DESIGN STANDARDS AND CRITERIA

for

STREETS, DRAINAGE, AND OTHER PUBLIC IMPROVEMENTS, INCLUDING ACCESS MANAGEMENT

City of Benbrook, Texas

Effective March 15, 2011

SECTION I
INTRODUCTION AND AUTHORITY

A. Authority

Section 16.12.030.A of Ordinance 1122 authorizes the City Manager "to promulgate rules, regulations, standards and specifications for the construction, installation, design, location and arrangement of streets, private streets, driveways, visibility triangles, curbs, street lights, street signs, alleys, utility layouts, utility easements, fences and gates for utility easements, sidewalks, fire hydrants, septic tanks, water wells, monuments, screening devices, criteria for drainage easement requirements, drainage facilities, and crosswalkways." These Design Criteria are intended to conform to that authorization and to supplement criteria included in the Subdivision Ordinance (Number 1122, as amended.) These criteria supersede previous criteria established under Ordinances 261, 416 and 836 and most recently amended on October 10, 2010.

B. Applicability

These criteria apply to all public and private construction within the City, whether new development or redevelopment.

SECTION II
GENERAL REQUIREMENTS

A. Permit Required

No person shall construct, reconstruct, cut or repair any street, storm sewer or other public improvement within the city limits, without first obtaining from the Inspections Department a permit to do so.

B. Fees

The City Council shall establish fees associated with any permits issued herein. No person shall be granted a permit to construct, reconstruct, cut or repair any street or storm sewer on any public property or right-of-way, without paying the specified fees to the City for inspection of such work. The currently authorized fee schedule for public improvements construction is included in Chapter 1.12 of the Benbrook Municipal Code, as amended.

C. Submittal and Approval of Plans, Specifications, and Cost Projections.

Prior to the commencement of any construction of public works improvements, the developer or person who intends to construct such projects shall present plans, specifications, and projections of probable cost setting forth in detail all elements of construction to the Community Development Division for approval. Unless otherwise waived by the City Engineer, the engineering plans (including all necessary off-site easements) must be submitted in accordance with all requirements of Chapter 16.20 of the Benbrook Municipal Code (1985, as amended.)

D. Standard Specifications and Details

Unless otherwise approved by the City, all specifications for construction shall conform to the Standard Specifications for Public Works Construction, North Central Texas, Fourth edition, published by the North Central Texas Council of Governments as adopted and modified by the City of Benbrook. Construction details shall conform to those adopted by the City of Benbrook and are included in Appendix 1 (updated, 2009).

SECTION III
STREETS AND ASSOCIATED FACILITIES

A. General Design Requirements for Streets

Unless otherwise approved by the City Engineer, streets and associated facilities shall be designed in accordance with the requirements included in Section 16.28.025 of the Benbrook Municipal Code (1985), as amended, and the provisions herein. Construction plans shall use the Standard Details included in Appendix 1. Any conflict between provisions of the Municipal Code, Standard Specifications and Standard Details shall be resolved by the City Engineer or Director of Public Services.

B. Traffic Control and Street Signs

The developer shall provide and install all street identification signs and attachment hardware for streets within any new subdivision. The street identification signs shall be constructed of standard nine-inch (9") flat 0.125 gauge aluminum and shall have engineer grade white reflective letters (6" Series "C") on a blue background (3M Engineer Grade Blue #2275) indicating the street name and block numbers, as provided in the City's Engineering Design standards. The Developer shall provide and install all poles and any necessary traffic control signs (such as stop signs) as directed by the City Engineer.

Following criteria must be used:

Traffic Control Signs:

1. Stop Signs: 30-inch engineer grade
2. Speed Limit Signs: 18" x 24" engineer grade, black/white
3. Stop Signs and Speed limit Signs: attached with sign to post clamps

Street Name Signs:

1. Round poles, 11-feet tall, 2 3/8" in diameter

2. Nine-inch flat 0.125 gauge street blades, blue background – 3M engineer grade Blue #2275

3. Six-inch white reflective letters, Series "C" engineer grade

4. All signs must have room for four-inch (4") City of Benbrook decal at the beginning of street name

5. Three-inch "Block Numbers" on bottom right hand side of signs, white Series "C" engineer grade

6. Three-inch street identification above block numbers (Dr., Rd., Ct., Lane, etc.) white Series "C" engineer grade

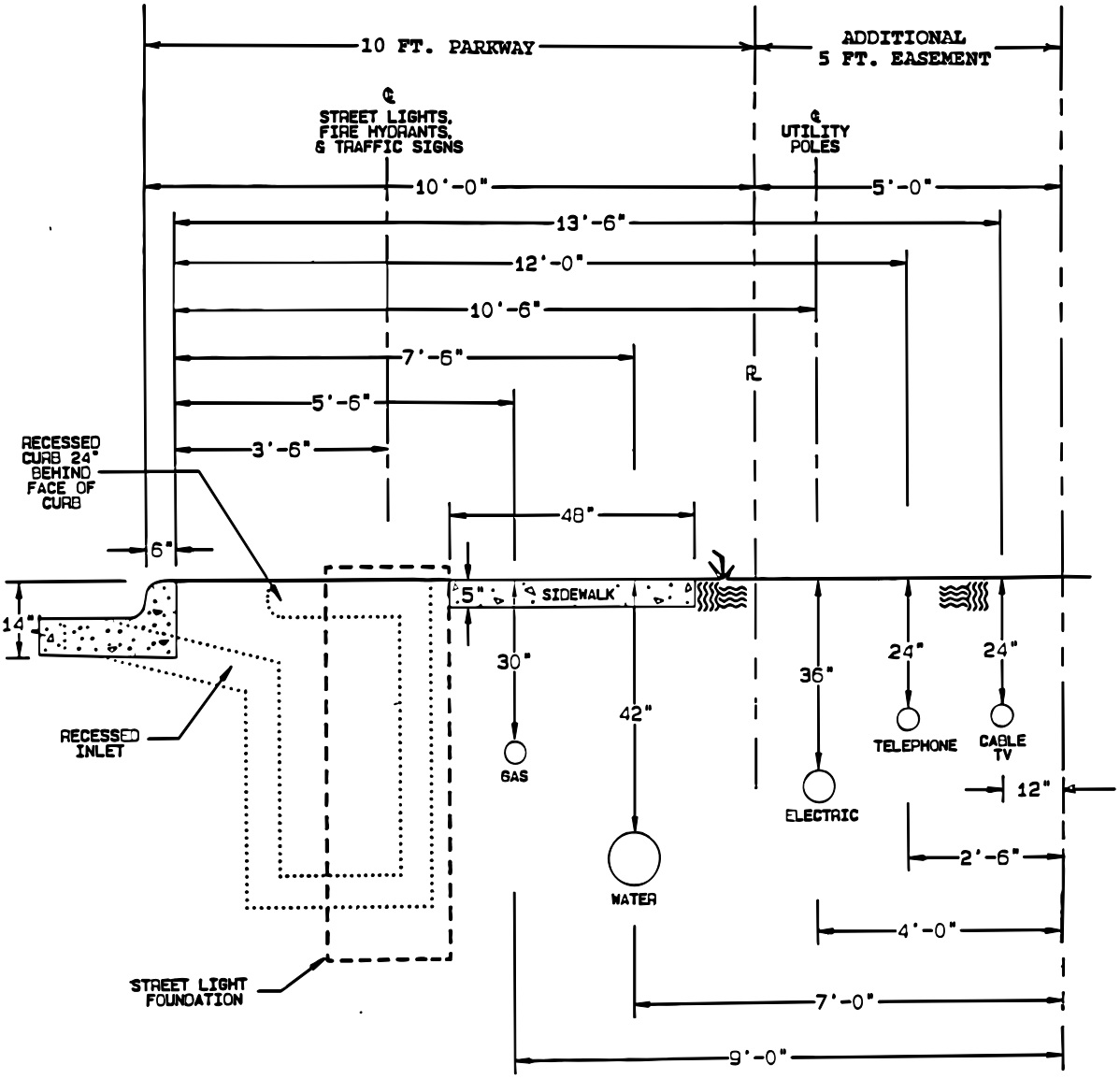
7. Street name signs shall be attached with caps and crosses

Signs shall be installed in the location required by the Texas Manual on Uniform Traffic Control Devices and this document. Unless otherwise approved, signs shall be installed on posts and foundations as required by AASHTO's "Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals". Typically, local street signs shall be encases in concrete within a 12-inch diameter hole to a depth of 2 feet.

C. Utilities

Unless otherwise approved by the City Engineer, utilities shall be located in the standardized locations promulgated by the Tarrant County Utility Coordinating Council (see Figure III-1). All pressurized utility systems (water, gas, etc.) shall be located behind the curb line wherever possible.

Figure III-1. Standard Locations for Utilities



LOCATIONS WITHIN 10 FT. PARKWAY AND 5 FT. EASEMENT
(all depths indicated are minimum depths)

D. Access Management

1. Driveways, Generally

While recognizing the need for access, it is the general policy of the City to minimize the number of driveway openings onto the City streets to reduce congestion and improve safety. The use of common driveways and cross-access easements is encouraged wherever feasible.

Unless otherwise specified herein, driveways and median openings shall conform to Section 16.28.025.D.11 of the Subdivision Ordinance. The minimum separation between two adjacent driveways or a driveway and intersection varies with lot width and the type of adjacent street (see Tables 1 & 2). Deviations from these standards shall be allowed only upon approval of the Director of Public Services. Whenever possible, driveways should be located directly opposite each other to minimize the potential points of conflict.

It is the intent of the City of Benbrook that this access management plan shall satisfy Texas Administrative Code, Title 43, Rule 11.52 for the purpose of applying the rules herein to new driveways entering onto State roadways within the City. It is not the intent of the City of Benbrook to seek authority to access permitting on State roadways. Where there may be a conflict between the requirements of the City or the State, the most restrictive shall apply.

2. Location and Spacing of Driveways

a. Traffic Impact Analysis (TIA):

A Traffic Impact Analysis shall be required for any development that will generate more than one hundred (100) trips per peak hour using data from the most recent edition of Trip Generation published by the Institute of Transportation Engineers. In general, this includes any development with more than 100 dwelling units or shopping area with more than 20,000 square feet of floor area. See Section 16.28.025.C of the Subdivision Ordinance for additional requirements for the TIA. Traffic Impact Analyses shall also meet the requirement for such studies established by the Fort Worth District of the Texas Department of Transportation.

b. Driveway Spacing:

Unless otherwise specified herein, driveways and median openings shall conform to Section 16.28.025.D.11 of the Subdivision Ordinance.

The minimum separation between two adjacent driveways or a driveway and intersection varies with lot width and the type of adjacent street (see Tables 1 & 2). Deviations from these standards shall be allowed only upon approval of the Director of Public Services. Except for residential driveways on local streets, driveways should be located directly opposite each other, thereby minimizing the potential points of conflict and maximizing the use of median openings.

c. Access to State Highways and Frontage Roads

As a general rule, State Highways (Benbrook Boulevard-US 377, Camp Bowie West-Spur 580, and RM 2871) and frontage roads on State roadways (I-20, I-820, Southwest Boulevard-SH 183) shall be considered arterial streets when using the spacing requirements in Tables 1 and 2. Access to the I-20 frontage road east of Winscott Road shall be limited to one street or driveway every 600 feet.

Table 1. Maximum Number of Driveways and Minimum Spacing Between Driveways

Land Use	Frontage (ft)[1]	Maximum Number of Driveways per Platted Lot	Minimum Spacing Between Driveways on Same Lot[2]	Minimum Spacing to Existing Driveway on Adjacent Lot[2,3]
Single Family Residential	Less than 60	1	N/A	10
	60 or More	2	20	10
Multifamily, Commercial or Industrial Abutting a Collector or Local Street	Less than 200	1	N/A	50
	200 to 300	2	75	50
	More than 300	1 per 150 ft. of frontage	100	50
Multifamily, Commercial or Industrial Abutting an Arterial Street	Less than 500	1	N/A	100
	500 to 1,000	2	250	100
	More than 1,000	1 per 500 ft. of frontage	250	100

Notes: 1. For corner lots, frontage is measured along shortest leg.
2. Spacing is measured from throat to throat.
3. When no driveway exists on adjacent property, spacing shall be a minimum of 50 percent of the distance listed when measured to the common property line.

Table 2. Minimum Corner Clearances Between Driveways and Intersections

Type of Street abutting Driveway	Type of Street that Driveway Intersects	Minimum Corner Clearance[1]	
		Approach Side of Intersection	Departure Side of Intersection
Arterial	Arterial	150	100
	Collector	100	70
	Local	50	30
Collector	Arterial	100	70
	Collector	70	50
	Local	40	30
Local	Arterial	50	30
	Collector	40	30
	Local	30	30

Notes: 1. Distance is measured from throat to extension of intersecting curb line.

Driveways entering onto frontage roads of controlled access highways shall be prohibited for a distance of one hundred feet (100') before the intersection with an exit ramp to a point three hundred feet (300') after the ramp intersection. Driveways are prohibited for a distance of one hundred feet (100') before the intersection with an entry ramp to a point of one hundred feet (100') beyond the ramp intersection. In addition, driveway locations and designs shall meet or exceed all other requirements of the Texas Department of Transportation.

d. Access to Arterials

Driveways from single family or two family residences shall not be permitted direct access to an arterial street. Shared residential driveway access to arterial streets may be permitted for major multiple-family "cluster" developments. Driveway access to arterials from commercial, industrial, or multifamily residential shall be limited in accordance with Tables 1 and 2.

e. Access to Collectors

Driveways from single family or two-family residences shall not be permitted direct access to collector streets, unless no other access is possible or unless such access is approved by the Planning and Zoning Commission. Driveway access to a residential lot from a minor collector street may be denied if: (a) the lot has access to a local street and/or (b) the proposed access would create a traffic flow or safety problem. Driveways are prohibited in all exclusive right turn lanes and right turn lane transition areas.

d. Access to Local Streets

Access to local streets is generally preferred and permitted subject to the limitations in Tables 1 and 2.

3. Design of Driveways

Table 3. Driveway Design Standards

Land Use	Driveway Width (ft)		Driveway Curb Radius (ft)	
	Minimum	Maximum	Minimum	Maximum
Single Family Residential				
Individual Lot	11	24	5	10
Common Drive	18	28	5	10
Commercial/Industrial				
One-way Drive	12	30	10	30
Two-way Drive	24	30	10	30
Multifamily	22	28	10	30

a. Commercial/Industrial Driveways

On proposed commercial and industrial tracts anticipated to contain several individual lots, the overall internal circulation, primary and secondary access points and additional turn lanes should be evaluated and considered during the preliminary platting process. Initial requirements may include but are not limited to the dedication of access easements extending to adjacent lots and properties, the designation and location of future shared major driveways and on-street frontage areas designated as "controlled access areas" where future deceleration lanes and turn lanes may require the construction of temporary driveways in lieu of permanent driveways (see Figure III-2). Minimum driveway storage lengths for entering and exiting vehicles from the site are shown in Figure III-3. Storage length is defined as the distance between the street right-of-way line and the first intersecting aisle or parking stall on site.

Figure III-2 Temporary Access Points

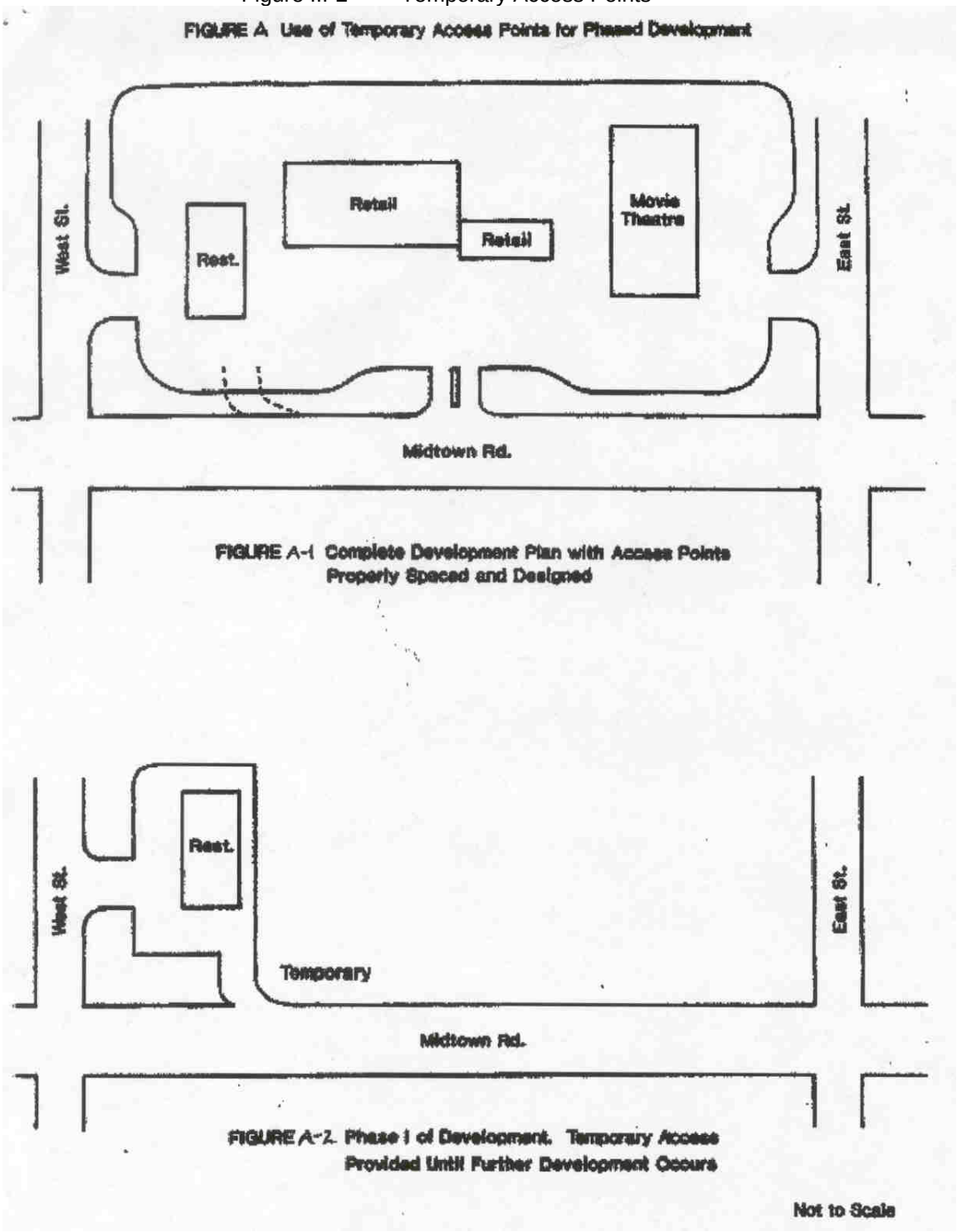


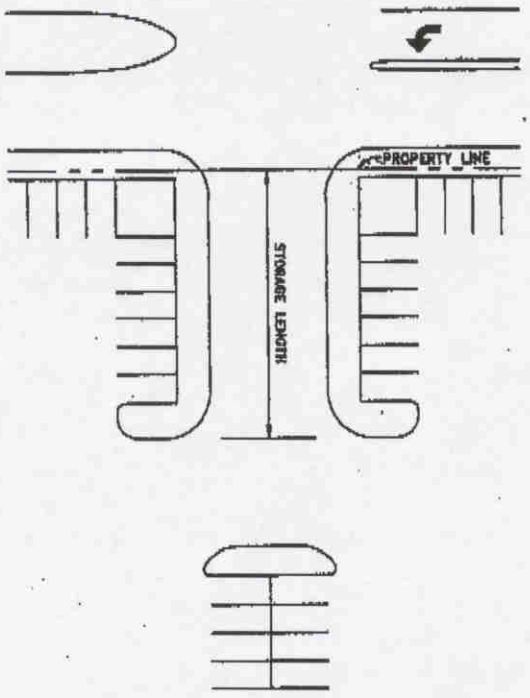
Figure III-3 Minimum Driveway Storage Length

FIGURE B

MINIMUM DRIVEWAY STORAGE LENGTH

Number of Parking Spaces Per Driveway	Minimum Storage Length* (Feet)
Less Than 50	18
50 to 200	50
More Than 200	75

* Storage length is defined as the distance between the street right-of-way line and the first intersecting aisle or parking stall on site.



(1) Min. & Max. Widths: Commercial driveways shall have a minimum driveway width of sixteen feet (12') for one-way traffic and twenty-four feet (24') for two-way traffic. Driveways (measured at the throat) should not exceed 65% of a property's frontage.

(2) Curb Return Radius: Commercial/industrial driveways shall have a minimum curb return radius of ten feet (10'). However, depending on the location, twenty feet (20') may be required by the City. Wherever possible, the driveway throat shall be located at least ten feet (10') from the side property line, or a distance equal to the curb return radius if greater than ten feet (10'), so that the entire curb return radius is located within the projection of the side property lines.

(3) Right In/Right Out Only Driveways: The width of right-in/right-out driveways shall be the same as a two-way drive (see Table 3) and shall be considered as a single drive for spacing (Table 1) and corner clearance (Table 2).

A summary of this information is shown on Table 3.

The results of the Traffic Impact Analysis may also generate additional design requirements, such as right-in/right-out driveways.

(4) Right Turn & Speed Transition Lanes

(a) Provision of Exclusive Turning Lanes and Deceleration/Acceleration Lanes:

Where projected traffic volumes entering or exiting a proposed development are likely to interfere with the peak traffic flow (approximately 40 or more right turning vehicles during the peak AM or PM traffic volume hours) on the adjoining street, additional right-of-way and construction in the form of channelized acceleration or deceleration lanes may be required. Deceleration lanes shall be at least 100 feet long with a 100-foot transition. At those access points where vehicles turning to and from the roadway will affect the capacity of the roadway or create an unacceptable accident risk, the developer shall dedicate sufficient right-of-way and construct turning lanes or deceleration/acceleration lanes as necessary to maintain the capacity of the roadway and minimize the potential accident risk. Projected volumes will be based on the TIA data or the most recent data from the Institute of Transportation Engineers Trip Generation Manual. Design of turn bays shall comply with the requirements of the Fort Worth District of the Texas Department of Transportation.

No driveway shall be permitted within right-turn or deceleration lane or the transition area of any separate right-turn or deceleration lane.

A continuous deceleration lane may be required as a condition of a driveway approval when two (2) or more deceleration lanes are planned, and their proximity necessitates that they be combined for proper traffic flow and safety. The transition taper for a continuous

deceleration lane shall not extend into or beyond a public street intersection.

If a development proposes to locate a driveway such that the associated auxiliary lane extends wholly or partially across one or more adjacent properties, the City may require the developer to obtain the necessary right-of-way from the adjacent property owner.

In the event a driveway with a deceleration lane is permitted within the clearance limits specified on Table 2, the developer may be required to extend the deceleration lane to the intersection. The City may require similar extensions if it is determined that the extension will improve traffic operations and reduce the potential accident risk.

(5) Median Openings

Every effort shall be made to construct median openings at street intersections or major driveways.

Cross access easements shall be required to grant each lot access to at least one median opening on each divided street which that lot abuts.

Construction of a left turn bay in the median shall be required where any street or private drive is constructed to align with an existing or proposed median opening.

Where sufficient room does not exist for the construction of a typical left turn bay, or where a proposed driveway cannot be properly aligned with the existing median access, permanent median and/or driveway channelization to prohibit left turn access for the requested driveway will be required or the proposed driveway shall be constructed at least 100 feet from the near side of the median opening.

Median openings shall not be less than 60 feet or greater than 90 feet wide for service to driveways and private streets.

Minimum spacing of median openings on any arterial street shall be four hundred (400) feet. The spacing may be reduced if a competent traffic study shows that a smaller spacing length will safely and efficiently accommodate left-turn movements to existing and projected future developments in the immediate vicinity. For design speeds greater than 35 miles per hour, median opening spacing shall comply with the criteria adopted by the Fort Worth District of the Texas Department of Transportation.

b. Multifamily Residential Driveways

(1) Min. & Max. Widths: Apartment driveways shall have a minimum width of twenty-two feet (22') and a maximum width of twenty-eight (28').

(2) Curb Return Radius: Apartment driveways shall have a minimum curb return radius of ten feet (10'). Wherever possible, the driveway throat shall be located at least ten feet (10') from the side property line, or a distance equal to the curb return radius if greater than ten feet (10'), so that the entire curb return radius is located within the projection of the side property lines.

A summary of this information is shown on Table 3.

c. Single family Residential Driveways

(1) Min. & Max. Widths: Low density residential driveways shall have a minimum width of eleven feet (11') and a maximum width of twenty-four feet (24'). This dimension may be increased to twenty-eight (28') for common driveways serving two adjacent properties.

(2) Curb Return Radius: Low density residential driveways entering onto local streets shall have a minimum curb return radius of five feet (5'). If permitted, low density residential driveways entering onto collector or thoroughfare streets shall have a minimum curb return radius of ten feet (10'). Wherever possible, the driveway throat shall be located at least five feet (5') from the side property line, or a distance equal to the curb return radius if greater than five feet (5'), so that the entire curb return radius is located within the projection of the side property lines.

(3) Circular Drives: A circular residential driveway may be allowed on local streets provided that the centerlines of the driveways are at least fifty feet (50') apart and the City Inspector determines that traffic safety is not hindered. Circular drives shall not be permitted on corner lots.

A summary of this information is shown on Table 3.

Shared residential driveways may be required for adjoining residential lots on collector street facilities to reduce the number of access points on those roadways. A residential driveway shared by two (2) adjacent properties shall have a minimum width of eighteen feet (18') and a maximum width of twenty-eight feet (28') with no less than nine feet (9') of width on each property.

A summary of this information is shown on Table 3.

d. Driveway Grades

(1) Maximum Grades: Any driveway approach shall have an initial positive approach grade not to exceed the following values:

High volume driveway on arterial or collector	6%
Low volume driveway on arterial or collector	8%
Low volume driveway on local street	12%

The initial approach grade shall have a length equal to or greater than the appropriate minimum approach length shown below, as measured from the present curb or any known future curb line, as determined by the Director of Public Services or his designee:

Residential drive on local or collector	6 feet

Commercial drive on local or collector	9 feet
Residential drive on arterial (if allowed)	9 feet
Commercial drive on arterial	17 feet

The initial approach shall extend onto private property if necessary, but driveways shall not be constructed at locations or in such a manner that water is diverted from the street onto private property. Any sidewalk affected by driveway approach construction shall be adequately transitioned with the driveway using a maximum eight percent (8%) grade.

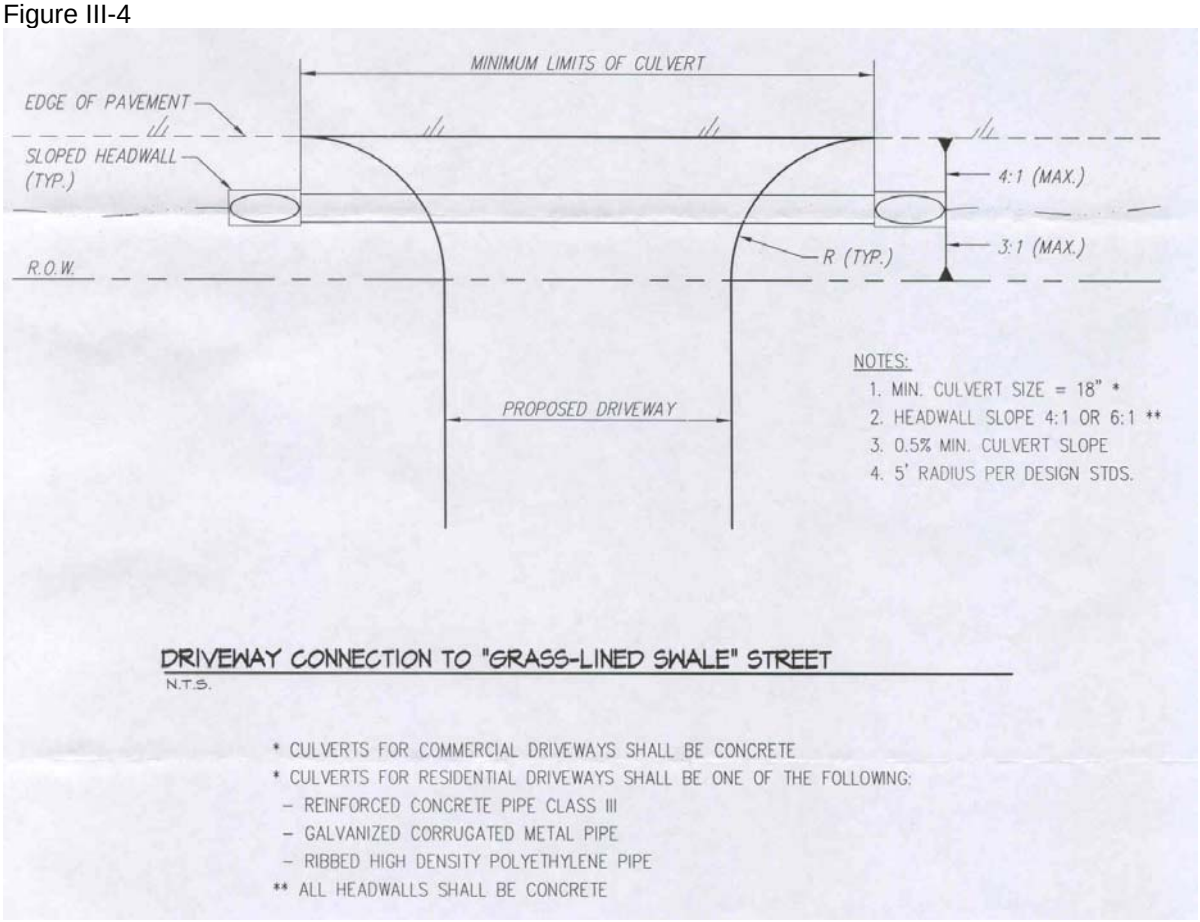
e. Driveway Sight Distance Requirements

Visibility triangles in the form of public open space easements (P.O.S.E.) shall be provided at the intersection of all public streets, alleys and/or private streets as required in Sections 16.28.025.A.12 and 16.28.020.C of the Subdivision Ordinance.

f. Driveways Crossing Grass-lined Swales

Where grass-lined swales are authorized, driveways shall be designed in accordance with Figure III-4.

Figure III-4



4. Removal of Abandoned Driveways

Whenever the use of any driveway approach is abandoned and not used for ingress and egress to the abutting property, the City may restore the curb to the standards of the City upon notice to the property owner. For the purposes of this Section, a driveway is considered abandoned if it is not used for a bona fide business or residence for a period of six months or longer, has been determined to be redundant or unnecessary for the provision of access to the property, and otherwise conflicts with the spacing or design standards herein. The City shall provide notice of its intent to close an abandoned driveway at least 15 days prior to its intent to do so. The property owner may appeal a decision to close a driveway to the City Council for reconsideration. The removal of existing driveways may be a condition to the authorization of establishing new driveways onto the City's street system.

E. Street Cut Repair Procedures and Specifications

1. Permit Required

A permit from the City of Benbrook is required prior to any excavation or street cut within City right-of-way. Except where otherwise approved by the City Manager, a right-of-way license as specified in Chapter 5.40 of the Benbrook Municipal Code (1985), as amended, must be obtained prior to the review of any request for an excavation permit. Excavation permits shall be made in accordance with the provisions of Chapter 5.40 of the Benbrook Municipal Code.

2. Street Cut and Repair Specifications

Upon approval of the excavation permit, and upon prior notification to and authorization by the City's Public Services Inspector, the contractor may initiate the street cut and repair in accordance with Items 402 and 504 of the Standard Specifications for Public Works Construction, Fourth Edition, published by the North Central Texas Council of Governments. The City's Public Services Inspector must approve any deviation from the Standard Specifications. The Inspector shall make a determination on the requirement for steel reinforcement on a case-by-case basis.

3. Restoration of Right-of-Way

After completion of work, the contractor shall restore the right-of-way in accordance with Section 5.40.230 of the Benbrook Municipal Code.

SECTION IV
STORM DRAINAGE

A. General Design Requirements

Unless otherwise approved by the City Engineer, drainage and associated facilities shall be designed in accordance with the requirements included in Section 16.24.035 of the Benbrook Municipal Code (1985), as amended, and the provisions herein. Construction plans shall use the Standard Details included in Appendix 1. Any conflict between provisions of the Municipal Code, Standard specifications and Standard Details shall be resolved by the City Engineer.

Unless otherwise specified herein, drainage requirements shall be based on the integrated Storm Water Management ™ Design Manual (iSWM™), published by the North Central Texas Council of Governments, with amendments and revisions except as herein amended. The Hydraulic Design Manual prepared and compiled by the Texas Department of Transportation Bridge Division, current version with latest revisions, may be used in cases not covered by the iSWM™ or these design requirements.

B. Determination of Runoff

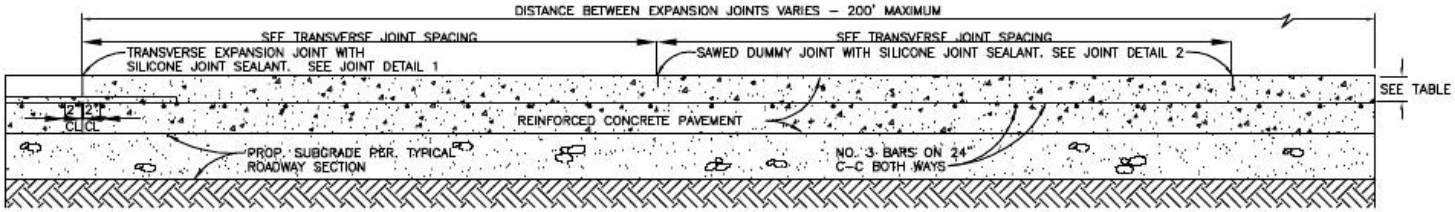
Refer to the hydrology section of the iSWM™ Technical Manual.

C. Retention and Detention Facilities

As designated by the Floodplain Administrator, the Integrated Storm Water Management™ (iSWM™) Design Manual for Development/Redevelopment, published by the North Central Texas Council of Governments, shall be used for the design of retention and detention facilities.

Appendix 1

Standard Drawings and Details

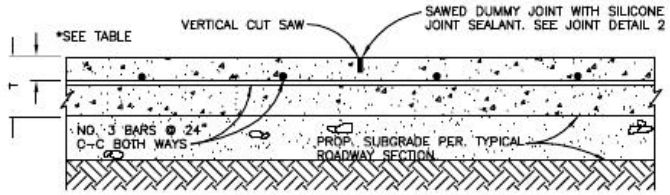


LONGITUDINAL PAVING SECTION

N.T.S.

STEEL REINFORCEMENT PLACEMENT	
PAVEMENT THICKNESS	CLEAR DISTANCE FROM FACE OF PAVEMENT
T = 5"	2"
T = 6"	2"
T = 7"	2 1/3"
T = 8"	2 2/3"

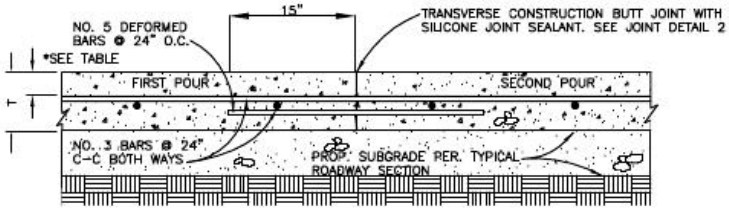
NOTE:
ALL DOWELS TO BE PLACED @ T/2



SAWED DUMMY JOINT

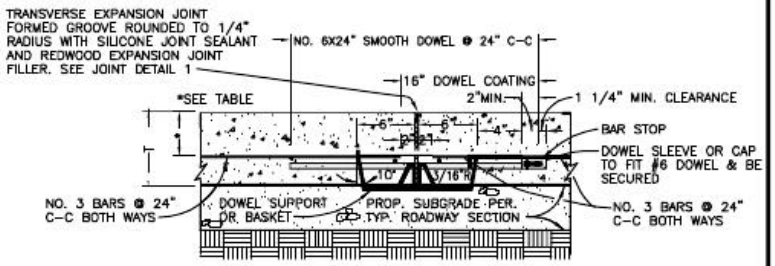
N.T.S.

NOTE:
1. POLYETHYLENE FOAM BACKER ROD DOES NOT SIT ON BOTTOM OF SAW – CUT JOINT
2. SILICONE HAS GENERAL WIDTH TO DEPTH RATIO OF 2:1
3. ALL EXPANSION JOINTS SHALL BE REDWOOD WITH CAPS.



TRANSVERSE CONSTRUCTION BUTT JOINT

N.T.S.



TRANSVERSE EXPANSION JOINT

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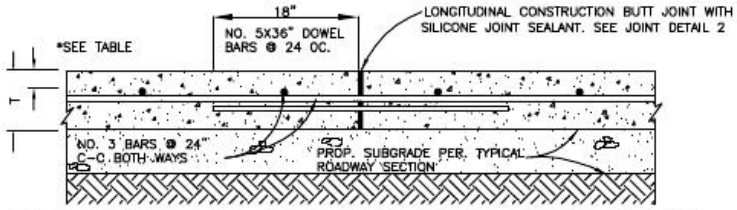


LONGITUDINAL CONSTRUCTION BUTT JOINT

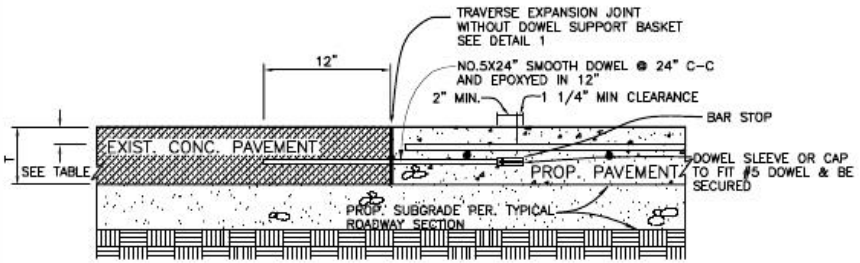
N.T.S.

CONCRETE PAVING DETAILS

Sheet 1 of 4

City of Benbrook

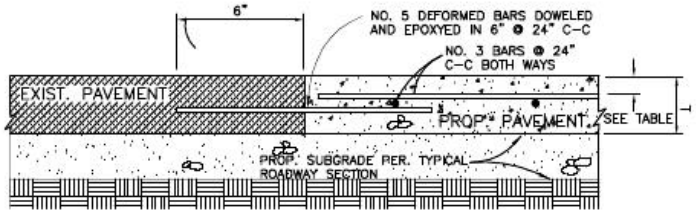
CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD–01



TRANSVERSE EXPANSION CONSTRUCTION BUTT JOINT

(BETWEEN EXIST. AND PROP. PAVEMENT)
(USED ONLY AT END OF RADIUS, P.C. OR P.T. STATIONS)

N.T.S.

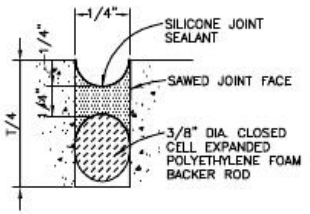


TRANSVERSE CONSTRUCTION BUTT JOINT

(BETWEEN EXIST. AND PROP. PAVEMENT)

N.T.S.

JOINT DEPTH	
PAVEMENT THICKNESS	JOINT DEPTH (T/4)
T = 5"	1 1/4"
T = 6"	1 1/2"
T = 7"	1 3/4"
T = 8"	2"



JOINT DETAIL NO. 2 SEAL FOR SAWED DUMMY JOINT

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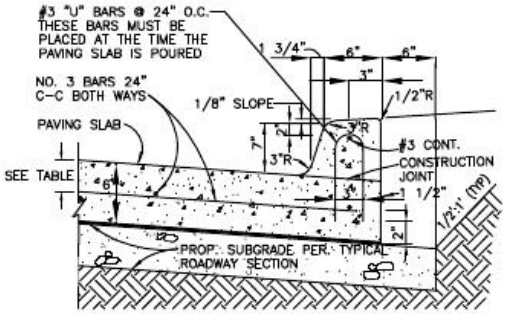


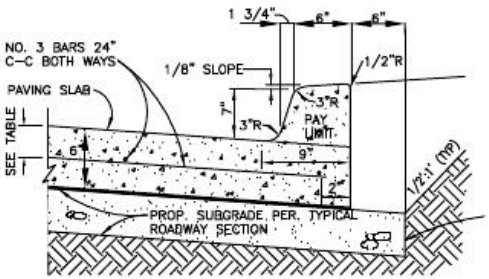
SUPERIMPOSED CURB

N.T.S.

NOTE:

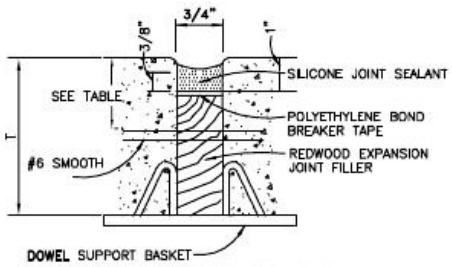
IF CURB SECTION IS POURED AFTER THE PAVING SLAB HAS BEEN CONSTRUCTED, THE SECTION MAY BE USED AS AN ALTERNATE METHOD FOR CONSTRUCTING THE ATTACHED CURB.

ALL REINFORCING STEEL MUST BE PLACED ON CHAIRS.



MONOLITHIC CURB

N.T.S.



JOINT DETAIL NO. 1 SEAL FOR EXPANSION JOINT

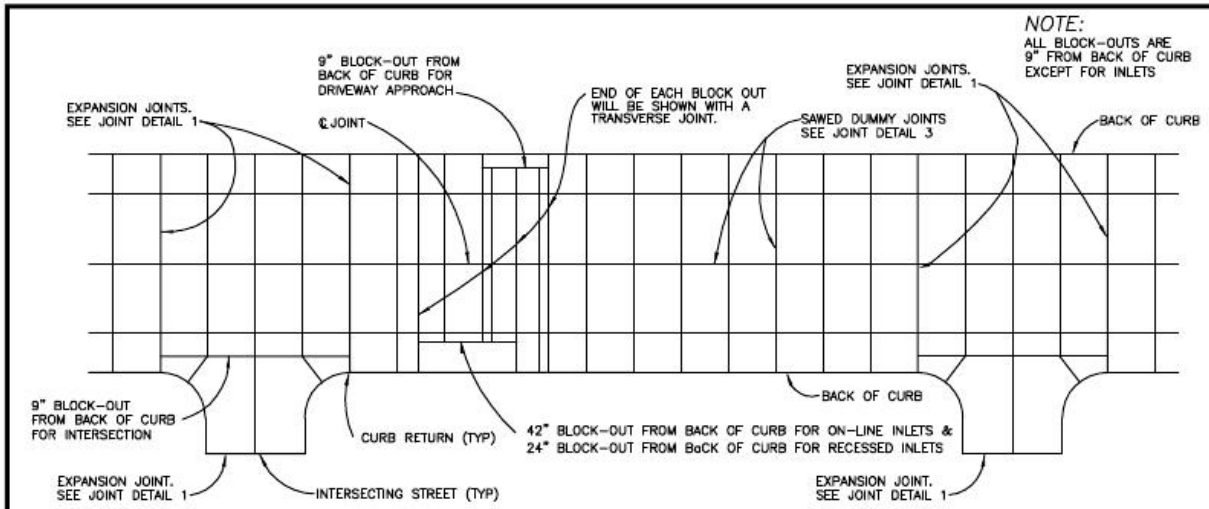
N.T.S.

CONCRETE PAVING DETAILS

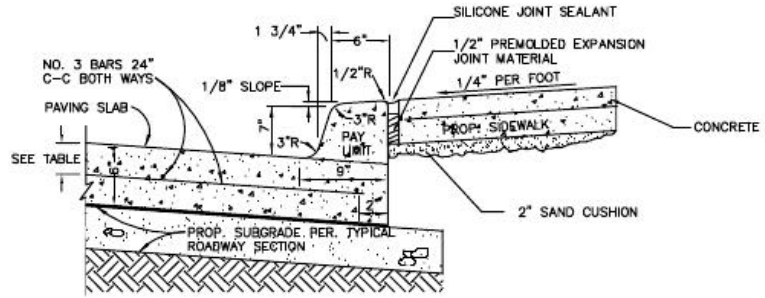
Sheet 2 of 4

City of Benbrook

CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD-01

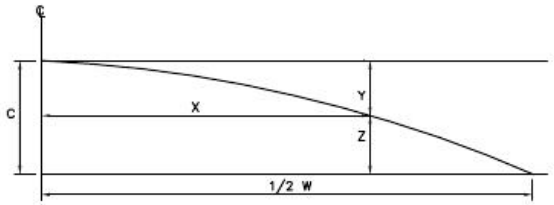


SPACING DIAGRAM FOR JOINTS



EXPANSION JOINT BETWEEN CURB & WALK

N.T.S.



ORDINATES FOR PARABOLIC CROWNS

N.T.S.

CONCRETE PAVING DETAILS

Sheet 3 of 4

City of Benbrook

CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD-01

30' ROADWAY
5" CROWN = 0.4167
CONSTANT = 0.001852

X	Y		Z	
Ft.	Feet	Inches	Feet	Inches
0	0.0000	0	0.4167	5
1	0.0019	1/45	0.4148	4 45/46
2	0.0074	4/45	0.4093	4 72/79
3	0.0167	1/5	0.4000	4 4/5
4	0.0296	16/45	0.3871	4 49/76
5	0.0463	5/9	0.3704	4 4/9
6	0.0667	4/5	0.3500	4 1/5
7	0.0907	1 4/45	0.3260	3 72/79
7.5	0.1042	1 1/4	0.3125	3 3/4
8	0.1185	1 19/45	0.2982	3 37/64
9	0.1500	1 4/5	0.2667	3 1/5
10	0.1852	2 2/9	0.2315	2 7/9
11	0.2241	2 51/74	0.1926	2 14/45
12	0.2667	3 1/5	0.1500	1 4/5
13	0.3130	3 65/86	0.1037	1 11/45
14	0.3630	4 21/59	0.0537	29/45
15	0.4167	5	0.0000	0

36' ROADWAY
5" CROWN = 0.4167
CONSTANT = 0.001286111

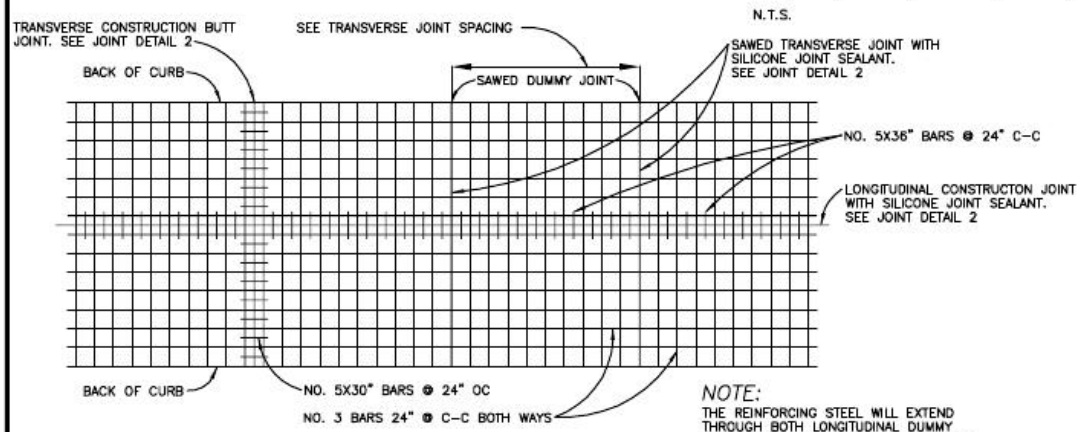
X	Y		Z	
Ft.	Feet	Inches	Feet	Inches
0	0.0000	0	0.4167	5
1	0.0013	1/65	0.4154	4 66/67
2	0.0051	5/81	0.4116	4 48/49
3	0.0116	5/36	0.4051	4 56/65
4	0.0206	20/81	0.3961	4 55/73
5	0.0322	22/57	0.3845	4 59/96
6	0.0463	5/9	0.3704	4 4/9
7	0.0630	31/41	0.3537	4 21/86
8	0.0823	81/82	0.3344	4 1/79
9	0.1042	1 1/4	0.3125	3 3/4
10	0.1286	1 25/46	0.2881	3 16/35
11	0.1556	1 72/83	0.2611	3 2/15
12	0.1852	2 2/9	0.2315	2 7/9
13	0.2174	2 59/97	0.1993	2 20/51
14	0.2521	3 1/40	0.1646	1 40/41
15	0.2894	3 43/91	0.1273	1 19/36
16	0.3292	3 58/61	0.0875	1 4/81
17	0.3717	4 29/63	0.0450	47/87
18	0.4167	5	0.0000	0

40' ROADWAY
5" CROWN = 0.4167
CONSTANT = 0.00104175

X	Y		Z	
Ft.	Feet	Inches	Feet	Inches
0	0.0000	0	0.4167	5
1	0.0010	1/80	0.4157	4 82/83
2	0.0042	1/20	0.4125	4 19/20
3	0.0094	9/80	0.4073	4 8/9
4	0.0167	1/5	0.4000	4 4/5
5	0.0260	5/16	0.3907	4 11/16
6	0.0375	9/20	0.3792	4 11/20
7	0.0510	49/80	0.3657	4 19/49
8	0.0667	4/5	0.3500	4 1/5
9	0.0844	1 1/79	0.3323	3 81/82
10	0.1042	1 1/4	0.3125	3 3/4
11	0.1261	1 20/39	0.2906	3 20/41
12	0.1500	1 4/5	0.2667	3 1/5
13	0.1761	2 8/71	0.2406	2 87/98
14	0.2042	2 9/20	0.2125	2 11/20
15	0.2344	2 13/16	0.1823	2 3/16
16	0.2667	3 1/5	0.1500	1 4/5
17	0.3011	3 19/31	0.1156	1 19/49
18	0.3375	4 1/20	0.0792	19/20
19	0.3761	4 20/39	0.0406	39/80
20	0.4167	5	0.0000	0

48' ROADWAY
5" CROWN = 0.4167
CONSTANT = 0.000723438

X	Y		Z	
Ft.	Feet	Inches	Feet	Inches
0	0.0000	0	0.4167	5
1	0.0007	0	0.4160	5
2	0.0029	1/29	0.4138	4 28/29
3	0.0065	5/64	0.4102	4 83/90
4	0.0116	5/36	0.4051	4 56/65
5	0.0181	5/23	0.3986	4 47/60
6	0.0260	5/16	0.3907	4 11/16
7	0.0354	20/47	0.3813	4 23/40
8	0.0463	5/9	0.3704	4 4/9
9	0.0586	45/64	0.3581	4 11/37
10	0.0723	79/91	0.3444	4 9/68
11	0.0875	1 5/99	0.3292	3 19/20
12	0.1042	1 1/4	0.3125	3 3/4
13	0.1223	1 7/15	0.2944	3 8/15
14	0.1418	1 47/67	0.2749	3 26/87
15	0.1628	1 41/43	0.2539	3 4/65
16	0.1852	2 2/9	0.2315	2 7/9
17	0.2091	2 29/57	0.2076	2 29/59
18	0.2344	2 13/16	0.1823	2 3/16
19	0.2612	3 13/97	0.1555	1 13/15
20	0.2894	3 43/91	0.1273	1 19/36
21	0.3190	3 29/35	0.0977	1 11/64
22	0.3501	4 1/5	0.0666	4/5
23	0.3827	4 16/27	0.0340	20/49
24	0.4167	5	0.0000	0



PLAN OF STEEL LAYOUT
N.T.S.

NOTE:
THE REINFORCING STEEL WILL EXTEND THROUGH BOTH LONGITUDINAL DUMMY AND TRANSVERSE CONSTRUCTION JOINTS

LONGITUDINAL JOINT SPACING

STREET WIDTH	SPACING
28' & 30'	ON ℄
36' & 40'	ON ℄ & 8' FROM BACK OF CURB
44'	ON ℄ & 11' OFF ℄
48'	ON ℄ & 12' OFF ℄
60'	6' & 18' OFF ℄

TRANSVERSE JOINT SPACING

PAVEMENT THICKNESS	SPACING
T = 5"	10'
T = 6"	12'
T = 7"	14'
T = 8"	16'

GENERAL NOTES:

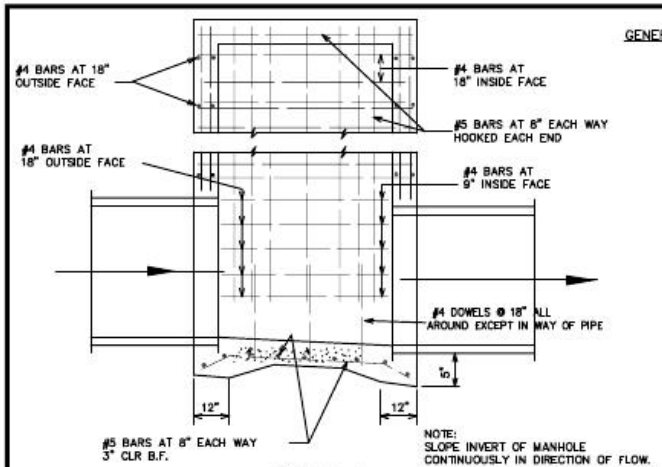
1. ALL CONSTRUCTION MATERIALS, METHODS AND PLACEMENTS NOT DETAILED ABOVE SHALL MEET OR EXCEED THE STANDARD SPECIFICATIONS OF THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS UNLESS SUPERCEDED BY CITY OF BENBROOK STANDARD SPECIFICATIONS.

CONCRETE PAVING DETAILS

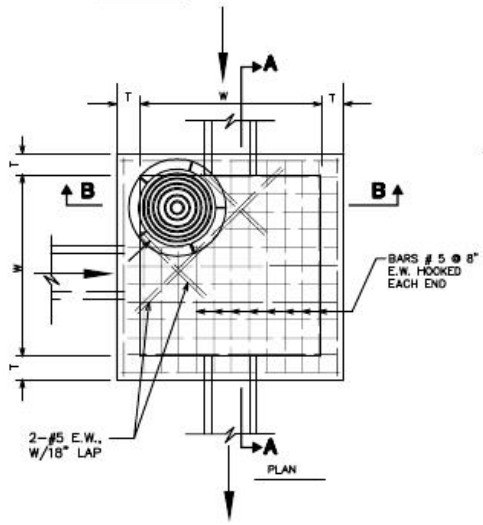
Sheet 4 of 4

City of Benbrook

CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD-01



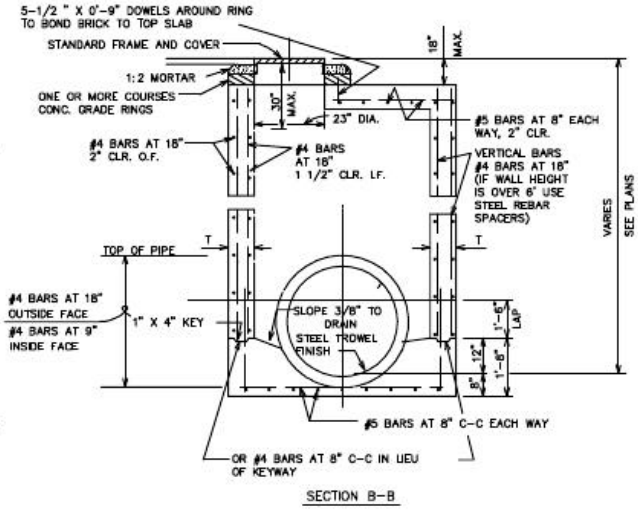
SECTION A–A



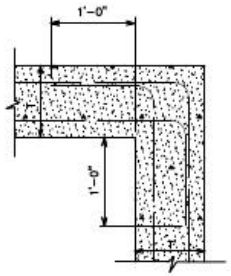
PLAN

GENERAL NOTES:

1. LAYERS OF REINFORCING STEEL NEAREST THE INTERIOR AND EXTERIOR SURFACES SHALL HAVE A COVER OF 2" TO THE CENTER OF BARS, UNLESS OTHERWISE NOTED.
2. EXCAVATION FOR INLET TO BE INCLUDED IN THE UNIT PRICE BID FOR INLET.
3. FOR DETAILS OF REINFORCING OF LOWER PORTIONS OF INLET SEE APPROPRIATE SQUARE INLET DETAILS.
4. DEPTH OF DROP INLET FROM FINISHED GRADE TO FLOW LINE OF INLET VARIABLE. APPROXIMATE DEPTH WILL BE SHOWN ON PLANS AT LOCATION OF INLET.
5. ALL STANDARD DROP INLETS SHALL HAVE ONE OPENING ON EACH SIDE UNLESS SHOWN OTHERWISE ON PLANS.



SECTION B–B



TYPICAL CORNER DETAIL
PLAN VIEW

NOTES:
T = 8" FOR H = 4' TO 8'
T = 9" FOR H = 6' TO 9'

STANDARD 4' SQUARE MANHOLE

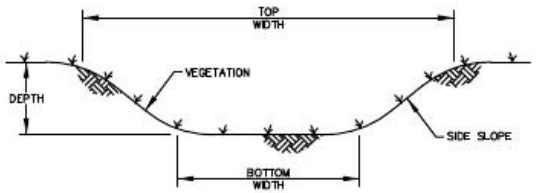
N.T.S.

STORM DRAIN DETAILS

Sheet 1 of 4

City of Benbrook

CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD–02

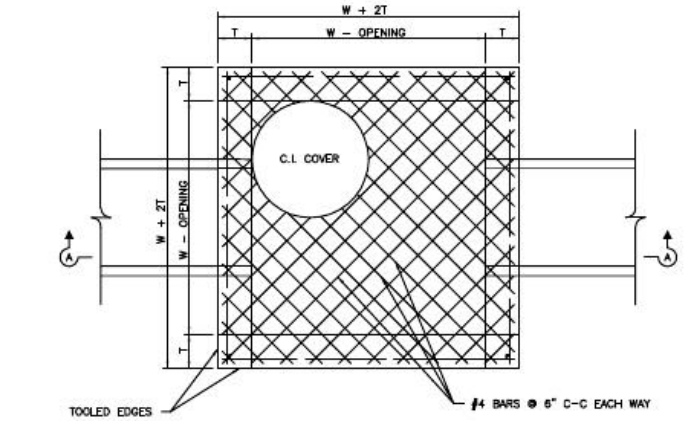


ROADSIDE GRASS SWALE SPECIFICATIONS AND DETAILS. UNLESS SPECIFICALLY APPROVED BY THE CITY, THE FOLLOWING CRITERIA SHALL APPLY:

SWALE GEOMETRY:	SIDE SLOPES NOT STEEPER THAN 4:1 SHAPE MUST BE TRAPEZOIDAL
DEPTH:	2 FEET MINIMUM – 4 FEET MAXIMUM
BOTTOM WIDTH:	2 FEET MINIMUM – 8 FEET MAXIMUM
VELOCITY:	NOT LESS THAN 2 fps, AND NOT MORE THAN 5 fps, IF GREATER THAN 5 fps MUST USE SOIL RETENTION BLANKET PER TxDOT SPECIFICATIONS, ITEM #169 (SEE NOTE BELOW REGARDING VEGETATION OR SIMILAR PENDING APPROVAL BY THE CITY)
LONGITUDINAL SLOPE:	1% MIN. – 4% MAX., IF GREATER THAN 4%, MUST USE CHECK DAMS (OR SIMILAR PENDING APPROVAL BY THE CITY)
DESIGN CAPACITY:	5 YEAR STORM EVENT, AS DETERMINED PER CITY REQUIREMENTS, R.O.W. TO CONTAIN 100 YEAR STORM EVENT
OUTLET & INLET POINTS:	ROCK RIP-RAP, GROUTED ROCK RIP-RAP, GABION MATTRESS OR SIMILAR
VEGETATION:	USE NATIVE SPECIES OF DENSE TURF GRASS, TOLERANT TO CLIMATE CONDITIONS. SOD SHALL BE STAPLED IN PLACE. MATRIX-TYPE BIODEGRADABLE OR NON-BIODEGRADABLE, SOIL RETENTION BLANKET (TURF REINFORCEMENT MAT) SEEDED AND FILLED WITH SOIL SUCH AS THOSE MANUFACTURED BY NORTH AMERICAN GREEN, ENKAMAT OR SI GEOSOLUTION (OR APPROVED EQUAL) MAY BE SUBSTITUTED ON PRIOR WRITTEN APPROVAL OF THE CITY. VEGETATION MUST BE APPROVED BY THE CITY PRIOR TO CONSTRUCTION.
CONSTRUCTION & MAINTENANCE:	MUST MAINTAIN SHAPE, LINE, GRADES AND DENSE COVER OF VEGETATION PRIOR TO CITY ACCEPTANCE.

GRASS SWALE DETAIL

N.T.S.



INLET SIZE	T	W
2' SQUARE	7"	2'– 0"
4' SQUARE	7"	4'– 0"
5' SQUARE	8"	5'– 0"
6' SQUARE	9"	8'– 0"
7' SQUARE	9"	7'– 0"
8' SQUARE	9"	8'– 0"

STANDARD SUMP INLET

N.T.S.

STORM DRAIN DETAILS

Sheet 2 of 4

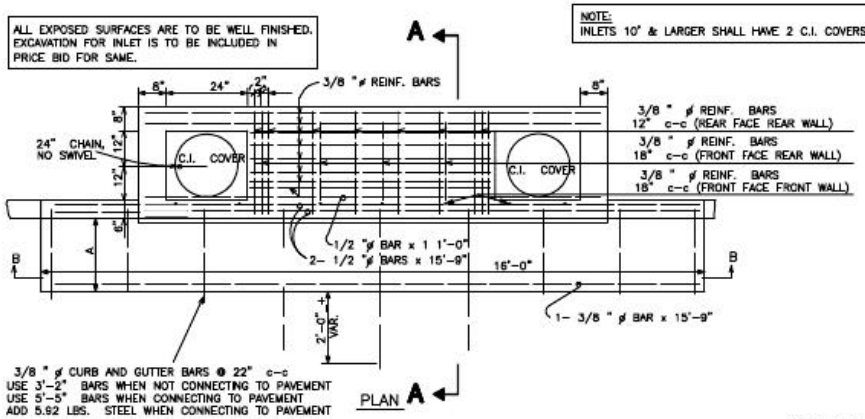
City of Benbrook

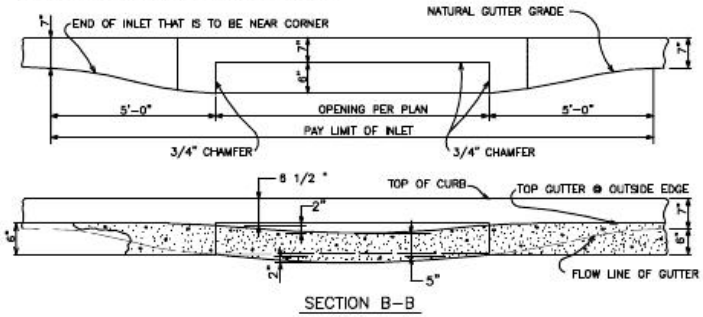
CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD–02

ALL EXPOSED SURFACES ARE TO BE WELL FINISHED. EXCAVATION FOR INLET IS TO BE INCLUDED IN PRICE BID FOR SAME.

NOTE: INLETS 10' & LARGER SHALL HAVE 2 C.I. COVERS

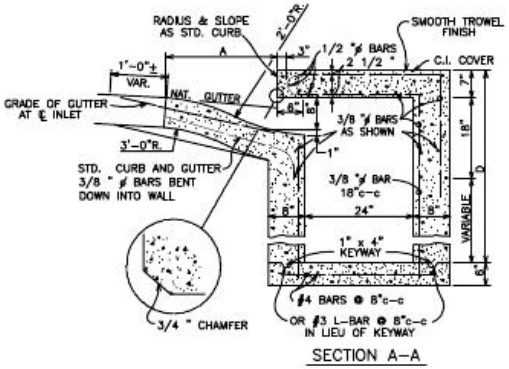
NOTE: THE DEPTH "D" FOR ALL THE STANDARD INLETS SHALL BE 4'-0" AT THE HIGH END AND 4'-8" AT THE OUTLET END FROM THE TOP OF CURB TO THE FLOW LINE OF THE INLET. IF THE INLET IS NOT STANDARD, THE DEPTHS WILL BE SHOWN ON THE PLANS.





SECTION B-B

NOTES: GUTTER CONSTRUCTION IN FRONT OF INLET AS SHOWN IS TO BE CONSIDERED AS PART OF SAME. DIMENSION "A" SHALL MATCH THE GUTTER DIMENSION IN USE ON THE PROJECT.



SECTION A-A

STANDARD STORM DRAIN CURB INLET

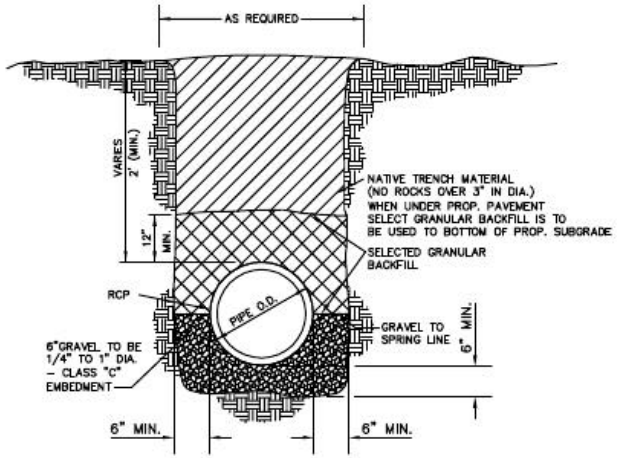
N.T.S.

STORM DRAIN DETAILS

Sheet 3 of 4

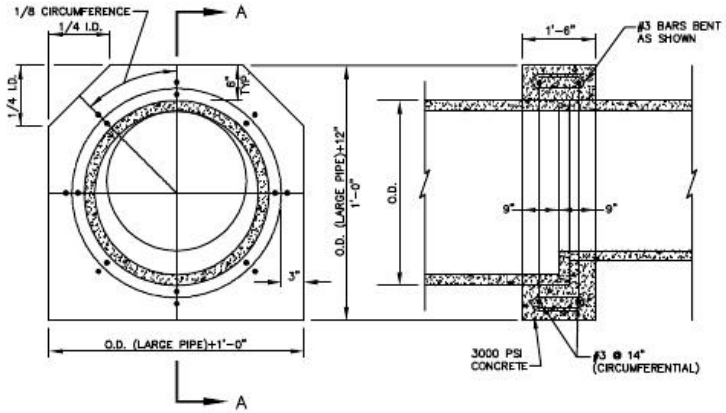
City of Benbrook

CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD-02



STORM DRAIN TRENCH EMBEDMENT & BACKFILL DETAIL

N.T.S.



CONCRETE COLLAR

N.T.S.

GENERAL NOTES:

1. ALL CONSTRUCTION MATERIALS, METHODS AND PLACEMENTS NOT DETAILED ABOVE SHALL MEET OR EXCEED THE STANDARD SPECIFICATIONS OF THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS UNLESS SUPERCEDED BY CITY OF BENBROOK STANDARD SPECIFICATIONS.

STORM DRAIN DETAILS

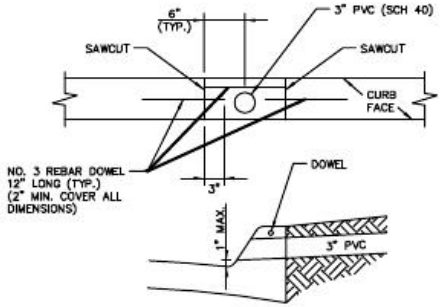
Sheet 4 of 4

City of Benbrook

CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD-02

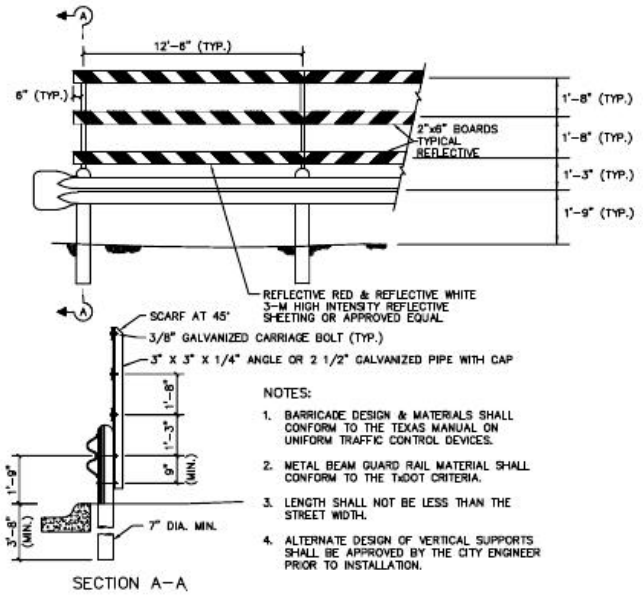
A. PREFERRED METHOD: A 3" HOLE MAY BE CORED THROUGH THE CURB WITH THE FLOW LINE OF THE CORE HOLE AT THE SAME LEVEL AS THE FLOW LINE OF THE GUTTER. A MINIMUM OF 2-3/4" OF UNDISTURBED CONCRETE CURB SHALL BE MAINTAINED ABOVE THE CORE HOLE. THE CORE HOLE SHALL BE SLEEVED WITH 3" O.D. SCHEDULE 40 PVC PIPE EXTENDING THROUGH THE HOLE TO THE FACE OF THE CURB. ANY VOIDS BETWEEN THE CORE HOLE AND THE PVC SLEEVE SHALL BE SEALED WITH SILICON SEALANT TO PREVENT INFILTRATION. IF THE PVC MUST BE SAWED LONGITUDINALLY TO BE INSERTED, THEN THE SAW JOINT MUST BE PLACED UPWARD.

B. ALTERNATE METHOD (ALLOWED ONLY UPON APPROVAL OF DIRECTOR OF COMMUNITY DEVELOPMENT): THE CURB MAY BE CLEANLY SAWED AND REMOVED TO THE GUTTER LINE AT LEAST SIX INCHES BEYOND EITHER SIDE OF THE PROPOSED PIPE. A 3" SCHEDULE 40 PVC PIPE SHALL BE PLACED WITH THE FLOW LINE OF THE PIPE AT THE SAME LEVEL AS THE FLOW LINE OF THE GUTTER. NUMBER 3 BARS SHALL BE DOWELLED INTO THE EXISTING CURB ON EITHER SIDE OF THE SAW CUT AND A #3 BAR PLACED IN THE CURB SECTION OVER THE PIPE. THE CURB SECTION SHALL BE REPOURED WITH 5-SACK, 3,000 LB. PSI CONCRETE AND TROWELLED TO MATCH THE EXISTING CURB.



TYPICAL FRENCH DRAIN CONNECTION TO CURB

N.T.S.



SECTION A-A

NOTES:

1. BARRICADE DESIGN & MATERIALS SHALL CONFORM TO THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
2. METAL BEAM GUARD RAIL MATERIAL SHALL CONFORM TO THE TxDOT CRITERIA.
3. LENGTH SHALL NOT BE LESS THAN THE STREET WIDTH.
4. ALTERNATE DESIGN OF VERTICAL SUPPORTS SHALL BE APPROVED BY THE CITY ENGINEER PRIOR TO INSTALLATION.

TYPICAL PERMANENT BARRICADE

N.T.S.

GENERAL NOTES:

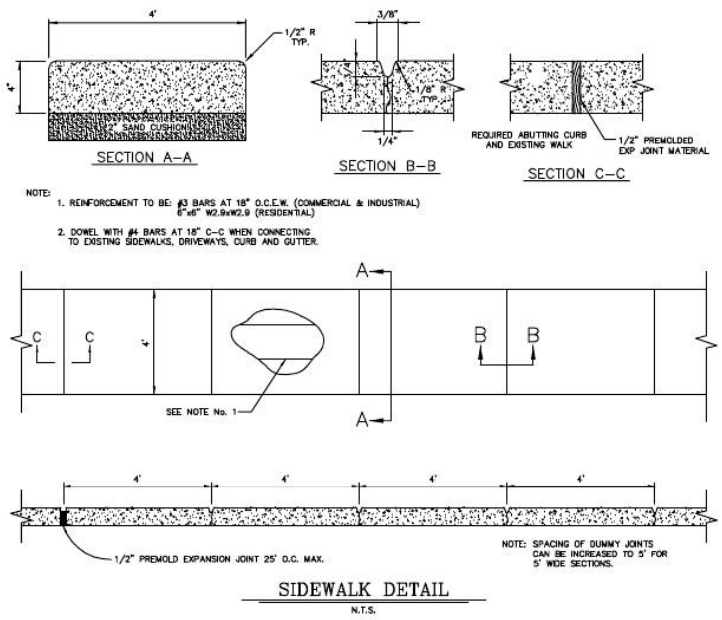
1. ALL CONSTRUCTION MATERIALS, METHODS AND PLACEMENTS NOT DETAILED ABOVE SHALL MEET OR EXCEED THE STANDARD SPECIFICATIONS OF THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS UNLESS SUPERCEDED BY CITY OF BENBROOK STANDARD SPECIFICATIONS.
2. IN NO CASE SHALL THE RAMP, OR THE FLARED SIDE SLOPES, BE STEEPER THAN 1" VERT. IN 12" HORIZ. (1:12).
3. PROVIDE ROUGH BROOM FINISH CROSS WAYS. SCORE 1/4" GROOVES 4" CC ACROSS RAMP.
4. ALL CONCRETE FLARED SURFACE (WHEELCHAIR RAMP WING OR CURB) SHALL BE COLORED WITH LITHOCHROME COLOR HARDENER OR EQUAL. A BRICK RED COLOR, A DRY-SHAKE HARDENER MANUFACTURED BY L.M. SCOFIELD COMPANY OR EQUAL, SHALL BE USED IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS. CONTRACTOR SHALL PROVIDE A COLORED SAMPLE CONCRETE PANEL OF ONE FOOT BY ONE FOOT BY THREE INCHES DIMENSION, OR OTHER DIMENSION APPROVED BY THE ENGINEER, MEETING THE AFOREMENTIONED SPECIFICATION. THE SAMPLE, UPON APPROVAL BY THE ENGINEER, SHALL BE THE ACCEPTABLE STANDARD TO BE APPLIED FOR ALL WHEELCHAIR CONSTRUCTION. THE METHOD OF APPLICATION SHALL BE BY SCREEN, SIFTER, SIEVE OR OTHER MEANS IN ORDER TO PROVIDE FOR A UNIFORM COLOR DISTRIBUTION. SURFACE COLORING SHALL BE SUBSIDIARY TO UNIT PRICE BID FOR THIS PAY ITEM.

MISCELLANEOUS DETAILS

Sheet 1 of 3

City of Benbrook

CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD-03



SIDEWALK DETAIL

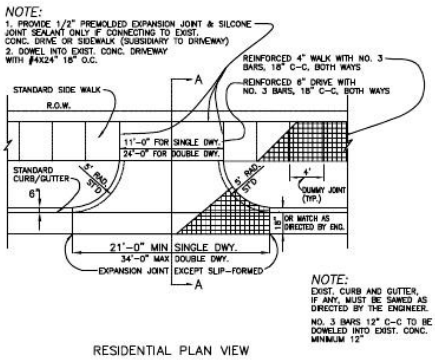
N.T.S.

MISCELLANEOUS DETAILS

Sheet 2 of 3

City of Benbrook

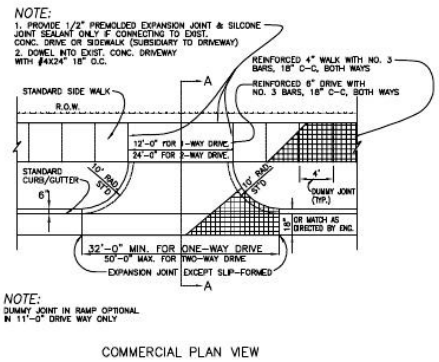
CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD-03



NOTE:
EXIST. CURB AND GUTTER, IF ANY, MUST BE SAWED AS DIRECTED BY THE ENGINEER.

NO. 3 BARS 12" C-C TO BE DOWELED INTO EXIST. CONC. MINIMUM 12"

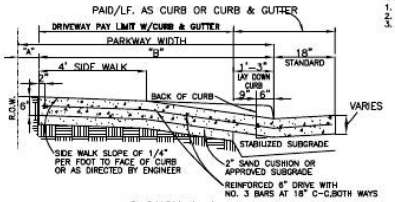
RESIDENTIAL PLAN VIEW



NOTE:
DUMMY JOINT IN RAMP OPTIONAL IN 11'-0" DRIVE WAY ONLY

COMMERCIAL PLAN VIEW

GENERAL NOTES:
1. FOR DEFORMED BAR SPLICES, LAP BARS 40 DIAMETERS AND TIE.
2. FOR DRIVE APPROACHES, AND WALK USE NO. 3 @ 18" C-C BOTH WAYS.
3. ALL HAND POURS IN THE STREET SHALL BE 6 SACK.



SECTION A-A

PARKWAY WIDTH	"A"	"B"
8'	1'	7'
10'	1'	9'
11',12',13',14'	2' TO 5'	9'
15',16',17',18',19'	3' TO 7'	12'
20',21',22'	5' TO 7'	15'

NOTE:
SIDEWALK SECTION THRU DRIVEWAY TO BE POURED SAME THICKNESS AS DRIVEWAY APPROACH AND PAID FOR AS DRIVEWAY APPROCH (EXIST. SIDEWALK, IF ANY, TO BE REMOVED & REPLACED)

DETAILS OF LAYDOWN CURB AND DRIVEWAY

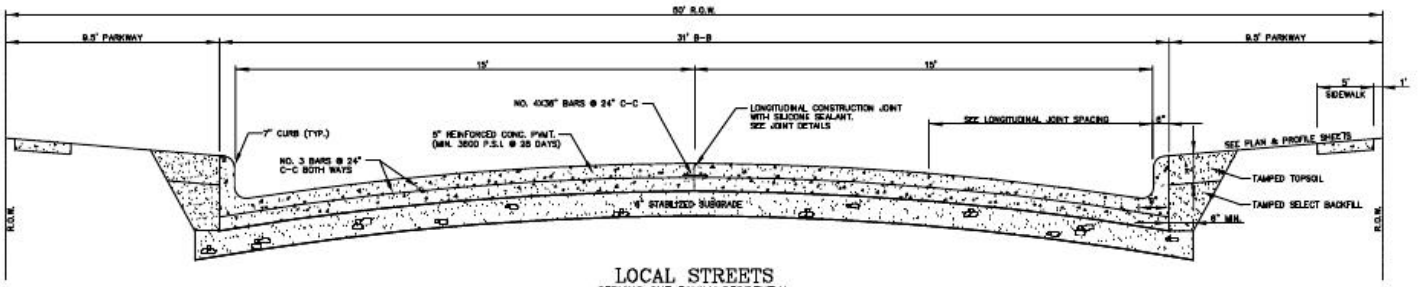
N.T.S.

MISCELLANEOUS DETAILS

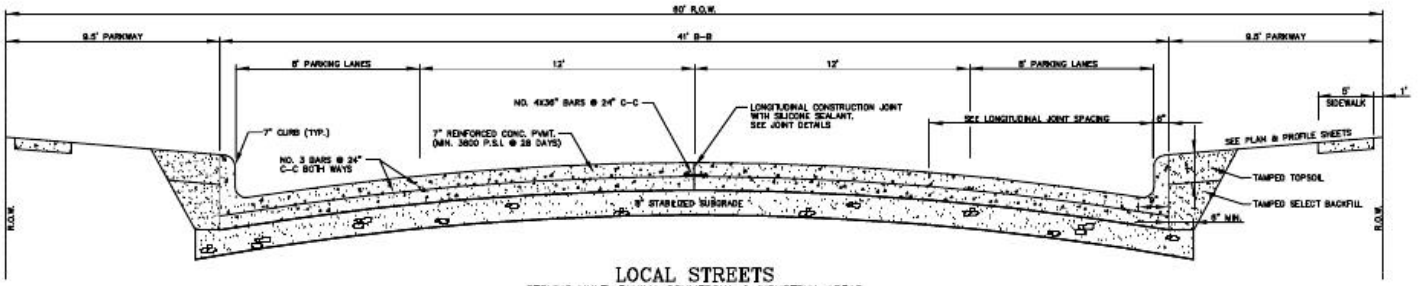
Sheet 3 of 3

City of Benbrook

CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD-03



LOCAL STREETS
SERVING ONE FAMILY RESIDENTIAL
N.T.S.
(6" PARABOLIC OR ROOFTOP CROWN)



LOCAL STREETS
SERVING MULTI-FAMILY, COMMERCIAL & INDUSTRIAL AREAS
N.T.S.
(6" PARABOLIC OR ROOFTOP CROWN)

NOTE: CONCRETE PAVING DETAILS SHEET TO SUPPLEMENT THIS SHEET

GENERAL NOTES:

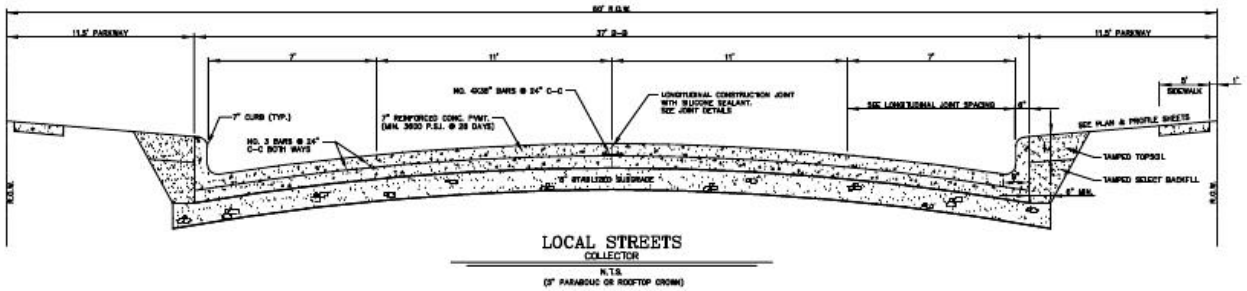
1. ALL CONSTRUCTION MATERIALS, METHODS AND PLACEMENTS NOT DETAILED ABOVE SHALL MEET OR EXCEED THE STANDARD SPECIFICATIONS OF THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS UNLESS SUPERCEDED BY CITY OF BENBROOK STANDARD SPECIFICATIONS.

TYPICAL ROADWAY SECTIONS

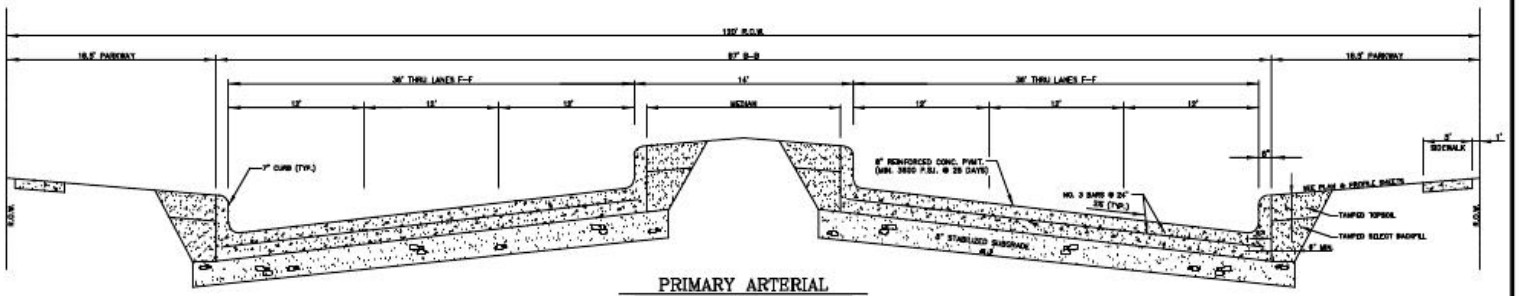
Sheet 1 of 3

City of Benbrook

CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD-04



LOCAL STREETS
COLLECTOR
N.T.S.
(5" PARABOLIC OR ROOFTOP CROWN)



PRIMARY ARTERIAL
N.T.S.

NOTE: CONCRETE PAVING DETAILS SHEET TO SUPPLEMENT THIS SHEET

GENERAL NOTES:

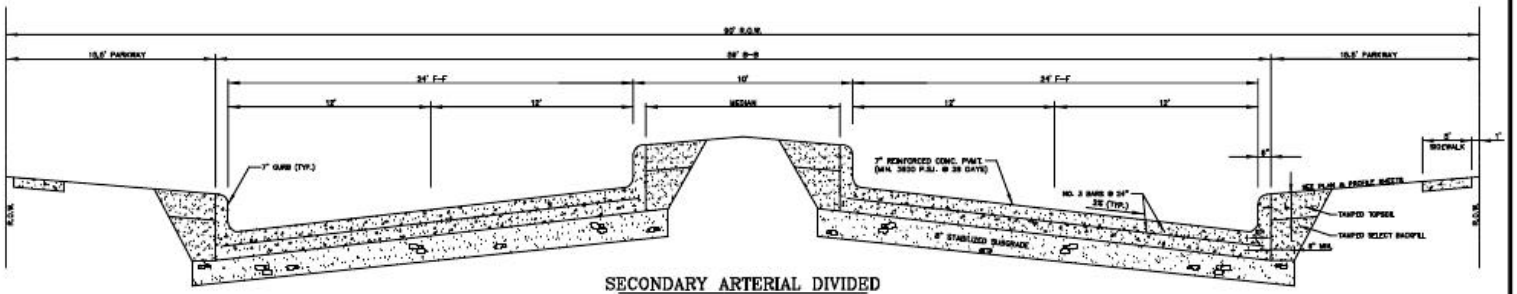
1. ALL CONSTRUCTION MATERIALS, METHODS AND PLACEMENTS NOT DETAILED ABOVE SHALL MEET OR EXCEED THE STANDARD SPECIFICATIONS OF THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS UNLESS SUPERCEDED BY CITY OF BENBROOK STANDARD SPECIFICATIONS.

TYPICAL ROADWAY SECTIONS

Sheet 2 of 3

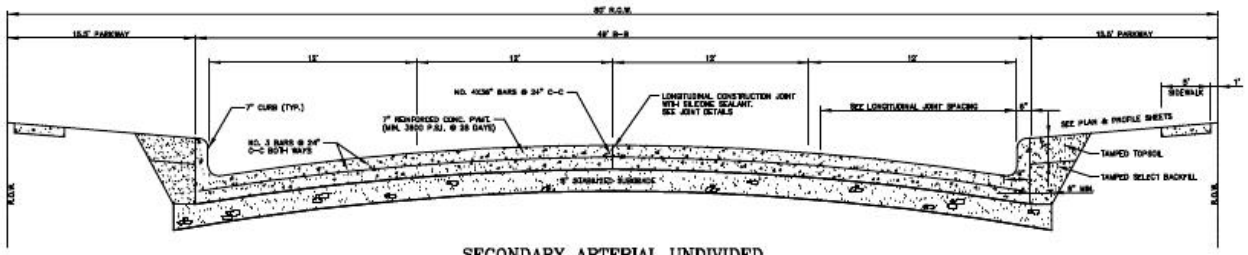
City of Benbrook

CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD-04



SECONDARY ARTERIAL DIVIDED

N.T.S.



SECONDARY ARTERIAL UNDIVIDED

N.T.S.

(2% PARABOLIC OR ROOFTOP CROWN)

NOTE: CONCRETE PAVING DETAILS SHEET TO SUPPLEMENT THIS SHEET

GENERAL NOTES:

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TYPICAL ROADWAY SECTIONS

Sheet 3 of 3

City of Benbrook

CITY OF BENBROOK	DATE: MAY 2009	SHEET NO. SD-04