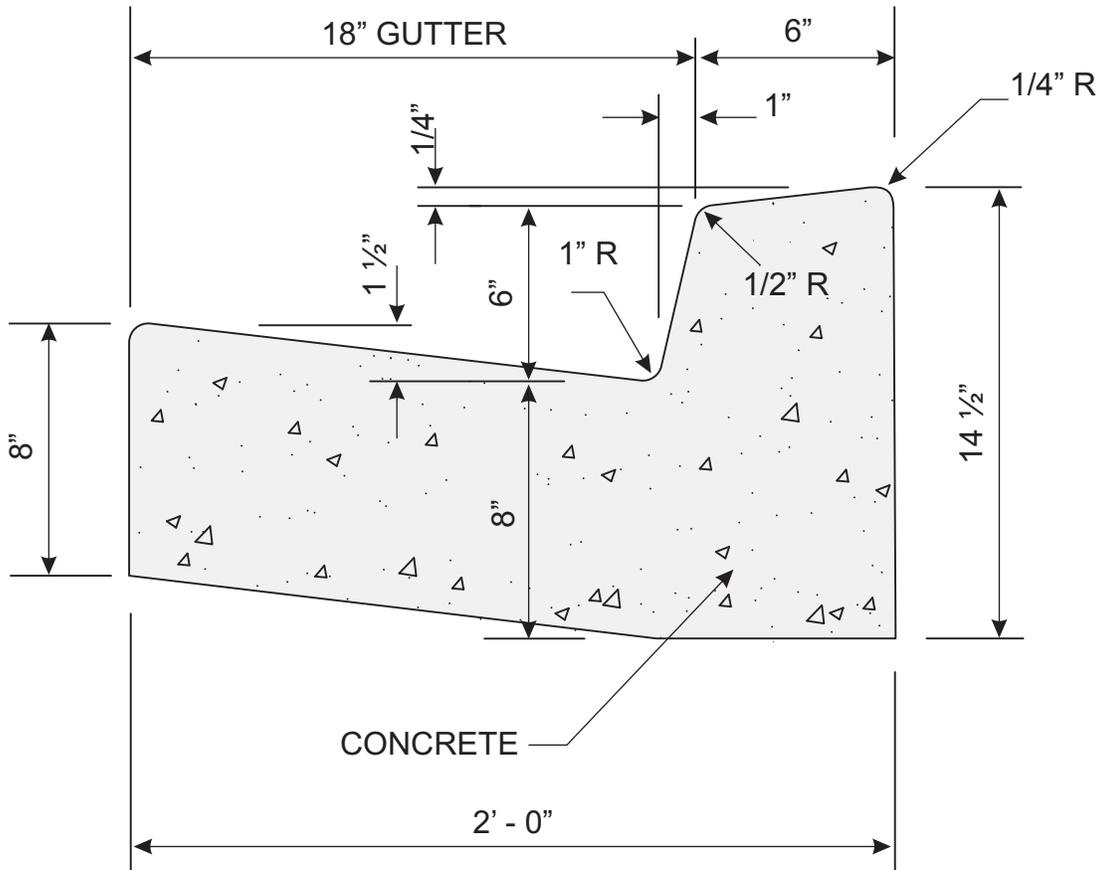
ASPHALTIC SURFACE

REVISIONS:	DATE:

TRENCH REPAIR

DRAWING NO: **ST-11** DATE: **July 2009**



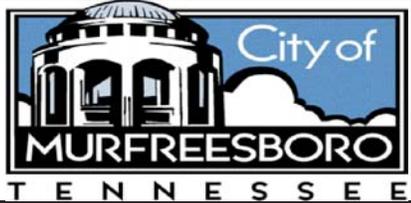


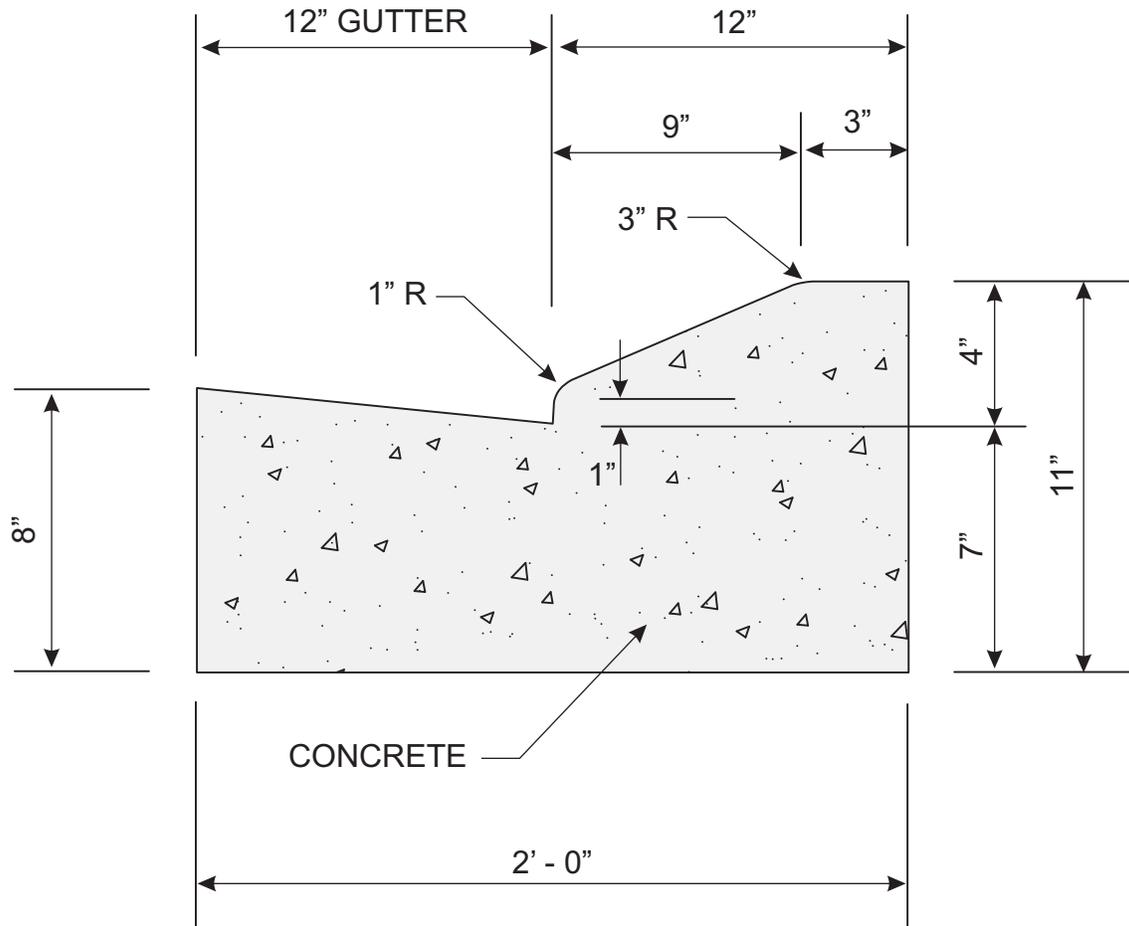
Note: This drawing will be amended to show a flat bottom on the curb instead of a gentle slope.

REVISIONS:	DATE:

CONCRETE CURB AND GUTTER
(TYPE 6-24)

DRAWING NO: ST-12 DATE: July 2009

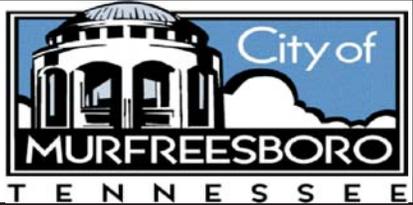


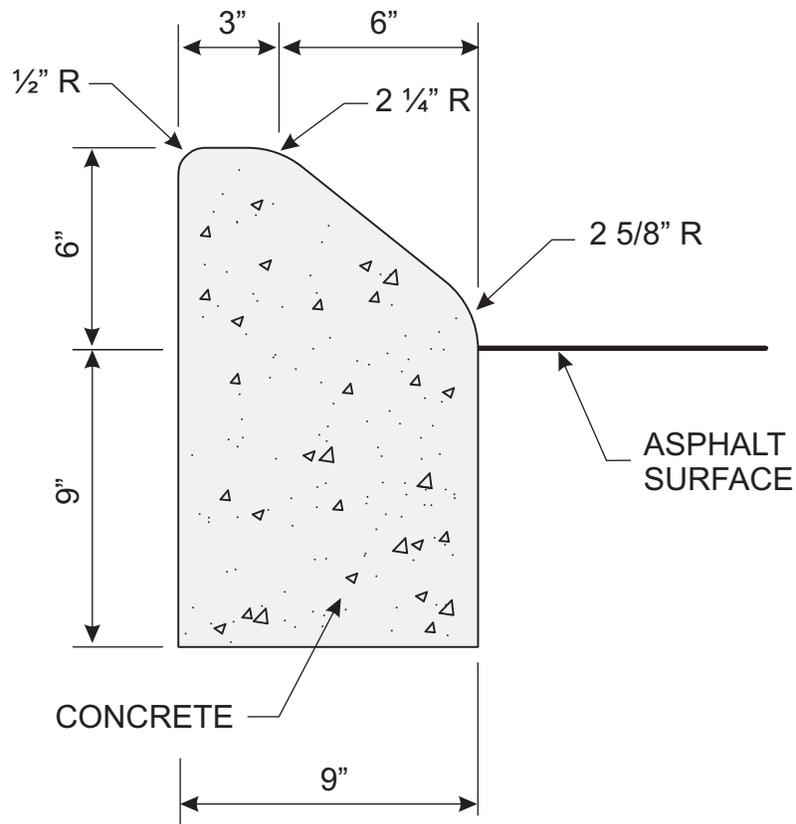


REVISIONS:	DATE:

**4" ROLLOVER CONCRETE
CURB AND GUTTER**

DRAWING NO: **ST-13** DATE: **July 2009**





REVISIONS:

DATE:

6" MOUNTABLE DETACHED
CONCRETE CURB

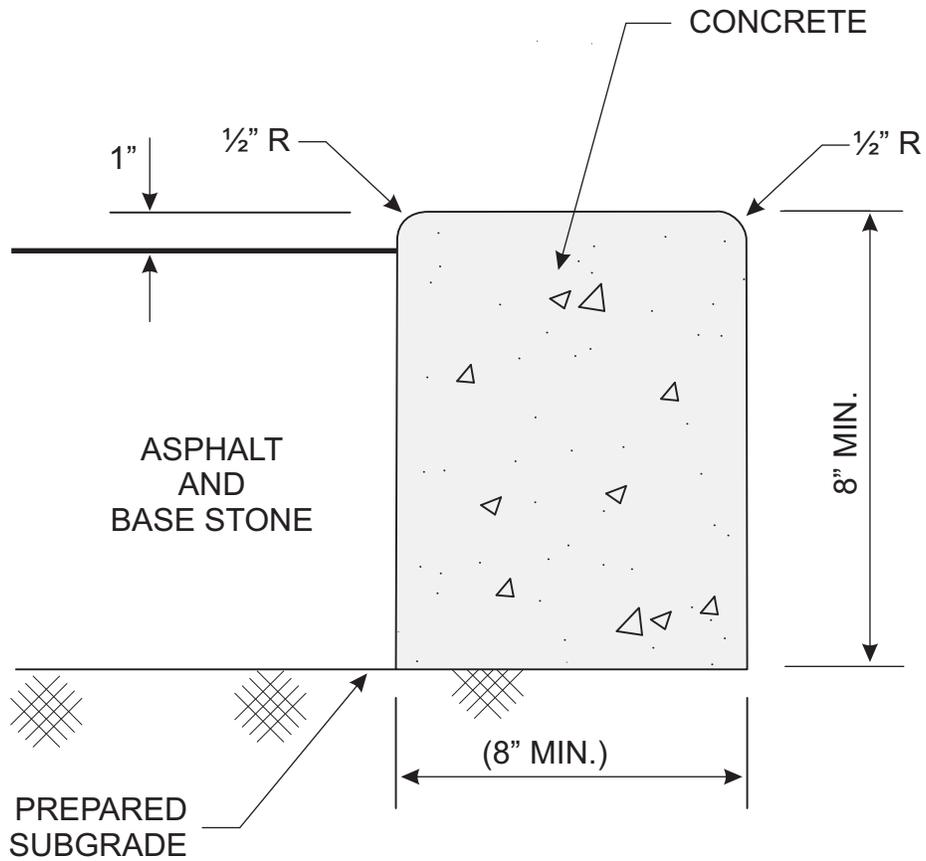
DRAWING NO:

ST-14

DATE:

July 2009



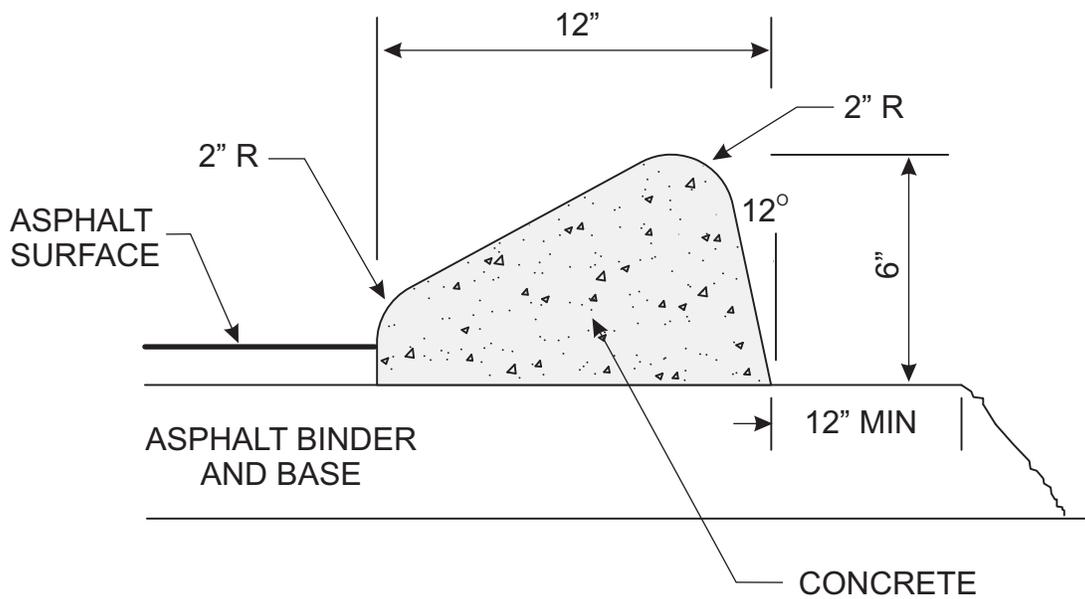


REVISIONS:	DATE:

**RIBBON CURB
(FOR ALLEY USE ONLY)**

DRAWING NO: **ST-15** DATE: **July 2009**



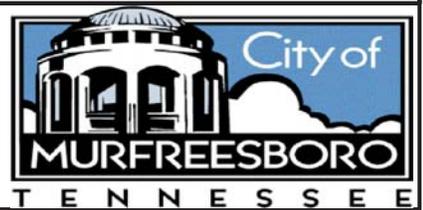


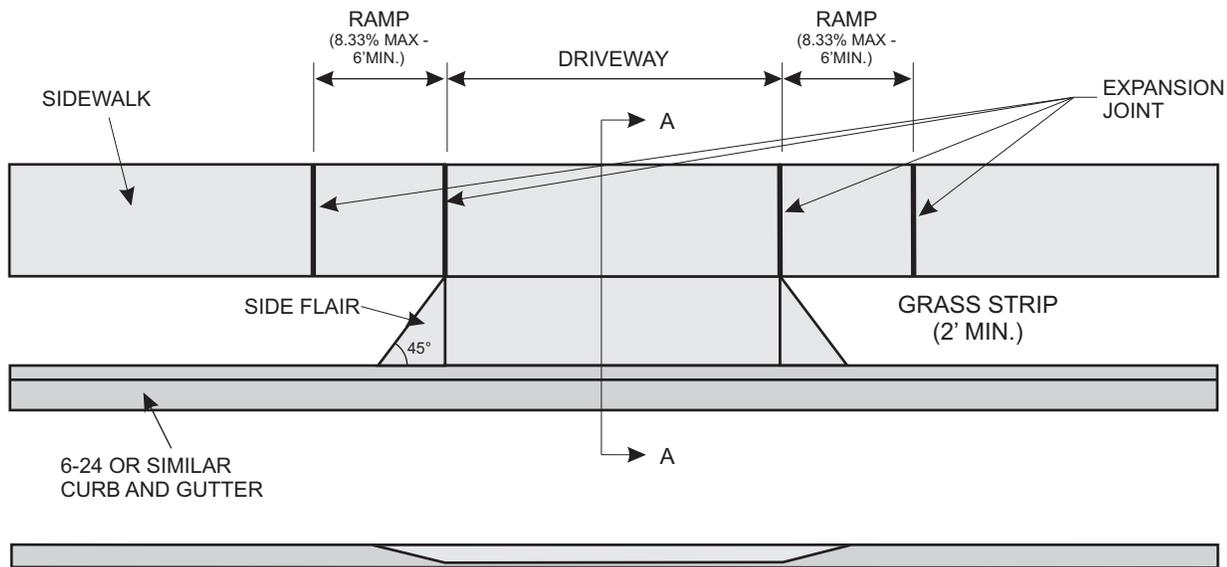
* NOT FOR USE ON PUBLIC STREETS*

REVISIONS:	DATE:

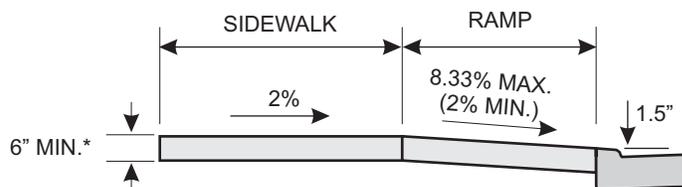
EXTRUDED CURB
(NOT FOR USE ON PUBLIC STREETS)

DRAWING NO: ST-16	DATE: July 2009
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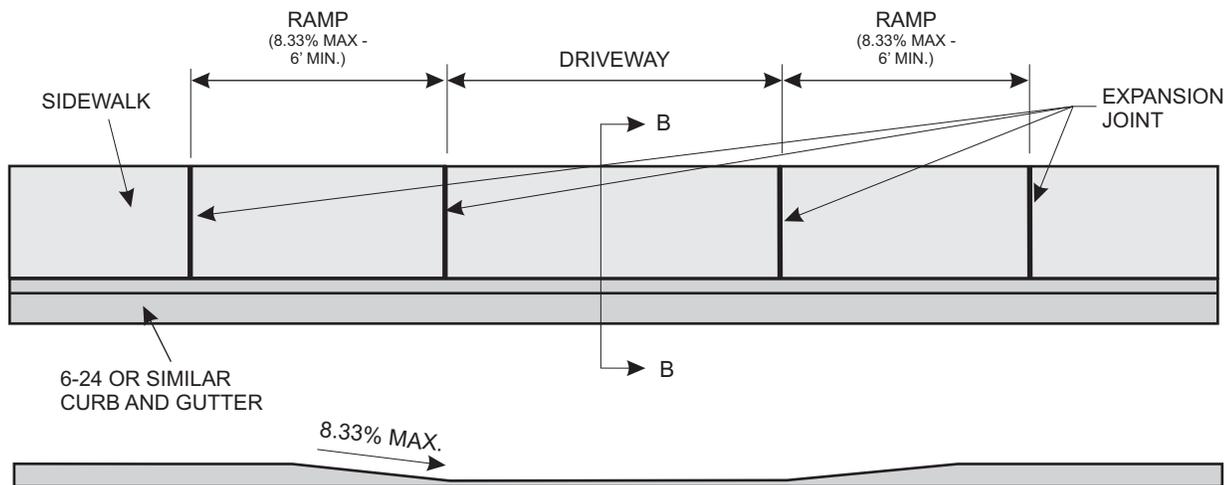




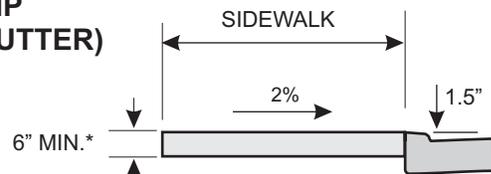
**DRIVEWAY DETAIL WITH GRASS STRIP
(FOR 6-24 OR SIMILAR VERTICAL CURB AND GUTTER)**



SECTION A-A
* SIDEWALK ACROSS DRIVEWAY SHALL BE 6" MIN. DEPTH FOR RESIDENTIAL AND 8" MIN. DEPTH FOR COMMERCIAL



**DRIVEWAY DETAIL WITHOUT GRASS STRIP
(FOR 6-24 OR SIMILAR VERTICAL CURB AND GUTTER)**



SECTION B-B
* SIDEWALK ACROSS DRIVEWAY SHALL BE 6" MIN. DEPTH FOR RESIDENTIAL AND 8" MIN. DEPTH FOR COMMERCIAL

NOTES:

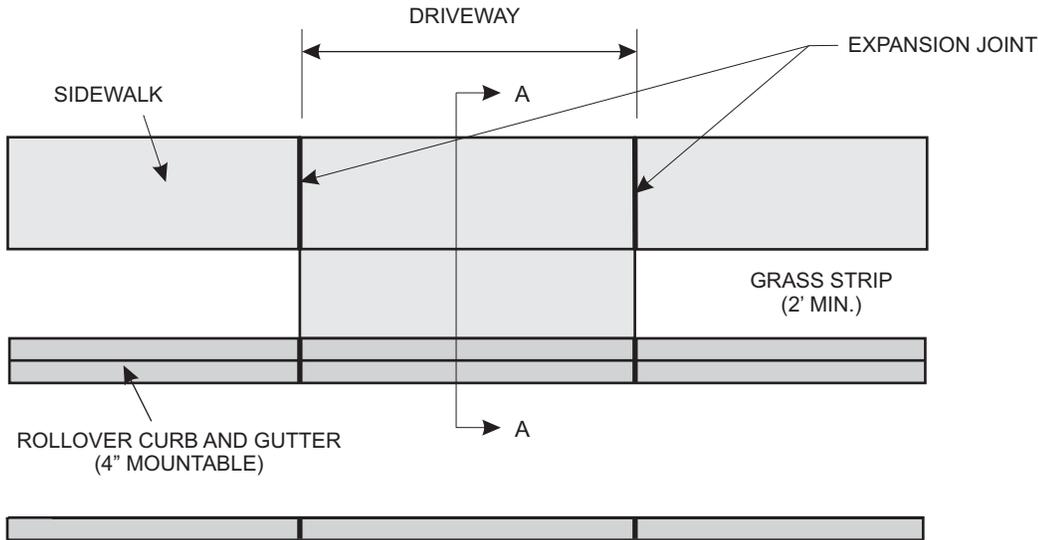
1. For sites lower than the curb, adjust site grade to maintain curb flow in the street.
2. 8.33% = 1:12, 2% = 1:48

REVISIONS:	DATE:

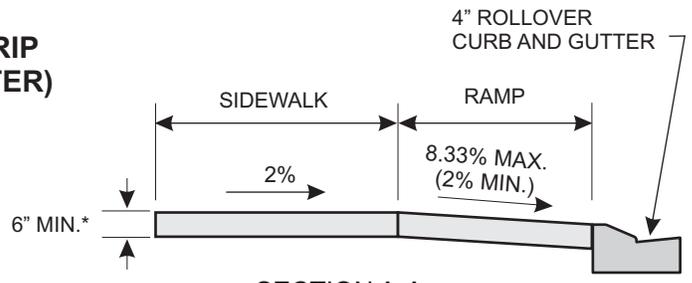
**DRIVEWAY LAYOUT
FOR VERTICAL CURB**

DRAWING NO: **DW-1** DATE: **July 2009**



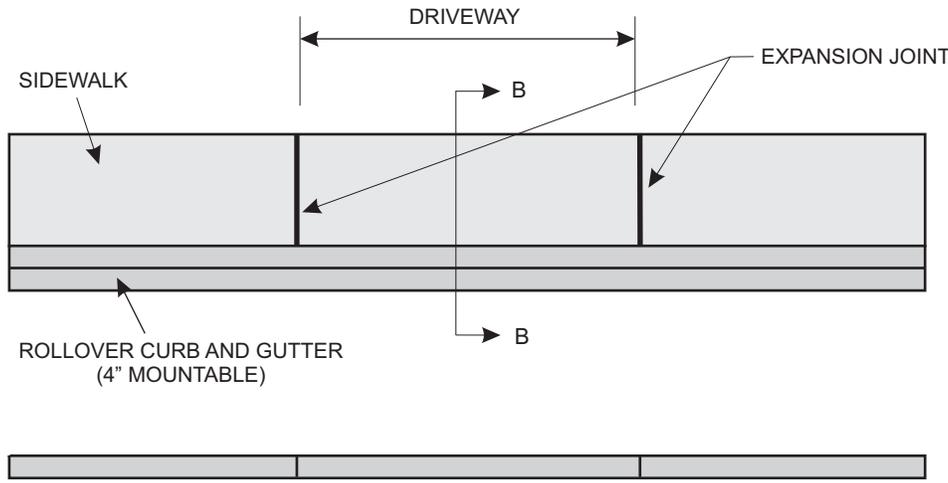


**DRIVEWAY DETAIL WITH GRASS STRIP
(FOR 4" ROLLOVER CURB AND GUTTER)**

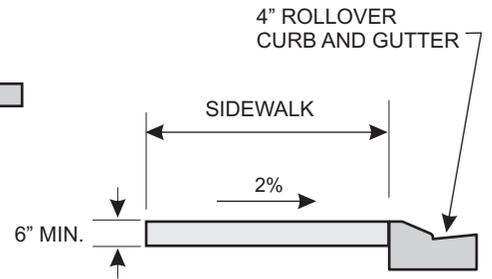


SECTION A-A

* SIDEWALK ACROSS DRIVEWAY SHALL BE 6" MIN. DEPTH



**DRIVEWAY DETAIL WITHOUT GRASS STRIP
(FOR 4" ROLLOVER CURB AND GUTTER)**



SECTION B-B

* SIDEWALK ACROSS DRIVEWAY SHALL BE 6" MIN. DEPTH

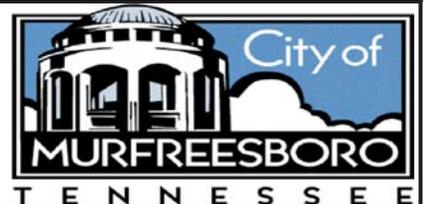
NOTES:

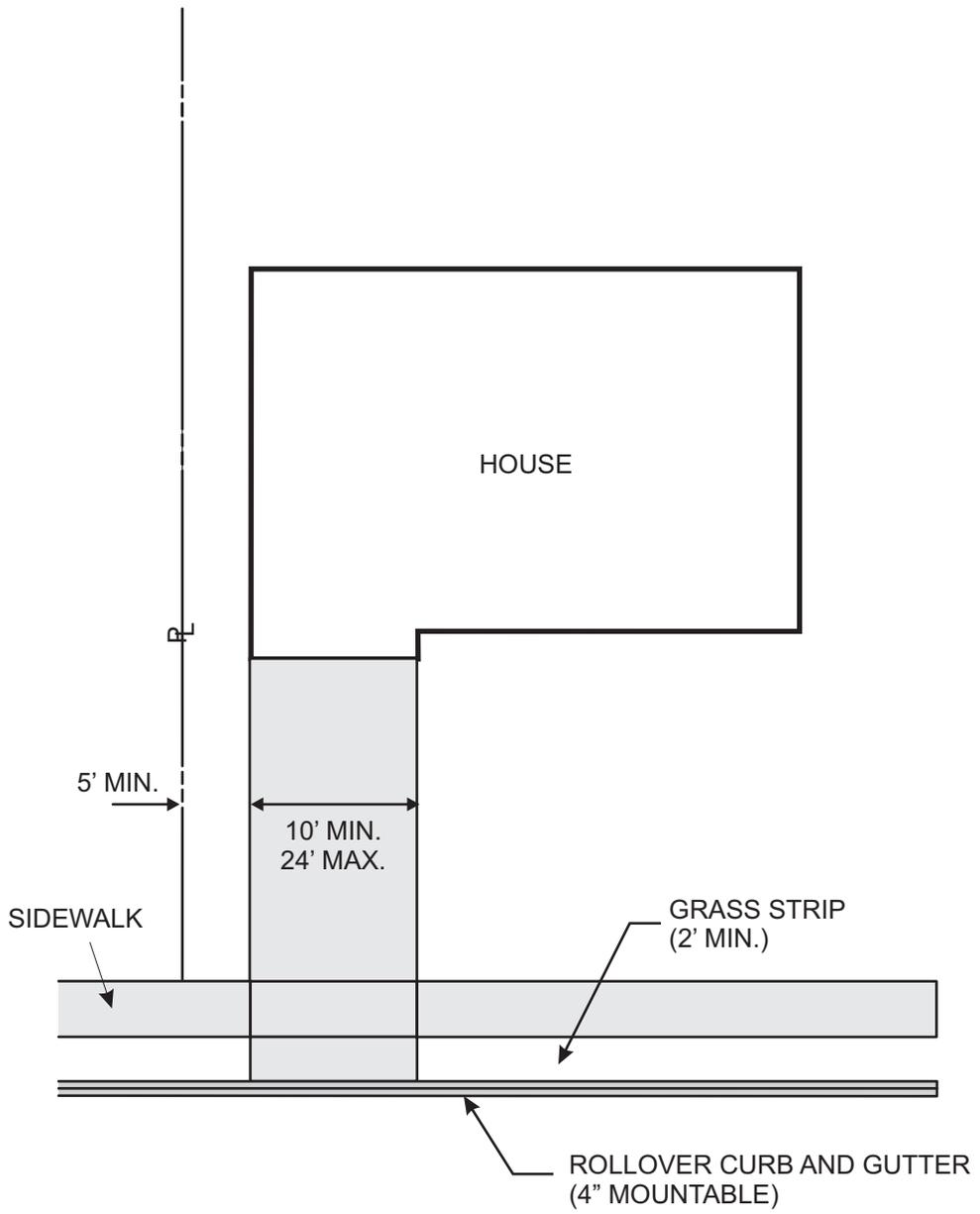
1. For sites lower than the curb, adjust site grade to maintain curb flow in the street.
2. 8.33% = 1:12, 2% = 1:48

REVISIONS:	DATE:

**RESIDENTIAL DRIVEWAY
LAYOUT FOR ROLLOVER CURB**

DRAWING NO: **DW-2** DATE: **July 2009**

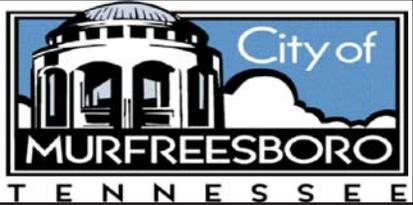


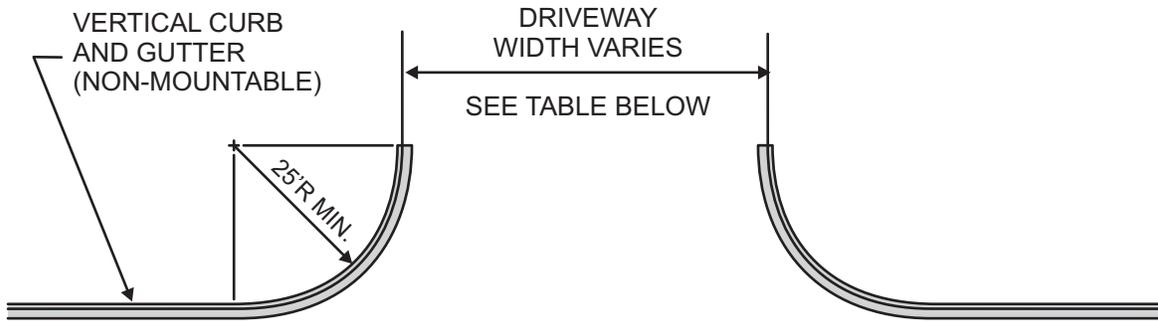


REVISIONS:	DATE:

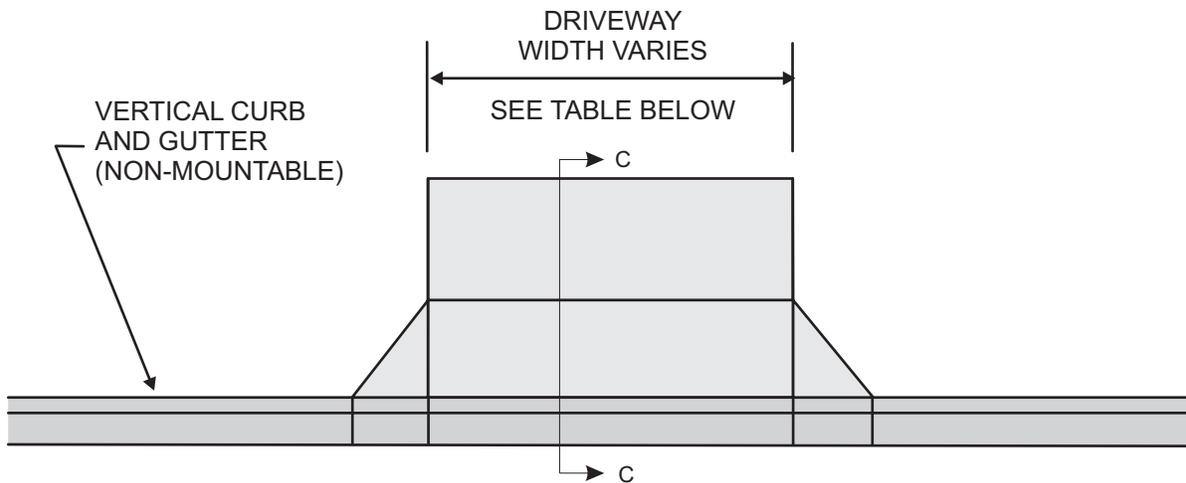
RESIDENTIAL DRIVEWAY

DRAWING NO: **DW-3** DATE: **July 2009**



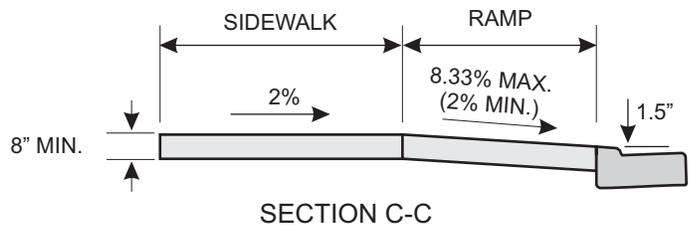


**COMMERCIAL DRIVE WITH RADIUS RETURN
(PAVED ENTRANCE)**



COMMERCIAL DRIVE WITH SIDE FLAIRS

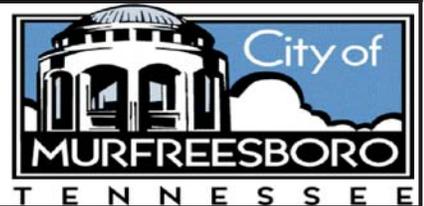
ENTRANCE WIDTHS	
ONE-WAY DRIVE	TWO-WAY DRIVE
20' MIN.	25' MIN.
26' MAX.	38' MAX.



REVISIONS:	DATE:

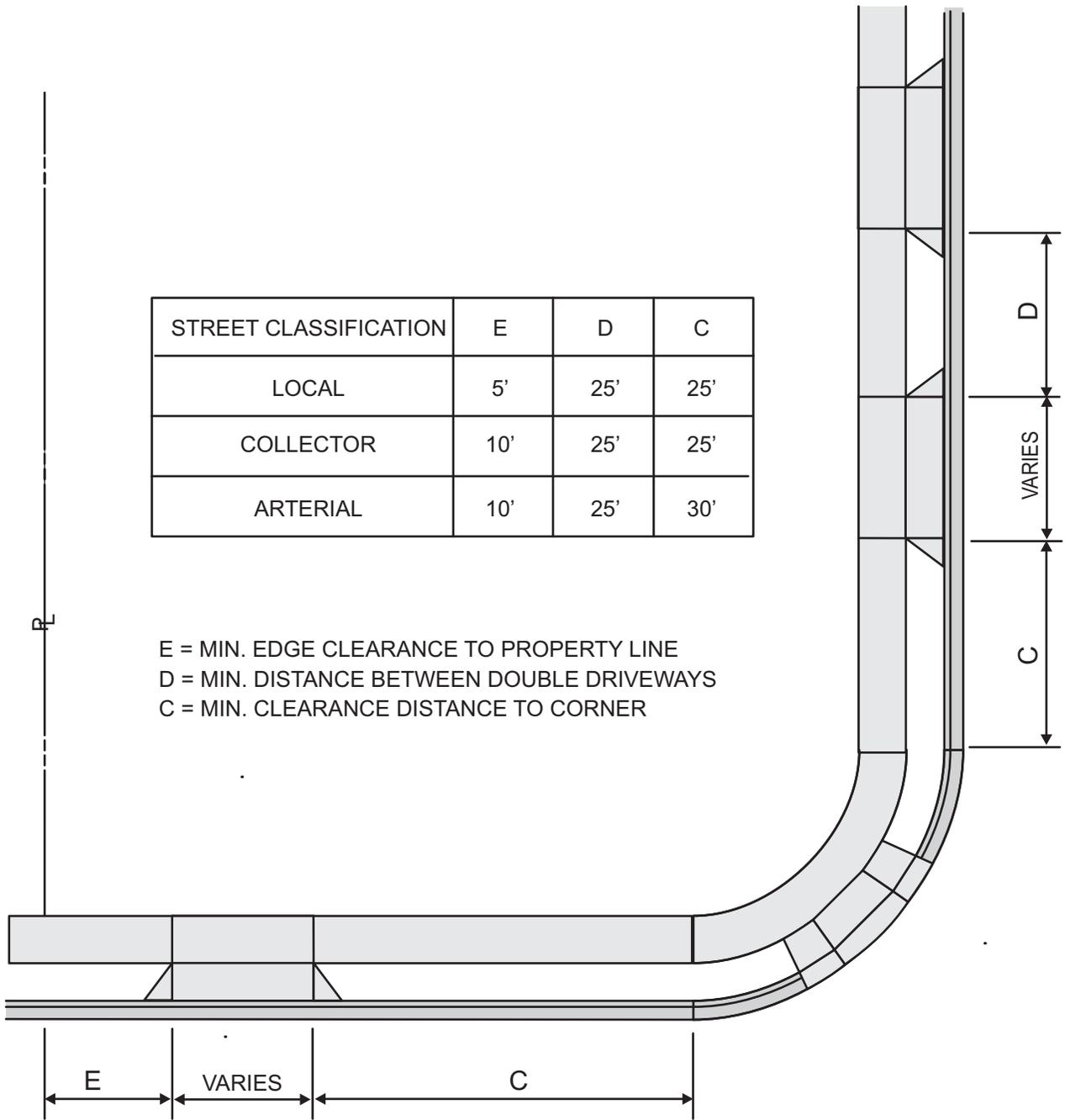
COMMERCIAL DRIVE

DRAWING NO: **DW-4** DATE: **July 2009**



STREET CLASSIFICATION	E	D	C
LOCAL	5'	25'	25'
COLLECTOR	10'	25'	25'
ARTERIAL	10'	25'	30'

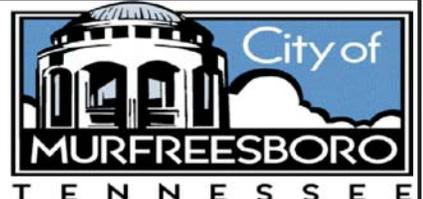
E = MIN. EDGE CLEARANCE TO PROPERTY LINE
D = MIN. DISTANCE BETWEEN DOUBLE DRIVEWAYS
C = MIN. CLEARANCE DISTANCE TO CORNER

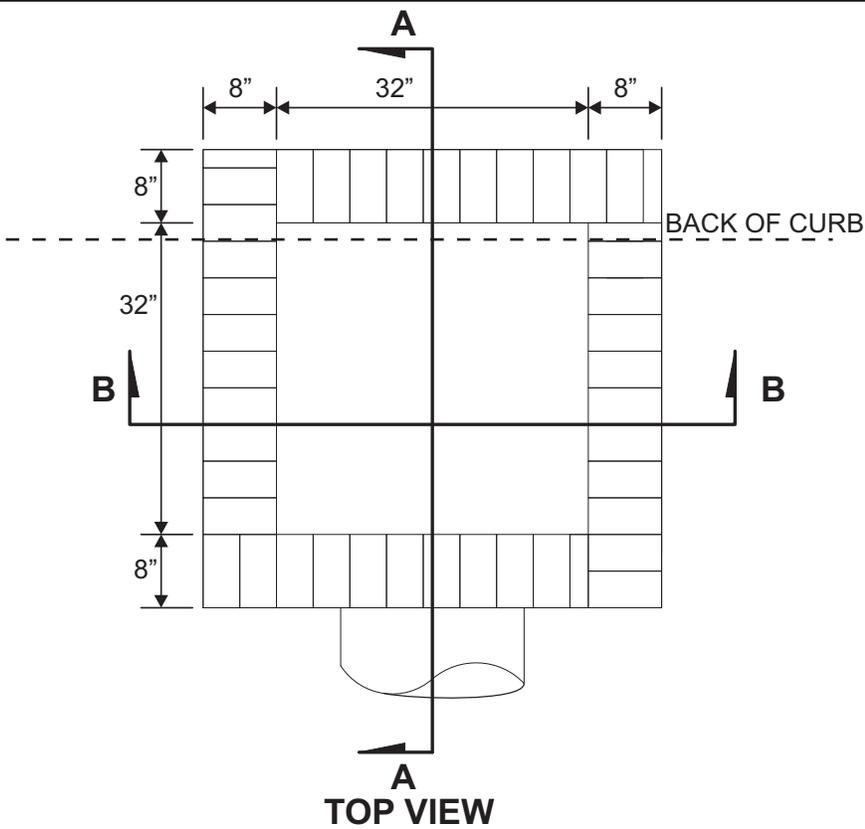


REVISIONS:	DATE:

DRIVEWAY SPACING

DRAWING NO: DW-5 DATE: July 2009

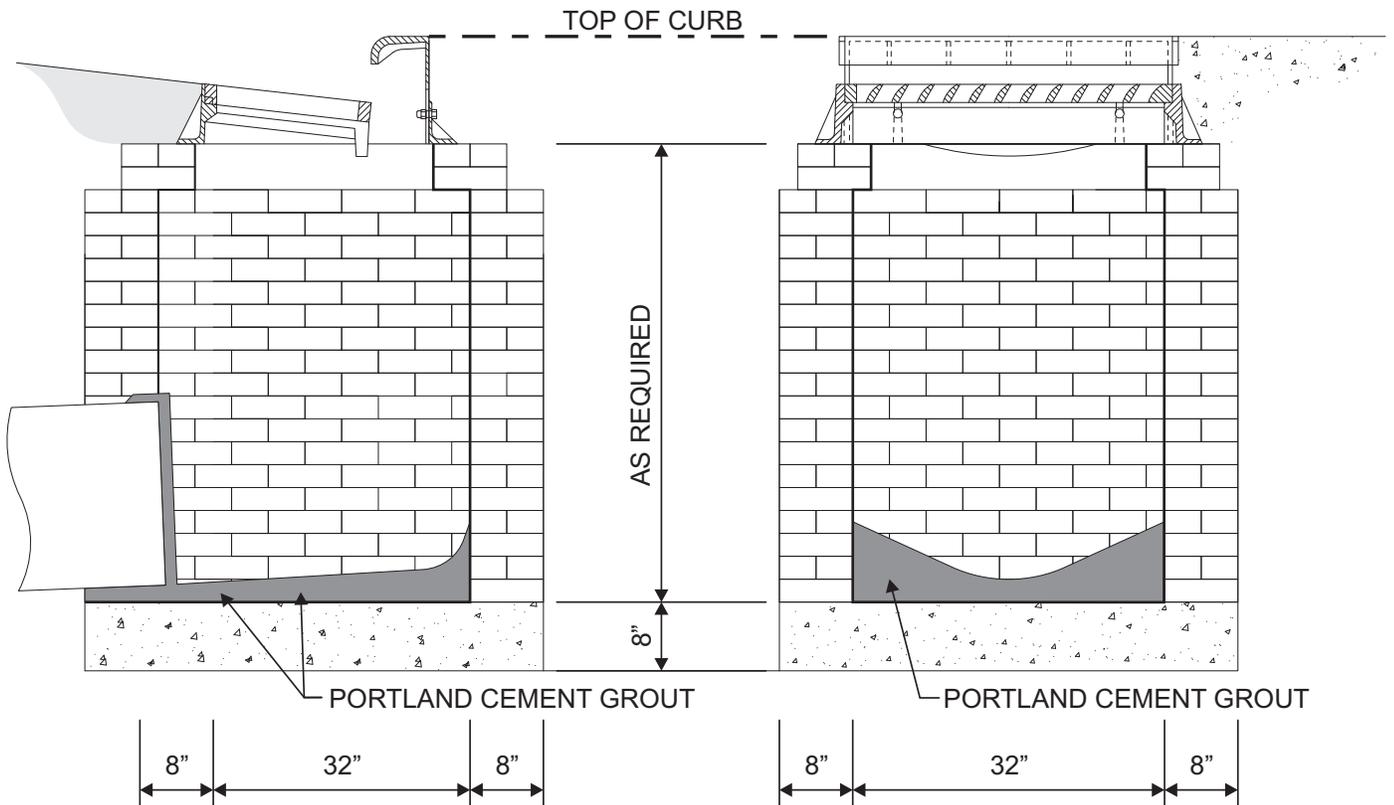




NOTES:

1. GRATE AND CASTING TO BE JOHN BOUCHARD & SON NO. 3080 OR EQUAL

**A
TOP VIEW**



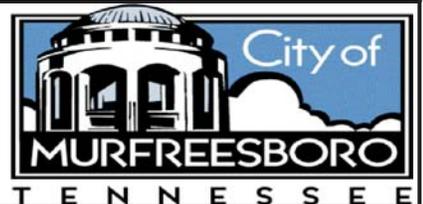
SECTION A-A

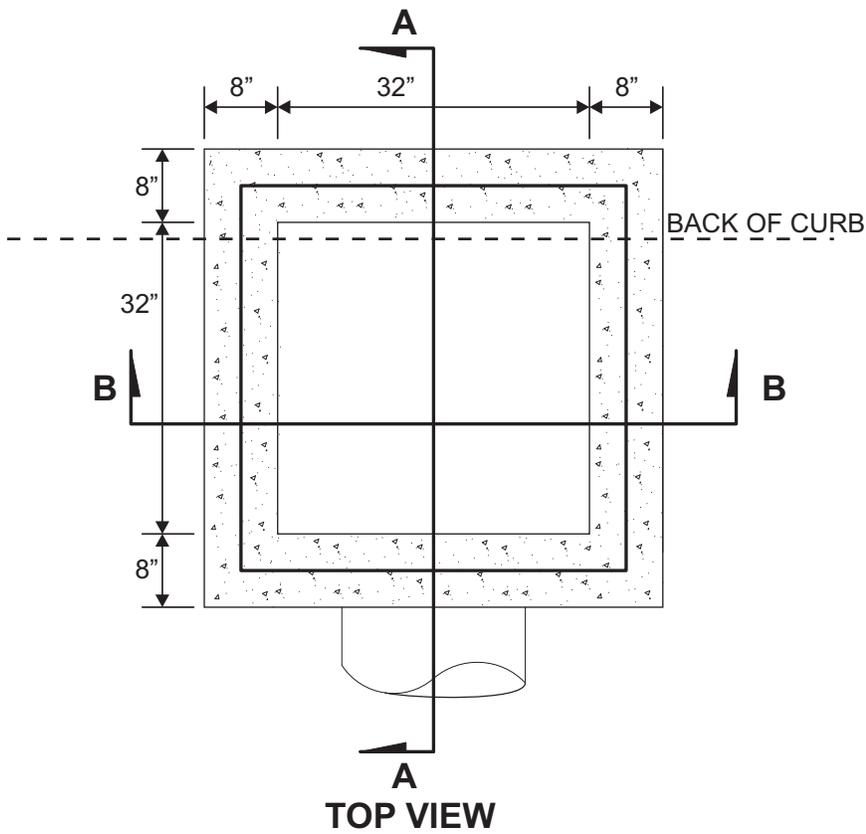
SECTION B-B

REVISIONS:	DATE:

**BRICK SINGLE INLET DETAIL
FOR TYPE 6-24 CURB AND GUTTER**

DRAWING NO: **DR-1** DATE: **July 2009**

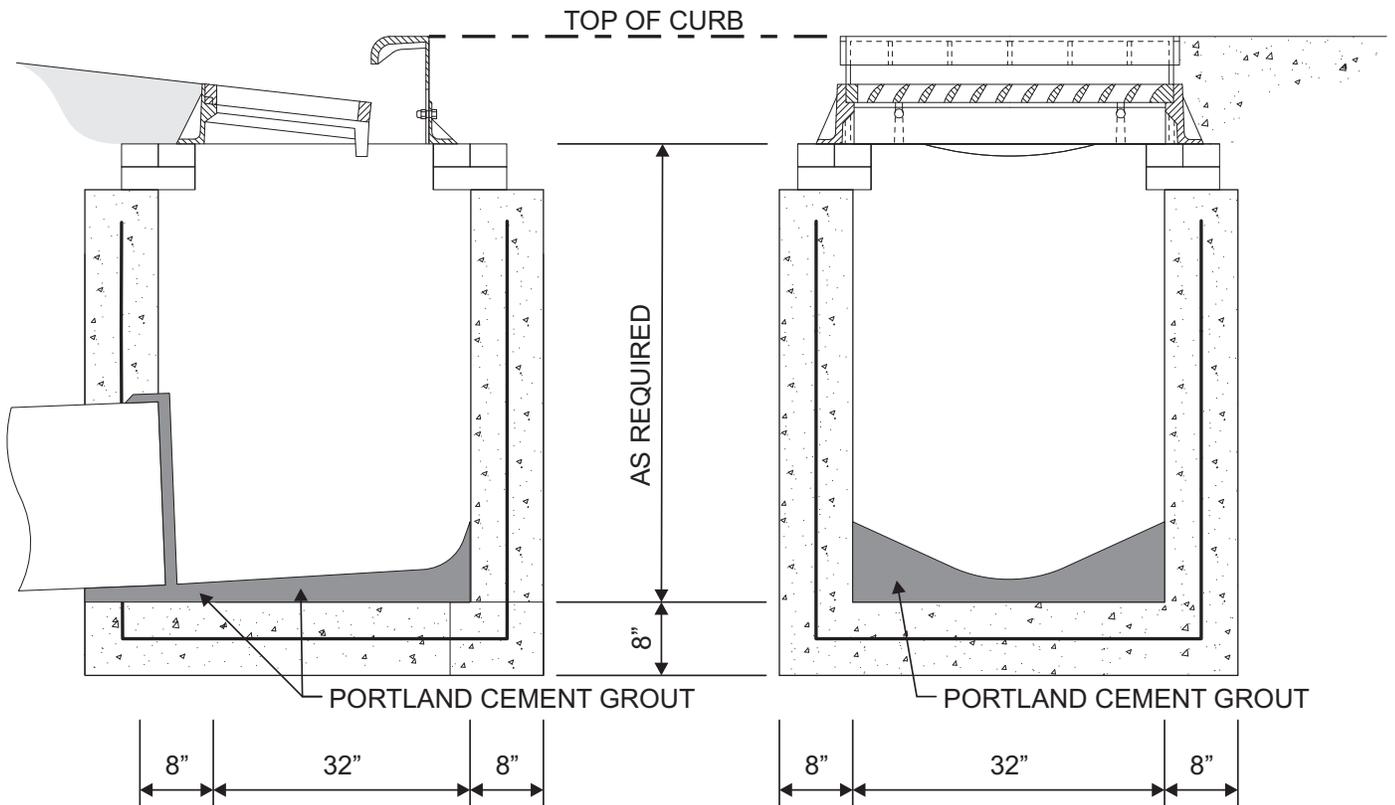




NOTES:

1. GRATE AND CASTING TO BE JOHN BOUCHARD & SON NO. 3080 OR EQUAL
2. GRADE 60 STEEL

TOP VIEW



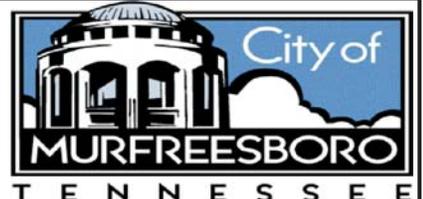
SECTION A-A

SECTION B-B

REVISIONS:	DATE:

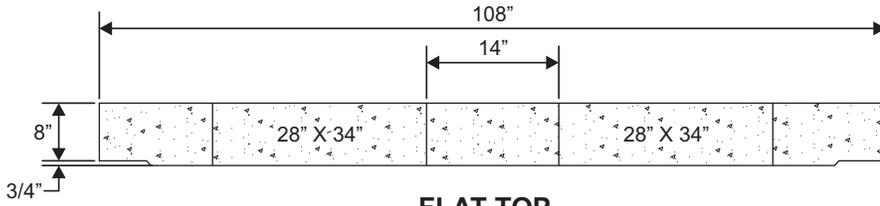
**CONC. SINGLE INLET DETAIL
FOR TYPE 6-24 CURB AND GUTTER**

DRAWING NO: DR-2	DATE: July 2009
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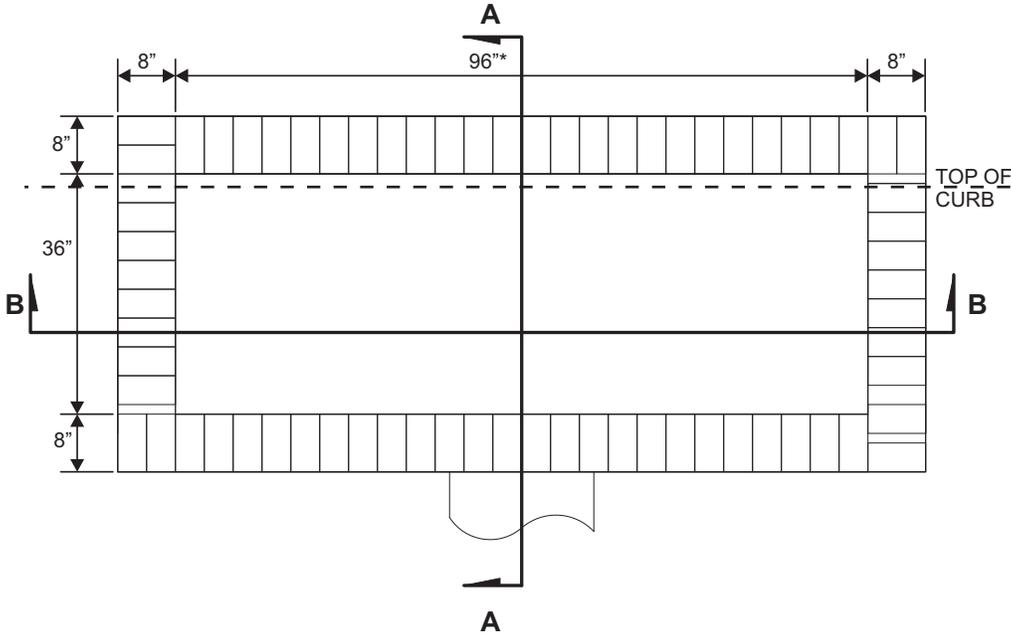


NOTES:

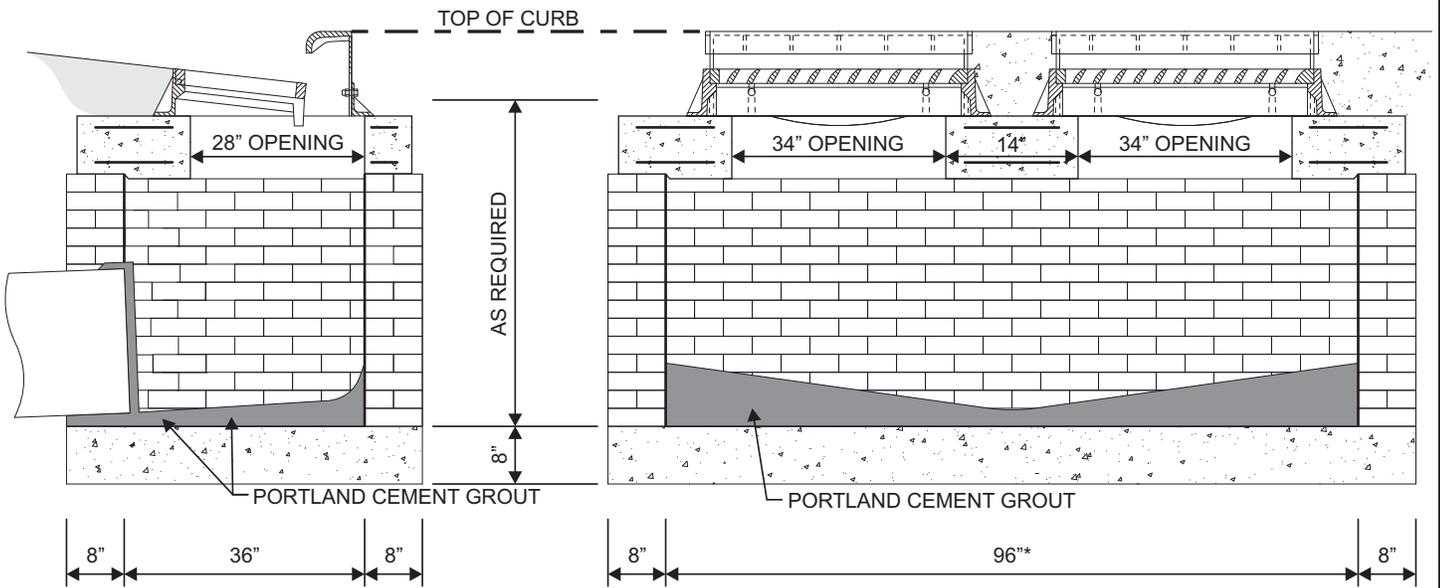
1. GRATE AND CASTING TO BE JOHN BOUCHARD & SON NO. 3080 OR EQUAL



FLAT TOP



TOP VIEW

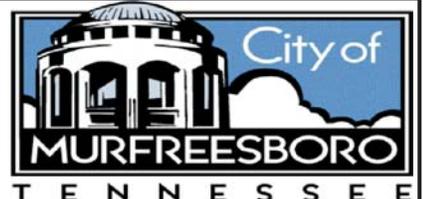


* 84" IF 1" X 14" LINTEL PLATE IS USED INSTEAD OF FLAT TOP

REVISIONS:	DATE:

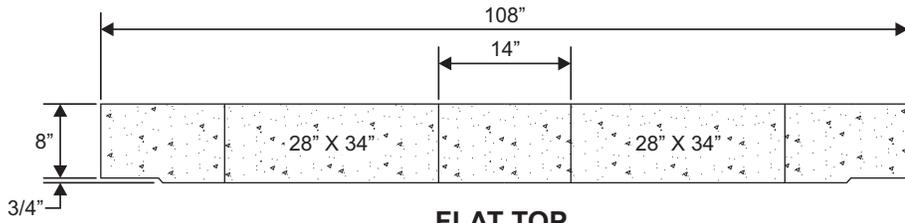
**BRICK DOUBLE INLET DETAIL
FOR TYPE 6-24 CURB AND GUTTER**

DRAWING NO: **DR-3** DATE: **July 2009**

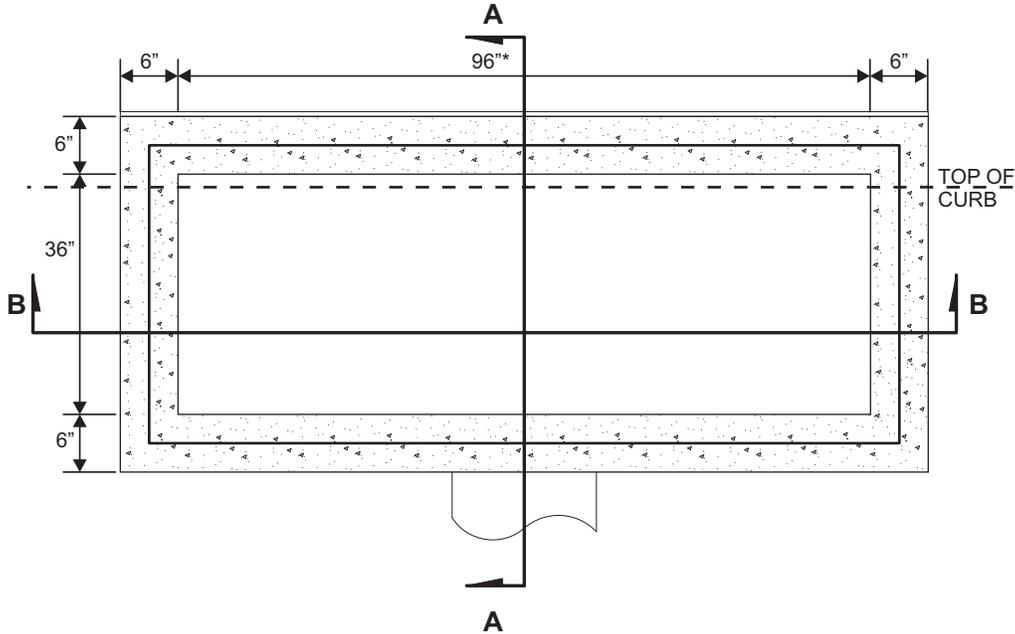


NOTES:

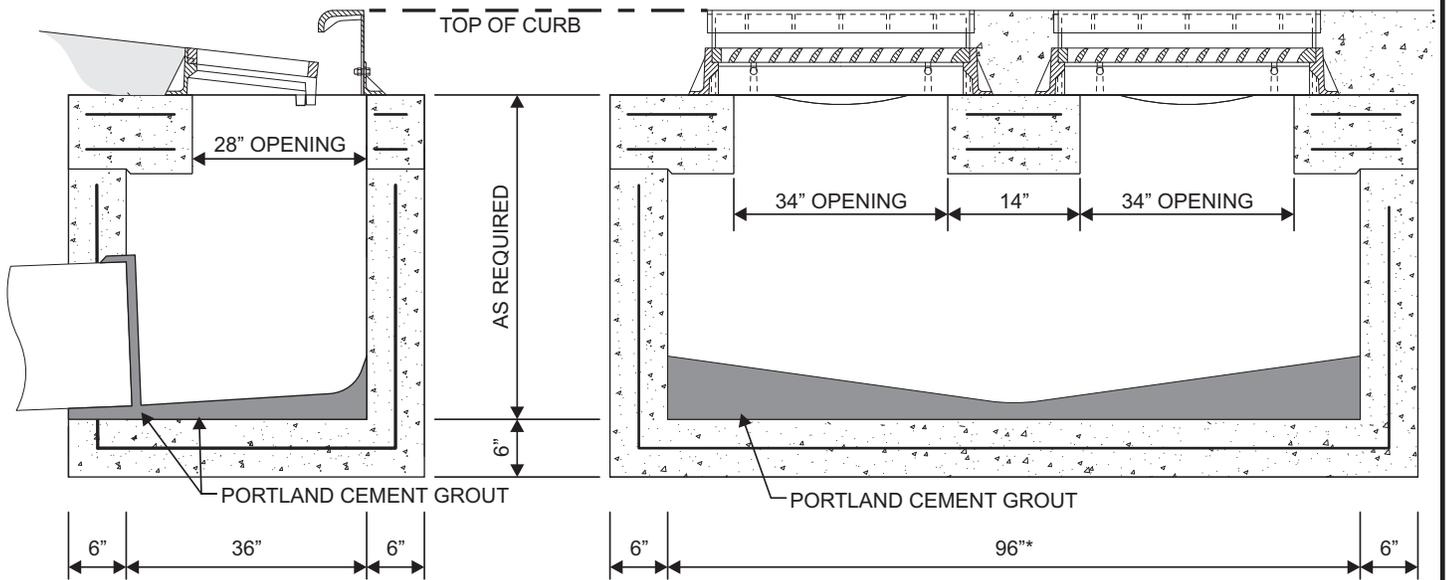
1. GRATE AND CASTING TO BE JOHN BOUCHARD & SON NO. 3080 OR EQUAL
2. GRADE 60 STEEL



FLAT TOP



TOP VIEW



SECTION A-A

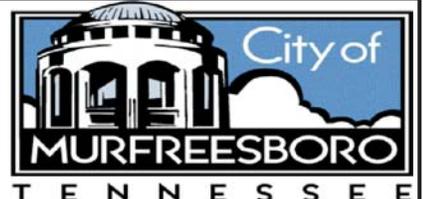
SECTION B-B

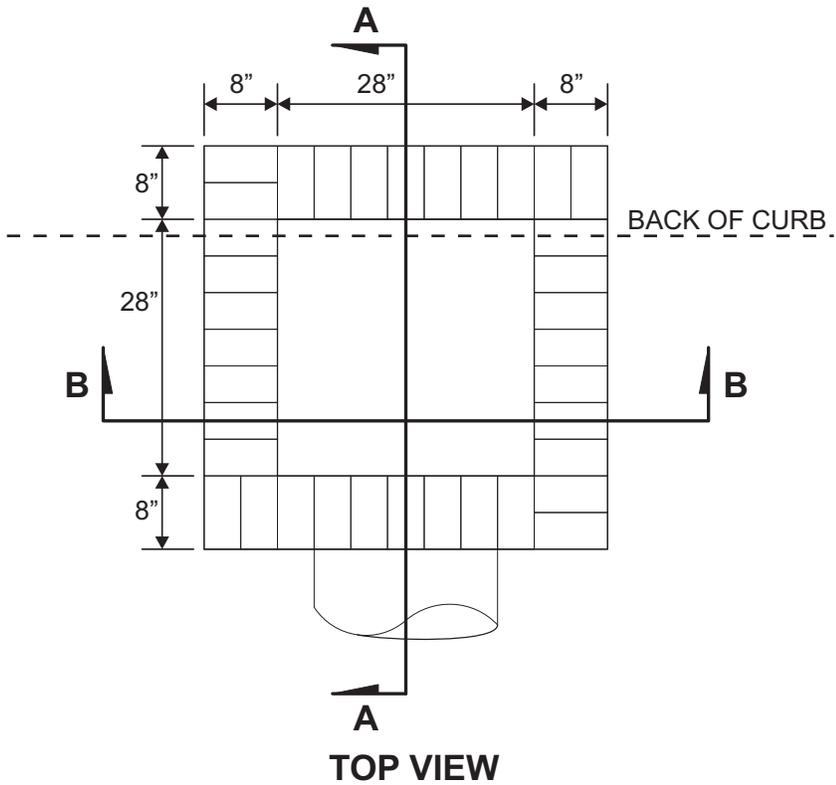
* 84" IF 1" X 14" LINTEL PLATE IS USED INSTEAD OF FLAT TOP

REVISIONS:	DATE:

CONC. DOUBLE INLET DETAIL FOR TYPE 6-24 CURB AND GUTTER

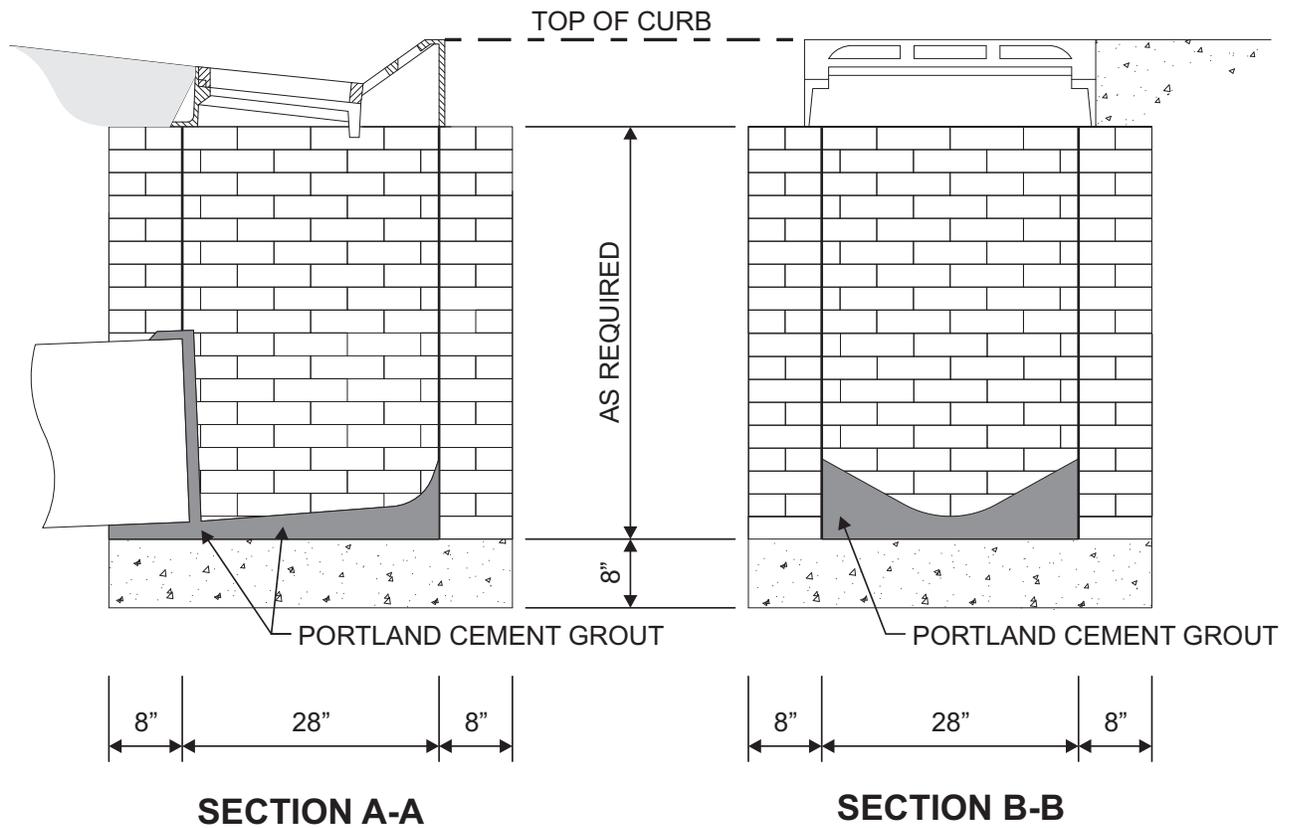
DRAWING NO: **DR-4** DATE: **July 2009**





NOTES:

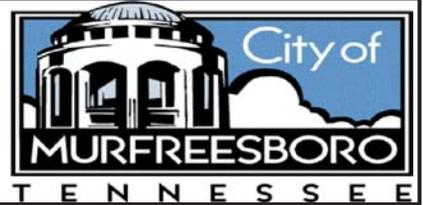
1. GRATE AND CASTING TO BE JOHN BOUCHARD & SON NO. 3104 OR EQUAL

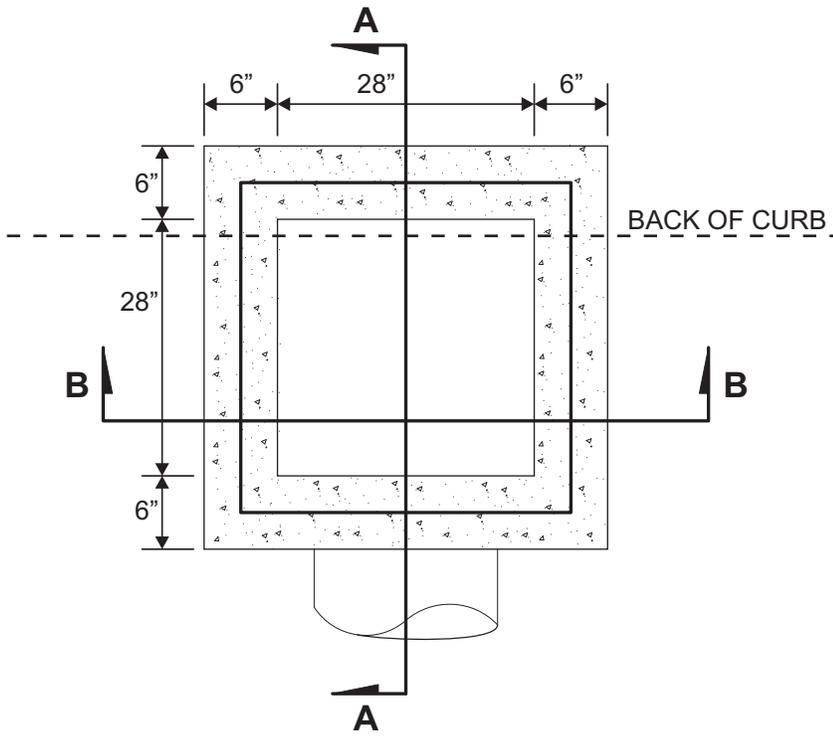


REVISIONS:	DATE:

**BRICK SINGLE INLET DETAIL
FOR ROLLOVER CURB AND GUTTER**

DRAWING NO: **DR-5** DATE: **July 2009**

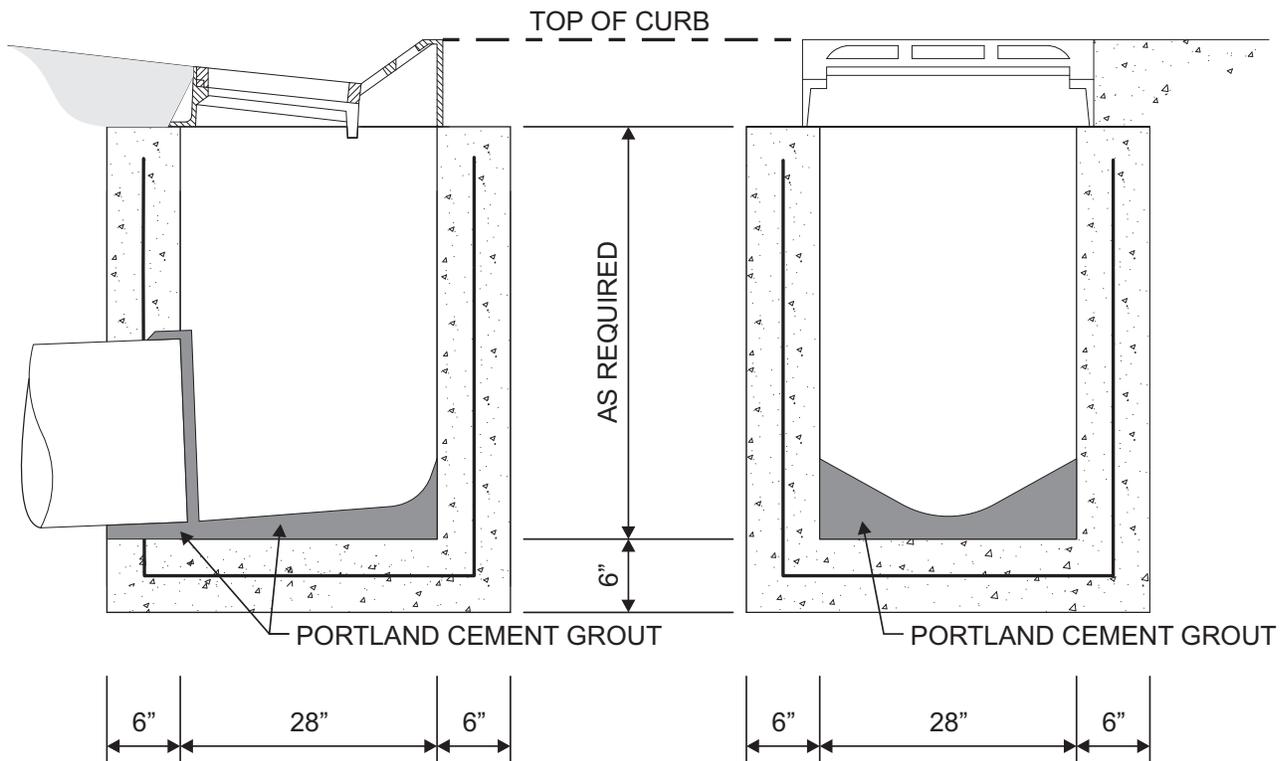




TOP VIEW

NOTES:

1. GRATE AND CASTING TO BE JOHN BOUCHARD & SON NO. 3104 OR EQUAL



SECTION A-A

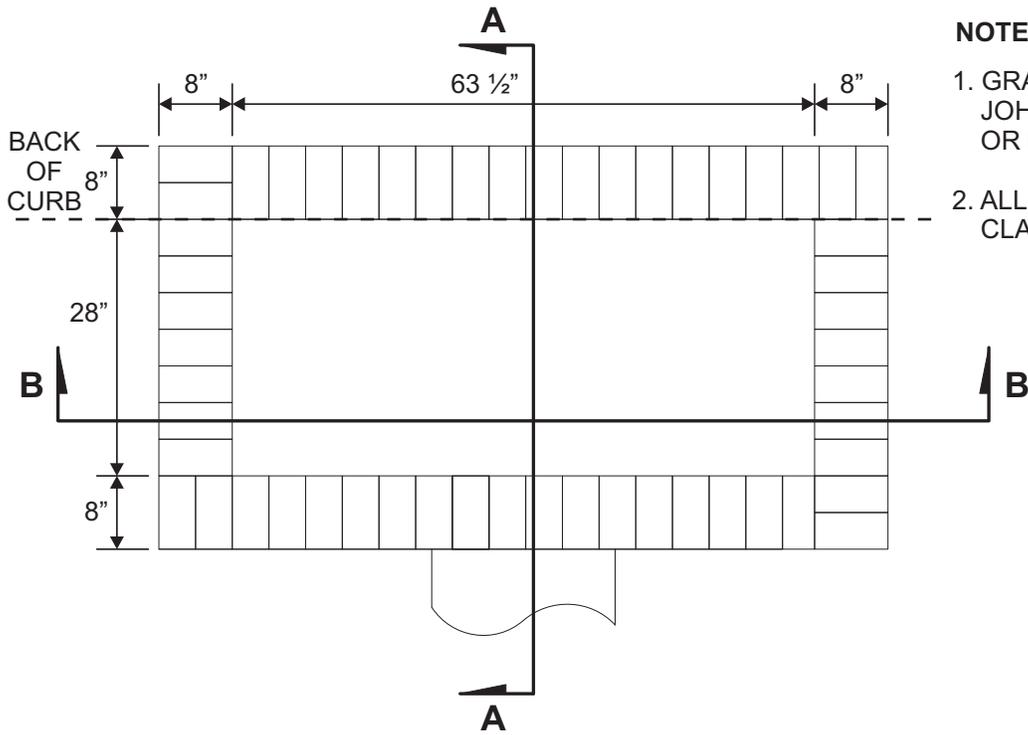
SECTION B-B

REVISIONS:	DATE:

**CONC. SINGLE INLET DETAIL
FOR ROLLOVER CURB AND GUTTER**

DRAWING NO: **DR-6** DATE: **July 2009**

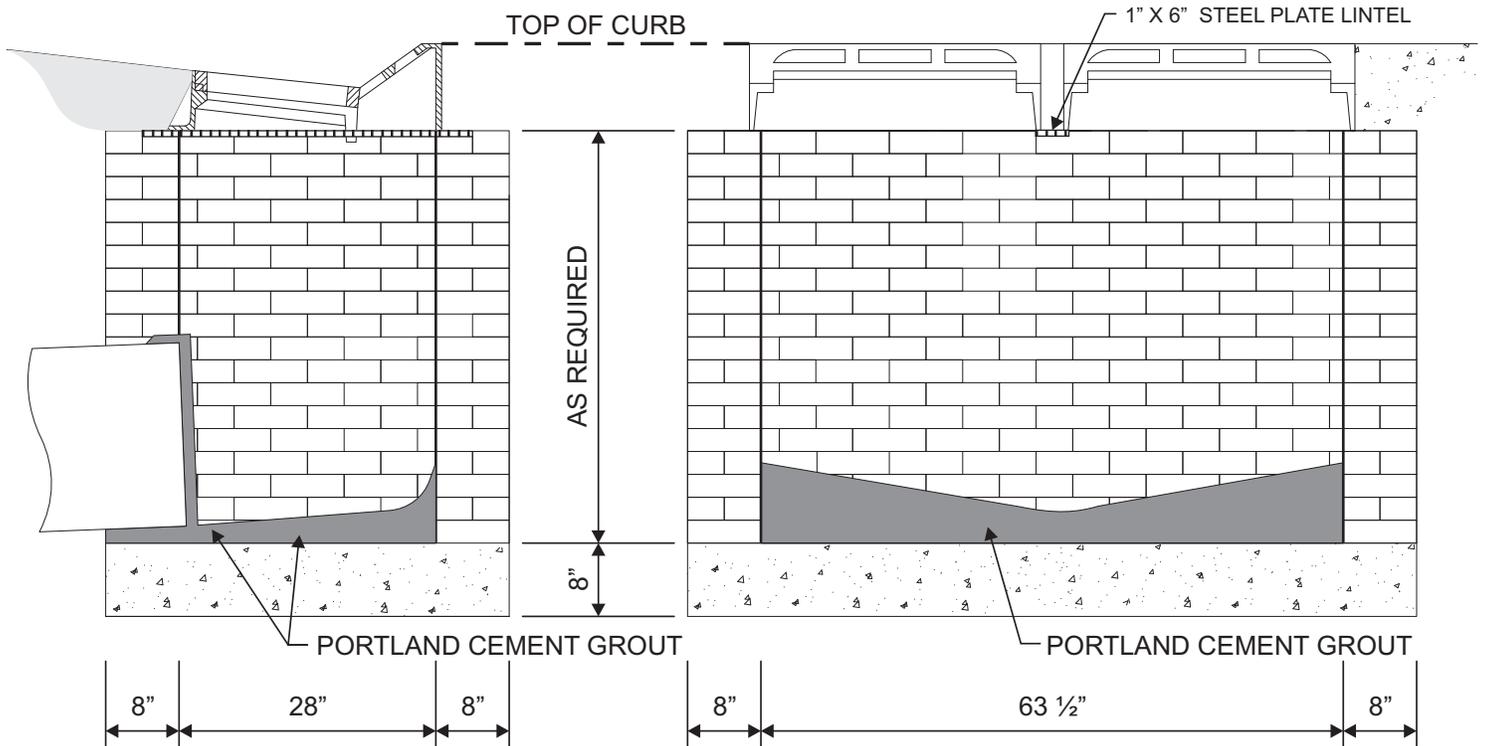




TOP VIEW

NOTES:

1. GRATE AND CASTING TO BE JOHN BOUCHARD & SON NO. 3104 OR EQUAL
2. ALL CONCRETE SHALL BE CLASS "B" CONCRETE



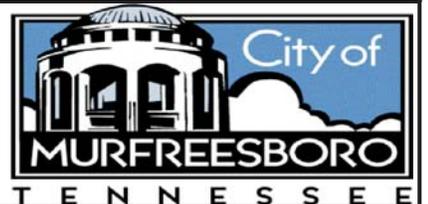
SECTION A-A

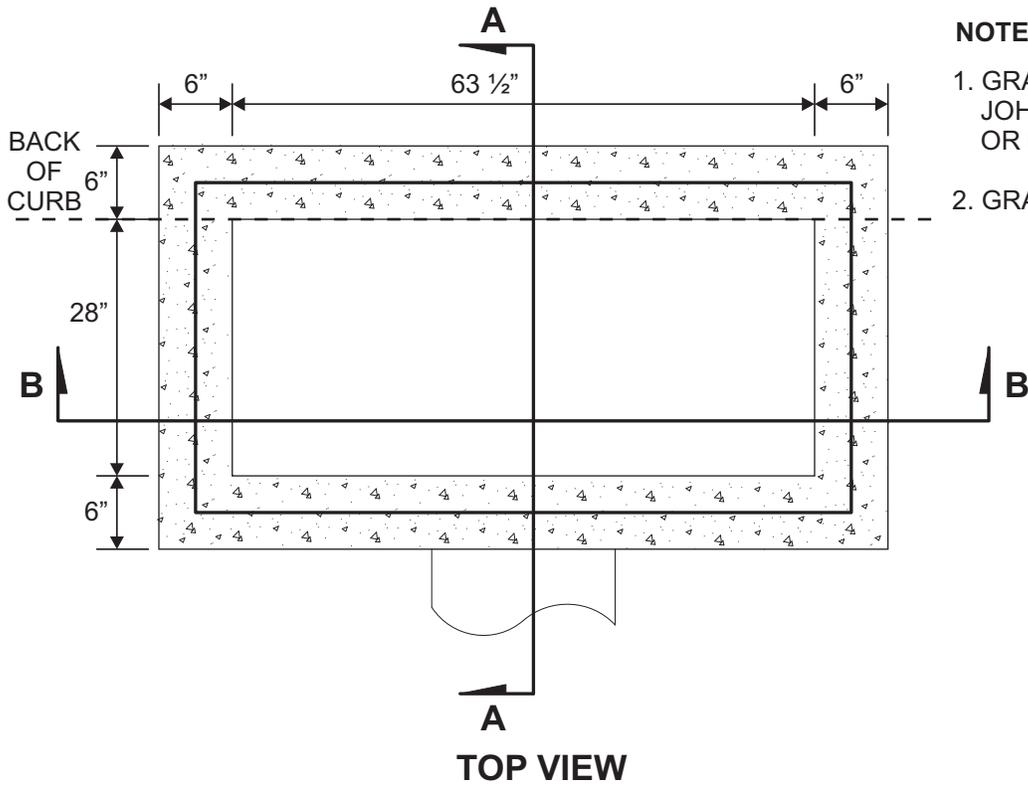
SECTION B-B

REVISIONS:	DATE:

**BRICK DOUBLE INLET DETAIL
FOR ROLLOVER CURB AND GUTTER**

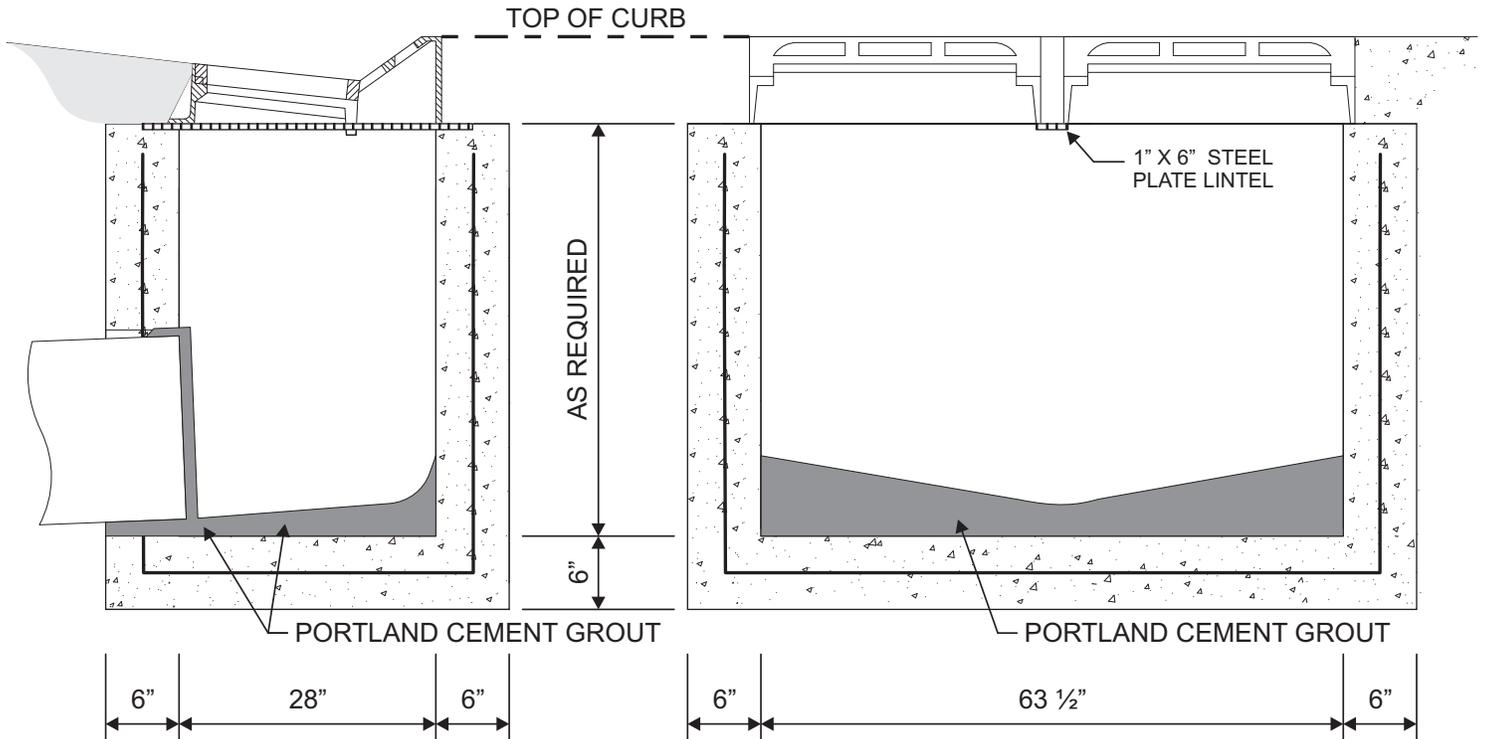
DRAWING NO: **DR-7** DATE: **July 2009**





NOTES:

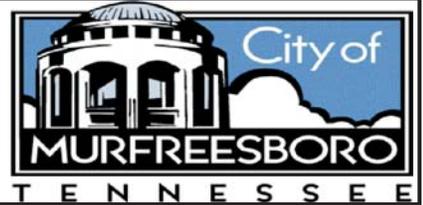
1. GRATE AND CASTING TO BE JOHN BOUCHARD & SON NO. 3104 OR EQUAL
2. GRADE 60 STEEL



REVISIONS:	DATE:

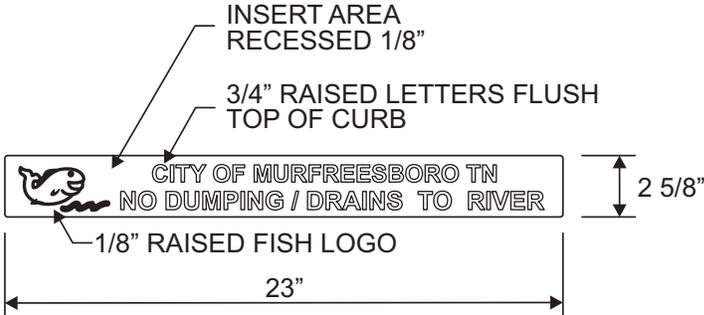
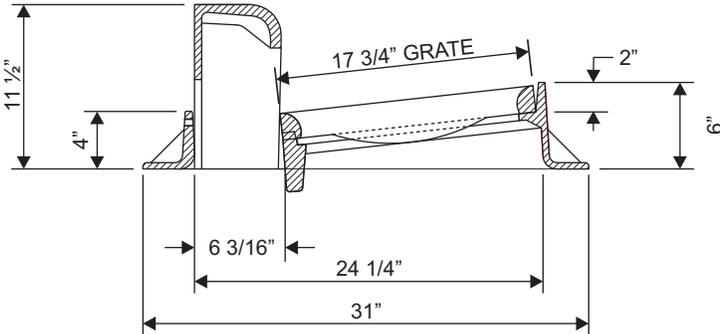
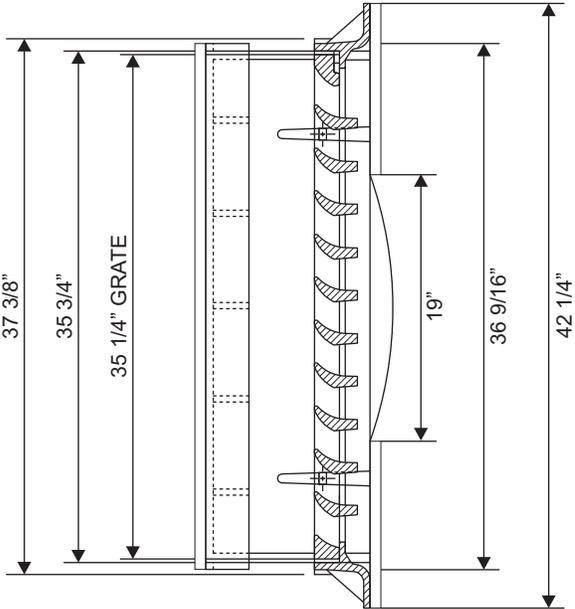
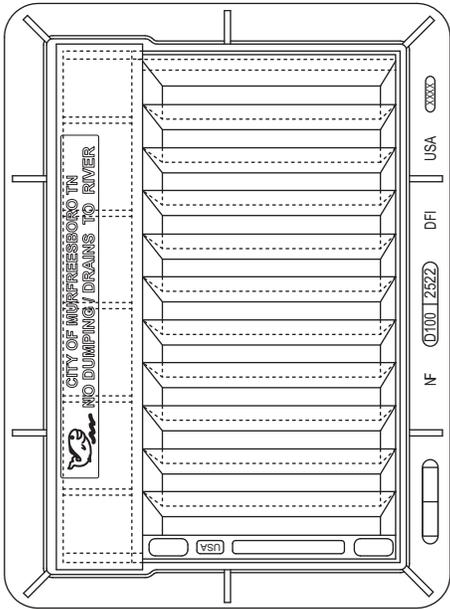
**CONC. DOUBLE INLET DETAIL
FOR ROLLOVER CURB AND GUTTER**

DRAWING NO: **DR-8** DATE: **July 2009**



NOTES:

- 1. GRATE AND CASTING TO BE JOHN BOUCHARD & SON NO. 3080 OR EQUAL



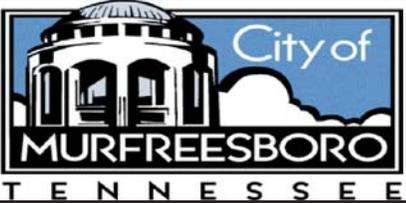
DETAIL OF ENVIRONMENTAL MESSAGE ON TOP OF CURB BACK

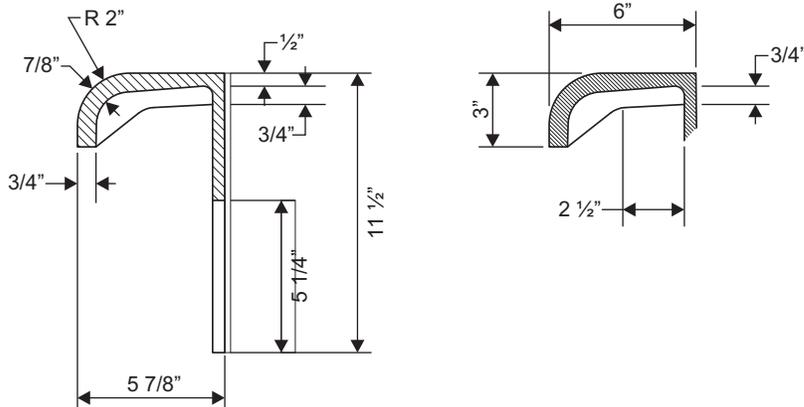
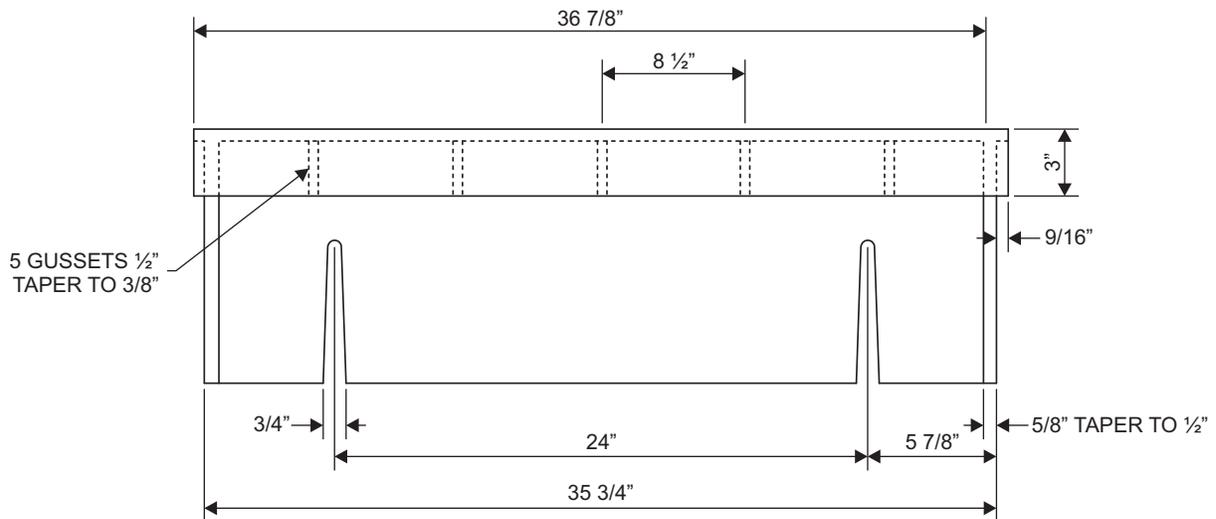
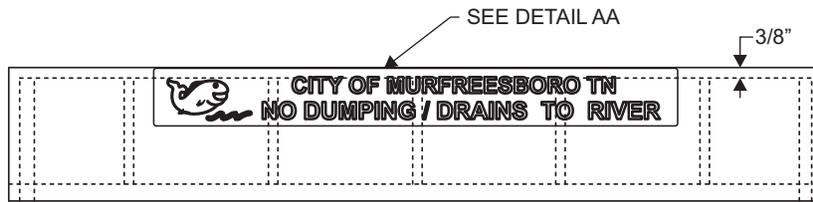
CLASS 35B GRAY IRON
 HEAVY DUTY, H20 LOAD RATED
 OPEN AREA = 1.8 SQUARE FT

REVISIONS:	DATE:

INLET GRATE AND FRAME DETAIL FOR TYPE 6-24 CURB AND GUTTER

DRAWING NO: **DR-9** DATE: **July 2009**





DETAIL AA

INSERT AREA
RECESSED 1/8"

3/4" RAISED LETTERS FLUSH
TOP OF CURB



DETAIL OF ENVIRONMENTAL MESSAGE
ON TOP OF CURB BACK

REVISIONS:	DATE:

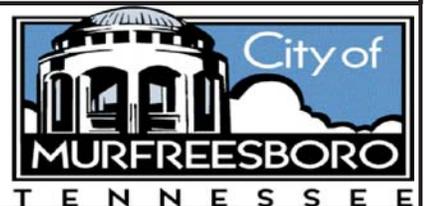
**CURB BACK DETAIL
FOR TYPE 6-24 CURB AND GUTTER**

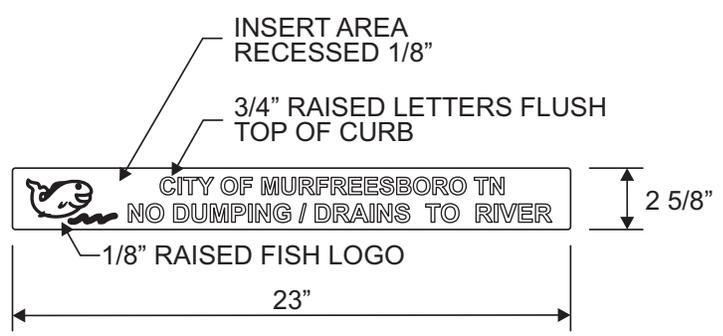
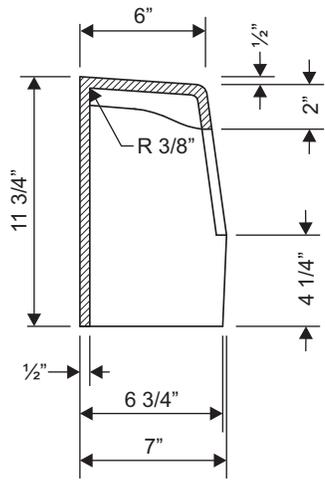
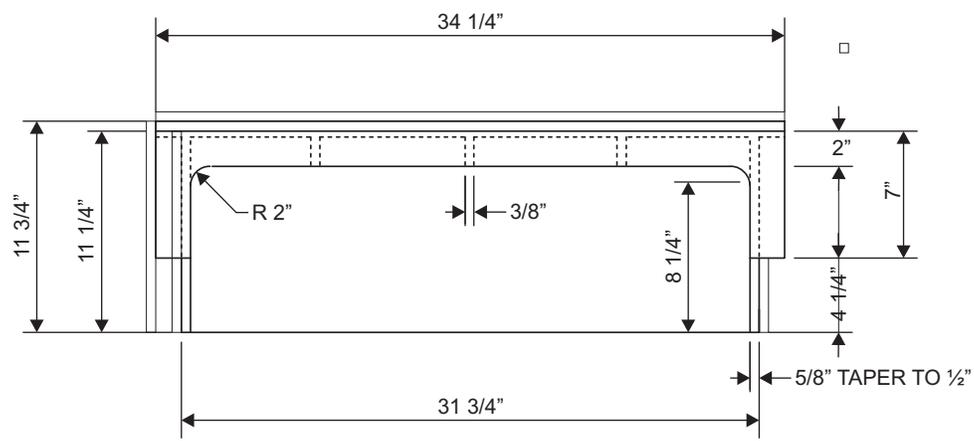
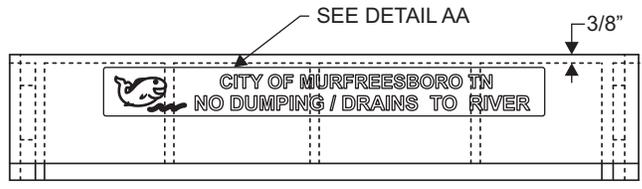
DRAWING NO:

DR-11

DATE:

July 2009





CLASS 35B GRAY IRON
 HEAVY DUTY, H20 LOAD RATED
 OPEN AREA = 1.98 SQUARE FT

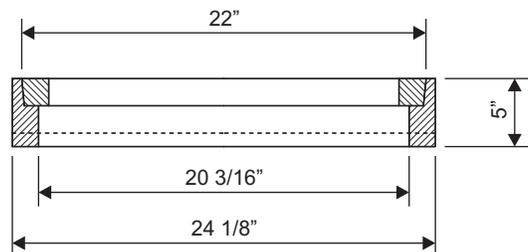
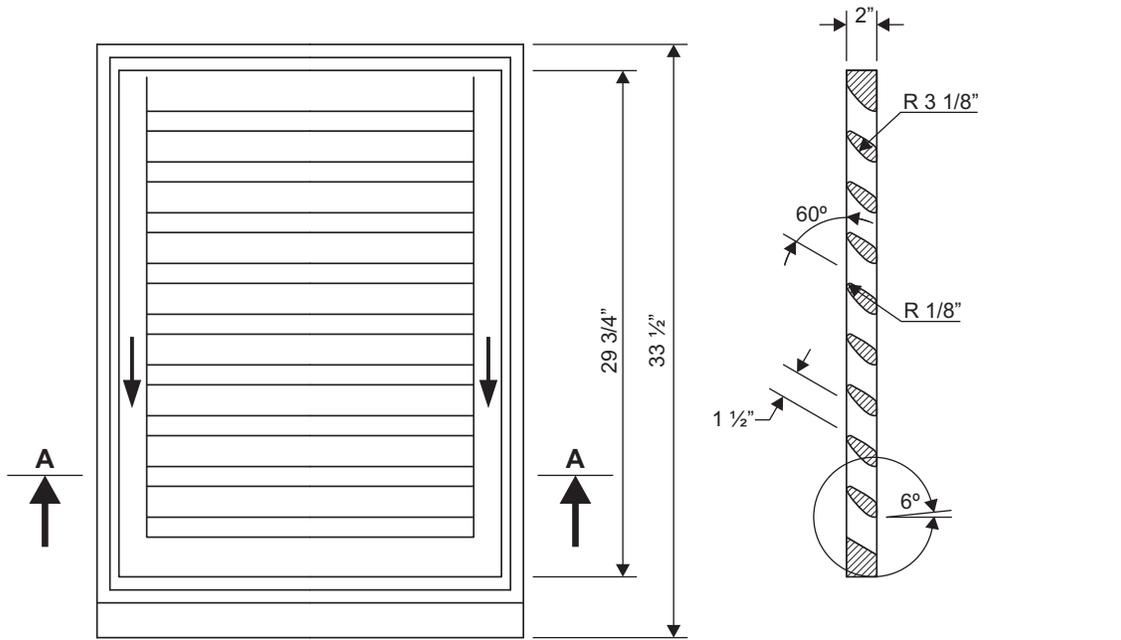
DETAIL OF ENVIRONMENTAL MESSAGE
 ON TOP OF CURB BACK

REVISIONS:	DATE:

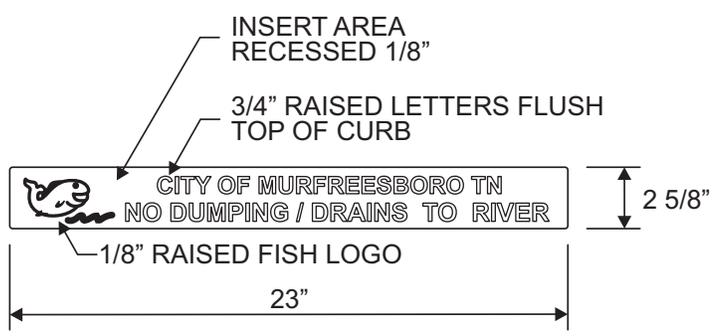
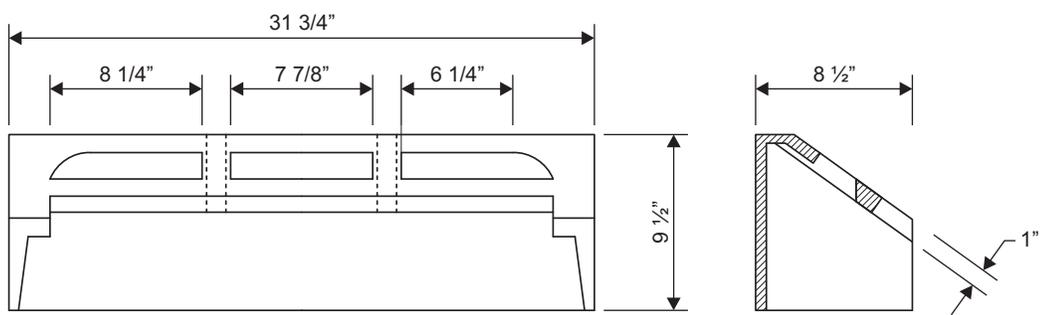
CURB BACK DETAIL
 FOR TYPE 6-30 CURB AND GUTTER

DRAWING NO: **DR-12** DATE: **July 2009**





SECTION A-A



DETAIL OF ENVIRONMENTAL MESSAGE ON TOP OF CURB BACK

REVISIONS:	DATE:

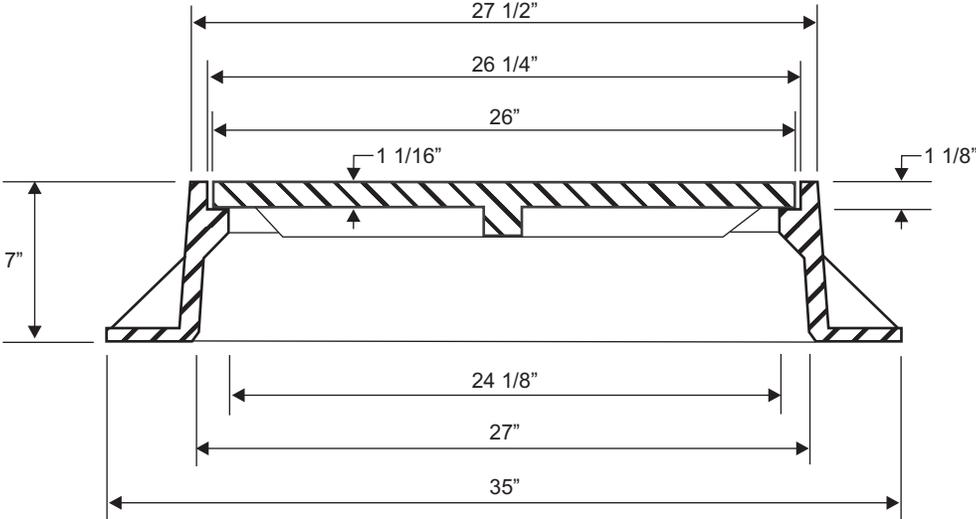
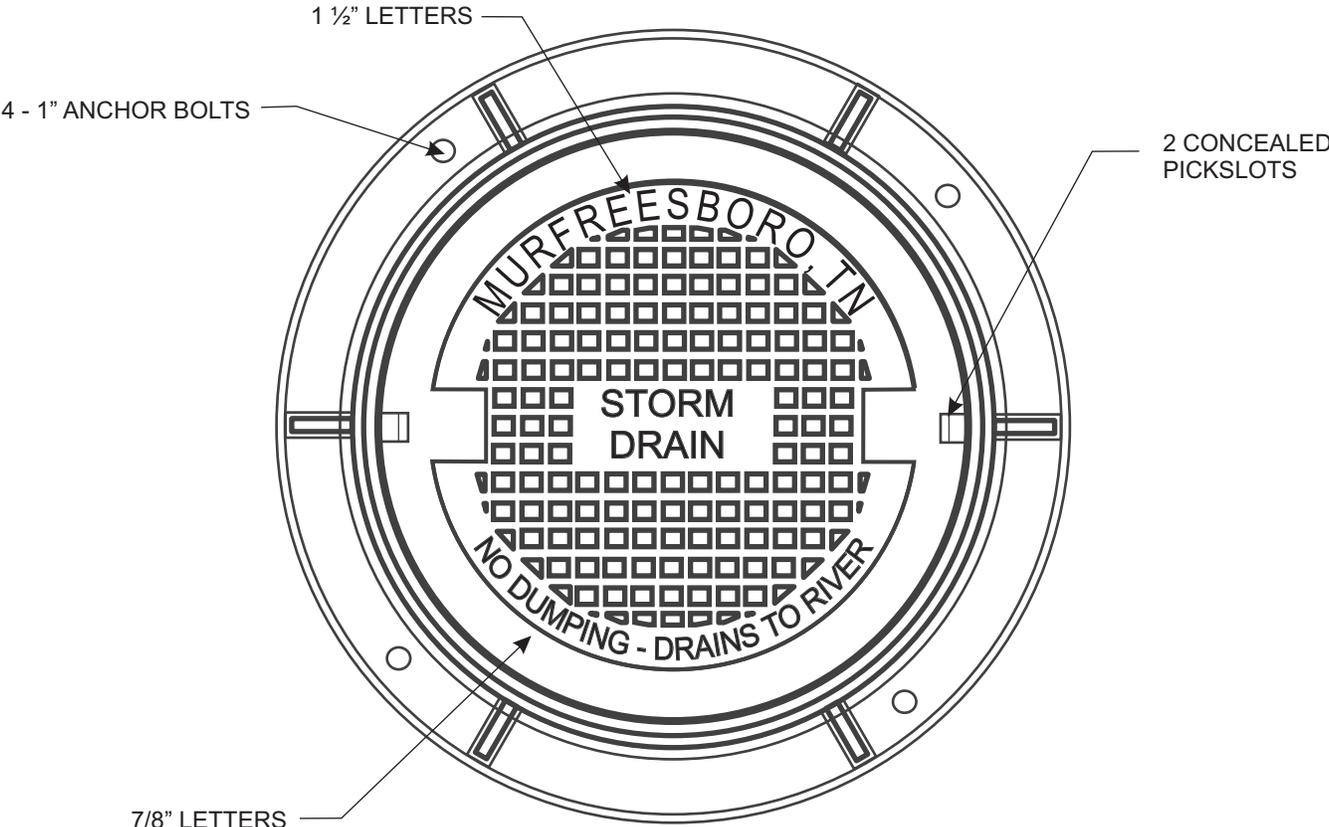
INLET GRATE AND CURB BACK DETAIL FOR ROLLOVER CURB AND GUTTER

DRAWING NO: **DR-13** DATE: **July 2009**



NOTES:

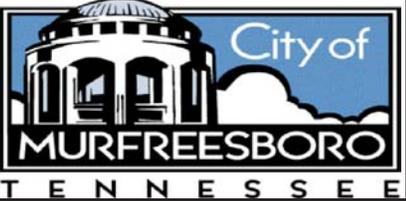
- 1. FRAME AND COVER TO BE JOHN BOUCHARD & SON NO. 1150 OR EQUAL



REVISIONS:	DATE:

MANHOLE FRAME AND COVER

DRAWING NO: **DR-14** DATE: **July 2009**



DRAINAGE STRUCTURES, MANHOLES AND ENDWALLS *

TYPE	NO. OF GRATES	TDOT STANDARD DRAWINGS
AREA DRAINS	1	D-CB-42 SERIES
AREA DRAINS	2	D-CB-43 SERIES
AREA DRAIN GRATES	N/A	D-CBB-42
JUNCTION BOX	N/A	D-JBS-1 THRU D-JBS-5
MANHOLE	N/A	D-MH-2 THRU D-MH-7
ENDWALLS	N/A	D-PE-1 THRU D-PE-9F
UNDERDRAINS	N/A	RD-UD-3 AND RD-UD-4

* INLETS, DRAINS, GRATES, MANHOLES AND ENDWALLS TO BE CONSTRUCTED IN ACCORDANCE WITH THE APPLICABLE TDOT STANDARD DRAWINGS.

REVISIONS:	DATE:

DRAINAGE STRUCTURES, MANHOLES AND ENDWALLS	
DRAWING NO: DR-15	DATE: July 2009

