

GENERAL DESIGN STANDARDS

CARROLTON TEXAS

Engineering Department

February, 2007

City of Carrollton

Engineering Department

GENERAL DESIGN STANDARDS

PART A

Procedural Guidelines

And

Amendments to the

North Central Texas Council of Governments

Standard Specifications

For

Public Works Construction

February, 2007

INDEX

Section		Page
1	Standard Engineering/Construction Procedures	1-1
2	Paving Improvements	2-1
3	Drainage Improvements	3-1
4	Water System Improvements	4-1
5	Sanitary Sewer Improvements	5-1
6	Right-of Way and Easement Management	6-1
7	Urban Design Standards	7-1
8	Screening Walls	8-1
9	Excavation Safety Requirements and Procedures	9-1
10	Testing Procedures for all Underground Utilities, Sub-grade Preparation and Pavement Construction	10-1
11	Traffic Signals, Signs & Street Lighting	11-1
12	Manual for the Design of Water and Sanitary Sewer Lines	12-1

These Guidelines, Amendments and Standard Details may also be obtained from the City of Carrollton website at:

<http://www.cityofcarrollton.com/development/engineering/gds/gds.shtml>

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4	Water System Improvements	4-1
5	Sanitary Sewer Improvements	5-1
6	Right-of Way and Easement Management	6-1
7	Urban Design Standards	7-1
8	Screening Walls	8-1
9	Excavation Safety Requirements and Procedures	9-1
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SECTION 1**STANDARD ENGINEERING/CONSTRUCTION PROCEDURES
ENGINEERING/CONSTRUCTION DEPARTMENT**

ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION AND THE CITY OF CARROLLTON GENERAL DESIGN STANDARDS.

A. Submitting plans for review:

1. Reports and calculations shall be submitted to demonstrate that capacity exists for the proposed development without adversely affecting current services. Submit two (2) copies of a professional engineering design report for additions or modifications to public infrastructure, including sanitary sewer, water and drainage systems. The design report shall include design calculations, monitoring data and computer simulations which demonstrate:
 - a. that the proposed design meets applicable federal, state and local regulations and standards, design criteria and system design assumptions;
 - b. that the design assumptions are consistent with existing data and assumptions from the city's infrastructure planning models;
 - c. the design meets requirements of the city's ordinances; and
 - d. that all relevant design criteria necessary to evaluate the impact of the proposed development on existing infrastructure has been included.

The acquisition of field data, including wastewater flow monitoring and water system pressure data, shall be at the expense of the developer. The report shall address sanitary sewer pipe sizing (including but not limited to wastewater contributions, pipe slope, pipe size and capacity), water distribution pipe sizing (including pipe size, velocity and pressure) and drainage improvements (including inlet and storm sewer pipe sizing, channel design and detention).

Pavement design shall be included in the design report and shall meet the requirements contained in Section 2.

2. Submit two (2) complete 24"x36", bound sets of blueline or blackline prints of the plans to the Engineering Department.
3. Resubmitting project plans for re-review **must** include the original and any subsequently submitted markups, which are to be retained by the Engineering Department.
4. The firm submitting (or resubmitting) project plans will be contacted when project plans are reviewed in entirety.

5. If proposed development abuts a major drainage channel or tributary, the developer will be assessed a fee not to exceed \$1,000.00 for the City's consulting engineer to verify the effect of the proposed development on the drainage within the channel or tributary. The fee also covers expenses to verify all hydraulic/hydrologic calculations associated with the development.
6. Once plans have been submitted for the initial review, the final plans must be approved within 180 days of the initial review date. After that time, a new submittal process begins and the plans will be required to comply with the most recently approved ordinances affecting developments. If construction of the approved plans has not begun within 180 days from the date of final plan approval, plans must be resubmitted for review and must comply with the most recently approved ordinances.

B. After submitted plans are approved for construction:

1. The Design Engineer is to:
 - a. Provide one (1) mylar sepia of the project cover sheet to be signed by the Director of Engineering or his representative. Once this drawing is signed it will be sent to the Design Engineer to produce copies of the drawings.
 - b. Supply ten (10) bound blue-line sets of prints to the Engineering Department for construction purposes. (Note: Designated number of sets of prints may vary.)
2. The General Contractor is to:
 - a. Furnish the drawings as required by Texas State Law HB 662 and HB 665 regarding the safety systems to be used during trench excavation (as stated in the Occupational Safety and Health Administration's Standards).
 - b. Supply one (1) copy of the accepted water, sanitary sewer, street paving, grading, screening fence and storm drainage construction contracts for the determination of Engineering/Construction inspections.
 - c. Notify the Engineering Department and submit qualifications of the proposed project superintendent for approval by the City.
 - d. Submit completed excavation and/or street cut permit request to the Engineering Department for approval.

NOTE: The work as authorized under the approved permit request shall begin within sixty (60) calendar days from the approval date. If work has not begun within this sixty (60) calendar days, the permit approval shall be voided.

C. Requirements and conditions prior to commencing construction:

1. Approval of all permits.
2. Have on file with the Engineering Department, the required construction and payment schedule. (For Municipal Projects only).
3. Fully executed pre-construction conference conducted by the Director of Engineering or a designated representative of the Engineering Department.

- a. To schedule a pre-construction conference, notify the Engineering Department two (2) working days in advance of the requested meeting date.
 - b. Inspection/Engineering fees [four percent (4%) of the total water, sanitary sewer, drainage, paving, grading and screening wall construction] must be paid prior to requesting a pre-construction date.
4. Two (2) copies of concrete mix designs (as determined by an approved independent laboratory or certified testing company) are to be submitted prior to paving for review by the Engineering Department. Possess on the project site one (1) copy of each approved construction permit pertaining to the project and at least one (1) copy each of the City of Carrollton General Design Standards and the North Central Texas Council of Government's Standard Specifications for Public Works Construction.
 5. Submit Shop Drawings of materials to be installed on the project including, but not limited to, pipe, valves, fire hydrants, reinforcing steel and pipe embedment.
 6. Notify the assigned Engineering/Construction Inspector two (2) working days prior to beginning any construction.
 7. Submit to the Engineering Department original unrecorded instrument or instruments for any additional Rights of Way or Easements dedicated to the City by separate instrument (legal description and an exhibit showing the metes and bounds on a plan view detail) on a form acceptable to the City along with a check made payable to the City of Carrollton for the applicable recording fee.
 8. A traffic control plan, signed, sealed, and dated by a registered Texas Professional Engineer, must be submitted to the Engineering Department prior to beginning construction. The plan must comply with the latest edition of the Texas Manual of Uniform Traffic Control Devices (TMUTCD).
 9. When working in City right-of-way, furnish one fully executed copy of the Indemnification Agreement, which form may be obtained from the Engineering Department; and a valid certificate of insurance showing coverage and limits as required by 53.11 of the Carrollton City Code.
 10. Submit to the Texas Department of Licensing and Regulation (TDLR), a set of plans and the required review and inspection fees. Provide proof to City that all fees have been paid and that all construction meets TDLR criteria.
 11. Storm Water Pollution Prevention Plans (SW3P):
 - a. For sites disturbing **5 or more acres** of land, an SW3P must be prepared and implemented before any land disturbance begins. The SW3P must be submitted to the City for review. In addition, a Notice of Intent (NOI) must be submitted to the Texas Commission on Environmental Quality (TCEQ) to obtain coverage under the TPDES Storm Water Permit for Construction Activities. TCEQ will also require the payment of permit fees. A copy of such NOI must be submitted to the City as proof

- of permit coverage. After construction has been completed and the site has achieved final stabilization and all temporary erosion and sediment controls have been removed, a Notice of Termination (NOT) must be submitted to TCEQ with a copy to the City.
- b. If the area of disturbance is between **1 and 5 acres**, an SW3P must be prepared and submitted to the City, but no NOI or fees are required by TCEQ; instead, a Construction Site Notice must be posted at the construction site, and copy of such Notice must be provided to the City.
 - c. If the area of disturbance is **less than 1 acre**, neither a plan nor a Notice are required, however, storm water pollution prevention measures must still be undertaken.

D. Requirements during construction:

1. Working hours:

- a. Weekdays 6:00 a.m. to 8:00 p.m., Saturday 8:00 a.m. to 7:00 p.m.

EXCEPTIONS:

- (1) Concrete work shall be scheduled so that all pouring and finishing shall be finished during standard daylight hours. When under emergency conditions, work that must be concluded under artificial lighting, lighting shall be erected and directed so that they shall not shine upon any residence or create a traffic visual hazard.
 - (2) Certain traffic congestion areas will require that modified standard work hours will be enforced where street blockage, traffic flow, channelization and/or flagmen are required. The contractor will be notified of these areas during the pre-construction conference.
 - (3) Lane closures in school zones or on streets other than residential streets will be limited to after 9:00 a.m. and before 3:00 p.m. unless prior approval is obtained from the Director. Arrow boards may be required by Director on lane closures, with all barricades, advanced warning signs and reflector cones placed according to the specifications contained in Part 6 of the Texas Manual on Uniform Traffic Control Devices.
- b. Saturday, City holidays, or off hours (Monday through Friday, before 7:30 am or after 4:30 pm), work shall be considered as overtime with inspection fees being charged accordingly. The charges will be at a rate of \$40.00 per hour (minimum two (2) hours). This will be paid in full before final acceptance of the project.

The Contractor will also be responsible for payment of overtime charges for Public Works staff for water or sanitary sewer services (valve shut downs, emergency repairs, etc.) before 7:30 a.m. and after 4:30 p.m. (Monday through Friday) and on Saturdays. The charges will be at a rate of \$50.00 per hour (minimum two (2) hours) plus equipment with a \$25.00 administrative fee. This will be paid in full before final acceptance of the project.

- c. Sunday work, other than emergency situations, is not allowed.

- d. Holiday workdays: The following holidays are to be observed and construction is not to be undertaken unless prior approval is received from the Director of Engineering.
 - 1) New Year's Day
 - 2) Memorial Day
 - 3) Independence Day
 - 4) Labor Day
 - 5) Thanksgiving Day and the following Friday
 - 6) Christmas Day

- 2. Possess at least one (1) copy of City of Carrollton General Design Standards on the project site and one copy of North Texas Council of Governments (NCTCOG) Specifications for Public Works Construction.

- 3. Each contractor or subcontractor must possess a stamped approved set of engineering plans pertaining to that contractor's phase of work at the project site.

- 4. One (1) copy of the pre-construction conference form must be in possession on the project for emergency contacts, and must include at least one (1) 24-hour project representative contact.

- 5. Portable Water Meters: if a contractor or City department, requires a portable fire hydrant water meter, arrangements are handled by the Utility Customer Service Division in City Hall at the Utility Customer Service payment counter. Guidelines for portable fire hydrant meters are covered in the Utility Customer Service Procedures. One (1) copy of the city water meter deposit receipt must be on file when construction of the project requires metered water. The City requires payment of a deposit of \$1,500 for each meter. A bill for water use is rendered each month.

Damages to these meters are the responsibility of the billed entity.

Fire hydrant meters for temporary water use at construction sites are routinely used to account for water usage prior to installation of a permanent water meter. These meters have a backflow prevention device attached. The City strongly recommends that the client support this device to prevent excessive torque when attached to a fire hydrant.

- 6. Sanitary facilities shall be provided on the project site and cleaned weekly.

- 7. Compliance with all city ordinances and state laws.

- 8. No tracked equipment will be allowed to be used on the streets of Carrollton. Vehicles with steel lugs and/or plates will not be allowed to be operated on the streets of the City of Carrollton. Where such machinery must be used for construction, the contractor shall use timbers, tires, or mounded earth over the paving surface to protect the pavement. Where such machinery must be loaded or unloaded from proper carrier vehicles, timbers, tires or mounded earth shall be used to protect paving and curbs. The general contractor

shall be responsible for any damage from operation of a tracked vehicle on his/her project with the damage being repaired to the satisfaction of the Engineering Department before acceptance of the project by the construction inspection department.

9. If any contractor is responsible for any damage to pavement, sod, or any other items in the vicinity of a project he is constructing, he shall be responsible for repairing or replacing the damaged items.
 10. No construction shall continue on property that is or becomes the subject of a city-initiated condemnation proceeding unless the construction is continued in conformance with approved engineering plans reflecting the post-condemnation condition of the property as set forth in the condemnation petition.
 11. All contractors working within City right-of-way must comply with the latest edition of the Texas Manual of Uniform Traffic Control Devices (TMUTCD).
- E. Requirements and conditions for final acceptance of the project by the City of Carrollton.
1. All sidewalks, sodding, seeding, screening fences and all required appurtenances must be constructed as required by the approved construction plans along with replacement of any traffic (lane divider) buttons and/or paving striping and any pavement damaged during construction activities before any final inspections can be scheduled. Grass coverage must be at least 95% before any project is considered complete. Final inspection of construction will be performed by each city department affected and all necessary corrections re-inspected.
 2. All fees and assessments due the City of Carrollton must be paid in full, inclusive but not necessarily conclusive of the following:
 - a. Water bacteriological testing fees.
 - b. Construction inspection fees.
 - c. Construction inspection overtime fees.
 - d. Park pro-rata fees.
 - e. Metered city water fees.
 - f. Sign/traffic button fees (if applicable).
 - g. Microfiche reproduction fees.(All School Districts within the City of Carrollton are exempt from paying construction inspection fees to the City)
 3. Original two-year maintenance bond(s) shall be furnished on the insuring company's form and shall be for be one hundred percent (100%) of the total project contract amount. The bond shall be dated to begin from the date of the acceptance of the project by the City. Maintenance bonds shall come from an approved surety company holding a permit from the State of Texas to act as surety and acceptable according to the latest list of companies holding certificates of approval from the State Board of Insurance under 7.19-1 of the Texas Insurance Code.

4. "Record Drawings": The contractor shall be responsible for providing "Record Drawings" to the Engineer for the Project. The Engineer will make the required corrections and submit the "Record Drawings" to the City of Carrollton Engineering Department. "Record Drawings" shall be 24" x 36" in size and shall consist of one (1) mylar sepia, three (3) mils in thickness or greater, and three (3) blue-line or blackline prints printed from said submitted mylar sepia. All information on the submitted mylar sepia prints shall be legible. The developer will be charged \$2.00 per sheet of approved Engineering plans for scanning the documents.

The developer will also be required to submit plans in Computer Aided Design (CAD) format. A copy of the plat, water, sanitary sewer, and storm sewer systems will be submitted in at least AutoCAD 2000 format. Raster files and other file formats are not acceptable.

If the design work was not produced in CAD format it will be the responsibility of the developer to have the appropriate drawings from the Record Drawings scanned and converted into "CAD Perfect" files. These files shall be provided in at least AutoCAD 2000 drawing (DWG) format only.

All files will be submitted on 3½" high-density diskettes in MS-DOS format, or CD-ROM in CD-R format. Final acceptance of CAD files will be at the approval of the Engineering Department.

5. Perimeter Markers or Monuments shall set per Article XI.C.1 of the Comprehensive Subdivision ordinance in accordance with Detail M-2.

F. Repairs and adjustments necessitated during the effective maintenance bond period.

1. Repairs or adjustments shall commence within ten (10) calendar days following notification from the Engineering Department.*
2. *Emergency situations shall be responded to immediately. City Forces will make repairs in emergency situations if the contractor cannot respond in an acceptable period of time. The Contractor/Bonding company will be charged for all costs associated with such repairs made by the City Forces in accordance with the City Fee Ordinance.
3. Repairs or adjustments will be inspected, and inspection overtime provisions will apply, if required.
4. Repairs or adjustments will meet the specifications in force during the initial construction period.

SECTION 2**PAVING IMPROVEMENTS**

ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION AND THE CITY OF CARROLLTON GENERAL DESIGN STANDARDS.

A. Soil Conditions and Paving Design:

1. The developer shall employ the services of a Texas registered and qualified geotechnical engineer and laboratory that shall stipulate in his/her report the recommended subgrade preparation and minimum pavement thickness. Recommendations shall be based on a minimum of one test bore per every two acres. The project area shall also be tested at least every 500 feet along the roadway length for the presence of sulfates. If sulfates are found, the report shall address options for paving design and construction. This report must be submitted at least two weeks prior to starting paving operations.
2. The design engineer, upon submitting plans for review, shall submit a copy of the geotechnical report and a statement that the pavement design is based on the findings of the geotechnical report. The pavement design shall in no case be less than that minimum as required by the City of Carrollton General Design Standards, and shall be based on a 30-year design life.

B. Excavation (NCTCOG Item 3.1 through Item 3.7):

1. Excavation within the paving right-of-way shall be performed full width in accordance with the improvements to be constructed.
2. Borrow materials shall be free from all foreign materials such as tree stumps, roots, grass or organic materials.

C. Subgrade Treatments (NCTCOG Item 4.6):

1. All pavement subgrade within designated right-of-ways shall be treated with hydrated lime slurry (dry lime placement shall not be allowed) to one foot beyond the edge of pavement. The amount of hydrated lime slurry shall be that which reduces the plasticity index of the treated soil to below 15. The minimum application shall be 30 lbs/SY. Remixing shall be performed three (3) days after the initial application. The contractor shall require a soils testing laboratory suitable to perform lime series testing to determine the amount of lime slurry needed for each soil encountered. *If paving operations haven't started within 72 hours after liming or testing, the subgrade shall be reworked and retested as required by the specifications.*

D. Concrete Pavement:

All concrete for paving of streets, alleys, and fire lanes shall meet or exceed the following minimum requirements for workability, strengths, and finish.

1. All sampling and testing of materials shall be in accordance with applicable ASTM test procedures and paid for by the contractor unless otherwise specified.
2. All concrete design mixes shall be generated by a certified laboratory. Concrete design mixes used successfully on recent projects that meet the specifications for use may be reviewed by a certified laboratory providing current testing data is available, as approved by the Engineering Department.
3. All concrete street paving design mixes shall have a minimum cement content of six (6) sacks per cubic yard. Flyash substitution of twenty (20) percent or less of cement content by weight may be approved on a specific project basis by the Director of Engineering if not specified in the project plans or contract. Concrete for all street surfaces constructed by handwork shall have a minimum cement content of six and one half (6-1/2) sacks per cubic yard. Concrete for sidewalks shall have a minimum cement content of five (5) sacks per cubic yard.
4. All concrete for paving shall be air entrained with a total air content of five (5) percent plus or minus one (1) percent. The use of air entraining admixtures shall conform to ASTM Designation C-260.
5. All concrete for paving shall include the use of water reducing admixtures conforming to ASTM Designation C-494, Types, A, D, F, and G.
6. All concrete for street paving shall be designed to meet or exceed a compressive strength requirement of 4,000 p.s.i. (or 4,500 p.s.i. for 6-1/2 sacks) at 28 days as per ASTM standard testing procedures. Sidewalks shall be designed to meet or exceed a compressive strength requirement of 3,000 p.s.i. at 28 days as per ASTM standard testing procedures. Maximum slump shall be 3 inches.
7. Placement of concrete shall meet the following requirements:
 - a. Mechanically placed concrete pavement shall be vibrated by machine.
 - b. Vibratory Screed placement shall be hand vibrated in front of the screed.
 - c. Hand pours shall be vibrated by hand vibrators.
8. Minimum Thickness of Concrete Pavement*:

a. Alleys	6 inches
b. Residential	6 inches
c. Residential Collector (C2U)	7 inches
d. Local Industrial	8 inches
e. Major Collector (C4U)	8 inches
f. Minor Arterial (A4D)	8 inches
g. Major Arterial (A6D)	8 inches
h. Major Arterial (A8D)	8 inches

*Contractor may pour an additional two inches of concrete over emulsified asphalt in lieu of lime treated subgrade provided it is approved by a geotechnical report from a certified laboratory and the Director of Engineering. For new street construction, a Type SS-1,

MS-2, MC-30 or SC-30 emulsion shall be applied to the subgrade at a rate of 0.15 gal/SY.

If sulfates are found in the project area, a Type SS-1, MS-2, MC-30 or SC-30 emulsion shall be applied to the subgrade at a rate of 0.15 gal/SY. In addition, Type I / II (sulfate resistant) cement with Class F flyash with a low water to cement ratio shall be used in the concrete mix or an alternate paving design may be submitted for approval.

9. The maximum time interval between the addition of cement to the batch, and the placing of concrete in the forms shall not exceed the following.

Air or Concrete Temperature (Whichever is Higher)	Maximum Time (Addition of Water or Cement to Placing in Forms)
Non-Agitated Concrete	
Over 80° F	15 Minutes
35° F to 79° F	30 Minutes
Agitated Concrete	
*90° F	45 Minutes
75° F to 89° F	60 Minutes
35° F to 74° F	90 Minutes

The use of an approved retarding agent in the concrete will permit the extension of each of the above temperature-time maximums by 30 minutes for bridge decks, top slabs of direct traffic culverts and cased drilled shafts, and one hour for all other concrete except that the maximum time shall not exceed 30 minutes for non-agitated concrete. *The temperature for all concrete shall not exceed ninety-five degrees (95°) Fahrenheit. Any concrete exceeding this condition will be rejected.

10. Cold Weather Concrete Placement:
 - 35° F and Rising – Okay to place
 - 40° F and Falling – Concrete pours must stop
11. New Lanes: The finish for new turn lane additions shall match the adjacent pavement finish.

E. Reinforcing:

1. The minimum reinforcing bar for all fire lanes and concrete paving within the City right-of-way shall be #3 bars and shall conform to ASTM Designation A615, with the spacing to be a maximum of eighteen (18) inches on center in each direction.

Exception: Alley paving will use an asymmetric reinforcing spacing. See Standard Detail P-6.

2. All reinforcing shall be supported on bar chairs or supports designed for the specific purpose of reinforcement support.
3. All placement of reinforcing shall be in a good workmanlike manner and shall conform to current C.R.S.I. standards. All bars, laps, and splices shall be secured with wire ties at 50% of mat steel and 100% at all ends. All reinforcing in concrete which is in contact with the ground shall have a minimum clearance of three (3) inches and two (2) inches from any formed surface. All dimensions are clear dimensions. In no case shall the reinforcing mat clearance exceed "T" (thickness) divided by 3.
4. Only new billet steel will be acceptable for field bending, and rust or oil contamination will be cause for rejection.

F. Final Grading:

After all concrete work has been completed; final grading will be complete to elevations established on the approved engineering plans. The area behind the back of curb shall be backfilled and compacted within 48 hours after placing concrete. The contractor shall sod all areas behind the back of curb and the right-of-way line on all major thoroughfares and collectors. The Contractor shall make the necessary arrangements to provide water to get the sod established. Any landscaping and irrigation system within the City medians and right-of-ways that are disturbed, removed, or damaged during construction shall be replaced to original condition or better.

G. Designated Fire Lanes:

1. A twenty-four (24) foot clear width lane shall be paved in accordance with the concrete pavement specifications. All fire lanes shall have a minimum inside radius of 20 feet and a maximum outside radius of 50 feet. All street approaches to fire lanes shall have a minimum radius of 20 feet. Thickness shall be seven (7) inches minimum. The subgrade shall be scarified to a depth of at least two (2) inches and compacted to ninety-five (95) percent of maximum density.
2. The maximum algebraic grade differential in percent, for fire lanes when vertical curves are not required shall be 10% for crests and 5% for sags.
3. Fire lane pavement shall be marked with the appropriate striping and the following designation:
 - a. Six (6) inch wide red stripe with four (4) inch high white letters stating "FIRE LANE – NO PARKING" or "NO PARKING – FIRE LANE" at fifteen (15) foot spacings. See Standard Details for details.

H. Commercial, Industrial and/or Multi-Family Parking Areas:

See Subsection N, Minimum Paving Classes, for details.

I. Jointing of Concrete Surfaces, Sawing, and Sealing:

1. The placement of concrete for paving shall be in accordance with the standard detail drawings, unless otherwise detailed on the approved project plans.
2. All construction joints shall run parallel to the driving lanes (all concrete placements shall end in an expansion joint or street header).

3. Expansion joints shall be installed a maximum distance of two hundred (200) feet apart, and at intersection radii and tie-ins to existing pavement. Expansion joints shall be as per standard details, full depth, and full width of the pavement cross section, and shall be perpendicular to the grade. Expansion joint materials shall be redwood strips with approved joint sealing compound and shall be free of open knots, splinters, or breaks.
4. Transverse and longitudinal sawn contraction joints shall be as in the standard detail drawings, and shall be performed within five to twelve hours following the placement of concrete.
5. Sealing of concrete pavement with hot poured rubber joint sealing compound shall be performed immediately following the cleaning of joints, and shall be performed prior to opening the pavement to any traffic.

J. Quality of Workmanship and Materials:

1. Straight edged with a ten foot finishing tool prior to applying the final finish. The final finish shall consist of a rough broom (baker broom or Astroturf) finish parallel with curb line. Inconsistent finish is grounds for removal. Finishing of the surface shall be performed without added water. The application of an acceptable curing compound (white in color) or wet curing process shall begin immediately following the dissipation of surface sheen, or in accordance with the manufacturer's recommendations. A tine broom finish will be acceptable on major thoroughfares.
2. Random drying shrinkage cracks or stress cracks of any nature in recently placed portland cement concrete pavement, sidewalks or slabs on grade are unacceptable and are subject to being removed and replaced at the discretion of the Director of Engineering at no additional cost to the City of Carrollton. Depending on the nature and amount of the cracking, cracks at the completion of the project may be route and sealed. Generally, this will apply to panels with one crack. When portland cement concrete pavement or slabs on grade must be removed and replaced, the area of removal will include the full panel.

K. Testing Procedures:

See detailed testing procedures in the Testing Section.

L. Variance to Location of Median Openings:

The Planning & Zoning Commission may consider variances to the median opening standards. These variances may be considered under the following conditions.

1. Conditions where a physical impossibility prevents use of the median opening at its required location, and
2. The applicant can demonstrate that safety, based on the proper design speed of the roadway, is not compromised.

Financial hardship shall not constitute physical impossibility. For those median openings located away from major intersections, safe design and the speeds along the given street segment shall be considered as a major part of the Commission's deliberations. Use of directional islands, elimination of turn lanes and left turn prohibitions and other reasonable restrictions related to the requested variance, may be required.

It is the intent of the City Council that variations of more than 25% on internal median openings or 15% at major intersections may not be finally decided by the Planning & Zoning Commission. The Commission shall make a recommendation to the City Council, which shall render a final decision. Planning & Zoning Commission decisions on variations of less than 25% on internal median openings or less than 15% at major intersections shall be final and not subject to City Council review.

If, after applying all of the foregoing standards and utilizing the applicable foregoing variations, the applicant can demonstrate that a materially adverse impact on its development is still in effect, the Planning & Zoning Commission may consider recommending to the City Council a variance greater than the 15%-25% mentioned above. A favorable recommendation by the Planning & Zoning Commission shall be referred to City Council for final approval by majority vote. A recommendation of denial by the Planning & Zoning Commission shall also be referred to City Council and shall require a three-quarters (75%) vote of the City Council to approve.

M. Deceleration Lane Requirements

1. A right-turn deceleration lane at a private driveway will be required to be constructed for new developments and re-developments along major collector streets (C4U) or major arterial streets (A4D or larger), as designated on the Transportation Plan. For any other development, the need for a right-turn deceleration lane will be determined at the time of development.
2. Deceleration lengths of right-turn bays will be determined based on the land use and intensity of development, as determined by the following table:

Land Use & Density Deceleration Length

Apartment (per dwelling unit)

Less than 25	None required
26 to 300	100 feet
301 to 500	150 feet
501 to 700	200 feet
Greater than 700	As approved by Traffic Engineer

General Retail (GLA sq. ft.)

Less than 15,000	None required
15,001 to 25,000	100 feet
25,001 to 50,000	150 feet
50,001 to 75,000	200 feet
Greater than 75,000	As approved by Traffic Engineer

Office (GFA sq. ft.)

Less than 40,000	None required
40,001 to 60,000	100 feet
60,001 to 100,000	150 feet
100,001 to 150,000	200 feet
Greater than 150,000	As approved by Traffic Engineer

For land uses not listed herein, the required deceleration length shall be determined using the trip generation rate of the use and comparing the number of trips generated with the uses listed above. Trip rates shall be based on the latest edition of I.T.E.'s Trip Generation Manual.

3. Taper lengths for deceleration lanes shall be based on the travel speed of the adjacent street, as determined by the following table:

Design Speed (mph)	Length (feet)
30	100
40	120
50	150

4. An additional 10 feet of right-of-way and appropriate taper will be required to accommodate deceleration lanes at private driveways.
5. Variances or waivers to the deceleration lane requirements may be considered by the Planning & Zoning Commission. A variance or waiver may be considered under the following conditions:
 - a. Conditions where a physical impossibility prevents the placement of a deceleration lane as required at a specific location, and
 - b. It can be demonstrated by the applicant that safety is not being compromised by reducing or eliminating the deceleration lane.

Financial hardship shall not constitute physical impossibility.

N. Signs and Sign Posts

1. Signs: All traffic signs must conform to the design and installation standards of the Texas Manual on Uniform Traffic Control Devices. Sign sheeting shall be equivalent to 3M Diamond Grade sheeting or ASTM Proposed Type 11 sheeting.
2. Posts:
 - a. Material: Steel posts shall conform to the standard specifications for cold rolled carbon sheet steel, commercial quality ATSM -446
 - b. Shape: The cross section of the post shall be square or rectangular tube formed of 12 gauge (.105" USS gauge) steel, carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding and externally scarfed to agree with corner radii.
 - c. Cross Section: Posts shall be 2"x 2" unless agreed upon by the City of Carrollton Traffic Department.
 - d. Holes: Holes shall be seven-sixteenths plus or minus one sixty fourth inches diameter on one (1) inch centers, on all four sides for the entire length of the post. On square tubing, holes shall be on the centerline of each side in true alignment and opposite to each other directly and diagonally. On rectangular tubing, holes shall be on the narrow side only.

O. Roadway Requirements

Type of Street (Thoroughfare Class)	No. of Traffic Lanes	Lane Width (Feet)	R.O.W. Width (Feet)	Pvmt. Width (F-F of Curb) (Feet)	Design Speed (MPH)		Min. Grade (%)	Max. Grade (%)	Min. Centerline Radius For Horizontal Curves With No Superlevation (Feet)		Vertical Clearance (Feet)	Lateral Clearance (Feet)	Min. Length of Vertical Curves (Feet)		Min. Paving Thickness (Inches) (Note 6)	Paving Crown Height (Inches)
					1	2			1	2			1	2		
Alleys	N/A	N/A	20*	12*	N/A	N/A	0.8	14	N/A	N/A	15	6	N/A	N/A	6	
Residential	2	12	50	30	25	20	0.8	10	250	200	15	6	A x 20	A x 15	6	5" Parabolic
Residential Divided	2	19	70	19-19	25	20	0.8	10	250	200	15	6	A x 20	A x 15	7	6" Parabolic
Residential Special*	2	12	60	36	25	20	0.8	10	250	200	15	6	A x 20	A x 15	7	6" Parabolic
Local Industrial	2	12	60	36	30	25	0.8	8	350	275	15	6	A x 30	A x 20	8	6" Parabolic
2-Lane Divided Collector (Class C2D)	2	19	70	19-19	30	25	0.8	8	350	275	15	6	A x 30	A x 20	7	6" Parabolic
2-Lane Undivided Collector (Class C2U)	2	12	60	36	30	25	0.8	8	350	275	15	6	A x 30	A x 20	7	6" Parabolic
4-Lane Undivided Major Coll. (Class C4U)	4	12	70	44	35		0.8	7	600		16.5	6	A x 50		8	1/4" per foot Inside to Outside
4-Lane Divided Arterial (Class A4D)	4	12	90	24-24	45		0.8	6	1000		16.5	6	A x 120		8	1/4" per foot Inside to Outside
6-Lane Divided Arterial (Class A6D)			100												8	1/4" per foot Inside to Outside
6-Lane Divided Arterial (Class A6D)	6	12	120	36-36	50		0.8	6	1000		16.5	6	A x 160	A x 110	8	1/4" per foot Inside to Outside
6-Lane Divided Art. W/Limited Access (Class A6DL)	8	12	150	36-36	50		0.8	6	1000		16.5	6	A x 160	A x 110	8	1/4" per foot Inside to Outside
8-Lane Divided Arterial (Class A8D)	8	12	150	48-48	50		0.8	6	1000		16.5	6	A x 160	A x 110	8	1/4" per foot Inside to Outside

All Values To Be Determined By Director of Engineering At Time of Submittal

- Notes:
- (1) Use Column 1 for ordinary terrain having average grades from 0 to 8 percent slopes.
 - (2) Use Column 2 for rolling terrain having average grades over 8 percent slopes.
 - (3) The maximum grade within 30 feet of a major thoroughfare shall be 3 percent.
 - (4) The maximum grade within 30 feet of the intersection of a residential or collector street shall be 5 percent.
 - (5) The sum "A" is the algebraic difference in grades, in percent.
 - (6) Minimum length of vertical curve shall be 3 times the design speed.
 - (7) Minimum reinforcing for all concrete pavement shall be #3 bars @ 18" on center each way. Subgrade shall be lime stabilized a min. depth of 6" until the P.I. < 15.
- * Residential street adjacent to public or private school or public park.

P. Minimum Paving Classes	<u>1 & 2 Family</u>	<u>Non-Residential & Multifamily</u>
Motor Vehicle Parking, Maneuvering, Storage, Display, Staging, Etc. ^V	3 ^I	7 ^{II}
Temporary Motor Vehicle Parking Longer Than 6 weeks ^{III}	2	2
Temporary Motor Vehicle Parking Less Than 6 weeks ^{III}	1	1
Fire Lanes, Permanent	N/A	9
Fire Lanes, Temporary	N/A	7
Driveway, ROW	10	10
Sidewalks, ROW or Easement ^{IV}	4	4
Driveway, Private Property	3 ^I	7
Sidewalks, Private Property	1	1

PAVING CLASS DESIGNATIONS (SEE DETAIL SHEETS):

1. No Minimum
2. Two-(2) inch gravel minimum.
3. Concrete 4” thick 3000 psi with #3 bars 18” O.C.
4. 4” thick 3000 psi, concrete minimum, 3-#3 longitudinal reinforcement bars and #3 transverse bars @ 18” O.C. Jointing and spacing per detail sheet.
5. Asphalt 3” type “B” Base + 1” type “D” surface.
6. Reserved.
7. Asphalt 5” type “B” Base + 1” type “D” surface.
8. Concrete 5” thick 3000 psi with #3 bars 18” O.C.
9. Concrete 7” thick 4000 psi with #3 bars 18” O.C..
10. Concrete shall match existing street thickness (minimum 7” thick) 4000 psi (comp) #3 bars 18” O.C.

GENERAL NOTES:

- A. Subgrade under all paving classes shall be compacted to 95% of maximum density per ASTM D698.
- B. Alternate designs may be approved by the Engineering Department based on soil reports & analysis by a Texas registered engineer.

FOOTNOTES:

- I. For 1 & 2 family lots greater than 20,000 SF and with driveways longer than 40’ and with existing unpaved parking areas: Gravel four(4) inches thick minimum with 2”x4” treated wood border anchored once every five (5) feet. Additional off street parking paving class must be equivalent to the paving class that exists for required parking.
- II. In the (FWY) Freeway District, see article XVI Section K(1)(b) of the Comprehensive Zoning Ordinance.
- III. For authorized construction office trailers, real estate sales, Christmas tree lots and snow cone stands.
- IV. Concrete paving classes No. 4 or higher only.
- V. Interim uses as authorized by the Comprehensive Zoning Ordinance may be paving class #2.

SECTION 3**DRAINAGE IMPROVEMENTS**

ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION AND THE CITY OF CARROLLTON GENERAL DESIGN STANDARDS.

A. Design Criteria:

1. Design shall be in accordance with the City of Carrollton's *Stormwater and Flood Protection Ordinance*, December, 2000, Ordinance No. 2581.
 - a. Pipe Sizes:
 - (1) Mains: Mains are to be sized for full flow using Mannings Equation.
 - (2) Laterals: Minimum sizes of laterals shall be 18-inches for eight foot inlets and 21-inches for ten foot or larger and all drop inlets. Engineer will verify flow capacity of all lateral lines.
 - b. Velocities: Minimum velocities in conduits shall be 2.5 feet per second. Maximum velocities shall not exceed the permitted velocity of the receiving channel or conduit at the outfall as stated in the *Stormwater and Flood Protection Ordinance*.

B. Materials:

1. Reinforced Concrete (RCP) Pipe:
 - a. Pipe: Pipe shall conform to the following ASTM Designations.
 - (1) Circular Pipe ASTM Designation C76; Wall "B".
 - (2) Arch Pipe ASTM Designation C506.
 - (3) Elliptical Pipe ASTM Designation C507.
2. Fittings: The design and manufacture of all special fittings shall be governed by the same requirements as the connecting pipe.
3. Joint Materials:
 - a. Gasket Material: ASTM C443. The polymer shall be synthetic rubber; natural rubber will not be acceptable.
 - b. Flexible Joint Sealant: Preformed butyl rubber sealant; Hamilton-Kent "Kent-Seal No. 2", Press-Seal, Gasket "E-Z Stik", or K.T. Snyder "RUB'R-NEK".
 - c. Mastic: Trowel grade sewer sealing compound; J.P. Petroleum Products "Tex-Mastic 726" or Grahn "Anchor-Tite Plastic Mastic".
 - d. Joints: Joints shall conform to ASTM Designation C76 and shall be suitable for the joint sealing material to be used. Joints with flexible sealant shall be positioned in accordance with the manufacturers recommended adhesive, and the joint sealant shall be positioned in accordance with the manufacturer's installation instructions. Joints shall be pulled together with sufficient force to uniformly fill and seal the annular

- space in the joint. The application of mastic to the inside to the joint will not be considered to be acceptable joint sealing practice. Joints shall not be made when adverse weather conditions may prevent proper sealing, nor when the temperature of the pipe and sealing materials is too low to achieve proper sealing.
- e. Lift Holes: Lift holes will be allowed if they are precast into the pipe wall. All lift holes shall be plugged with precast concrete plugs and shall be sealed with elastic joint compound.
- 4. Cause for rejection of delivered pipe and fittings. Broken pipe joints where the sealant is exposed on the spigot end of the last laid pipe joint will be cause for rejection.
- C. Offsite Installation:
- 1. All relative specifications for storm drain improvement materials shall apply to offsite installations.
 - 2. Installation: As per approved drawings and specification. Any landscaping and irrigation system within the City medians and right-of-ways that are disturbed, removed, or damaged during construction shall be replaced to original condition or better.
 - 3. Manhole Markers: The contractor shall, at the direction of the Engineering Department or his appointed representatives, furnish and install two manhole markers at each off-site manhole as per Standard Detail Drawing S-15.
- D. Excavation:
- 1. Excavation in general, shall be made in open cut from the surface of the ground and shall be no greater in width and depth than is necessary to permit the proper construction of the work. When the trench depth exceeds five (5) feet in depth, see Excavation Safety Section regarding “trench safety” requirements. The amount of trench excavation to grade shall not exceed 100 feet from the end of the pipe laying operations and no excavation shall be 300 feet in advance of the completed pipe operations (including backfilling). At the end of the workday, all trench excavations shall be backfilled.
- E. Installation:
- 1. Bedding: A compacted crushed stone or pea gravel cushion, three (3) inches minimum in thickness, shall be required on the trench bottom unless otherwise stated on the project plans. (See Standard Detail D-4)
 - 2. Embedment: All installations shall conform to the latest NCTCOG Specifications, (as amended by the City of Carrollton) and as detailed under “Embedment Details”.
 - 3. Backfill Compaction:
 - a. Mechanical Method: Compaction and consolidation of the backfill materials shall meet NCTCOG Specification Item 6.2.9. Trenches shall be backfilled using the native material and compacted to 95 percent of maximum density in six (6) inch lifts at optimum moisture content (to plus 4 percent above optimum moisture content) in

areas influenced by vehicular traffic and in ten (10) inch lifts in areas not subjected to or influenced by vehicular traffic.

- b. Water Jetting Method: Water jetting will not be allowed for any trench within the existing or proposed right-of-way. During jetting operations, jets must be used at close intervals along the trench in such a manner that sufficient water to lubricate and consolidate the fill reaches all parts of the backfill, and all of the backfill material is saturated. The jet pipe should be kept at least two (2) feet away from the pipeline to prevent the eroding of the embedment. Only that amount of water should be used which is necessary to consolidate the backfill. The jet ordinarily will consist of a pipe to which a two-inch diameter hose is attached at its upper end, utilizing conventional pipe fittings or swivel fittings. The jet pipe should be not less than 1-1/2 inch steel pipe and its length should be approximately two feet shorter than the depth of the lift of backfill to be compacted. It should be used with a continuous supply of water with a pressure sufficient to cause backfill displacement.

F. Miscellaneous Appurtenances:

1. Manholes:

- a. Manholes shall be rectangular and as shown in the City of Carrollton Standard Details and constructed of 4,000 psi concrete.
- b. Manholes shall be spaced at a maximum of 500 feet apart and shall be accessible to City vehicles.
- c. Any connections to existing manholes shall be core drilled.

2. Storm Drainage Curb Inlets: The size of drainage inlets shall be as shown in the approved engineering plans. Curb inlets shall be a minimum of 8 feet in length. The type of inlet shall be as follows:

- a. For secondary and major street sections, a recessed type of inlet is to be used.
- b. For industrial and residential streets, a curb line inlet is to be used, unless otherwise approved by the Engineering Department.
- c. Inlets shall be constructed of 4,000 psi concrete.
- d. Precast inlets shall not be installed in the City of Carrollton.

3. Storm Drainage Inlet and Junction Boxes:

- a. The size and type of drainage inlet or junction box shall be as shown on the approved engineering plans in accordance with the city of Carrollton Standard Details.
- b. Inlets over four-feet deep shall be constructed with steps starting 18 inches above the floor spaced at 12 inches apart.
- c. Inlets and junction boxes shall be constructed of 4,000 psi concrete.

4. Storm Drainage Wyes:

- a. All storm sewer wyes shall be factory made unless authorized by the Engineering Department or their representative.

G. Subsurface Drainage Systems:

1. **Design Criteria:** Where a contractor encounters underground water, or the design engineer's subsurface investigations indicate the presence of underground water of a flow rate judged by the Engineering Department to be detrimental to the adjoining city maintained structures or property, a subsurface drainage system shall be installed. The minimum pipe diameter is to be six (6) inches with cleanouts located at a maximum distance of 300 feet.
2. **French Drain System:** A french drain system, composed of a minimum six inch diameter perforated PVC pipe, will be installed between the back of curb and right-of-way line whenever adjoining lot elevations necessitate the use of retaining walls to maintain lot grades. French drain system must be connected to the storm sewer system.
3. **Pipe Materials:** The perforated pipe shall be Type PS 46, or approved equal, PVC pipe conforming to ASTM 758 and ASTM D-1784 with a minimum of four (4) hole rows of ¼ inch diameter perforations on four (4) inch maximum centers. The perforated pipe and conducting pipe shall be white in color.
4. **Installation:** For installation and embedment details see City of Carrollton Standard Details.

H. Detention/ Retention Pond Guidelines:

These guidelines only affect detention/retention basins that are between a public right-of-way and any improvements on the property. If the detention/retention basin is not between a public right-of-way and any improvements on the property, it must only meet the zoning ordinance requirements (property landscaping etc...) and engineering design standards (capacity, drainage etc...). The design of these facilities must be in accordance with the city's Stormwater and Flood Protection Ordinance. For retention basins only, water rights issues will have to be coordinated with Dallas Water Utilities. The City Manager, or his designee, may approve an alternative detention/retention basin design after staff review of the proposal.

1. Sides

The sides of the detention/retention basin may be constructed of either a retaining wall or an earthen slope.

If an earthen slope is used, the maximum slope is four-to-one (4:1) (See Figure 1).

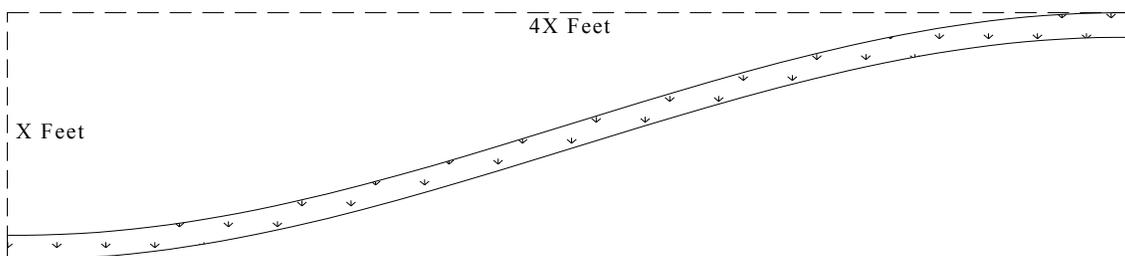


Figure 1. Earthen slope

If a retaining wall is used, the exterior wall surface must be constructed of ‘brick or stone’ as described in the Comprehensive Zoning Ordinance (Article XXXIV, Section A, Number 42). The retaining wall shall have a maximum height of four feet (4’) visible height only. (This does not include any footers or other foundations.) (See Figure 2). If the required detention/retention volume necessitates a basin deeper than four (4’) feet, the basin must be terraced (See Figure 3). Each terrace shall have a *maximum height* of four (4’) feet, a *minimum width* of three (3’) feet face of wall to face of wall. Each terrace shall have a strip of ground cover a minimum of two (2’) feet wide and a maximum slope of four-to-one (4:1).

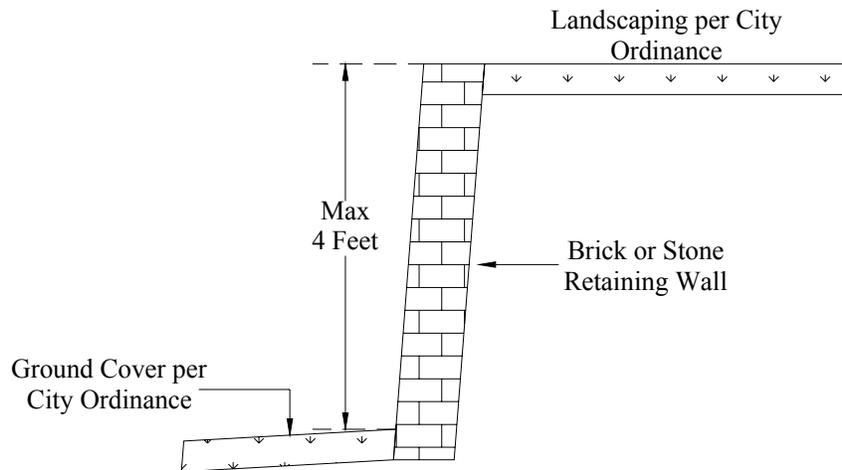


Figure 2. Brick or stone retaining wall

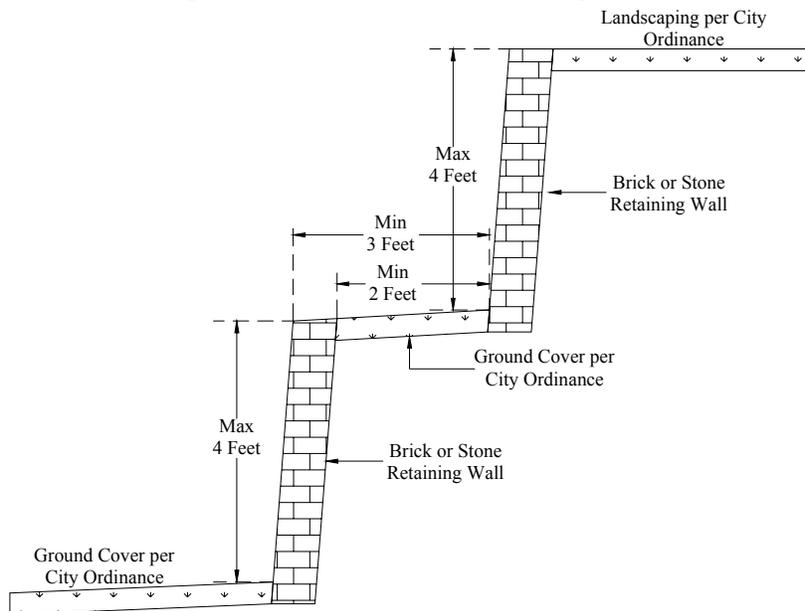


Figure 3. Terrace of Brick or Stone Retaining Walls

2. Screening

If the detention/retention basin uses retaining walls on *all* sides, the basin must be screened from the right(s)-of-way. Said screening shall be of a hedgerow, an earthen berm or a combination of the two.

If only a hedgerow is used, it must be of an approved species of ‘Parking Screening’ or ‘Screening’ shrubs (see the Landscape Ordinance for a list of approved species). The screening shrubs shall be a minimum of five (5) gallon, planted at a maximum of three (3’) feet on center and shall be a minimum of three (3’) feet in height at the time of planting. The shrubs must be maintained at a minimum of three (3’) feet in height and shall not be allowed to grow past a reasonable and maintainable height.

If only an earthen berm is used, it must be constructed to a minimum height of three (3’) feet, measured from grade level to the crest of the berm. The berm shall have a maximum slope of four-to-one (4:1) (See Figure 1). The earthen berm shall not be used as a freeboard for the detention basin.

If a combination of a hedgerow and an earthen berm is used, the combined height (measured from grade level to the top of the hedgerow) must be a minimum of three (3’) feet at the time of planting. Hedgerow and berm must meet the other respective requirements described above and in the Landscape Ordinance.

3. Fencing

If a security fence is used around a detention/retention basin, it must be screened from the public right(s)-of-way using a hedgerow. The hedgerow must meet the requirements detailed in Section 2 above. Any landscaping used to screen a security fence may be counted toward the screening of the detention/retention basin sides (if required above). If the security fence screening is between parking and the public right(s)-of-way, and the hedgerow is of an approved species of ‘Parking Screening,’ it may be counted toward parking screening requirements. A gate with a minimum width of four (4’) feet must be constructed to provide proper maintenance access and emergency access to the detention/retention basin.

4. General Information

The detention/retention basin and any screening may be located partially or wholly within the required landscape buffer. All plantings required by the Landscape Ordinance (shade trees and ornamental trees) shall be planted between the public right(s)-of-way and the adjacent edge of the detention/retention basin. If landscape screening is used for the detention/retention basin or for a security fence, it may be counted toward any shrubs required by the Landscape Ordinance. *Required* landscaping may not be planted within the detention/retention basin (if an earthen slope is used, required landscaping must be planted above the one-hundred (100) year water surface height).

I. Testing Procedures: See detailed testing procedures in the Testing Section.

SECTION 4**WATER SYSTEM IMPROVEMENTS**

ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION AND THE CITY OF CARROLLTON GENERAL DESIGN STANDARDS.

A. Water Pipe Materials:**1. Polyvinyl Chloride (PVC) Pipe**

- a. Pipe: American National Standard for PVC pipe 12 inches and under, AWWA Standard C900, Class 200 (DR14). Pipe greater than 12 inches shall be AWWA Standard C905, Class 200 (DR14).
- b. Color: Blue in color.
- c. Fittings: Ductile Iron ANSI/AWWA-C153/A21.53; Cast Iron ANSI/AWWA-C110/A21.10 and ANSI/AWWA-C111/A21.11 Standards.
- d. Joints: Push on joints, ASTM D-3139. Megalug™ retaining glands or equal shall be used on all bends, tees and plugs..
- e. Gaskets: ASTM F477 Standards.

2. Ductile Iron Pipe (Not allowed without prior approval)

- a. Pipe: American National Standard for ductile-iron AWWA Standard C151 (ANSI A21.51) Class 51.
- b. Fittings: Ductile iron ANSI/AWWA C111/A21.11, except gaskets shall be neoprene or other synthetic rubber. Natural rubber will not be acceptable.
- c. Joints:
 - (1) Push on Joint: ANSI/AWWA C111/A21.11, except gaskets shall be neoprene or other synthetic rubber. Natural rubber will not be acceptable.
 - (2) Flanged Joint: ANSI/AWWA C115/21.15.
 - (3) Mechanical Joints: ANSI/AWWA C111/A21.11 except gaskets shall be neoprene or other synthetic rubber. Natural rubber will not be acceptable. Megalug™ retaining glands or equal shall be used.
 - (4) All bolts and nuts shall be ASTM A325 Type III Enhanced Corrosion Resistant steel, or stainless steel Grade 304 or 316.
 - (5) Polyethylene Tube Wrap: ANSI/AWWA C105/A21.5 ASTM Designation D1248.

3. Reinforced Concrete Cylinder Pipe

- a. Pipe: American National Standard for reinforced concrete cylinder pipe, AWWA Standard C303, Class 150 for pipes 36-inch diameter and below, and AWWA Standard C301, Class 150 for pipes 48-inch diameter and above. Sizes in the middle range shall be determined after consultation with the pipe manufacturer.
- b. Fittings: Fittings shall be of welded steel sheet plate and shall be lined and coated with cement mortar.

- c. Joints: Joints shall be sealed with a continuous solid-ring rubber gasket.
- d. Gaskets: ASTM F412 Standards.

B. Valves:

- 1. Gate valves, 12” and under (resilient seated): AWWA C509 Standard
 - a. General Description: Valves shall be full opening, iron body, non-rising stem, resilient seated wedge type so designed to have complete **ZERO** leakage with flow in either direction at pressures up to two hundred (200) psi. The valves shall be designed for throttling if required.
 - b. Coating: Valves shall have all internal ferrous metal surfaces coated with an approved epoxy coating to provide a corrosion resistant barrier. The epoxy coating shall be holiday free with a minimum thickness of not less than four (4) mils. The coating shall be non-toxic after application and shall impart no taste to water.
 - c. Operating stems: Valves shall have two (2) “O” ring stem seals. Valves shall have the thrust collar and bearing surfaces isolated from the waterway and be provided with continuous lubrication, or they shall be provided with non-corrosive thrust bearings above and below the thrust collar. Where the operating nut exceeds forty-eight (48) inches, in depth (below finish grade), a permanently attached extension shall be attached to the valve stem to bring it to the minimum depth of forty-eight (48) inches. All valves shall open by turning to the left and shall have a two-(2) inch-operating nut or be handwheel operated as shown on the plans.
 - d. Approved Manufacturers:
 - (1) Mueller
 - (2) Waterous
 - (3) Kennedy
 - (4) American-Darling
 - (5) Clow Corporation
- 2. Butterfly valves, greater than 12”
 - a. Approved manufacturers AWWA Standard C504, Class 150B, or approved equal.
 - (1) Mueller
 - (2) Pratt

C. Fittings:

- 1. Mechanical Joint: ANSI/AWWA-C110/A21.10 Standards
- 2. Flange Joint: ANSI/AWWA-C111/A21.11 Standards
- 3. Push-on Joint: ANSI/AWWA-C111-A21.10 Standards

D. Bolts, Bolt-studs and “T” Head Bolts:

- 1. Length: Shall be such that the ends project $\frac{1}{4}$ to $\frac{1}{2}$ inch beyond surface of nuts.
- 2. Ends: Chamfer or rounded.
- 3. Threading: ANSI B1.1 coarse thread series, class 2A Fit. Bolt-studs may be threaded full length. Studs for tapped holes shall be threaded to match threading in holes.
- 4. Materials: All bolts, bolt-studs and “T” head bolts (ANSI/AWWA C111/A21.11-80) shall be either A242 high strength low alloy steel with enhanced atmospheric corrosion

resistance (ASTM A325 Type III) or Stainless Steel Grade 304 or 316 high strength bolts. All nuts are to be A563 carbon alloy steel. Grade and finish to be C3.

Exception: All-thread rod to be used in thrust harness only, shall be high strength, corrosion-resistant alloy (ASTM A325 Type II) with hexagonal nuts. Where all-thread rods, nuts and washer are used, they are to be painted with the following rubberized mastic coating:

- a. "ROYSTON ROSKOTE MASTIC R28" Rubberized mastic as manufactured by ROYSTON LABORATORIES, INC. of Pittsburgh, Pennsylvania.
- b. Or, as approved by City of Carrollton Director of Engineering.

E. Reaction Anchorage and Blocking:

1. Anchorage and thrust blocking: All piping with mechanical coupling, push-on or mechanical joints, or similar joints subject to internal pressure shall be blocked, anchored, or harnessed to preclude separation of joints.

F. Installation:

1. Excavation: Excavation in general, shall be made in open cut from the surface of the ground and shall be no greater in width and depth than is necessary to permit the proper construction of the work. When the trench depth exceeds five (5) feet, see Excavation Safety Section regarding "trench safety" requirements. The amount of trench excavation to grade shall not exceed 100 (one hundred) feet from the end of the pipe laying operations and no excavation shall be 300 (three hundred) feet in advance of the completed pipe operations (includes backfilling). At the end of the workday, all trench excavation shall be backfilled. Any landscaping and irrigation system within the City medians and right-of-ways that are disturbed, removed, or damaged during construction shall be replaced to original condition or better.
2. Minimum bury depth: Minimum bury depth shall be forty-eight (48) inches from finished grade to the top of the pipe.
3. North Central Texas Council of Governments: All installations shall conform to the latest NCTCOG Specifications, as amended by the City of Carrollton and as detailed under "embedments" in this manual.
4. Polyethylene tube wrap: Where ductile-iron pipe is to be used, the Contractor shall furnish and install polyethylene tube wrap around the ductile-iron pipe and/or ductile-iron fittings. The tube wrap shall be installed in accordance with AWWA C105, Method A as follows: The wrap shall be 8 mil in thickness and seamless. Seams shall be wrapped and held in place by 2" wide (minimum) Scotch wrap no. 50, or an approved equal with approximately two (2) foot laps on the polyethylene tube, allowing the film to shift with the soil. The wrap shall be installed without breaks, tears, or holes in the film. The cost of the polyethylene wrapping and complete installation shall be included in the unit price bid for the furnishing and the installation of ductile iron pipe and related fittings and valves.

5. Cathodic Protection: A cathodic protection system must be provided and installed on any water main system composed of ductile iron pipe. It shall be the responsibility of the project design engineer to determine the size and type of anodes necessary for adequate protection of the system. Installation of the cathodic protection system shall be as shown in the Standard Details.
6. Dead-end lines will not be accepted in Carrollton. All water lines shall be looped into the system unless approved by the Director of Engineering.
7. Backfill Compaction:
 - a. Mechanical Method: Compaction and consolidation of the backfill materials shall meet NCTCOG Specification Item 6.2.9. Trenches shall be backfilled using the native material and compacted to 95 percent of maximum density as determined by ASTM D698 in six (6) inch lifts at optimum moisture content (to plus 4 percent above optimum moisture content) in areas influenced by vehicular traffic and in ten (10) inch lifts in areas not subjected to or influenced by vehicular traffic. Density tests shall be performed at the rate of one test per 300 LF per one foot of trench depth.
 - b. Water Jetting Method: Water jetting will not be allowed for any trench within the existing or proposed right-of-way. During jetting operations, jets must be used at close intervals along the trench in such a manner that sufficient water to lubricate and consolidate the fill reaches all parts of the backfill, and all of the backfill material is saturated. The jet pipe should be kept at least two (2) feet away from the pipeline to prevent the eroding of the embedment. Only that amount of water should be used which is necessary to consolidate the backfill. The jet ordinarily will consist of a pipe to which a two-inch diameter hose is attached at its upper end, utilizing conventional pipe fittings or swivel fittings. The jet pipe should be not less than 1-1/2 inch steel pipe and its length should be approximately two feet shorter than the depth of the lift of backfill to be compacted. It should be used with a continuous supply of water with a pressure sufficient to cause backfill displacement.

G. Fire Hydrants (installed at indicated locations)

1. Manufacturers and models or approved equal
 - a. Models shall comply with AWWA C-502
 - b. Approved manufacturers and models
 - (1) Clow (Medallion)
 - (2) Mueller (Centurion)
 - (3) Waterous (Pacer)
2. Installation:
 - a. Installation shall be of a type as detailed in these standards. The usage of anchoring fittings shall be required as detailed.
 - b. Spacing:
 - (1) Non-residential and multifamily (apartment) zones - three hundred (300) foot centers.
 - (2) One and two family residential zones - six hundred (600) foot centers.

3. Valves:
 - a. All valves shall be resilient seat gate valves (restrained) AWWA Standard C509.

4. Markers:
 - a. Approved manufacturers:
 - (1) Stemsonite Model 88-SSA
 - (2) Approved equal
 - b. Location:
 - (1) Fire hydrant markers shall be placed by City of Carrollton. The location of the markers shall be perpendicular to the curb, and at the center of the driving lane closest to the fire hydrant.
 - c. Installation:
 - (1) As per manufacturer's instructions.

5. Painting (color coding):
 - a. All fire hydrants are to be painted with a **base coat** consisting of two (2) **coats** of aluminum paint as specified below. When a color code other than aluminum is required, the top bonnet (from operating nut to underneath the uppermost flange) shall be painted two coats of the appropriate color in accordance with the following color code. Nozzle caps shall be silver and not color-coded.
 - (1) Base undercoat (two (2) coats required) all hydrants, ICI "Devoe" Aluminum #43089020.
 - (2) Overcoats (additional two (2) coats required over undercoats)
 - Six (6) inch main color code
ICI "Devoe" Aluminum #43089020
 - Eight (8) inch main color code
ICI "Devoe" alkyd industrial enamel "Imperial Blue" #43087850
 - Twelve (12) inch main or larger color code
ICI "Devoe" alkyd industrial enamel "Safety Yellow" #43089400
 - All caps shall be ICI "Devoe" Aluminum #43089020

H. Miscellaneous Appurtenances:

1. Water Service Lines: The Utility Contractor shall install the water service line at the center of the residential lot, terminating in a curb stop two (2) feet behind the curb. See detail drawings for burial depths and types of materials for each particular service size.

2. Water Meters and Boxes:
 - a. Water meter boxes shall be plastic with locking lids and shall be installed a clear distance of two (2) feet behind the curb and out of paved areas. All meter boxes shall be located within a R.O.W. or dedicated easement and within a protected area. See detail drawings for type and size requirements. The meter box shall be furnished and installed by the Contractor after the Paving Contractor has completed the fine grading back of the curb. (Meter Boxes shall be Types 34P, 59P or 5P as manufactured by East Jordan Iron Works, Inc. or equal.)

- b. Meters must be accessible at all times - In the event of a meter that is not accessible, the contractor will be advised and will be required to correct the problem that same day.
 - c. Cost for damages to the meter can, the meter and/or the meter loop will be the responsibility of the contractor. Necessary replacement of the meter loop and meter can will be the responsibility of the contractor. The City will replace the meter and charge the contractor for the appropriate time and material for the replacement.
 - d. If grade changes occur, the meter can and service must be raised or lowered to grade.
 - If the grade is raised the contractor will be required to raise the service or add a riser to the meter to the height required in the GDS. The contractor is responsible for all parts and materials to complete this work;
 - If lowering the service, the City service line and the customer's line must be lowered to assure the meter lid is secure on the meter can
 - e. If the meter can is removed or damaged, it must be replaced and centered to assure the meter is at grade level.
 - f. Leaks caused by the Contractor:
 - Contractor will be responsible for repairing the leak. The meter must be inspected and approved by the City;
 - Additional water charges caused due to such leaks will be the responsibility of the contractor.
 - g. The City project manager will assure that appropriate documentation is provided to the UCS billing department regarding repair charges for which the contractor is responsible.
3. Location Marking:
- a. After curb and paving has been completed, contractor shall cut one 3-inch long notch in the top of the curb above the location of the water service.
 - b. Valves located within a right-of-way shall be indicated on the face of the curb, or where curbs do not exist, in a conspicuous location adjacent to the valve location. Markings are to be the cutting of a four (4) inch high letter "V" with the point of the "V" pointing towards the valve location. The "V" shall be cut into the curb or paving using an approved motor driven concrete saw.
 - c. Fire Protection Valves for private services shall be indicated on the face of the curb, or where curbs do not exist, in a conspicuous location adjacent to the valve location. Markings are to be the cutting of a four (4) inch high letter "FPV" with the point of the "V" pointing towards the valve location. The "FPV" shall be cut into the curb or paving using an approved motor driven concrete saw.
 - d. Offsite valve locations shall be marked by the installation of an "Offsite Utilities Control Marker." See standard detail drawing.

4. Double strap service clamps: Service clamps shall be installed on all PVC pipe taps as per standard detail drawing and material lists. Where taps are to be provided on ductile iron pipe, tapping saddles are to be used wherever wall thickness minus the foundry tolerance at the tapped connection is less than that required for four (4) thread engagement as set forth in Table A.1, Appendix A of ANSI/AWWA C151/A21.51.
 5. Three piece adjustable valve boxes: Adjustable valve boxes shall be furnished and set on each valve in accordance with the detail drawings. After the final clean up and alignment has been completed, the Contractor shall cast in place a concrete block, 24" x 24" x 6" around all valve box tops at the finish grade.
- I. Connections with Existing Lines:
1. Existing line connections: Where connections are to be made between new pipe and existing pipe, such connections shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made with mechanical joint tapping sleeve and resilient seat gate valve. The tapping sleeve shall be a ductile or cast iron casting of the split sleeve type. The gaskets shall be neoprene or other synthetic rubber, conforming to ASTM D2000 BA508. Natural rubber will not be acceptable.
EXCEPTION: In some cases where the size of the tap approaches the size of the main, as judged by the Engineering Department, the use of a cut-in sleeve and tee will be required.
 2. Alternative Casting: An alternative to the ductile or cast iron casting will be a fabricated steel tapping sleeve with special corrosion protection as follows:
 - a. Body – Shall be welded 3/8" inch fabricated steel with a 3/4" inch test plug and a flat-faced flange recessed for the tapping valve, conforming to AWWA C207 Class D-ANSI 150 pound drilling.
 - b. Finish – Shall be fusion-applied epoxy coating approximately 12 mils thick.
 - c. Bolts and Nuts – All bolts shall be Grade 18-8, Type 304 Stainless steel with heavy hex nuts. Bolts will be fluorocarbon coated to prevent galling.
 - d. Gasket – Shall be Buna-N rubber, conforming to ASTM D2000, BA508, with resistance to water, oil and hydrocarbon fluids. The gasket shall be of hydraulically loaded design to provide a positive seal against the pipe surface.
 3. Tapping: Tapping is to be accomplished with no interruption of service. Facilities shall be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property. Special care shall be taken to prevent contamination of the existing potable water line when dewatering, cutting into, and making connections with existing pipe. No trench water, mud, or other contaminating substances shall be permitted to enter into the existing lines. The interior of all tapping sleeves, tapping machine cutter assemblies, and tapping gate valves installed in such connections, and the surface of the existing pipe at these connections, shall be thoroughly cleaned and then swabbed with a solution having a chlorine content of 200 milligrams per liter.
- J. Testing Procedures: See detailed procedures in the Testing Section.

K. Approved Service Materials:

Item	Manufacturer				
	Mueller	Ford	Rockwell	Cambridge	McDonald
1" Copper Water Service (3/4" Meter) - Standard Residential Installation					
1" Tapping Saddle	H-16000 Series (PVC Only)	FC 202 Series	317 Series (PVC Only)		
1" Corporation Stop	H-15000 Series	F-1000 Series		302-A4H4	4701
1" Copper Pipe	Type "K" Soft Copper				
1" Curb Stop	H-15174, B.V., B-25174	B-21-444		204-H4F4	4711
1"x 3/4" Brass Bushing	Standard Fitting				
3/4"x 3" Long Brass Nipple	Standard Fitting				
3/4" Meter Setter (Meter Loop)	H-1404-2A Connection	VHH-72-9 WW w/ Saddle Nuts		6020 -2070303-VQ	Series 20 w/ ASSE Approved
Meter Box	Type 59 P Box				
1" Copper Water Service (1" Meter) - Standard Residential Installation					
1" Tapping Saddle	H-16000 Series (PVC Only)	FC 202 Series	317 Series (PVC Only)		
1" Corporation Stop	H-15000 Series	F-1000 Series			4701
1" Copper Pipe	Type "K" Soft Copper				
1" Curb Stop	B-25174	B-21-444		6020 -410D4D4-VQ	4711
1"x 3" Long Brass Nipple	Standard Fitting				
1" Meter Setter (Meter Loop)	H-1404-2A Connection	VHH-74-15 WW w/ Saddle Nuts			Series 20
Meter Box	Type 59 P Box				
1-1/2" Copper Water Service (1-1/2" Meter) - Standard Residential Installation					
1-1/2" Tapping Saddle	H-16000 Series	FC 202 Series	317 Series		
1-1/2" Corporation Stop	H-15000 Series	FB-1000 Series		301-A6H6	4701
1-1/2" Copper Pipe	Type "K" Soft Copper				
1-1/2" Curb Stop	B-25174	B-21-666		212-H6F6	4711
1-1/2"x 3" Long Brass Nipple	To Be Furnished and Installed by the City				
1-1/2" Meter Setter (Meter Loop)	To Be Furnished and Installed by the City				
Meter Box	Type 59 P Box				
2" Copper Water Service (2" Meter) - Standard Residential Installation					
2" Tapping Saddle	H-16000 Series	FC 202 Series	317 Series		
2" Corporation Stop	H-15000 Series	FB-1000 Series		301-A7H7	4701
2" Copper Pipe	Type "K" Soft Copper				
2" Curb Stop	B-25174	B-21-777		212-H7F7	4711
2"x 3" Long Brass Nipple	Standard Fitting				
2" Meter Setter (Meter Loop)	Not Available	V-77-12-11-77 w/ Saddle Nuts			
Meter Box	Type 5 P Box				

No angle stops shall be used.

SECTION 5**SANITARY SEWER IMPROVEMENTS**

ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION AND THE CITY OF CARROLLTON GENERAL DESIGN STANDARDS.

A. Design Criteria:

1. Minimum Size
 - a. Mains: Eight (8) inches in diameter
 - b. Service Laterals: Four (4) inches in diameter w/property line cleanouts.
2. Flow velocity: Maximum, ten (10) feet per second; minimum, two (2) feet per second.
3. The location of water and sanitary sewer mains shall conform to the separation distances prescribed by the Texas Commission on Environmental Quality (TCEQ), 30TAC290.44, or by superceding provisions of state regulations. Those being, when new water mains and new sanitary sewers are installed, they shall be installed no closer to each other than nine feet. Where this cannot be achieved, the sanitary sewer shall be constructed of pressure type pipe with watertight joints as used in water main construction. In no cases shall the outside of pipes be closer than four feet.
4. Minimum Depth:
 - a. All sanitary sewer mains are to have a minimum cover of four (4) feet from the top of the pipe to the top of ground or proposed pavement.
 - b. Whenever a proposed sanitary sewer pipe crossing a channel or creek has less than four (4) feet of cover between the top of pipe and flowline of the channel or creek, the proposed pipe will be supported by a pier system as shown in the Aerial Crossing Detail (S-12).

B. Pipe Materials:

1. Polyvinyl Chloride (PVC) Pipe:
 - a. Mains are to be a minimum eight (8) inches in diameter conforming to current ASTM designation D3034, SDR 35 or ASTM Designation F789 for 4 through 15 inch diameter and ASTM Designation F679 or ASTM Designation F794 for greater than 15 inch diameter. All SDR 35 PVC pipes shall be green in color. *For lines that are 12-feet or deeper, SDR 26 PVC shall be used.*
 - b. For mains within nine feet of a water line, SDR 26 PVC pressure pipe conforming to ASTM D2241/D3139 shall be used. All SDR 26 PVC pipe shall be green in color.
2. Clay Sewer Pipe (not allowed without prior approval) :
 - a. ASTM Designation C-200 Extra Strength Vitrified Clay Pipe

- b. Compression joints current ASTM Specification C425
3. Reinforced Concrete (RCP) Pipe:
- a. Pipe: ASTM Designation C76, Wall “B”
 - b. Fittings: The design and manufacture of all special fittings shall be governed by the same requirements as the connecting pipe.
 - c. Gaskets: ASTM C443. The polymer shall be synthetic rubber; natural rubber will not be acceptable.
4. Lateral Sewer Services:
- a. Connect to tee or wye fitting to be installed on the main.
 - b. Services shall be the same material as the main, minimum of four (4) inches in diameter, polyvinyl chloride (PVC) pipe, Schedule 40 or SDR 35, green in color, or SDR 26, green in color.
 - c. Locate the lateral ten (10) feet downstream of the water service for the lot (water service to be located at the centerline of the lot), at a maximum depth of six (6) feet and plugged suitable for testing. Contractor shall install a cleanout at the property line for each lot. See standard details for required residential cleanout or other required assemblies.
 - d. After curb and paving has been completed, contractor shall cut two 3-inch long notches in the top of the curb.
 - e. Services shall be designed for 1% minimum slope. Designer shall ensure that services will clear all crossing pipes.
- C. Manholes:
- 1. Materials:
 - a. Precast concrete shall conform to ASTM designation C478 (C478M) as amended by the NCTCOG Specifications. If precast manholes are used and holes do not match existing lines as required, it is the contractor’s responsibility to core the manhole wall and patch the original hole.
 - b. Poured-in-place concrete manholes shall conform to City of Carrollton Standard Details.
 - c. No other manhole construction materials will be allowed without written permission of the Engineering Department.
 - 2. Rings & Covers
 - a. Manhole rings and covers as per City of Carrollton Standard Detail S-6.
 - b. Manholes located next to creeks or flood prone areas shall have sealed rings and covers as per City of Carrollton Standard Detail S-7.
 - c. Manhole rings and covers shall be adjusted by the use of precast concrete grade rings or HDPE recycled manhole adjusting rings only. Bricks and broken concrete are not acceptable.
 - d. Manhole covers located in easements and remote areas shall be painted red.

3. Appurtenances
 - a. All manholes shall contain an external manhole chimney seal as produced by Cretex Specialty Products, Infishield by Sealing Systems, Inc., or a Wrapidseal shrink-wrap external chimney seal, or equal; or an internal chimney seal by Flex Seal Utility Sealant by Sealing Systems, Inc., or equal.
 - b. Drop manholes shall be installed when the inflow elevation is more than 18-inches above the outflow elevation. The manholes shall have external drops with a minimum diameter of five feet in accordance with Standard Detail S-3. Internal drop manholes will only be allowed with permission from the Director of Engineering.
 - c. Connections to existing manholes shall be core drilled.
 - d. After curb and paving has been completed, contractor shall cut a four (4) inch high letter “MH” on the curb indicating the location of the manhole.
 4. Spacing and Sizing
 - a. Manholes shall be spaced at a maximum of 500 feet apart and shall be accessible to City vehicles. A manhole is required when a six-inch (6”) or larger service line is connected to the main line.
 - b. Manhole diameters shall be as follows: those with lines 27-inches and smaller shall be 5 feet minimum; and those with 30 and 36 inch lines shall be 6 feet minimum.
- D. Cleanouts:
1. Cleanouts are to be located and installed as per approved drawings and City of Carrollton Standard Details.
 2. After curb and paving has been completed, contractor shall cut a four (4) inch high letter “X” on the curb indicating the location of the cleanout.
 3. Cleanouts shall not be used on City maintained collection system construction for multifamily, commercial and industrial development.
- E. Offsite Installation:
1. Materials: All relative specifications for sanitary sewer improvement material shall apply to offsite installations.
 2. Excavation: In general, all excavation shall be made in open cut from the surface of the ground and shall be no greater in width and depth than is necessary to permit the proper construction of the work. Where the trench exceeds five (5) feet in depth see Section 9 regarding “trench safety” requirements. The amount of excavation to grade shall not exceed 100 (one-hundred) feet from the end of the pipe laying operations and no excavation shall be more than 300 (three-hundred) feet in advance of the completed pipe operations (includes backfilling). *At the end of the workday, all trench excavation shall be backfilled.*
-

3. Installation: As per approved drawings. Any landscaping and irrigation system within the City medians and right-of-ways that are disturbed, removed, or damaged during construction shall be replaced to original condition or better.
4. Manhole Markers: The contractor shall furnish and install two manhole location markers as per City of Carrollton Standard Details. Markers shall be placed on top of the main lines entering and exiting the manhole. Manholes located along creeks shall be constructed so that the rim is two feet above existing ground. These manholes shall also have four evenly spaced 3/8" thick, 18" long, metal straps with two 3/4" Hilti bolts per strap, attached to the lid and cone to ensure that the manhole top remains intact during flooding situations.
5. Testing: All relative specifications for sanitary sewer system improvement testing shall apply to offsite installations. See testing section for details.

F. Installation:

1. All installations shall conform to the latest NCTCOG Specifications (as amended by the City of Carrollton). See details under "embedment" and excavation notes under offsite installation. Any landscaping and irrigation system within the City medians and right-of-ways that are disturbed, removed, or damaged during construction shall be replaced to original condition or better.
2. Only full pipe joints are acceptable except at the installation of service tees and manholes, and only full pipe joints shall be installed after a tee. No other short or "left over" pieces of any kind will be allowed.
3. If temporary wye or tee connections are necessary during construction to keep existing lines in service, they shall either be removed or turned upright and vertical, capped and encased in concrete before acceptance.
4. Backfill Compaction:
 - a. Mechanical Method: Compaction and consolidation of the backfill materials shall meet NCTCOG Specification Item 6.2.9. Trenches shall be backfilled using the native material and compacted to 95 percent of maximum density as determined by ASTM D698 in six (6) inch lifts at optimum moisture content (to plus 4 percent above optimum moisture content) in areas influenced by vehicular traffic and in ten (10) inch lifts in areas not subjected to or influenced by vehicular traffic.
 - b. Water Jetting Method: Water jetting will not be allowed for any trench within the existing or proposed right-of-way. During jetting operations, jets must be used at close intervals along the trench in such a manner that sufficient water to lubricate and consolidate the fill reaches all parts of the backfill, and all of the backfill material is saturated. The jet pipe should be kept at least two (2) feet away from the pipeline to prevent the eroding of the embedment. Only that amount of water should be used which is necessary to consolidate the backfill. The jet ordinarily will consist of a pipe

to which a two-inch diameter hose is attached at its upper end, utilizing conventional pipe fittings or swivel fittings. The jet pipe should be not less than 1 – ½ inch steel pipe and its length should be approximately two feet shorter than the depth of the lift of backfill to be compacted. It should be used with a continuous supply of water with a pressure sufficient to cause backfill displacement.

G. Lift Stations:

1. Lift Stations will only be allowed after all other alternatives for transporting wastewater flows have been investigated and the lift station is found to be the best alternative for service area.
2. If allowed, lift station facilities shall be designed in accordance with TCEQ criteria and shall consider, but not be limited to, the following factors:
 - a. Site selection – protected from 100-year flood and accessible during a 25-year flood.
 - b. Stations shall contain a minimum of two pumps and shall be capable of handling peak flows with one pump out of service. Capacity shall be projected based on the number of users and contribution rates specified in Section 12.
 - c. Alternative power sources shall be provided if existing power sources are shown to be unreliable and may include an additional electric service line or a standby generator.
 - d. All lift stations shall have Remote Transmitting Units (RTU) connected to the City's SCADA system.
 - e. A security assessment shall be made to determine the need for surveillance and lighting at the site.
 - f. Wetwell interiors shall be coated with a Polyamide Epoxy-Coal Tar coating or equal.
 - g. Force Main piping shall be PVC with a pressure rating of 150 psi with a four foot minimum cover depth.
 - h. Lift Station area shall be fenced off and landscaped to blend in with the surrounding environment.

H. Testing Procedures: See detailed testing procedures in the Testing Section.

SECTION 6

RIGHT-OF-WAY AND EASEMENT MANAGEMENT

ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION AND THE CITY OF CARROLLTON GENERAL DESIGN STANDARDS.

A. Registration

1. General

All users constructing, installing, maintaining, or operating facilities in the City’s ROW must register with the City of Carrollton Engineering Department.

Registration will be in the name of the entity that owns or will own the facility and must be renewed every two years.

Request applicable registration information from the Engineering Department.

2. Insurance and Bonds

Owner must provide proof of liability insurance in accordance with the Right-of-Way Management Ordinance.

3. Plans of Record

Complete “Plans of Record” which indicate existing facilities must be supplied to the City in both written and digital format. The format will be specified by the City. Updated plans will be submitted no later than January 31 of each year.

B. Types of Facilities

The Director may require or approve the location of facilities underground.

When poles are used, the type of poles, location, depth, upgrades; etc. shall be subject to the approval of the Director.

Roadside hazards such as bollards are not allowed and will be required to be removed unless need is approved by Director.

The Director shall approve the size of Facilities to be installed or require User to prove its need to install any particular size of Facilities, which are the subject of User’s request for a permit.

C. Location of Facilities

Cutting or excavation of street, alley or sidewalk surfaces that **are less than five (5) years old is prohibited**, unless approved by Director. City shall allow cutting or excavation of a street, alley, or sidewalk surfaces, **older than five (5) years, granted the pavement replacement criteria of this document is met**.

Above ground facilities located within the right-of-way shall not be less than 1.5 feet from the face of curb or edge of pavement, or within six (6) inches of a sidewalk.

Facilities will not be allowed that will interfere with reasonable horizontal or vertical working limits of all existing facilities or proposed City facilities.

D. Above Ground Structures

The term utility structure shall mean any structure other than a pole or device attached to a pole which is owned or used by a utility and shall not include devices or structures used to control or direct pedestrian or vehicular traffic on an adjacent roadway.

1. In The Right-of-Way:

Above ground (or partially above ground) utility structures not exceeding nine (9) cubic feet are allowed in the right-of-way or utility easements without screening, subject to available room and located as approved by the Director.

2. Outside the Right-of-Way, But Inside a Public Utility Easement:

Director determines that there is sufficient space available and if such structure does not interfere with sight easements or visibility triangles required for safe operation of motor vehicles.

3. Private Property - Outside Both the Right-of-Way and the Public Utility Easement:

Above ground and underground structures – may be located wherever the private landowner will allow them to, subject to any pre-existing easements.

4. Caveat

(a) All the above would be subject to a determination by Director as to how much space is available and how much space would be consumed in the ROW or utility easements by a particular request, as well as visibility requirements.

(b) Transmission facilities, trunk mains, interceptors, or similar shall be installed **six (6) feet or deeper** unless approved by the Director.

E. Permit Application

1. Submittal Requirements

The following will be provided to the Engineering Department with documentation in the format specified by the Director. An example of a **Utility Construction Permit Application** may be requested from the Engineering Department.

The name, address and phone numbers of the contractor or subcontractor who will perform the actual construction, including the name and telephone number of an individual with the contractor who will be available at all times during construction. Detailed emergency procedures and a list of “on-call” contacts.

The construction and installation methods and materials to be employed for the protection of existing structures, fixtures, and facilities within or adjacent to the right-of-way, and the dates and times work will occur, all of which (methods, dates, times, etc.) are subject to approval of the Director.

A statement that proof of insurance, bond or other required financial information is current and on file.

Five (5) sets of detailed engineering plans in accordance with the criteria listed in this document.

F. Engineering Plans/Construction Drawings

Five (5) sets of Engineering Plans on 24" x 36" or 11" x 17" paper shall be submitted with each work permit application. They shall include the following information and be in the prescribed format:

1. A scale not to exceed 1"=100' unless otherwise approved by the Director.
2. The proposed location and route of all Facilities to be constructed or installed and the applicant's plan for right-of-way construction.
3. Details of the location of all right-of-way and utility easements that applicant plans to use.
4. Details of all existing City utilities in relationship to applicant's proposed route.
5. Details of what applicant proposes to install, such as pipe size, number of interducts, valves, etc.
6. Details of plans to remove and replace asphalt or concrete in streets, driveways, alleys and sidewalks.
7. Drawings of any bores, trenches, handholes, manholes, switch gear, transformers, pedestals, etc. including depth.
8. Handholes and/or manholes typical of the type of manholes and/or handholes applicant plans to use or access.
9. Complete legend of drawings submitted by applicant. Applicant may submit a standard legend for all permit applications, provided the applicant submits updated or revised versions of the standard details.
10. Traffic Control Plan in accordance with the Texas Manual on Uniform Traffic Control Devices.
11. Erosion Control Plans consistent with the City's Stormwater Ordinance (Article 10).
12. Tree Survey in accordance with the City's Tree Preservation Ordinance.
13. Provisions for compliance with all Federal, States, or City statutes.
14. All construction and installation shall be in accordance with the City's "Utility Standard Construction Drawings" unless otherwise indicated.
15. Refer to page 6-11 for **Engineering Utility Plan Submittal Requirements**.

G. Work Permit

1. General

No person shall perform any construction, maintenance or installation of facilities, whether aboveground or underground, in the right-of-way without first obtaining a construction work permit.

The permit will be in the name of the person who owns or will own the facilities to be constructed, maintained, repaired, or upgraded. The permit must be completed and signed by a representative of the owner of the facilities to be constructed.

Emergency responses related to existing facilities may be undertaken without first obtaining a permit; however, the Director shall be notified in writing, on a form approved by the Director, on the next business day of any construction related to an emergency response; including a reasonably detailed description of the work performed in the right-of-way and an updated map of any facilities that were moved or repaired.

New facilities, services, and the like will not be considered an emergency and will be viewed as violation of City Ordinance No. 2490.

The phrase “construction, maintenance or installation of facilities” does not include the installation of facilities necessary to initiate service to a customer’s property, or repair or maintenance of existing facilities unless such repair or maintenance requires the breaking of cutting of pavement; the closure of a nonresidential traffic lane; or excavation within the right-of-way or boring.

A request for a permit, complete with all information required under this section, must be submitted at least ten (10) working days before the commencement of work proposed in the request, unless waived by the Director.

The Director may require a pre-construction meeting with the right-of-way User and the User’s construction contractor.

All construction and installation in the right-of-way shall be in accordance with the permit for the Facilities. The City shall be provided access to the work and to such further information to ensure compliance with the permit.

A copy of the construction permit and approved engineering plans shall be maintained at the construction site and made available for inspection by the City at all times when construction or installation work is occurring.

All construction or installation work authorized by permit must be completed in the time specified in the construction permit. If the work cannot be completed in the specified time periods, the right-of-way User may request an extension.

A copy of any permit or approval issued by federal or state authorities for work in federal or state right-of-ways located in the City shall be maintained at the construction site and made available for inspection by the City at all times when construction or installation work is occurring.

Requests for permits will either be approved or disapproved by the Director promptly after receiving all necessary information.

Permits are not transferable to another User or another location.

H. Construction

1. General

No person shall perform any construction, maintenance or installation of Facilities, whether aboveground or underground, in the right-of-way without first obtaining a construction permit.

Emergency responses related to existing Facilities may be undertaken without first obtaining a permit; however, the Director shall be notified in writing, on a form approved by the Director, on the next business day of any construction related to an emergency response; including a reasonably detailed description of the work performed in the right-of-way and an updated map of any Facilities that were moved or repaired.

All work in the City's right-of-way, easements, or land shall be in accordance with the permit, the approved engineering plans, the "Utility Construction Standard Drawings", all City codes and applicable local, state and federal laws.

Working hours shall be as described in Section 1.D.1. Procedures.

The Director may require a pre-construction meeting with the right-of-way User and the User's construction contractor. For new subdivisions, if the franchised utility company installs new lines after paving has been completed, any sanitary and storm sewer lines that were crossed must be internally inspected by that franchised utility company to ensure their integrity.

Users are responsible for obtaining line locations from all affected utilities at least forty-eight (48) hours prior to any excavation and will need a permit number.

Right-of-way User will be responsible for verifying both the horizontal and vertical location of all affected facilities whether by pot holing or hand digging prior to any excavation or boring with the exception of work involving lane closures, as discussed above.

Placement of all handholes, manholes or other access facilities must be approved in advance by the Director.

Refer to page 6-14 for **Utility Construction Checklist**.

2. Permits

A copy of the construction permit and approved engineering plans shall be maintained at the construction site and made available for inspection by the City at all times when construction or installation work is occurring.

A copy of any permit or approval issued by federal or state authorities for work in federal or state rights-of-way located in the City shall be maintained at the construction site and made available for inspection by the City at all times when construction or installation work is occurring.

3. Excavations

Unless otherwise specifically allowed in writing by the Director, all excavations within the right-of-way shall be filled and compacted within twenty-four (24) hours of excavation and pavements of streets, alleys and sidewalks shall be completely restored within fourteen (14) days of excavation.

The Director must be notified twenty-four (24) hours in advance that construction is ready to proceed by either the right-of-way User or User's contractor or representative. Notification shall include the reference number assigned to excavation by the one-call system.

4. On-Site

Three feet by three feet information signs, stating the identity of the person doing the work on the Facilities, telephone number and User's identity and telephone number, shall be placed in the right-of-way on each approach to the location where construction is to occur twenty-four (24) hours prior to the beginning of work in the right-of-way and shall continue to be posted at the location during the entire time the work is occurring.

Erosion control measures and advance warning signs, markers, cones and barricades must be in place before work begins.

Reflective barricades and flashing lights must be restored at the end of each day.

The right-of-way User shall be responsible for the workmanship and any damages by their contractors and subcontractors. A responsible representative of the User will be available to the Director at all times during construction.

The right-of-way User shall be responsible for storm water management and erosion control that complies with city, state and federal guidelines. Requirements shall include, but not be limited to, silt fencing in erosion areas until vegetation is restored, barricade fencing around open holes, and high erosion areas will require wire backed silt fencing.

User or User's contractor or subcontractor shall notify the Director immediately of any damage to other utilities, whether owned by the City or privately owned.

User must not interfere with City utilities, in particular gravity dependent Facilities.

When a street, alley or sidewalk cut is required, prior approval must be obtained by the Director and all of the Director's requirements shall be followed. Repair of all street, alley and sidewalk removals must be made promptly to avoid safety hazards to vehicle and pedestrian traffic.

Cutting or excavation of street, alley or sidewalk surfaces that **are less than five (5) years old is prohibited**, unless approved by Director. City shall allow cutting or excavation of a street, alley or sidewalk surfaces **older than five (5) years granted the following criteria is met**.

I. Concrete Streets, Driveways, and/or Drive Approaches

1. Pavement saw cut and removal shall extend to the limits of “good” concrete as defined by the City of Carrollton. This means concrete that is primarily free of failures and allows for proper doweling of the joints between the existing and new paving surfaces. The City’s Inspector will determine the limits of “good” concrete prior to replacing the concrete paving.
2. The minimum pavement replacement width shall be one (1) typical panel unless the excavation is a trench that runs parallel with the flow of traffic. In this case, the minimum pavement replacement width shall be one-half(1/2) of a typical panel, granted the concrete removal limits listed below are met. The width shall be defined as transverse to the flow of traffic (perpendicular to the edge of pavement). The limits of the edge of pavement, expansion joint, and/or saw joint (control joint) shall define a panel. Concrete removal limits shall be as follows:
 - A minimum of one (1) foot beyond the edge of the excavation on each side.
 - A maximum of three (3) feet from the edge of the excavation if needed to repair/replace inferior concrete.
 - The minimum limits shall be no closer than five (5) feet from a joint or the edge of pavement. Should the minimum one (1) foot or maximum three (3) feet (items 1 and 2 above) fall within the five (5) foot boundary, removal to the edge of pavement, expansion joint, or control joint shall be required. The Utility Company and/or the Contractor will assume the responsibility for all costs associated with the pavement replacement.
 - Should inferior concrete extend beyond the limits established as the contractor’s responsibility (see item 3), the City may request that the concrete be replaced up to the limits of “good” concrete. The City would reimburse the cost difference. City participation is dependent upon the Utility Company receiving approval prior to pouring the concrete. Generally, this will not exceed an additional two (2) panels in any direction.
3. Trench compaction and consolidation of the backfill materials shall meet NCTCOG Specification Item 6.2.9. Trenches shall be backfilled using the native material and compacted to 95 percent of maximum density as determined by ASTM D698 in six (6) inch lifts at optimum moisture content (to plus 4 percent above optimum moisture content) in areas influenced by vehicular traffic and in ten (10) inch lifts in areas not subjected to or influenced by vehicular traffic. Density tests shall be performed at the rate of one test per 300 LF per one foot of trench depth.
4. All pavement markings, striping, and buttons shall be replaced.
5. Minimum concrete paving strength shall be Class ‘C’ as defined according to the *North Central Texas Council of Governments (NCTCOG) Standard Specifications for Public Works Construction, Current Edition*.
6. Refer to Standard Details for Street Cut Repairs - **Typical Concrete Street Removal/Replacement Details**.

J. Concrete Alleys

1. Pavement saw cut and removal shall extend to the limits of “good” concrete. This means concrete that is primarily free of failures and allows for proper doweling of the joints between the existing and new paving surfaces. The City’s Inspector will determine the limits of “good” concrete prior to replacing the concrete paving.
2. The minimum pavement replacement width shall be one (1) panel (full width of the alley). The width shall be defined as transverse to the flow of traffic (perpendicular to the edge of pavement). Concrete removal limits shall be as follows:
 - A minimum of one (1) foot beyond the edge of the excavation on each side.
 - A maximum of three (3) feet from the edge of the excavation if needed to repair/replace inferior concrete.
 - The minimum limits shall be no closer than five (5) feet from a joint or the edge of pavement. Should the minimum one (1) foot or maximum three (3) feet (items 1 and 2 above) fall within the five (5) foot boundary, removal to the edge of pavement, expansion joint, or control joint shall be required. The Utility Company and/or the Contractor will assume the responsibility for all costs associated with the pavement replacement.
 - Should inferior concrete extend beyond the limits established as the contractor’s responsibility (see item 3), the City may request that the concrete be replaced up to the limits of “good” concrete. The City would reimburse the cost difference. City participation is dependent upon the Utility Company receiving approval prior to pouring the concrete. Generally, this will not exceed an additional two (2) panels in any direction.
3. All trench backfill material under concrete paving shall be compacted cement treated sand (2 sacks cement per cubic yard of sand) or approved flowable fill.
4. All pavement markings, striping, and buttons shall be replaced.
5. Refer to Standard Details for Street Cut Repairs - **Typical Concrete Alley Removal/Replacement Detail.**

K. Asphalt Streets

1. Pavement saw cut and removal shall extend to the limits of “good” asphalt. This means asphalt that is primarily free of failures. The City’s Inspector will determine the limits of “good” asphalt prior to replacing the paving.
2. The pavement replacement width shall extend beyond the width of the excavated trench up to three (3) feet each side.
3. Refer to Standard Details for Street Cut Repairs - **Typical Asphalt Street Removal/Replacement Detail.**

L. Concrete Sidewalks

Pavement saw cut and removal shall extend to the limits of “good” concrete. This means concrete that is primarily free of failures and allows for proper doweling of the joints between the existing and new paving surfaces. The City’s Inspector will determine the limits of “good” concrete prior to replacing the concrete sidewalk.

M. Improperly Installed, Repaired, or Maintained Facilities

Any User of the City right-of-way shall properly install, repair, upgrade and maintain facilities.

Facilities shall be considered to be improperly installed, repaired, upgraded or maintained if:

1. The installation, repair, upgrade or maintenance endangers public health, safety or welfare;
2. The facilities encroach upon private property or extend outside the right-of-way or easement locations.
3. Above ground facilities located within the right-of-way shall not be less than 1.5 feet from the face of curb or edge of pavement, or within six (6) inches of a sidewalk.
4. The facilities do not meet the applicable state, federal, or local laws;
5. The facilities are not capable of being located or maintained using standard practices;
6. The facilities are placed in an area that interferes with another user’s facilities. Nothing in this section shall diminish the authority of the Director to require specific placement of specific lines.
7. The facilities are not installed or repaired according to the approved work permit, engineering plans, or Utility Construction Standard Drawings.

N. Restoration

Users with facilities in the right-of-way shall restore property affected by construction, repair, maintenance, installation, or upgrade of Facilities to a condition that is equal to or better than the most recent specification of the City’s Engineering Design Guidelines. Restoration must be approved by the Director.

Restoration must be to the reasonable satisfaction of the Director. The restoration shall include, but not be limited to:

1. Replacing all ground cover equal to the type of ground cover damaged during work or better either by sodding or seeding as required by Director; installation of all manholes and handholes, as required.
2. Backfilling and compacting all bore pits, potholes, trenches or any other holes shall be filled in daily unless other safety requirements are approved by the Director.
3. Street and sidewalk repair that conforms with City specifications.
4. Leveling of all trenches and backhoe lines.
5. Restoration of excavation site to City’s specifications.

6. Restoration of all landscaping, ground cover, and sprinkler systems.
7. Removal of all locate flags.
8. Restoration must be made in a timely manner and to the satisfaction of Director. If restoration is not satisfactory or not performed in a timely manner, then all of right-of-way User's work in progress, (except for that work related to the problem), will be halted and no other permit will be approved until all restoration is complete. The hold on right-of-way User's work will include work previously permitted but not complete.

O. Utility Crossings

1. Tunneling and boring:

Tunneling and boring under City streets shall be accomplished by means of jacking, boring or tunneling equipment. This work requires City approval prior to start of operation. All directional boring shall have locator place bore marks and depths while bore is in progress. Locator shall place mark at each stem with paint dot and depth at least every other stem.

2. Standard details:

The street sections that are shown as typical sections shall apply to any alleys, driveways, roadways, etc. that will be within a City right-of-way or easement.

3. Encasement pipe requirements:

The usage of an encasement pipe will be based upon the specific project location and prevailing soil conditions. The approved plans shall show the encasement pipe when so required.

4. Filling of voids:

The voids outside of the carrier or casing pipe and where an encasement pipe is not used shall be backfilled by hydraulically placed cement grout material so that there are no open voids around the tunnel or bore. The grout placement operation shall be done without damage to the roadway surface.

5. Backfill:

All bore pits; trenches and inspection holes shall be backfilled within forty-eight (48) hours of the installation of the utility lines. No bore pit shall remain open in excess of 72 hours without properly installed shoring to prevent lateral soil movement. All bore pits shall comply with trench safety regulations where applicable.

6. Backfill Compaction:

- a. Mechanical: Compaction and consolidation of the backfill materials in bore pits shall meet NCTCOG Specification Item 6.2.9. Trenches shall be backfilled using the native material and compacted to 95 percent of maximum density in six (6) inch lifts at optimum moisture content (to plus 4 percent above optimum moisture content) in all areas. Trench compaction testing shall be performed at the rate of 1 density test per 300 LF per 1 foot of lift. Test results shall be provided to the City.
- b. Water Jetting: Water Jetting will not be allowed within a proposed or existing R.O.W.. During jetting operations, jets must be used at close intervals along the bore pit and in such a manner that sufficient water to lubricate and consolidate the fill reaches all parts of the backfill, and that all the backfill material is saturated. The jet pipe should be kept

at least two (2) feet away from the pipeline or utility to prevent the eroding of the embedment. Only that amount of water should be used which is necessary to consolidate the backfill. A jet ordinarily will consist of a pipe to which a two-inch diameter hose is attached at its upper end, utilizing conventional pipe fittings or swivel fittings. The jet pipe should not be less than 1-1 ½ inch steel pipe and its length should be approximately two feet shorter than the excavated ditch line. It should be used with a continuous supply of water with a pressure sufficient to cause backfill displacement.

7. Clean up:

After the trench and/or bore pit(s) have been backfilled and compacted, the Contractor shall remove any excess spoil dirt and clean the street and site as soon as practical in an acceptable manner to the City. Contractor is responsible for re-establishing the ground cover on all the areas disturbed by this operation to equal or better condition prior to beginning work.

P. Engineering Utility Plan Submittal Requirements

The Utility Company and the engineer are encouraged to meet with the Engineering Department to review site specific concerns. The overview is a work in progress. If you feel that a particular item is unclear or more information should be provided please contact us for clarification.

The Utility Company or its engineer shall submit five complete sets of engineering plans to the City of Carrollton Engineering Department. All plans shall be submitted on 24"x36" or 11"x17" paper and include a cover sheet with table of contents. The project name, engineer's name, license number, and date shall be on all plan sheets and state "Preliminary Not For Construction".

A complete set of engineering plans shall include the following stapled together. These are minimum requirements, additional plans/details may be required where site conditions dictate:

- The proposed, approximate location and route of all facilities to be constructed or installed and the applicant's plan for right-of-way construction.
- Engineering plans signed and sealed by a registered engineer at a scale not to exceed one inch (1") equals one hundred feet (100') unless otherwise approved by the Director. A north arrow shall be included.
- Details of the location of all right-of-way and utility easements that applicant plans to use.
- Details of all existing City and non-City utilities and facilities in relationship to applicant's proposed route.
- Details of what applicant proposed to install, such as pipe size, number of interducts, valves, etc.
- Details of plans to remove and replace asphalt or concrete in streets, driveways, alleys and sidewalks.
- Drawings of any bores, trenches, handholes, manholes, switch gear, transformers, pedestals, etc. (including depth).

-
- Handholes and/or manholes typical of the type of manholes and/or handholes applicant plans to construct, use or access.
 - Complete legend of drawings submitted by applicant. Applicant may submit a standard legend for all permit applications, provided the applicant submits updated or revised versions of the standard details.
 - Five sets of engineering plans must be submitted with the permit application.
 - The name, address and phone numbers of the contractor or subcontractor who will perform the actual construction, including the name and telephone number of an individual with the contractor who will be available at all times during construction. Such information shall be required prior to the commencement of any work.
 - The construction and installation methods and materials to be employed for the protection of existing structures, fixtures, and Facilities within or adjacent to the right-of-way, and the dates and times work will occur, all of which (methods, dates, times, etc.) are subject to approval of the Director.
 - A traffic control plan including proper barricading, traffic detours, work zones, signage, etc.
 - A statement of compliance with the NPDES stormwater permit requirements and other provisions of the Federal Clean Water Act.
 - A statement that all necessary and applicable state and federal permits have been obtained for the project and that User is in compliance with those permits.

Engineering plans are reviewed for compliance with the following City of Carrollton documents and other criteria:

- ◆ Right-of-Way Management Ordinance
- ◆ Texas Manual on Uniform Traffic Control Devices
- ◆ City of Carrollton Thoroughfare Plan
- ◆ City of Carrollton General Design Standards
- ◆ City of Carrollton Tree Preservation Ordinance
- ◆ Water and Sewer Master Plans (where applicable)
- ◆ North Central Texas Council of Governments Specifications for Public Works Construction

Staff will notify the applicant of necessary corrections and comments. Resubmission of two to three sets of corrected engineering plans along with the prior marked-up plans will be required until “approval” is given to the engineering plans.

Full Engineering Plan Release

Plans are released for construction once all the mark-ups are addressed. An approval letter will be sent to the developer’s engineer, identifying the number of plan sets needed for stamping and details. The construction inspector will recognize only plans bearing the City of Carrollton’s RELEASE FOR CONSTRUCTION stamp. No unstamped plans should be present on the job site. The City of Carrollton will not accept any work constructed using unstamped plans.

All applicable fees and taxes must be paid.

The utility company and contractor shall schedule a pre-construction meeting with the Engineering Department at (972)466-3200 a minimum of seventy-two (72) hours prior to the start of construction.

The following permits, analysis, easements, plans, etc. must be acquired, completed, and submitted prior to full engineering plan release:

- ◆ All engineering plans shall be complete;
- ◆ Provide evidence showing compliance with the Corps of Engineers wetlands and waters of US regulations;
- ◆ Highway permits from the Texas Department of Transportation for any work within state right-of-way, if applicable;
- ◆ Excavation safety plans prepared by a licensed professional engineer in the State of Texas, for utility excavation(s) exceeding a five-foot depth.

UTILITY CONSTRUCTION CHECKLIST

THIS "CHECKLIST" IS INTENDED FOR GENERAL INFORMATION ONLY, AND DOES NOT INCLUDE ALL REQUIREMENTS OF CARROLLTON'S R.O.W. ORDINANCE NO. 2490.

- _____ CONSTRUCTION/MAINTENANCE PERMIT OBTAINED
- _____ PERMIT AND ENGINEERING PLANS POSTED ON SITE
- _____ STATE AND/OR FEDERAL PERMITS POSTED ON SITE
- _____ CITY OF CARROLLTON UTILITY CONSTRUCTION STANDARD DRAWINGS ON SITE
- _____ UTILITY LINE LOCATES CALLED A MINIMUM OF 48 HOURS PRIOR TO ANY EXCAVATION
- _____ EXISTING UTILITIES LOCATED BY POT HOLING OR HAND DIGGING
- _____ DIRECTOR NOTIFIED A MINIMUM OF 24 HOURS PRIOR TO START OF WORK
- _____ EROSION CONTROL MEASURES IN PLACE
- _____ STORM WATER MANAGEMENT IN PLACE
- _____ STREETS, ALLEYS AND SIDEWALKS LESS THAN FIVE (5) YEARS OLD CAN NOT BE CUT
- _____ LANE CLOSURES IN SCHOOL ZONES AND OTHER THAN RESIDENTIAL STREETS IS LIMITED TO AFTER 9:00 A.M. AND BEFORE 3:00 P.M.
- _____ WORKING HOURS NOT INVOLVING TRAFFIC LANE CLOSURES ARE 7:00 A.M. TO 7:00 P.M.
- _____ EXCAVATIONS UNDER PAVING (STREET AND ALLEY) REQUIRE CEMENT STABILIZED SAND BACKFILL
- _____ EXCAVATIONS BACKFILLED AND COMPACTED IN LIFTS WITHIN 24 HOURS
- _____ STREET, ALLEY AND SIDEWALKS RESTORED WITHIN 14 DAYS
- _____ RESTORE TOP SOIL LANDSCAPING, GROUND COVER AND SPRINKLER SYSTEMS
- _____ REMOVE UTILITY LOCATE FLAGS
- _____ IN ACCORDANCE WITH TREE PRESERVATION ORDINANCE
- _____ OTHER

SECTION 7

URBAN DESIGN STANDARDS

I. MEDIAN LANDSCAPING & DESIGN - CITYWIDE

The median landscape concept has a band of ground cover, which acts as a unifying element and creates pocket-planting areas for all plant material. Planting patterns within pockets vary, depending on size of the median.

A. Landscaping - Recommended Plant List

1. Large Trees – Trees shall be planted along medians spaced a minimum of 30 feet apart. Trees shall be balled and burlapped and shall have a minimum caliper of 3 inches, and a minimum height of 12 feet at the time of planting. No tree shall be planted within 20 feet of a median nose.

Trees shall be of the type listed below:

Shumardi Oaks	Bald Cypress
Chinkapin Oaks	Lacebark Elm
Chinese Pistachio	Live Oak
Cedar Elm	

Any tree planted within 15 feet of any curb (including private residences) shall have a Tree Root Barrier installed in accordance with Standard Detail M-10. The root barrier shall be 20 feet long and centered on the tree along the curb.

2. Ornamental Trees – Trees shall be planted along medians in groups and spaced a minimum of 15 feet apart. Trees shall be balled and burlapped and shall have a minimum height of six (6) feet at the time of planting. No trees shall be planted within twenty (20) feet of a median nose.

Trees shall be of the type listed below:

Wax Myrtle	Crepe Myrtle
Possumhaw Holly (Staggered)	Yaupon Holly
Purpleleaf Plum	Foster Holly
Fraser’s Photina	Japanese Yew
Nellie R. Stevens Holly	

3. Shrubs – Shrubs shall be planted along medians in prepared planting beds. Shrubs shall be spaced and planted a maximum of 36 inches on-center and shall be a minimum of 5 gallon size at the time of planting.

Shrubs shall be of the type listed below:

Crimson Pygmy Barberry	Dwarf Burford Holly
Dwarf Crepe Myrtle	Dwarf Texas Sage
Dwarf Yaupon Holly	Harbor Dwarf Nandina
Burning Bush (Specimen Only)	

Note: A planting plan shall be submitted by a registered landscape architect to the Engineering Department for review and approval prior to any planting. The planting plan shall be submitted with the engineering plans to assure a quality product without conflicts to the proposed improvements (see tree planting details).

B. Landscape Irrigation

1. General

- a. Landscape irrigation plans shall be submitted to the City of Carrollton Building Inspections and Parks Departments for review and approval.
- b. Contractor shall place the appropriate sleeve pipe (minimum size shall be twice the irrigation pipe diameter) for the irrigation system prior to placement of street pavement and/or median brick pavers.
- c. Provide a complete and operational irrigation system and all related components for full and complete coverage of ground covers and trees. Systems shall include battery powered controllers, DC voltage latching solenoids, irrigation-only water meters followed by a city approved backflow prevention device, 12” rise pressure compensating shrub sprays with low angle nozzles sized and adjusted to fit the area, 4” rise spray head bodies having internal pressure compensation and Netafem dripline irrigation lines.
- d. Prior to beginning construction, a static water pressure test shall be conducted and a written report to the City’s representative shall be submitted stating the discharge pressure of the system at the outlet of the irrigation-only water meter. The reading must be the same as the design pressure as stated on the Contractor’s design.

2. Applicable Standards

- a. The following ASTM designations apply:
 - D2241-Polyvinyl Chloride (PVC) Pipe (Class 200, SDR-21).
 - D2241-Polyvinyl Chloride (PVC) Pipe (Class 315, SDR-13.5).
 - D2464- Polyvinyl Chloride (PVC) Threaded Plastic Pipe Fittings, Schedule 40.
 - D2466-Polyvinyl Chloride (PVC) Socket Type Plastic Pipe Fittings, Sched. 40.
 - D2564-Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings.
 - F656-Polyvinyl chloride (PVC) solvent weld primer.
 - D2855-Making Solvent Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.

3. System Components

- a. Polyvinyl Chloride Pipe (hereinafter referred to as PVC pipe) shall be manufactured in accordance with the following Product Standards:
 - (1) Product Standard PS-22-70 shall apply to mainline piping and lateral piping and shall be rated at the latest Class 200, SDR 21 PVC specifications.
 - (2) Marking and Identification: All PVC pipe shall be continuously and permanently marked with the following information - manufacturer's name, pipe size, type of pipe and material, Commercial Standard number and NSF (National Sanitation Foundation) seal.

- b. Wire, including all valve signal and common wiring, shall be solid copper #14 gauge, single strand UL-UF wire with a either PVC or polyethylene insulation as approved for direct underground burial in 30 volt AC or less service by the National Electrical Code. The color of insulation on the common wire from the control module to each solenoid valve shall be white and each signal wire shall have solid red insulation.

All wiring shall be loosely bundled with locking plastic strips every 10 feet. Install wire consistently on the same sides of all trenches i.e. north/east or south/west. Valves must be wired in accordance to the manufacturer's directions and at no time shall the length of wire from a control module to a DC latching solenoid exceed 32 feet.

- c. Backflow Prevention Device shall include I/O brass ball. Contractor must test and certify it's proper operation as per state law before system acceptance will be issued.
- d. Water Meter shall be installed in an irrigation-only water meter in a City approved valve box with locking lid.
- e. Irrigation Control System shall be Nelson, or equal, field transmitter/programmer (8081 Radio Programmer Plus), series remote programmable actuator (8034).
- f. Solenoid valves shall be installed in a level position with at least six (6) inches of cover over the valve with a valve box over each ball valve/solenoid valve unit with the flow control handles positioned in the box to enable easy access for adjustment of both. Boxes are to rest on non-wooden supports (bricks). Units must not rest in the inlet or outlet pipes or wires. Group multiple boxes together in a straight row evenly spaced apart and uniformly away from any hardscape.
- g. Pressure compensating 12" rise shrub sprays shall be installed. The connection pipe from the solid PVC pipe into the spray head body shall be from the bottom.

h. Approved Materials List

<u>ITEM</u>	<u>MANUFACTURER</u>	<u>MODEL</u>
Field transmitter/programmer. (Medians only)	Nelson	8081 Radio Programmer Plus
Series remote programmable valve actuator (Medians only)	Nelson	8034 and Model 77424 adapter (Nelson to Rainbird)
Pressure compensating spray head, 4.0" rise w/check valve.	Rain Bird	1804-SAM-PRS
Pressure compensating spray head, 6.0" rise w/check valve.	Rain Bird	1806-SAM-PRS
Pressure compensating spray head, 12.0" rise w/check valve.	Rain Bird	1812-SAM-PRS
Netaphen Dripline	Netaphen	TLDL4-1201=100' TLDL4-12025=250' TLDL4-1210=1000'
Spray Nozzles (Turf Areas)	Rainbird	1800 Low Angle
Shrub nozzle adapter (Plant Bed Areas)	Riggs	RB-5
Shrub nozzles (Plant Bed Areas)	Riggs	SN8-24
Brass gate valve, domestic manufacturer.	Nibco	T-113
Solenoid valve w/DC latching solenoid.	Rain Bird	PEB series
Quick Coupling Valves	Rain Bird	Model 44RC
PVC ball valves.	Spears	Compact unit
Backflow Preventer	Watts Regulator	Series 007 (1/2"-2"), Series 007DCDA (2") w/ SS BV handles
Concrete Double Check Box	Brooks Products	No. 65 C.I. Cover w/ No. 65 Body (2 sets req'd)

<u>ITEM</u>	<u>MANUFACTURER</u>	<u>MODEL</u>
Concrete Valve Box	Brooks Products	No. 37T C.I. Cover w/ No. 37 Body
Quick Coupler Valve Box	Ametek	10" Circular Box w/ Lid
PVC solvent & purple tinted primer.	IPS	Turftite & P-70/PVC purple tinted.
Teflon paste.	IPS	Rectorseal T Plus Z
UL-UF 24 v. wire.	Regency	#14 gauge, solid copper.
Wire splice tubes & gel.	Scotch, 3-M	DBY / DBR

All other materials as called for or required for the proper completion of work, shall be subject to approval by the City's representative.

4. Execution

- a. Before installation is started, flag where each irrigation head, solenoid valve, etc. is to be located in accordance with plans. The flagging shall be approved in writing by the City's representative before the installation is started. Should a discrepancy in the plans become apparent at this time, in regard to size and/or shape of areas to be irrigated, such discrepancy shall be pointed out to the contractor. Work must not proceed until any changes that might be necessary by such a discrepancy has been approved by the City representative.
- b. Electrical work shall be performed in strict accordance with the local codes and regulations, and as required for an operational system. Copies of all permits and inspection tags shall be given to the City prior to completion. All wire splices must be made so that the splice can be raised above the top of the valve box a minimum of 12". Use only the splicing materials called for in these specifications.
- c. Pipe Installation.
 - (1) Inspect all pipe prior to installation. Defective pipe shall be removed from the site at the end of each workday.
 - (2) Mainline Piping: All PVC mainline shall be rigid PVC with solvent welded style joints. Pipe shall be installed in a trench with a minimum eighteen (18) inches of cover.
 - (3) Lateral Piping: Install in a trench deep enough to allow for installation of irrigation heads and valves, but in no case with less than twelve (12) inches of cover.
 - (4) Piping Layout: Piping shall be installed as shown on the Contractor supplied plans that reflect actual conditions at each site. Route piping around trees and shrubs in

such a manner as to avoid damage to their root balls. Do not dig within the root ball of any tree or shrub. Pipes must not be installed in the trench laying on top of each other. Pipes must be positioned equal depths and running horizontally to each other.

- (5) All excavation and backfill shall be unclassified and soil used for backfill must not have rocks larger than one-half inch in diameter and all edges must be smooth. Compact all trenches and backfill around heads and valve boxes to 90% density.
- (6) Adjust arc and/or change nozzle to fit site conditions. Prevailing wind conditions and area to be covered will determine correct arc of spray. Filter screens must be under all nozzles and must be free of debris for system acceptance.

C. Brick Pavers

1. Paving Stone Description:

- a. Paving stones shall conform to the requirements of ASTM C936-82, and shall be "UNI-DÉCOR" as manufactured by the Pavestone Company, Paving Systems, or approved equal.
- b. Paving stone thickness shall be 2 3/8". Standard color shall be antique red unless approved otherwise by the Engineering Department.
- c. Cement shall conform to ASTM C150 and aggregates to ASTM C33. The average compressive strength of all units shall be 8,000 psi with no individual unit strength less than 7,200 psi, as tested in accordance with ASTM C140..
- d. All paving stones shall be sound and free of defects that would interfere with the proper placing of units or impair the strength or permanence of the construction.

2. Concrete Base:

- a. Concrete shall be type 1A.
- b. Concrete shall have a minimum compressive strength of 3000 PSI @ 28 days.
- c. Concrete shall be free of retarders or accelerators, unless approved by the Engineering Department.
- d. Concrete shall have a slump range of 2" to 4".

3. Sand Laying Course:

The sand laying course shall be well-graded clean washed sharp sand and graded with 100 percent passing 3/8" sieve and a maximum of 3 percent passing a No. 200 sieve size. The use of masonry sand is not permitted.

4. Edge Restraint:

- a. All edges of the installed paving stones shall be restrained. The type of edge restraint shall be detailed on the contract drawings.
- b. If, in the event the plans do not indicate an edge restraint, the following shall be used:

- (1) A precast paver edger, approved by the Engineering Department.
 - (2) A 6" wide concrete mow strip, monolithically placed with the concrete base.
 - (3) Masonry saw cut blocks, which match inside face surface of median curb.
 - (4) Poured paving blocks, which match inside surface face of median curb.
5. Installation:
- a. A concrete base must be prepared as detailed in the contract drawings.
 - b. The base course shall be shaped to grade and cross-section with an allowable tolerance of $\frac{1}{4}$ ".
 - c. The compacted sub-grade, compacted to 95 percent standard proctor, shall be 6" below the standard curb cross-section.
 - d. The Director of Engineering or his representative before the placement of the sand-bedding course shall approve the finished base surface.
 - e. The uncompacted sand laying course shall be spread evenly over the area to be paved and be screeded to a level that will produce 1" thickness, plus or minus $\frac{1}{4}$ inch, when the paving stones have been placed and vibrated. Paving stones shall have a final grade slightly higher than the standard curb/concrete beam border to allow for any minor settling that may occur within the base.
 - f. Once screeded and leveled to the desired elevation, the sand-laying course shall not be disturbed.
 - g. The paving stones shall be in a pattern as approved by the Engineering Department.
 - h. The paving stones shall be laid in such a manner that the desired pattern is maintained and the joints between the paving stones are as tight as possible. Joints between pavers shall not exceed $\frac{1}{8}$ ". Joints between ends and/or edges and expansion joint material shall not exceed $\frac{1}{4}$ ".
 - i. String lines shall be used to hold all pattern lines true to grade and line.
 - j. Pavers shall be vibrated into the sand laying course using a vibrator capable of 3,000 to 5,000 pounds compaction force with the surface clean and the joints open.
 - k. After vibration, clean masonry type sand containing at least 30 percent of $\frac{1}{8}$ " particles shall be spread over the paver surface, allowed to dry, and vibrated into joints with additional vibrator passes and brushing so as to completely fill all joints.
 - l. Surplus material shall then be swept from the surface and disposed of offsite.

II. TRANSIT-ORIENTED DEVELOPMENT (TOD) AREA DESIGN STANDARDS

The current boundaries of the two existing districts intended for transit-oriented development in the City (around the DART Downtown Carrollton LRT Station and the DART Trinity Mills LRT Station) are shown in Figures 1 & 2 of this section. However, the standards set forth in this subsection shall apply to any area zoned for the (TC) Transit Center District without regard to whether they are in the boundaries shown in Figures 1 & 2.

These standards shall be in addition to any other design or construction standards of the City of Carrollton. If there is a direct conflict between the requirements of these standards and any other standards (e.g. dimension, material, etc.) then these standards shall apply. If there exists an irreconcilable conflict between these standards and any other design or construction standards of the City of Carrollton, the City Manager or his or her designee shall determine an appropriate standard which best fulfils the intent of this section.

A. INTENT

The intent of the TOD Area Standards is to promote the development and redevelopment of the areas around Carrollton’s DART LRT stations as walkable, urban, **pedestrian-oriented** areas. To that end, the needs and desires of pedestrians should be prioritized above the needs and desires of vehicular traffic.

These standards shall be a general guide. Specific construction details (dimensions, details, materials, etc.) may differ slightly where required as development occurs and construction drawings are created. Any such deviance from the standards set forth in this subsection shall be approved by the City Manager or his or her designee after review for and conformance with the intent and goals of this subsection.

B. STREET TYPES

Although all streets in TOD areas are intended to encourage pedestrian activity, development adjacent to the streets is not expected to be uniform. Some areas will develop primarily as residential areas (although retail and office uses may be interspersed), and others will develop primarily as retail or office areas (although residential uses may be interspersed). Thus, the character of the street itself may be different. For the purposes of this sub-section, streets may be classified as “Residential Character” or “Commercial Character” based on the expected primary uses of adjacent future development. These designations are in addition to and independent of the traffic function/volume designations (e.g. “A6D,” “C2U” etc.) established by the Transportation (or Thoroughfare) Plan.

“Commercial Character” streets are those designated in bold in Figures 3 & 4. All other streets shall be “Residential Character” streets.

Residential Character streets are characterized by extremely low traffic speeds, volumes and “throughput (defined here as traffic simply ‘passing through’ the area);” ubiquitous

on-street parallel parking; a very low number of traffic lanes, narrower sidewalks reflecting lower pedestrian counts, and; more extensive streetside landscaping.

For the Downtown Carrollton area, “Residential Character” streets shall generally be:

- Any street between Belt Line Road and Crosby Road AND east of the DART LRT line (including Carroll Avenue and Myers Avenue).
- Any street between Fourth Avenue and Crosby Road AND between IH-35E and the DART LRT line (including Fifth, Vandergriff and Roberts Avenue).
- Any street between Belt Line Road and the “Cotton Belt” Railroad AND east of Jackson Street.
- Any street between the “Cotton Belt” Railroad and Northside Drive AND east of Broadway Street EXCEPT Denton Drive.

Commercial Character streets are characterized by somewhat higher traffic speeds, volumes and “throughput,” less-ubiquitous (although still commonplace) on-street parallel (or frequently, angled) parking, slightly more traffic lanes, wider sidewalks reflecting higher pedestrian counts, and; greater use of hard (although attractive and decorative) surfaces instead of turf or groundcovers in streetside landscaping.

Commercial Character streets shall be those not listed as Residential Character streets, nor shown in Figures 3 & 4.

Exceptions to these street type designations shall be:

- Crosby Road
- Belt Line Road
- Dickerson Parkway
- Interstate Highway 35E (and frontage roads)
- President George Bush Turnpike (and frontage roads/Trinity Mills Road)

For the purpose of this subsection, “exceptions” shall mean only that the design speed, traffic lane number & width, curb return radii and presence of on-street parking shall not be governed by the provisions of this subsection.

C. STREET NETWORKS & BLOCKS

Compactness and density of development is intrinsically linked to pedestrian activity, which relies on a fine-grained, well-integrated and universally-connected network of streets. Therefore, a traditional street grid is mandatory for development in the TOD areas. Dead-end streets (including permanent cul-de-sacs) which do not allow for future extension and connection to other streets are prohibited.

Existing streets may be relocated and new streets created where appropriate to better create a more regular network or grid.

Block length shall be relatively short, with the ideal being approximately three hundred (300) feet. In no instance shall a block exceed four hundred (400) feet. Existing blocks may be maintained wherever appropriate to better create a more regular network or grid. Blocks shall be square or rectangular in shape wherever physically possible.

D. STREET DESIGN & DIMENSIONING

Street layout shall be based on a “modular” approach. Sidewalks, streetside landscaping, parking lanes, traffic lanes and medians shall be “assembled” from a standard “bin of parts” to create a whole street. Specific criteria and dimensions are listed in Table 1, below.

TABLE 1		
	Residential Character Street	Commercial Character Street
Max Number, Traffic Lanes	2	4
Max Design Speed	25 MPH	30 MPH
Max Traffic Lane Width	10 feet	11 feet
Max Curb Return Radius	20 feet *	25 feet *
Min Number, On-Street Parking Lanes	2	2
Type of Parking	Parallel	Parallel or Angle
Min Sidewalk Width	6 feet	6 feet
Min Landscaping Strip Width	6 feet	6 feet
Landscaping Strip Surface Material	Turf or Groundcover	Special Paving
* Where a Residential Character street intersects with a Commercial Character or “Excepted” street or where a Commercial Character street intersects with an “Excepted” street, the curb return radius at the intersection shall be the larger of the two required distances.		

E. UTILITY APPURTANCES

Above-ground traffic control boxes, utility risers and similar equipment and appurtenances shall not be placed within fifty (50) feet of an intersecting street. Such equipment and appurtenances are allowed when installed underground or in a closet or enclosed recess in the side of a building.

F. STREET LIGHTS

With the exception of Belt Line Road, street lights shall be installed in the “landscaping strip” in an alternating pattern, and 48 feet on-center. See Figures 8 & 9 for the general layout and dimensions.

Streetlights shall be of the following designs:

Downtown Carrollton TOD Area

ALONG BELT LINE ROAD

Sternberg Lighting Company, or equal
 Base style 5200 “Barrington,”
 Pole style RT “roadway tapered ,”
 Arm/bracket style “CAS” (double arm/bracket),
 Luminaire style 1913 “Libertyville”
 (See Figure 5)

ALL OTHER STREETS

TXU Electric Delivery decorative street light
 Base/pole style “American,”
 Luminaire style “Paragon.”
 (See Figure 6)

Trinity Mills TOD Area

ALL STREETS

TXU Electric Delivery decorative street light
 Base/pole style “Philadelphia,”
 Luminaire style “Hanover.”
 (See Figure 7)

Exception to the above design may be approved by the City Manager or his designee.

G. STREETSIDE LANDSCAPING

Landscaping shall be installed between the back of curb and the sidewalk in the “landscaping strip.” Landscaping shall consist of street trees and turf or groundcover (along residential character streets), and street trees and special paving (along commercial character streets).

Street trees shall be a species found in Subsection I of this section and shall be approved by the City Manager or designee for appropriateness in a specific location. Street trees shall be planted in a regular pattern along the street, 24 feet on center. See Figures 8 & 9 for general layout and dimensions.

Tree grates shall be required for all trees. Tree grates shall be of the following designs:

Downtown Carrollton TOD Area

Neenah Foundry Company, or equal
Model R-8738-1 (from the Parkway Collection)
Better: Model R-8730, modified to be 72" square (Other Creations)

Trinity Mills TOD Area

Neenah Foundry Company, or equal
Model R-8716 (from the Boulevard Collection)

Exception to the above design may be approved by the City Manager or his designee.

Special paving shall consist of brick pavers conforming to the design and installation requirements of Subection I C (Brick Pavers) of this Section, except that a concrete base shall not be used . See Figures 8 & 9 for general layout and dimensions.

H. CROSSWALKS

Crosswalks shall be paved with special paving in accordance with the requirements of Subsection I C (Brick Pavers) of this Section. See Figures 8 & 9 for general layout and dimensions.

FIGURE 1: DOWNTOWN CARROLLTON TOD AREA

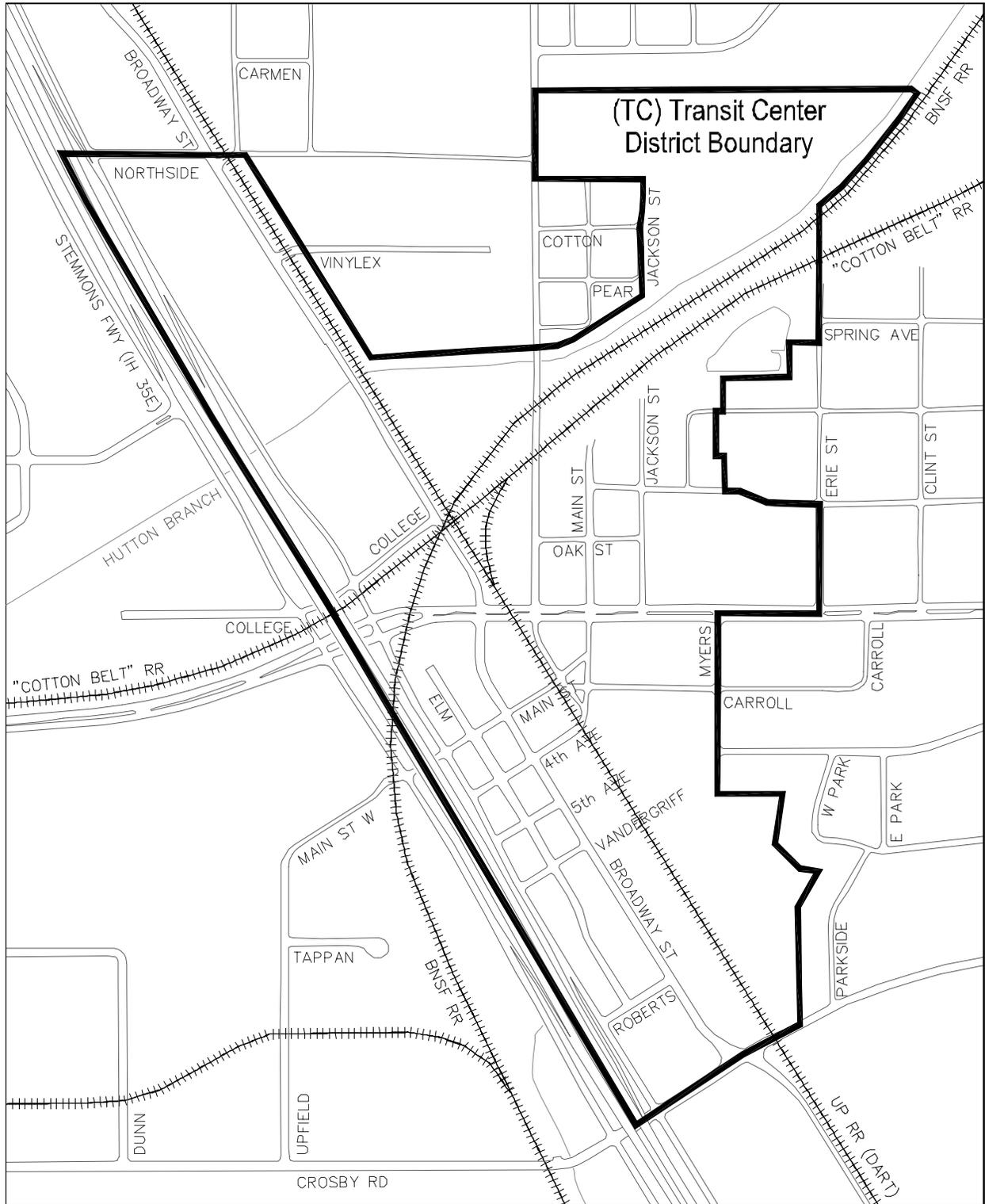


FIGURE 2: TRINITY MILLS TOD AREA

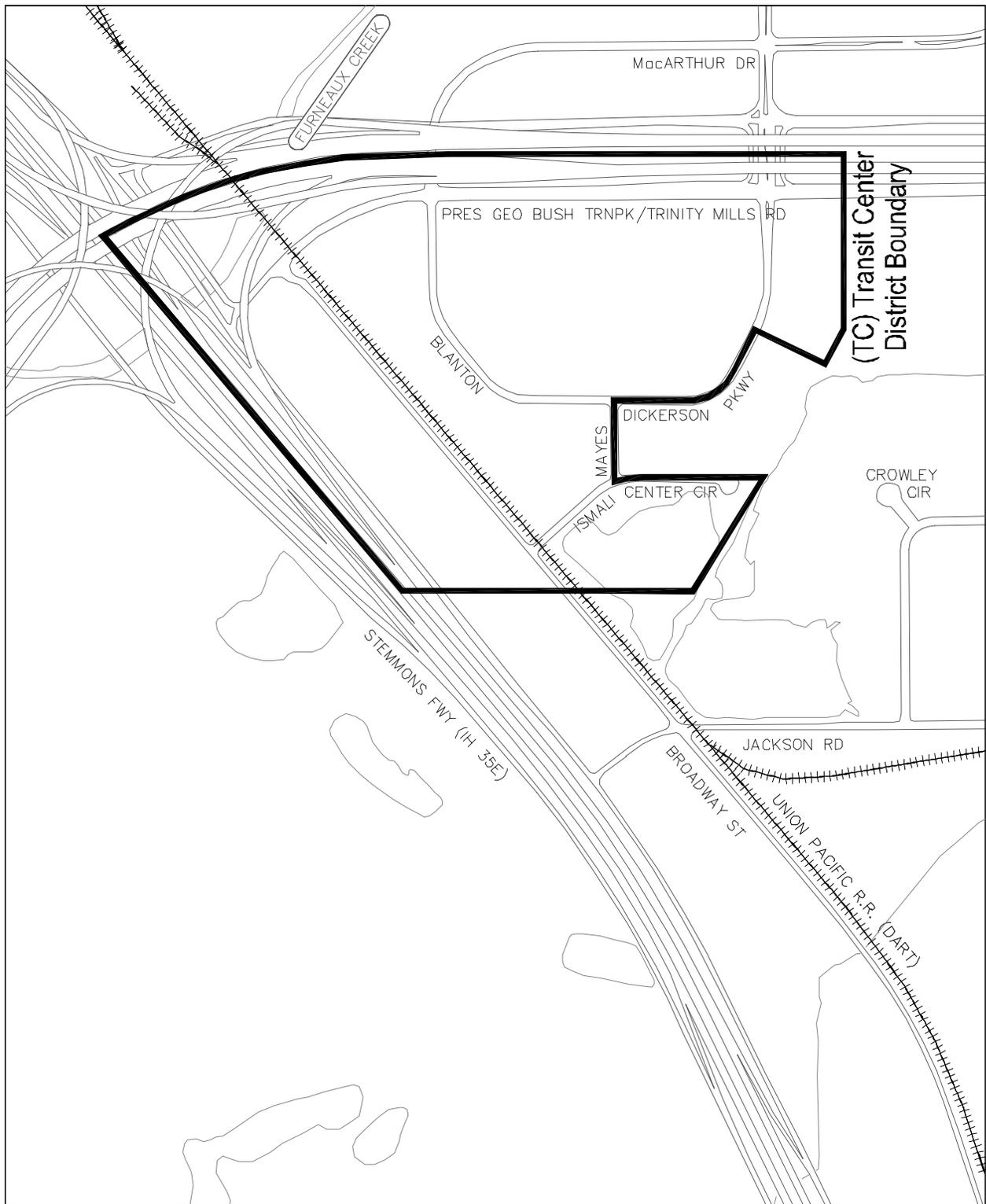


FIGURE 3: DOWNTOWN CARROLLTON COMMERCIAL CHARACTER STREETS

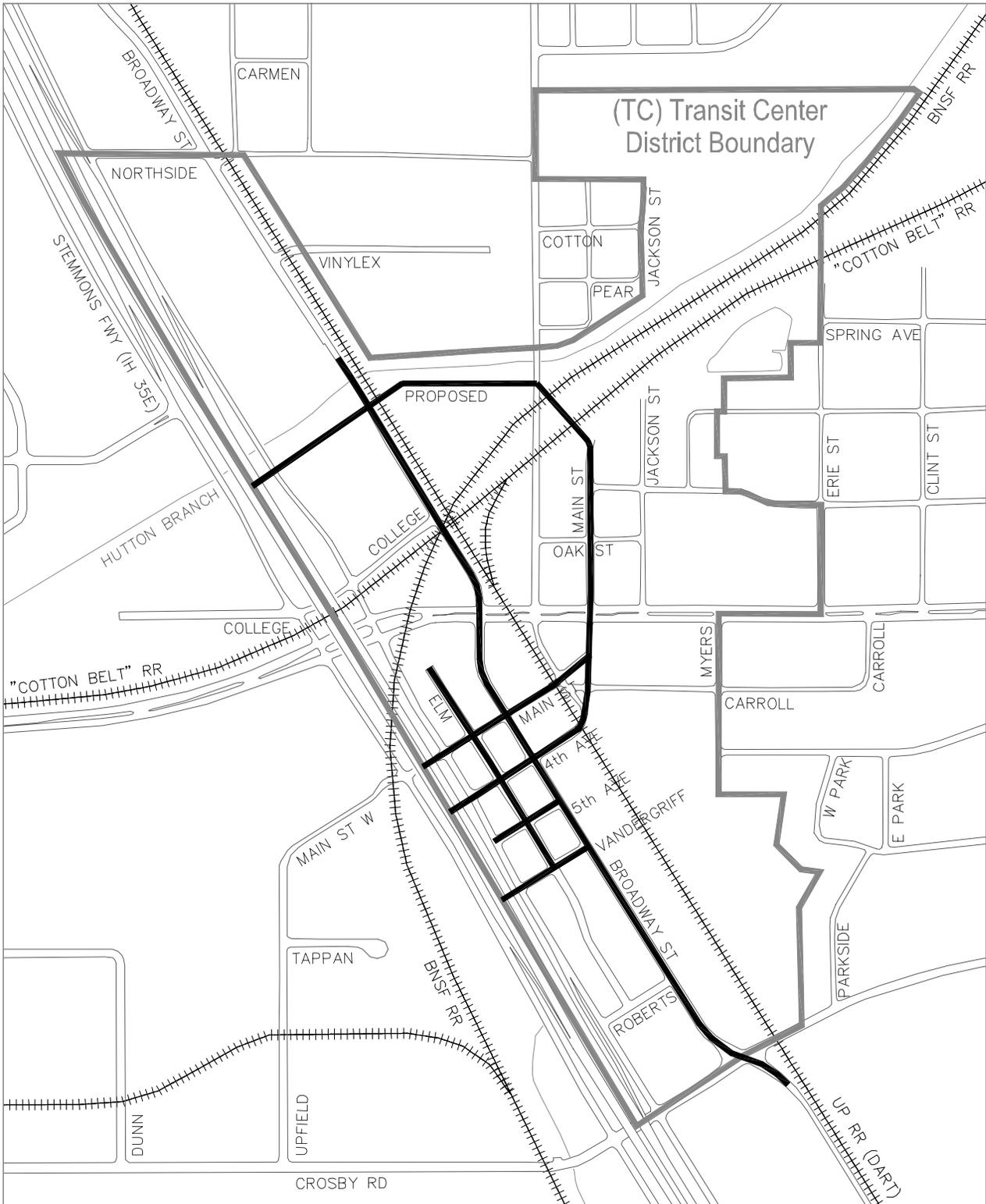


FIGURE 4: TRINITY MILLS
COMMERCIAL CHARACTER STREETS

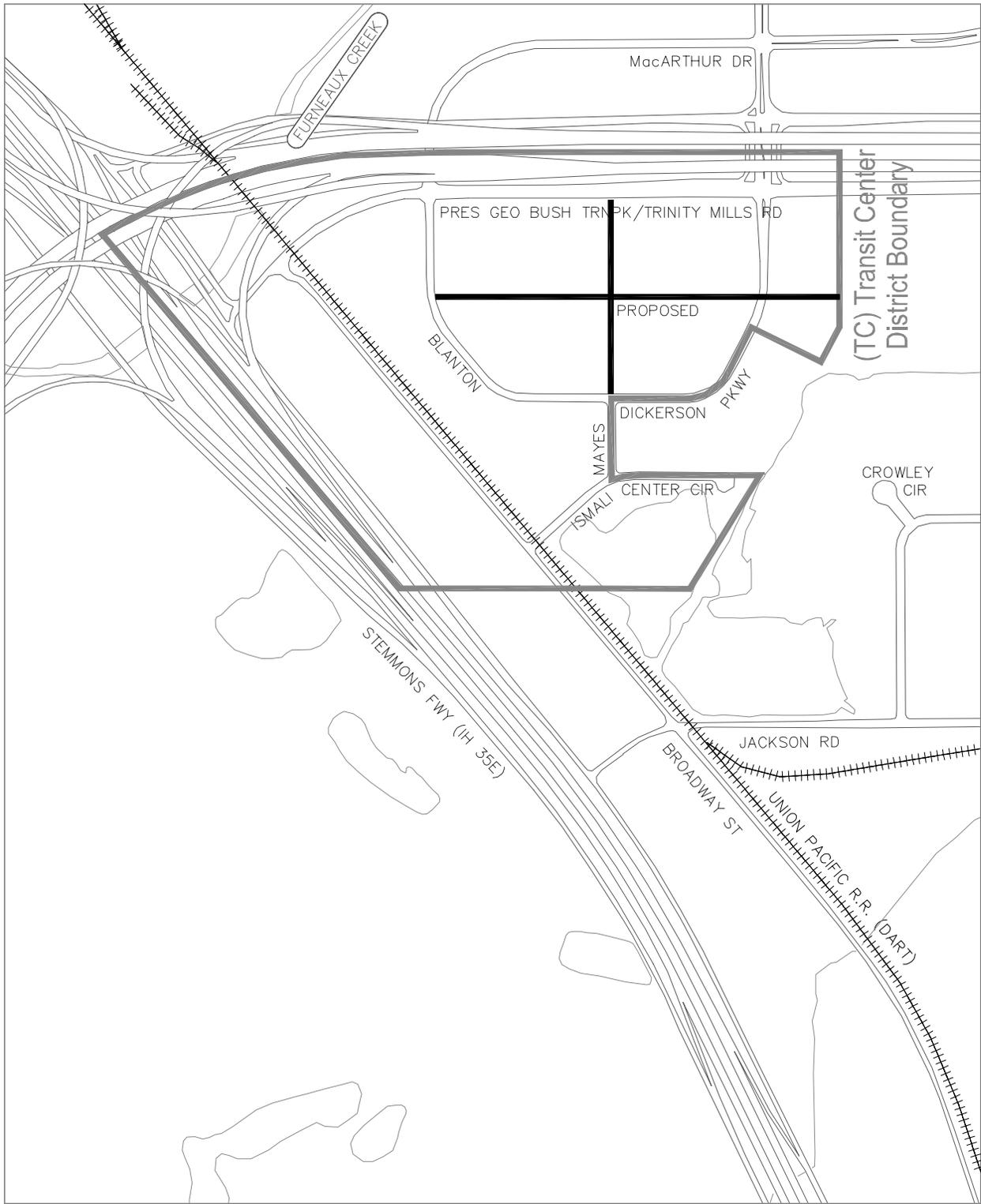


FIGURE 5: BELT LINE ROAD
STREET LIGHTS
(Sternberg Lighting Company, Roselle, Illinois)

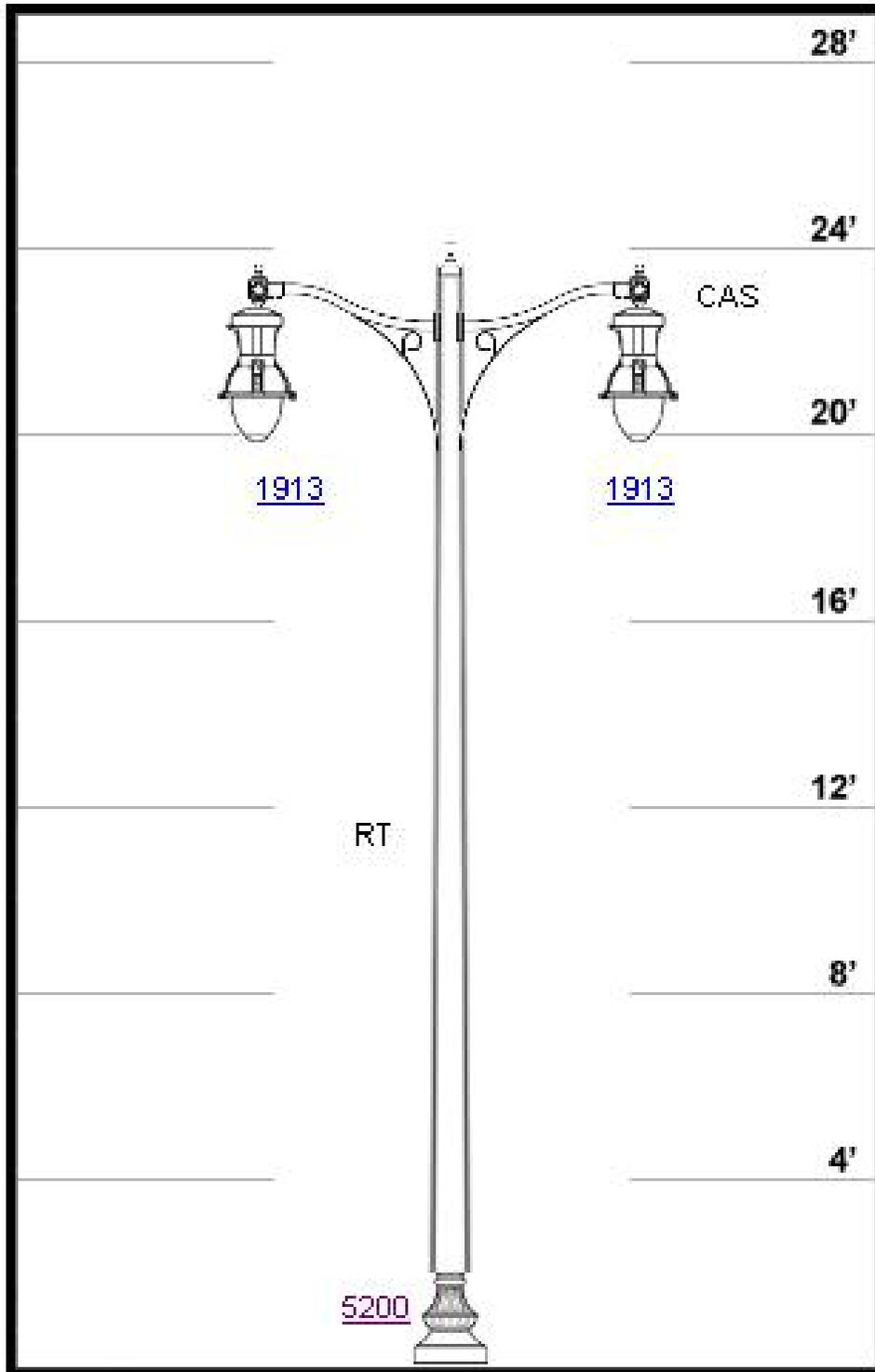


FIGURE 6: DOWNTOWN CARROLLTON
TOD AREA STREETLIGHTS
(TXU Electric Delivery)

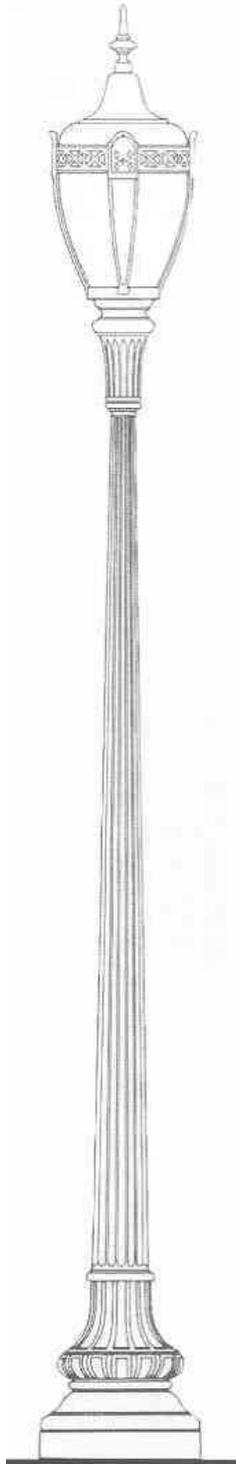
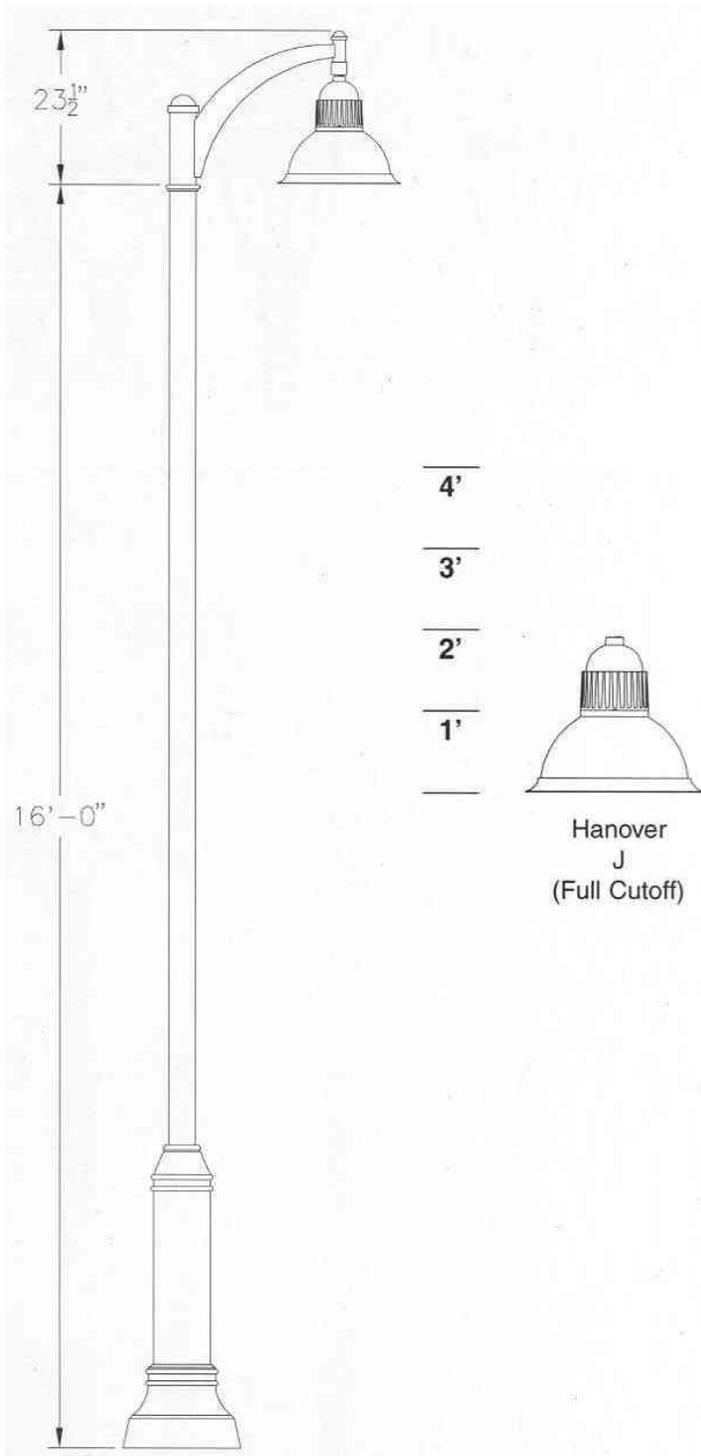
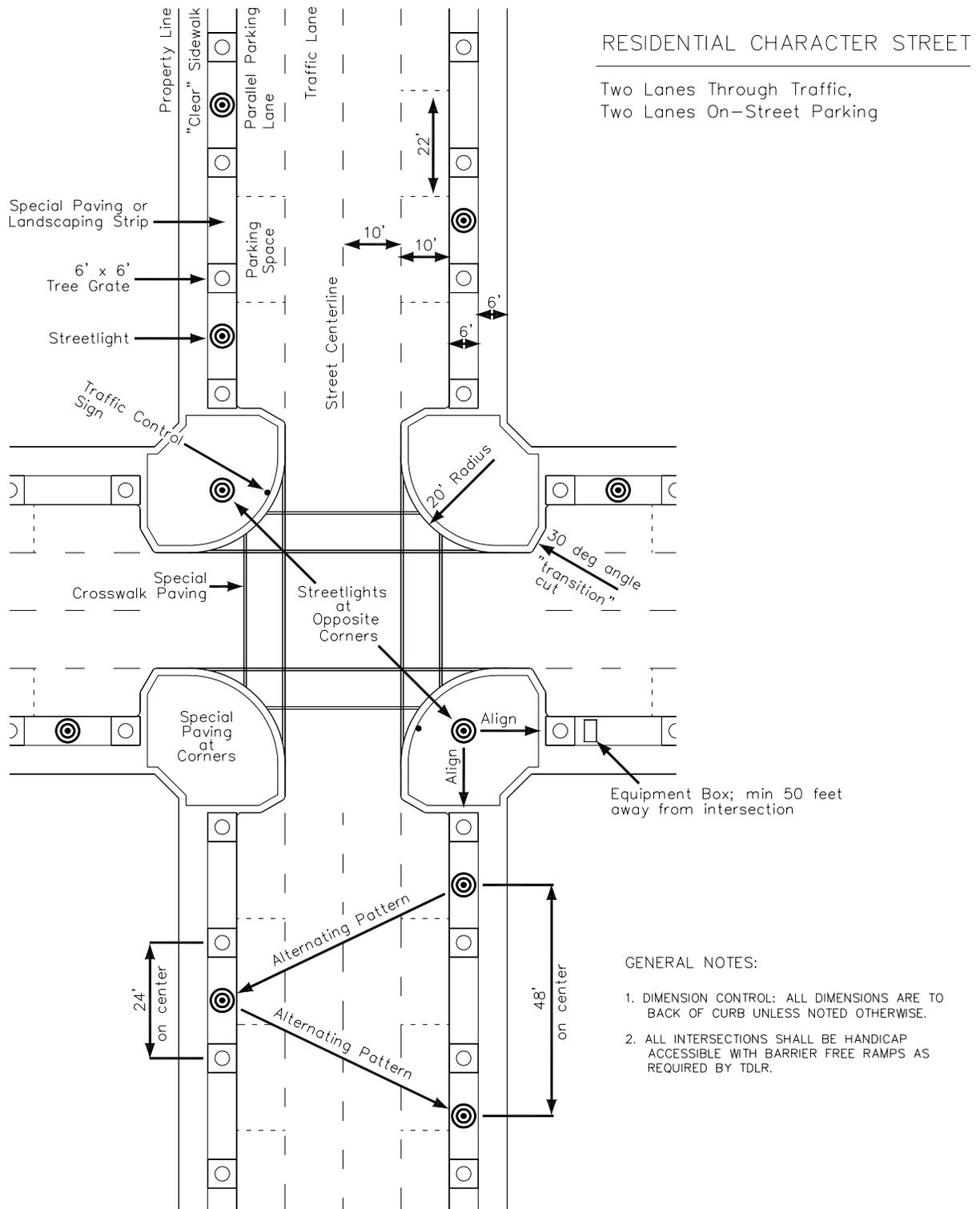


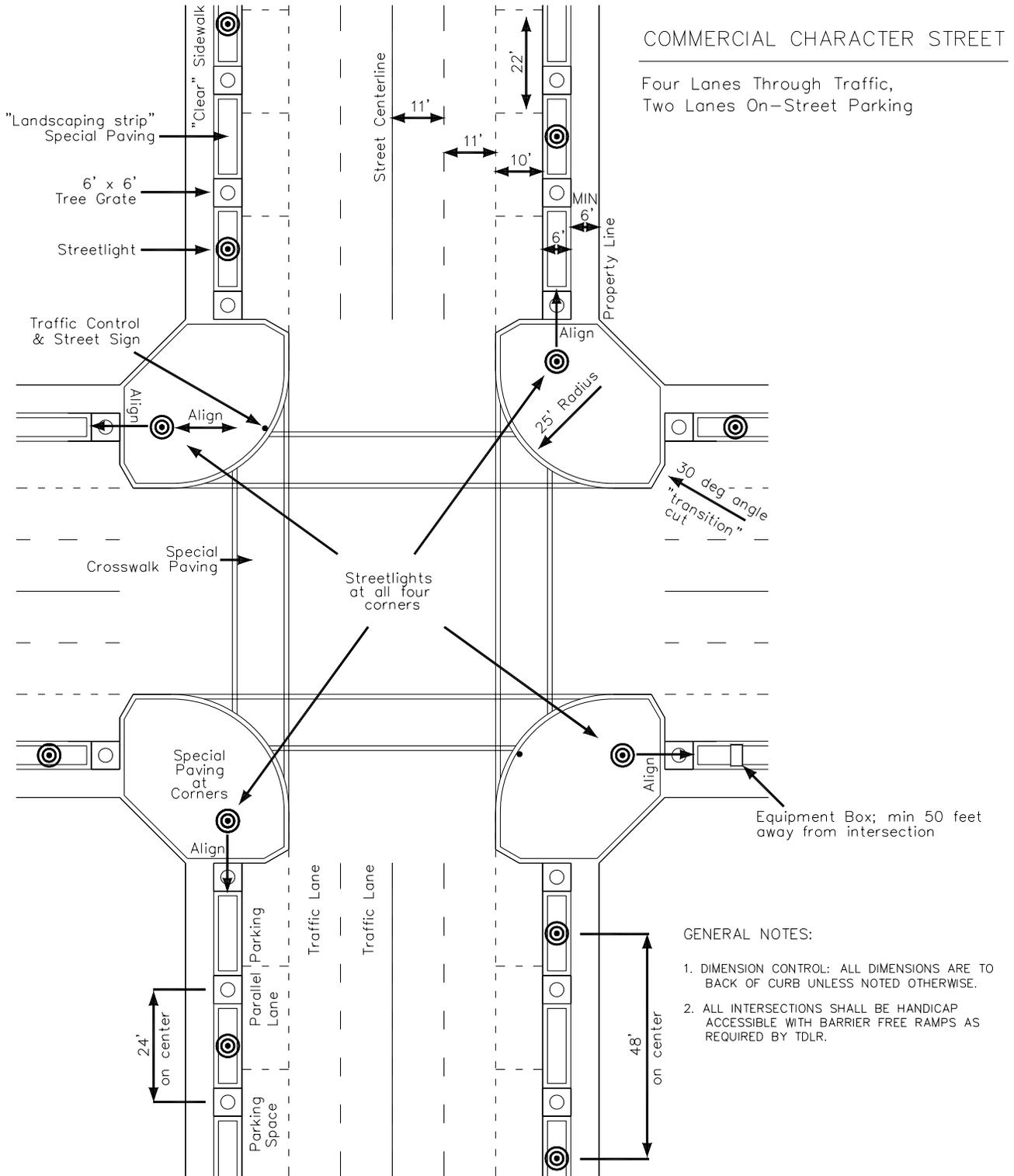
FIGURE 7: TRINITY MILLS
TOD AREA STREETLIGHTS
(TXU Electric Delivery)



**FIGURE 8: RESIDENTIAL CHARACTER STREETS
GENERAL DESIGN, LAYOUT AND DIMENSIONS**



**FIGURE 9: COMMERCIAL CHARACTER STREETS
GENERAL DESIGN, LAYOUT AND DIMENSIONS**



SECTION 8**SCREENING WALLS****I. BRICK SCREENING WALLS****A. Piers:**

1. Design wind pressure shall be 20 psf.
2. Concrete strength shall be a minimum of 3,000 psi at 28 days with ¾" max. aggregate size poured at 3-4" slump.
3. Reinforcing steel is to be ASTM A615 grade 60 and shall extend from the full depth of the pier to the full height of the brick column (less the thickness of the column cap
4. Reinforcing tie wires in piers shall be 9 gauge hot dipped galvanized 60,000 psi wire.
5. The bottom of the drilled pier shaft shall be clean and dry prior to the placement of concrete. Spacing requirements shall be determined by the design engineer.
6. Concrete shall be placed within eight (8) hours after the pier shaft has been drilled.
7. A geotechnical analysis shall be submitted to the city by a certified soil laboratory to determine the plasticity index of the project site soils. This geotechnical analysis shall also indicate the spacing requirements and depths recommended for the use of belled piers.
8. Straight shaft piers shall penetrate a minimum of three (3) feet into rock or eighteen (18) inch diameter piers with a twenty-four (24) inch bell shall bear on stiff clay at a minimum depth of twelve (12) feet. The soil laboratory shall determine the depth of the stiff clay.
9. A registered engineer may submit an alternate design.

B. Walls and Columns:

1. Brick shall conform to ASTM C216 or C62, grade SW, with a minimum compressive strength of 3,000 psi and shall be cored. Walls shall be capped with either solid brick or a soldier course. The brick shall be from a supplier from which replacement bricks are readily available to the Carrollton area and shall be manufactured within the state of Texas. Used brick will not be allowed.
2. Mortar shall conform to ASTM C270, type S (1 part Portland cement, 1/2 part hydrated lime, and 4 1/2 parts sand by volume). *Masonry cement shall not be used.*
3. Reinforcing in walls shall be #9 gauge, 1 3/4" wide hot-dipped galvanized ladder wire in the top, bottom and every other course of masonry. Yield strength of the steel shall be 60,000 psi.
4. Columns shall have #9 gauge hot dipped galvanized fabricated wire ties, as detailed, in every other masonry course. Yield strength of the steel, for the ties, shall be 60,000 psi.
5. Reinforcing in the columns shall extend to within three (3) inches of the top of the column, splices in vertical reinforcing steel, from the pier, shall be a minimum of 24 inches in length.

6. Columns shall be filled with a pea gravel concrete grout conforming to ASTM C476 that has a maximum slump of ten (10) inches and a compressive strength of 3,000 psi in twenty-eight (28) days.
7. Walls shall be supported on a 3"x3"x3/8" galvanized steel angle iron placed on one brick course spanning between piers as shown in the standard details.
8. An 24" wide, 4" inch thick, reinforced concrete mow strip shall be constructed under the wall throughout its length

C. Miscellaneous Items

1. Soil shall be a minimum of 3" from the bottom of the wall panels.
2. Grades must be maintained to allow water to flow away from all pilasters and columns. Irrigation heads and water flow shall not be directed against the wall
3. Provide expansion joints at posts no more than 24' o.c. Soldier courses shall not be mortared solidly into piers as it causes cracking at the pier or wall.

D. Workmanship:

1. Head and bedding courses shall be filled solid with mortar.
2. Grout in the columns shall surround vertical reinforcing steel and completely fill all voids; grout shall be mechanically vibrated.
3. All masonry joints shall have concave tooled joints. No raked joints will be allowed.
4. Construction shall be in accordance with the requirements for the "RECOMMENDED PRACTICE FOR ENGINEERED BRICK MASONRY" from the "BRICK INSTITUTE OF AMERICA".

E. Maintenance Bond:

1. A maintenance bond of one-hundred (100) percent of the screening wall contract for a period of two (2) years will be required. The maintenance bond shall be dated from the date of the acceptance of the screening wall by the City of Carrollton Engineering Department.
2. An inspection fee of three (3%) percent of the screening wall contract will be required for all screening wall construction projects.

F. Alternate Placement:

Where a subdivision within the city is developed adjacent to an arterial or collector thoroughfare, as designated on the Transportation Plan, and the developer, upon approval from the Planning and Zoning Commission, dedicates additional right-of-way for the arterial or collector thoroughfare above the minimum required by this ordinance, this additional right-of-way will be for the purpose of the developer providing landscaping, additional areas for sidewalk or wall locations, or other amenities as approved by the Planning and Zoning Commission.

In conjunction with the submittal, the request shall include landscape/design plans developed by a landscape authority, as defined herein. Such plan will clearly delineate and identify any

existing or proposed landscaping elements, walls, sidewalks, or any other design component to be incorporated.

The developer and/or Homeowners Association would enter into a license agreement with the City of Carrollton and be responsible for the installation and maintenance of all landscape areas. Such areas shall be maintained so as to present a healthy, neat and orderly appearance at all times, and shall be kept free of debris and trash.

All landscape areas shall be permanently landscaped with living plant material, and shall have an irrigation system installed meeting all applicable requirements of the City of Carrollton.

Shrubs shall be, at a minimum, a five-gallon container size at the time of planting. Trees shall be of at least three (3) inches in trunk diameter at the time of planting, measured twelve (12) inches above grade, and shall be maintained in a living and growing condition.

Grass areas may be sodded, plugged, sprigged or seeded, except that solid sod shall be used in swales or other areas subject to erosion, as determined by the Engineering Department, based upon accepted engineering practice.

Landscape material, inclusive of decorative walls, benches, or other component, shall comply with the provisions of Chapter 53 of the Carrollton Code of Ordinances, otherwise known as the Visibility Obstructions Ordinance.

All walls, walks, and any other man-made component of the proposed design shall be designed and constructed in accordance with the Standard Details of the City of Carrollton.

II. PRECAST CONCRETE SCREENING WALLS (FOR PRIVATE USE ONLY)

These walls are for screening walls on private property required by the Comprehensive Zoning Ordinance between Commercial & Residential Districts and Multi-Family and Single-Family Districts. These screening walls cannot be used if they are parallel with any City streets.

A. Piers and Concrete Beam (Mow Strip):

1. Design wind pressure loading shall be 20 PSF.
2. Design concrete strength shall be a minimum of 2,500 PSI at 28 days.
3. Reinforcing design shall be deformed bars ASTM A615 grade 60 and/or welded wire fabric conforming to ASTM A185 or A497. The design drawing showing the reinforcing placement for the precast concrete fence shall have a registered engineers seal and signature.
4. A geotechnical analysis shall be submitted to the city by a certified soil laboratory to determine the plasticity index of the project site soils. This geotechnical analysis shall also indicate the spacing requirements and depths recommended for the drilled piers.
5. Straight shaft piers shall penetrate a minimum of three (3) feet into rock or shall bear on stiff clay at a minimum depth of twelve (12) feet. The soil laboratory shall determine the depth of the stiff clay.

6. The depth of the required piers shall be determined by the design engineer and shall be shown on the signed and sealed design drawings.
7. The bottom of the drilled pier shaft shall be clean and dry prior to the placement of concrete.
8. Concrete shall be placed within eight (8) hours after the pier shaft has been drilled.
9. The concrete beam (mow strip) between piers shall be designed by the product engineer but shall be the same width as the drilled piers.

B. Walls and Columns:

1. Concrete and/or product materials shall be from a supplier from which replacement units are readily available to the City of Carrollton and shall be manufactured within the State of Texas.
2. Mortar (where used) shall conform to ASTM C270. Type S (1 part Portland cement, ½ part hydrated lime, and 4 ½ parts sand by volume, unless so specified by the product design engineer).
3. Reinforcing design shall be deformed bars, ASTM A615, grade 60 and/or welded wire fabric as designed by the product engineer.
4. Design concrete strength shall be a minimum of 2,500 PSI at 28 days.
5. Fence post and precast fence sections shall have a standard finish (simulated wood grain or brick pattern). The finish shall be submitted to the City of Carrollton Engineering Department for approval prior to construction.
6. Forms shall be of the approved pattern and constructed of steel. All joints in the forms shall be smooth and mortar-tight to avoid irregular finishes or blemishes. Plugging of holes and slots or other repairs shall be done in such a manner to provide a smooth even finish.
7. Drain holes two (2) inches by eight (8) inches in size shall be provided at the third points of the bottom panel where the bottom panels bear directly on the concrete beam (mow strip).

C. Miscellaneous:

1. The grade between the existing back of curb and the screening fence shall not exceed a 4:1 slope. Any slope greater than 4:1 will require slope protection material (i.e., brick pavers, concrete riprap and/or a retaining wall).
2. Concrete for the piers shall be flushed with the finished ground elevation.
3. After the final grading has been completed, the Contractor will block sod all exposed areas between the back of curb and the screening fence.

D. Workmanship:

1. Construction of panels and fence posts shall conform to all local building codes and ordinances. Panels shall be uniform in finish, color, and appearance and shall be readily interchangeable.
2. Curing of precast panels shall be in accordance with the recommended practice of the Precast Concrete Institute of America.

E. Maintenance Bond:

1. Original two (2) year maintenance bond(s) shall be furnished on the insuring company's form. The bond shall be dated to begin from the date of the acceptance of the project by the City. Maintenance bonds, for one hundred (100) percent of the total contract amount for the project, shall come from an approved surety company holding a permit from the State of Texas to act as surety and acceptable according to the latest list of companies holding certificates of approval from the State Board of Insurance under 7.19-1 of the Texas Insurance Code.

SECTION 9**EXCAVATION SAFETY REQUIREMENTS AND PROCEDURES****A. Bid Document Inclusion Requirements:**

In a municipality or in the extraterritorial jurisdiction of a municipality as provided by the Municipal Annexation Act (Article 970a, Vernon's Texas Civil Statutes), on construction projects in which excavation will exceed a depth of five feet, the bid document and the contract must include detailed plans and specifications for excavation safety systems or provide a bid item that compensates the Contractor to furnish the plans and specifications for excavation safety systems.

B. Additional Submittal Requirements:

Prior to execution of a contract, the contractor will be required to submit an excavation safety plan for the project. This excavation safety plan must be designed and sealed by a professional engineer registered in the State of Texas with professional experience in soil mechanics. The contractor is responsible for obtaining borings and soil analysis as required for plan design. The excavation safety plan shall be designed in conformance with Occupational Safety and Health Administration (OSHA) standards and regulations.

C. Review and Approval:

After review of the excavation safety plan, the Engineering Department will forward the reviewed plan to the city construction division for use in inspection. The Engineering Department will not release plans for construction until this plan is reviewed. Changes in the excavation safety plan after initiation of construction may not be cause for extension of time or change order, and will require the same review process. Contractor accepts sole responsibility for compliance with all applicable safety requirements. The review is only for general conformance with OSHA safety standards. Release of the excavation safety plan by the Engineering Department does not relieve contractor from any property damage or bodily injury (including death) that arises from use of the excavation safety plan, from contractor's negligence in performance of contract work, or from city's failure to note exceptions to the excavation plan. The safety plan shall remain the sole responsibility and liability of contractor. A separate pay item for an excavation safety and support system shall be included in the bid documents.

D. Compliance With Occupational Safety and Health Administration (OSHA) Standards:

Contractors have three ways to meet OSHA standards for excavation safety. They are as follows:

- Minimum angle of repose for sloping of the sides of excavations.
- Utilization of a Trench Box.
- Shoring, Sheet piling and Bracing Methods.

1. Minimum Angle of Repose: Contractors electing to utilize the minimum angle of repose must submit:
 - a. Soil classification according to the unified soil classification system including water content and plasticity indexes, and a minimum angle of the slope excavation.
 - b. A detailed plan of the excavation area and the impact on existing right-of-way and infrastructure.
 - c. Waiver of claim for delay cost.
2. Trench Box: Contractors electing to utilize a trench box must submit:
 - a. Physical dimensions, materials, position in the trench, expected loads, and the strength of the box.
 - b. Waiver of claim for delay cost.
3. Shoring, Sheeting and Bracing Method: Contractors electing to utilize shoring, sheeting and bracing must submit:
 - a. Dimensions and materials of all uprights, stringers, crossbracing and spacing required to meet OSHA requirements.
 - b. Waiver of claim for delay cost.

SECTION 10**TESTING PROCEDURES FOR ALL UNDERGROUND UTILITIES,
SUB-GRADE PREPARATION AND PAVEMENT CONSTRUCTION****A. Water Mains and Lines (including fire sprinkler mains):**

1. All water lines 4" diameter and larger are to be hydrostatically tested at two hundred (200) psi (pounds per square inch) for three (3) hours continuous. All concrete steel cylinder lines are to be hydrostatically tested at one hundred eighty (180) psi for four hours continuous.
2. The leakage rate for that period shall not exceed 11.65 gallons per inch in diameter per mile of pipe over a twenty-four (24) hour period.
3. The Contractor shall sterilize the installed pipe system by the injection of a chlorine solution of such a strength to obtain a chlorine solution to water ratio of 50 parts per million throughout the installed pipe system.
4. The chlorine solution shall remain in the installed pipe system for twenty-four (24) hours after, which the Contractor shall flush and fill the system with potable water.
5. After the system has been flushed, tested and approved by the City Inspector for a nominal chlorine residue, the Contractor, in the presence of the City's Inspector, or a representative from the City's Water Utilities' Division, shall take water samples (1 per 1,000 LF). These samples normally will be at each end of the project with additional samples at each dead end or as deemed necessary by the City Inspector. The Contractor or a representative from the City's Water Utilities' Division, shall carry the samples to a city approved testing laboratory. This laboratory shall provide tests as required by state health codes pertaining to potable water. When these tests show the samples provided are not acceptable for potable water (coliform organisms, silt, etc.), the Contractor shall flush and/or re-sterilize the underground piping system. Re-sampling shall be required. The cost of all laboratory testing will be billed to the Contractor. Flushing shall be to sanitary sewer mains or by proper dechlorination methods approved by the City.
6. Trench compaction testing shall be performed at the rate of 1 density test per 300 LF per 1 foot of lift.

B. Sanitary Sewer Mains, Lines and Manholes:

1. Air Testing
 - a. Lines less than thirty-six (36) inches in diameter shall be air tested by the following procedures:
 - (1) All openings are to be plugged, sealed or capped with one (1) opening being capped with a suitable tap for an air supply connection.
 - (2) An air compressor with the capability to supply at least three hundred (300) cubic feet per minute at one hundred (100) pounds per square inch. The air compressor is to be connected to the tapped cap with suitable air hose,

connections, valves, pressure gauges, and other suitable equipment to monitor the air flows to the test section.

- (3) The City Inspector shall note the height of the ground water.
- (4) The air compressor shall be started and the injection of air into the test section may begin. The air pressure within the test section shall be constantly monitored by the contractor so that the internal pressure does not exceed five (5) pounds per square inch.

NOTE: A reduction of 0.43 psi of pressure is to be applied to the internal pressure of the test system for each vertical foot of ground water over the top of the test section pipe.

- (5) When the internal air pressure of the test section reaches 4.0 p.s.i.g., the air supply is to be throttled so that the internal pressure is maintained between 4.0 and 3.5 p.s.i.g. for at least two (2) minutes. This two (2) minute period is to allow the air temperature within the test section to stabilize.
- (6) After temperature stabilization the air supply is to be disconnected and the internal air pressure allowed to decrease to 3.5 p.s.i.g.
- (7) Upon reaching 3.5 p.s.i.g. a stopwatch is to be started to measure the time required for the internal air pressure to drop to 2.5 p.s.i.g.
- (8) The section of pipe being tested shall be considered within the allowable leakage range if the time required in seconds for the pressure to decrease from 3.5 to 2.5 p.s.i.g. is equal to or greater than that shown in the table in Section 6.7.2 of the NCTCOG Specifications.

- b. Manholes shall be vacuum tested in accordance with Section 6.7.2 of the NCTCOG Specifications. Manholes which fail the initial test must be repaired with a non-shrink grout or other suitable material based on the material from which the manhole is constructed. Manholes shall be retested until a successful test is achieved.

2. Trench Compaction

- a. Trench compaction testing shall be performed at the rate of 1 density test per 300 LF per 1 foot of lift.
- b. Manholes shall be tested in a spiral fashion around the manhole in one foot lifts.

3. Certification of Materials:

- a. A certified mandrel gauge shall be passed through the installed system after the backfilling operation has been completed. This mandrel gauge is to verify that a maximum of five (5) percent deflection is not exceeded with the installed system.
- b. A color television camera recording of the interior of the installed sanitary sewer system, including service laterals, is to be provided by the contractor to the City of Carrollton. The inspection shall follow NASSCO's Pipeline Assessment and Certification Program (PACP) Format for CCTV'ing and shall be provided to the City in VHS or DVD and written or printed formats.

C. Storm Sewer Mains and Lines:

1. Two color television camera tape-recordings (VHS format) of the interior of the installed storm sewer system are to be provided by the contractor to the City of Carrollton. One tape shall be made after remixing of lime has been completed and one at the end of the project to ensure that the pipe is free of mud and debris.
2. Trench compaction testing shall be performed at the rate of 1 density test per 300 LF per 1 foot of lift.

D. Pavement Subgrade:

All testing associated with paving improvements will be conducted by a certified laboratory selected by the contractor, and approved by the Engineering Department. The contractor will pay for all tests performed unless noted on the plans and specifications.

1. Embankment materials shall be tested and certified for density, moisture and graduations as set forth in the NCTCOG Specifications, following standard test procedures.
 - a. Density testing shall be performed on each lift of properly placed and compacted material, and minimum requirements for density shall be ninety-five (95) percent of the maximum density as determined by ASTM D698. Moisture content of the material shall be from optimum moisture content to plus four (4) percent above optimum moisture content. The minimum frequency of density testing shall be three (3) tests per one (1) foot loose lift per two thousand (2000) square yards of surface area. Retesting of materials shall be performed at the original test location. *If paving operations haven't started within 72 hours after liming, the subgrade shall be reworked and retested as required by the specifications.*
 - b. Graduations after the final mixing shall be as follows:
 - Minimum passing 1 $\frac{3}{4}$ inch laboratory sieve 100%
 - Minimum passing no. 4 laboratory sieve 60%
 - These tests will be taken every 1,000 square yards.
2. Subgrade compaction shall be tested for density and moisture following standard test procedure. Density testing shall be performed on each lift of properly placed and compacted material. Minimum requirements for density shall be ninety-five (95) percent of the maximum density as determined by ASTM D698. Moisture content of the material shall be from optimum moisture content. The minimum frequency of testing shall be three-(3) test per one (1) foot loose lift per two thousand (2000) square yards of surface area. Retesting of materials shall be performed at the original test locations at the contractor's expense, as shall additional testing, to assure specifications compliance.

E. Concrete Pavement:

All testing associated with paving improvements will be conducted by a certified laboratory selected by the contractor, and approved by the Engineering Department. The contractor will pay for all tests performed unless noted on the plans and specifications.

1. Upon completion of the work and before final acceptance/final payment shall be made, pavement thickness tests will be conducted. The number of cores required for thickness verification will be based on three (3) cores for every two thousand (2000) square yards

of pavement surface area. A minimum of three (3) cores per project will be required, unless otherwise authorized by the Director of Engineering or his appointed representative.

Pavement thickness within one-quarter inch ($\frac{1}{4}$ ") of the thickness required by the plans will be considered satisfactory. Pavement of a thickness less than the thickness shown on the plans by more than $\frac{1}{4}$ " , but less than $\frac{3}{4}$ " will be considered a deficient thickness.

Pavement with a thickness deficiency shall be removed and replaced completely at the contractor's expense. However, at the sole discretion of the Director of Engineering, if the pavement is found to be deficient in thickness as defined above, the Contractor may instead pay to the City of Carrollton twice (2 times) the unit bid price per square yard for the area determined to be deficient in thickness. The length of the area of such deficient thickness shall be determined by additional cores at intervals of ten (10') feet along the length of the plans. The width of such area shall be the entire pavement width. In any case, pavement with a thickness deficiency of more than $\frac{3}{4}$ " shall be removed and replaced completely at the contractor's expense.

2. During the progress of the work, the contractor shall cast test cylinders to maintain a check on the compressive strength of the concrete being placed. Sampling and molding of test specimens shall meet the applicable A.S.T.M. guidelines. Concrete pavement testing shall require three (3) individual strength samples per test, at a frequency of one test per one hundred (100) cubic yards, or fraction thereof, of concrete placed per day. A copy of the test results shall be delivered to the Engineering Department and shall include the date and time of sampling, exact location concrete was placed, truck ticket number, slump, air content, and temperature of concrete.

Pavement with any strength deficiency shall be removed and replaced completely. Pavement of a strength less than that called for in these specifications, as determined by cores and as stipulated, will be considered deficient in strength. However, at the sole discretion of the Director of Engineering, if the pavement is found to be deficient in strength by not more than 500 pounds per square inch, the Contractor may instead pay to the City of Carrollton one (1 time) the unit bid price per square yard. For the area determined to be deficient in strength by more than 500 pounds per square inch, but not more than 1000 pounds per square inch, the Contractor may instead pay to the City of Carrollton twice (2 times) the unit bid price per square yard for the area determined to be so deficient. In any case, pavement of a strength deficiency of more than 1000 pounds per square inch shall be removed and replaced completely.

SECTION 11**TRAFFIC SIGNALS, SIGNS & STREET LIGHTING**

Traffic Signals and appurtenances shall meet the following requirements in the City of Carrollton:

A. Conduits:

1. **Conduits:** All conduits shall be PVC Schedule 80 and meet requirements of the 1999 National Electrical Code (N.E.C.).
2. **90° Elbows:** All 90° elbows shall be PVC Schedule 40 and have a minimum radius of 12 diameters of the nominal size of the conduit.
3. **Couplings:** All couplings shall be PVC Schedule 40 and used to connect conduits and elbows as needed.
4. **PVC Solvent-Cement:** The joining of conduits, elbows, etc. by coupling shall be by the use of a cleaner or primer, then a cement or weld compound in compliance with the manufacturer's recommendation.
5. **Conduit Terminations:**
 - a. **Conduit Terminations in Signal Pole Foundations:** All conduit terminations in signal pole foundations shall extend a minimum of one inch (1") above the surface of the foundations and shall be covered to prevent the likelihood of debris entering the conduits.
 - b. **Conduit Terminations in Pull Boxes (Bottom Entry):** All conduit terminations entering the bottom of pull boxes shall be no closer than six inches (6") to the bottom of the pull box cover, and no further than nine inches (9") from the bottom of the pull box cover. All conduit terminations shall be covered to prevent the likelihood of debris entering the conduits.
 - c. **Conduit Terminations in Pull Boxes (Side Entry):** All conduit terminations entering the side(s) of pull boxes shall not extend more than three inches (3") into the pull box. Conduits entering pull boxes from opposite directions but at the same elevation shall be offset. All increases and decreases in conduit size on continuous conduit runs shall occur only at a pull box or signal pole foundation. All conduit terminations shall be covered to prevent the likelihood of debris entering the conduits.
6. **Conduit Installation Methods:** All conduits may be installed by trenching, boring, or pushing. Conduits installed under roadways, driveways, alleys, and sidewalks shall be done by boring or pushing methods at a minimum depth of 24 inches. All conduits placed in an open trench shall be placed a minimum of twenty-four (24) inches deep. All conduits shall leave a nylon pull string (minimum 400 lb. test) inside the conduits with a minimum of two feet (2') of string extending from the conduit ends at points of entry and termination of all conduit runs.

B. Pull Boxes: Three types of pull boxes will be allowed. When installed in sidewalks or any other concrete surface, the top of the pull box shall be flush with surface grade. When installed in any other type surface (i.e. grass, etc.) it shall be level with the surrounding surface. Pull box shall have a layer of washed gravel or crushed stone with a minimum thickness of twelve inches (12") for drainage in the bottom of the pull box providing the full 12" height of the pull box for conduit use. The layer of gravel shall not extend above the bottom of the pull and extend a minimum of four inches (4") beyond the outside perimeter of the pull box. All covers (lids) shall say "Traffic Signals".

1. Type One pull boxes shall be 20" long x 13" wide x 12" deep and shall be installed with a 8" skirt around the box at a depth of 4 inches with reinforcing steel.
2. Type Two pull boxes shall be used when 3 or more 3" PVC conduits enter the box. Type Two pull boxes shall be 23" long x 14" wide x 12.5" deep and shall be installed with a 8" skirt around the box at a depth of 4 inches with reinforcing steel.
3. TxDOT Type C pull boxes shall be used when 3 or more 4" PVC conduits enter the box. Type C pull boxes shall be 30" long x 17" wide x 12" deep and shall be installed with a 8" skirt around the box at a depth of 4" with reinforced steel.

C. Pole Foundations:

1. General: Signal pole foundations shall be either thirty six inches (36") in diameter with a twelve foot minimum depth for 30 foot combination poles and poles with 48 foot arms and ten feet (10') deep for all other arm lengths. It shall have rolled steel rebar, three-inch (3") conduit and a one-inch (1") conduit entering the center of the pier. The top of the pier shall extend six inches (6") above the curb grade. Pedestrian signal pole foundations shall be as shown in the detail M-13, sheet 4 of 4.
2. Foundation Forms: At ground level there shall be a 42" x 42" x 6" form with a 1-1/16" chamfer edge for 36" diameter piers and a 54" x 54" x 6" form for 48" piers. Foundation surface shall be level so as to be able to bolt the pole without the use of shims for leveling. All bolt circles shall be 19". The Contractor shall furnish and use steel templates for bolt circles. See the standard details for more information.
3. Anchor Bolts: Anchor bolts shall be hook anchor 2-1/4" x 90" x 6" hook for an overall length of ninety six inches (96") for combination poles and poles with 48' arms. Anchor bolts for arms shorter than 48' shall be 2 1/4" x 54" x 6" hook for an overall length of 60". Anchor bolts for 60' arms shall be 2 1/2" x 63" x 6" hook for an overall length of 69". All anchor bolts shall be galvanized and fabricated from steel with a minimum yield strength of 55,000 psi and a minimum ultimate tensile strength of 70,000 psi. There shall be four (4) anchor bolts per pier with two (2) galvanized nuts and two (2) galvanized flat washers per bolt. The contractor shall furnish a template for anchor bolts. Each anchor bolt shall have a minimum of eight and one-half inches (8-1/2") of threads extended above the top of the piers, and be covered so that threads are not damaged or coated with concrete.

- D. Controller Pad Foundation: The pad foundation shall conform to the following requirements as shown in Detail M-14 and may only be altered with the approval of the Traffic Department.
1. Pad shall be concrete and be 6-feet by 6-feet by 4 to 6-inches thick (6'x 6'x 6") with a 20-inch by 10-inch (20"x 10") block out in the center of the pad. Concrete strength shall be 3,000 psi at 28 days with #3 rebar spaced at 18-inches on center.
 2. The block out shall receive three 4-inch diameter Schedule 80 PVC conduits and one 1½" diameter Schedule 80 PVC conduit. The conduits shall extend 14-inches above the pad and cut at the same level. The area around the conduits shall be backfilled with pea gravel. The controller pad shall have one 5/8" x 8' copper clad ground rod sleeved in a one inch (1") PVC conduit located as per the standard details.
 3. The traffic signal controller base shall be comprised of a polymer material and shall be Armorcast part #A6001848X24TXDT or equal. The controller base is to be placed in the center of the pad over the block out and attached to the pad via drop in anchors or anchor bolts.
 4. Expansion joints shall be used when tying into an existing sidewalk. Joint material shall be ½"-inch thick redwood for the full depth of the controller pad. The pad shall be doweled into the sidewalk with greased 24-inch long smooth ½" diameter steel bars with caps.
- E. Vehicle Detection: Video detection shall be used at all intersections. In these cases, the Econolite Solo Prosystem, Iteris System, or city approved equivalent detection system, shall be used.

Detector Loops will only be allowed as approved by the Director of Engineering: The following four types of loops may be used: 6'x 6', 5'x 5', 5'x 20' and 5'x 40'. Other sizes may be allowed as permitted through City approved plans. Detector loops shall meet the following requirements.

1. Saw Cuts: All saw cuts shall be a minimum of one and one half inches (1-1/2") deep by one quarter inch (1/4") wide. All saw cuts crossing a curb shall be terminated halfway up the curb with a 3/4" hole drilled through bottom of curb for passage of loop wires to the pull box. Saw cuts over the top of a curb will not be permitted.
2. Wire: All loops shall be wired with a minimum #14 A.W.G. T.H.H.N. stranded copper wire, with a minimum of two (2) turns per loop in asphalt and three (3) turns per loop in concrete. All loops shall be marked in the pull boxes identifying each individual loop.
3. Sealer: All loops shall be sealed with 3/8" backer rod. No exceptions. Plans shall show loop sizes, configurations, and locations.

F. Intersection Wiring and Splicing

1. Pole Bases: There shall be a single 20 conductor (#14 A.W.G. stranded copper I.M.S.A. specification 19-1) run to the base of each pole foundation from the controller pad. There shall be no cuts or splices allowed between runs. There shall be a minimum of (4') of cable at both ends to be used for cabinet and pole connections. Each cable shall be marked so as to identify which cable goes to which pole.

Color Code for 20 Conductor:

1.	Red	-	Red ball
2.	Green	-	Green ball
3.	Yellow	-	Yellow ball
4.	White	-	A/C common
5.	Black	-	Yellow arrow left turn
6.	Blue	-	Green arrow left turn
7.	Red/White	-	Ped don't walk (main street)
8.	Green/White	-	Ped walk (main street)
9.	Blue/White	-	Ped button (main street)
10.	White/Black	-	Ped button ground
11.	Red/Black	-	Ped don't walk (side street)
12.	Green/Black	-	Ped walk (side street)
13.	Blue/Black	-	Ped button (side street)
14.	Black/Red	-	Red ball (side street)
15.	Orange/Black	-	Yellow ball (side street)
16.	Black/White	-	Green ball (side street)
17.	White/Red	-	Spare
18.	Orange/Red	-	Spare
19.	Blue/Red	-	Spare
20.	Red/Green	-	Spare

Pole connections shall be made by using red vinyl wire nuts or blue butt connectors (see City for more details).

2. Signal Head Wiring: Three types of signal heads shall be used: (1) 3 Section 12" Poly Signal R.Y.G., (2) 5 Section 12" Poly Signal R.Y.G., and (3) Pedestrian signals symbol type. The Contractor shall furnish and install a 5 conductor (#14 A.W.G. stranded copper I.M.S.A. specification 19-1) to run from the base of the pole to each 3 section signal and each pedestrian signal with no splice permitted except at the base of the pole and signal and pedestrian head terminal blocks. 5 section signal heads will require a 7 conductor (#14 A.W.G. stranded copper I.M.S.A. specification 19-1) cable and run from the signal head to the base of the pole in the same manner as the 5 conductor wire. Wire connections in signal heads shall be performed by using a blue nylon screw down spade terminal (see City for more details).
3. Pedestrian button wiring: The Contractor shall furnish and install a 3 conductor (#14 A.W.G. stranded copper wire I.M.S.A. specification 19-1) cable to run from the button to

- the base of the pole. The white wire shall be used for the common and the black wire to normally open on the back of the button.
4. Opticom Detector (3MP205) Wiring: Where called for the Contractor shall furnish and use 3M brand Model 138 Detector Cable to be run from cabinet foundation to the detector on the mast arms without any splices in between. A minimum of four feet of excess cable shall be left for cabinet wiring.
 5. Loop Detector Home Run Cable (3M Brand Model 30003): The Contractor shall furnish and use Model 30003 home run cable. Home run cable shall be run from the cabinet foundation to the pull box (as shown on intersection plans) with no splices permitted between the cabinet foundation and the pull box. Home run cable to loop lead in wires shall be spliced only at the pull box. A solder type splice on each wire and cover shall be used on each solder splice with sealing compound patch (see City for more details). Wire code to be used for wiring: for left turn loops use red and white pair of home run cable to loop lead in and use green and black for through traffic loops.
 6. Cabinet Wiring: The City will accomplish the cabinet wiring with assistance of the Contractor. A minimum of four feet on each cable shall be used in cabinet wiring. Each cable shall be marked to identify its directional purpose.
- G. Electrical Service: The Contractor shall install and furnish the electrical service from the disconnect up at all locations needing new service, where existing electrical services are to be used. Care shall be taken to insure no damages occur while construction is being performed.
- H. Signal Head Assembly: All poles and arms necessary to complete each job shall be furnished by the Contractor according to specifications. The City shall furnish the ornamental pole caps and base covers. The poles and mast arms shall be a Valmont brand or The Pole Company brand and type or approved equal.
1. Pole Erection: All necessary safety devices shall be used to insure safety to the public while erecting poles, no less than required by the MUTCD's most recent copy of standards. A plan and method of erection shall be submitted and approved by the City before the installation of each intersection.
 2. Signal Head Assembly and Installation: The Contractor shall furnish signal heads, back plates, and red, yellow and green L.E.D.'s. Mounting hardware shall be Pelco AB-0125-3-84 or AB-0125-5-84 for each signal. The signals shall be black Eagle brand polycarbonate type or approved equal. The Contractor shall assemble each head with backplates, L.E.D.'s, and mounting brackets. L.E.D.'s used shall be as specified by the City of Carrollton or an approved equal.
 3. Signal Placement: No signals shall be placed without City approval. The City shall spot and align signal placement at all intersections. Upon approval, the Contractor shall drill a

1-1/8" hole in the bottom side of the mast arm and install a rubber grommet for each signal's wire entrance.

4. Pedestrian Signal Placement and Installation: The Contractor shall furnish all pedestrian signal I.C.C. brand Pedestrian signals with clamshell mounting hardware and L.E.D. indicators. No pedestrian signals shall be installed without City approval. A 1-1/8" hole shall be drilled in the side of the pole shaft and a rubber grommet installed for each pedestrian signal's wire entrance. A Band-it band, 5/8" stainless steel band - two per pedestrian signal with Band-it buckles (see City for more details) shall be used in all installations.
5. Pedestrian Push Button: The Contractor shall furnish all pedestrian buttons with Pelco 5" x 7" sign types. Pedestrian buttons shall not be installed without City approval of placement. Pedestrian buttons shall be fastened to the pole shaft with two 1/4" x 1-1/4" hex head self-tapping screws. A 1-1/8" hole shall be drilled for each wire entrance - no grommet shall be needed.

I. Miscellaneous Fixtures:

1. Wind Wings: The Contractor shall furnish all necessary hardware to assemble wind wings. Wind wings shall be assembled and installed behind each 5 section signal on poles that exceed 34' in length. Pelco mast arm sign bracket types shall be used. The wind wing shall be elevated above the mast arm so that air may flow over and under the wing without the 5 section backplate hindering air flow.
2. Opticom Detector: The Contractor shall furnish all 3M Opticom 721 detectors and mounting hardware. Opticom detectors shall not be installed without City approval of placement. The Contractor shall drill a 1-1/8" hole and install a rubber grommet for the wire entrance.

J. Requirements and Liabilities:

1. Existing Signals: The continued operation of those locations with existing working signals shall be the responsibility of the Contractor. The signals shall be maintained to operate in the same manner they were designed to operate until they are removed and replaced with the new signals. The Contractor shall submit in writing a plan with diagrams as to how they will achieve this task for each intersection. After approval from the City the contractor may begin construction.
2. Removal of Existing Signals: The Contractor shall be responsible for the removal of all old signal equipment at each intersection where traffic signal controls are currently in operation. When removing and disabling mast arms, the contractor shall take care as to not damage any reusable parts. The Contractor shall be liable for damages due to unnecessary procedures used in the removal of any signal equipment.

The Contractor shall be expected to pay for or replace damaged equipment. Equipment shall be delivered to the signal shop at 1420 Hutton Drive and unloaded where instructed. All old or unused piers and controller concrete bases shall be broken out a minimum of

24" below ground surface. All old and unused pull boxes and all old or unused cable and wires shall be removed.

3. Contractor On-Call: The Contractor shall have a minimum of two phone numbers with the City so as to be able to contact the Contractor in the event of any emergencies that might occur due to the Contractor's construction. The Contractor shall respond to any such call within two hours. Should the City be required to take over this duty, the Contractor shall be billed for all City expenses.
4. Signs and Barricades: The Contractor shall furnish and maintain all cones, signs, barricades, etc. necessary to safely complete construction, through all phases of said construction, in compliance with the Texas Manual on Uniform Traffic Devices. (MUTCD). The Contractor shall obtain a permit from the City of Carrollton to work within the Right of Way as per City Ordinance #2490.

The Contractor shall also furnish and wear safety vests at all times while on any job site. For daytime work the vests shall be orange, yellow, yellow-green, or a fluorescent version of these colors. For nighttime work, similar outside garments shall be retro reflective. The retro reflective material shall be orange, yellow, white, silver, yellow-green or a fluorescent version of these colors and shall be visible at a minimum distance of 1,000 feet. Failure to comply with safety standards will result in a shut down of work until they have been met.

K. **Traffic Sign** installations shall comply with the 2006 Texas Manual on Uniform Traffic Control Devices (MUTCD) and meet the following requirements in the City of Carrollton:

1. Signs shall be mounted on a 2-inch, 12 gauge, square pole perforated with 7/16-inch holes on 1-inch centers on all four sides. The pole is to be 12 feet long and then cut to the proper length for installation as required by the MUTCD.
2. Poles are to be set in the ground to a minimum depth of 24 inches and set in concrete (sackcrete). Each pole shall be vertical and not leaning in any direction after concrete has set.
3. Each sign installed must follow the current MUTCD standards in regard to design and size. All signs shall be 0.080 gauge in thickness and coated with a high intensity sheeting or equivalent. Nothing less than high intensity will be accepted.
4. When installing signs in median tips that are concreted or in brick pavers, the sign post shall be sleeved. The sleeve shall consist of a 2¼-inch section concreted in place. A 2-inch piece shall be dropped into the 2¼-inch piece and secured in place with a 7/16-inch bolt. The post with the sign attached shall be a 1¾-inch, 14 gauge, square pole dropped into the 2-inch piece and secured with a 7/16-inch bolt.

L. Arterial Street Lighting

1. Street lighting luminaires, poles and foundations for non-TOD areas shall be per the Street Light Luminaire detail. The poles shall be square, steel and painted dark bronze with a “shoe box” style luminaire. Lights shall be 250 watt high pressure sodium and the pole shall be 30 feet long. Spacing shall be from 200 to 250 feet on center. Wire shall be a #8 AWG. Conduit shall be 2 inch, schedule 80 PVC. Street lights shall be operated and tested for 15 days after installation.

2. Street lighting luminaires, poles and foundations for TOD areas shall be as outlined in Section 7, Urban Design Standards.

SECTION 12

**MANUAL FOR THE DESIGN OF
WATER AND SANITARY SEWER LINES**

CARROLTON TEXAS

Engineering Department

January, 2007

SECTION 12
MANUAL FOR THE DESIGN OF
WATER AND SANITARY SEWER LINES

INTRODUCTION

This manual is intended to aid and assist engineers in the layout and design of sanitary sewers and water lines to definite standards and to obtain uniformity in the plans. It is recognized that each project has its individual problems and that no fixed rules will apply to all cases. In general, the plans must be prepared in accordance with:

- The Standard Specifications for Public Works Construction, North Central Texas
- The City of Carrollton General Design Standards
- Texas Commission on Environmental Quality (TCEQ) criteria
- This design manual

Furthermore, existing facilities shall be analyzed to demonstrate that capacity exists for proposed developments without adversely affecting current services. For example, for redeveloped areas, the engineer shall analyze downstream sanitary sewer capacity to the TRA system to ensure that the system is capable of handling increased flows or to determine improvements that are needed to handle the flows. Engineers shall submit design reports for additions or modifications to public infrastructure, including sanitary sewer, water and drainage systems. The design report shall include design calculations, monitoring data and computer simulations which demonstrate:

- that the proposed design meets applicable federal, state and local regulations and standards, design criteria and system design assumptions;
- that the design assumptions are consistent with existing data and assumptions from the city's infrastructure planning models;
- the design meets requirements of the city's ordinances; and
- that all relevant design criteria necessary to evaluate the impact of the proposed development on existing infrastructure has been included.

The acquisition of field data, including wastewater flow monitoring and water system pressure data, shall be at the expense of the developer. The report shall address sanitary sewer pipe sizing (including but not limited to wastewater contributions, pipe slope, pipe size and capacity), water distribution pipe sizing (including pipe size, velocity and pressure) and drainage improvements (including inlet and storm sewer pipe sizing, channel design and detention).

SECTION A – WATER MAINS

In general, water mains are placed on the north and west sides of a street, between the sidewalk and back of curb, or as directed by Engineering. Standard Detail U-1 in the General Design Standards shows preferred locations for new water mains. Where applicable, line sizes shall comply with the Water Distribution System Master Plan dated January 2003, or subsequent revisions.

1. For mains over 1,200 feet in length or mains supplying more than one fire hydrant, 8-inch pipe will be required in residential districts. For mains over 600 feet in length in commercial and manufacturing district, 12-inch pipe may be required.
2. For mains less than 1,200 feet in length in residential districts and supplying not more than one fire hydrant, 6-inch pipe will be required. Systems must be designed without deadend mains. All water lines shall be looped into the system unless approved by the Director of Engineering.
3. In non-residential developments, minimum 8-inch mains will be required. Water mains must be of adequate size to provide for the building total fire flow.
4. No water main shall be located nearer than five feet from any tree or structure.
5. Water Main Material:
 - a. All water mains 12-inch in diameter and under shall be AWWA C900 PVC, mechanical joint, or a joint of the type which provides a recession in the bell for the employment of a single rubber gasket to be placed before the insertion of the succeeding spigot. Joint material for PVC shall conform to ASTM F477.
 - b. All water mains 14-inch in diameter and larger shall be Reinforced Concrete, Pretensioned Reinforcement (Steel Cylinder Type)”, complying with American Water Works Association Specifications C-303. Profile elevations shall be provided for mains 12-inch in diameter and larger.
 - c. All mains supplying fire sprinkler systems outside of utility easements shall be minimum 200 PSI working pressure and U.L. listed.
6. Valves 12-inch and under shall be placed on or near street property lines not over 1,000 feet apart in residential, duplex, and apartment districts and not over 500 feet apart in all other districts; and in such a manner as to require preferably two, but not more than three valves to shut down each City block, or as may be required to prevent shutting off more than one fire hydrant. On cross-feed mains without services, a maximum of four valves shall be used to shut down each block. Also, valves shall be placed at or near the ends of mains in such manner that a shut down can be made for a future main extension without causing loss of service on the existing main. The location of valves larger than 12-inch will be as approved by Engineering. Valves 12-inch and under will be Resilient Seat Gate Valves (RSGV). Valves over 12-inch will be Butterfly Valves.

7. Fire Hydrants:

- a. Number and Locations: A sufficient number of fire hydrants shall be installed to provide hose stream protection for every point on the exterior wall of the building with the lengths of hose normally attached to the hydrants. There shall be sufficient hydrants to concentrate the required fire flow, as determined by the City of Carrollton Fire Department. Deviations may be approved but the following guidelines shall generally be met or exceeded:
- 1) Single Family and Duplex Residential – As the property is developed, fire hydrants shall be located at all intersecting streets and at intermediate locations between intersections at a maximum spacing of 600 feet between fire hydrants as measured along the route that fire hose is laid by a fire vehicle.
 - 2) Non-Residential, Multi-Family Residential and Other Districts – As the property is developed, fire hydrants shall be located at all intersecting streets and at intermediate locations between intersections at a maximum spacing of 300 feet as measured along the length of the centerline of the roadway, and the front of any structure at grade shall be no further than 400 feet from a minimum of two fire hydrants as measured along the route that a fire hose is laid by a fire vehicle.
 - 3) Generally, no fire hydrant shall be located closer than fifty (50) feet to a non-residential building or structure unless approved by Engineering and the Fire Department.
 - 4) In instances where access between the fire hydrant and the building, which it is intended to serve, may be blocked, extra fire hydrants shall be provided to improve the fire protection. Railroads, divided thoroughfares, expressways, blocks which are subject to buildings restricting movement, and other manmade or natural obstacles are considered as barriers.
- b. Restrictions
- 1) All required fire hydrants shall conform to the provisions of the latest AWWA specifications C-502 and shall be placed upon water mains of no less than six (6) inches in size.
 - 2) Valves shall be placed on all fire hydrants leads in a location that is readily accessible at all times.
 - 3) Required fire hydrants shall be installed so the break-away point will be no less than two (2) inches, and no greater than six (6) inches above the grade surface.
 - 4) Fire hydrants shall generally be located a minimum of two (2) feet and a maximum of six (6) feet behind the curb line, based on the location of the sidewalk. The fire hydrant shall not be in the sidewalk.
 - 5) All required fire hydrants placed on private property shall be adequately protected by either curb stops or concrete posts or other methods as approved by Engineering and the Fire Department and shall be in easements. Such stops or

posts shall be the responsibility of the land owner on which the said fire hydrant is placed.

- 6) All required fire hydrants shall be installed so that the steamer connection will face the fire lane or street, or as directed by the Fire Department.
- 7) Fire hydrants shall be located at street or fire lane intersections, when feasible.
- 8) A Blue Stimsonite, Fire-Lite reflector (or approved equal) shall be placed in the center of the street opposite fire hydrants.
- 9) Fire hydrant bonnets shall be painted according to the main size to which it is attached as follows. The remainder of the hydrant above ground shall be painted aluminum.

<u>Water Main Size</u>	<u>Color</u>
6"	ICI "Devoe" Aluminum (No. 43089020)
8"	ICI "Devoe" Imperial Blue (No. 43087850)
10" & larger	ICI "Devoe" Safety Yellow (No. 43089400)

- 8. The minimum cover to the top of the pipe must vary with the valve stem. In general, the minimum cover below the top of the street subgrade should be as follows: 12-inch and smaller, 4.0 feet; and 16-inch, 5.0 feet to 5.5 feet. Lines larger than 16-inch shall have a minimum of six feet of cover which is sufficient to allow water and sewer and other utilities to go over the large main. For water lines to be constructed along county-type roads commonly built with a high crown about the surrounding property, increase the cover as required to allow for future paving grade changes.
- 9. A service with a meter box is constructed from the main to a point just behind the curb line, usually in advance of paving. The location of the meter box is at or near the center of the front of the lot to be served. On multiple apartments and business properties, the desired size and location are usually specified by the owners or architect. Minimum requirements for water service sizes are:
 - a. One-inch copper services are required to serve all residential lots including townhouse lots and patio homes. One-inch copper services are required to serve lots zoned Duplex. Separate services shall be provided for each of the family units.
 - b. The size of apartment, condominium, or multi-family services will depend on the number of units served with a minimum of one meter per building.
 - c. All services on existing water mains that are 2" or smaller should be made by Public Works.
 - d. Domestic service connections shall not be allowed on fire hydrant leads.

SECTION B – SANITARY SEWER

The City of Carrollton has been authorized by the Texas Commission on Environmental Quality to review all plans for proposed sanitary sewers within the city. To comply with this authorization the city has adopted a policy that all sewers will be designed in accordance with Chapter 30 Texas Administrative Code Chapter 317 – “Design Criteria For Sanitary Sewage Systems.” In accordance with TCEQ, the Engineer is required to keep all required calculations and data on file for a period of one (1) year from the date of final acceptance of the completed project. When requested in writing the Engineer will furnish, within five (5) working days of receiving the notice, copies of all calculations to the City of Carrollton.

As a minimum, the Engineer shall keep on file copies of submittal documents and correspondence related to the review and approval of the project.

1. Sizes and grades for sanitary sewer shall be as required by Engineering, and consideration shall be given as to possible extensions for future development. No sanitary sewers, other than laterals and force mains, shall be less than 8-inches in diameter. Sewers are usually located between the sidewalk and back of curb on the opposite side of the street from the water line. Each addition has its individual problems, therefore, no fixed rules will apply to all cases. Exhibit A provides examples for wastewater contributions for sizing sanitary sewer lines. However, these amounts may be revised based on a specific type of development. See the General Design Standards for details of locations.
2. The minimum acceptable “n” factor for use in design of sanitary sewers shall be 0.013. Pipes should be placed on such a grade that the velocity when flowing full is not less than two feet or more than ten feet per second. Minimum grades based on n = 0.013 shall be as follows:

Size of Pipe (in.)	Minimum Slope (%)	Maximum Slope (%)
6	0.50	12.35
8	0.33	8.40
10	0.25	6.23
12	0.20	4.88
15	0.15	3.62
18	0.11	2.83
21	0.09	2.30
24	0.08	1.93
27	0.06	1.65
30	0.055	1.43
33	0.05	1.26
36	0.045	1.12
39	0.04	1.01
>39	*	*

*For lines larger than 39-inches in diameter, the slope shall be determined using Manning's equation to maintain a minimum velocity of 2 feet per second when flowing full and a maximum velocity of 10 feet per second when flowing full.

Where V = velocity (ft/sec)
 n = Manning's Roughness Coefficient(0.013)
 R = Hydraulic Radius (ft)
 S = Slope (ft/ft)

3. The location of water and sanitary sewer mains shall conform to the separation distances prescribed by the Texas Commission on Environmental Quality (TCEQ), 30TAC290.44, or by superceding provisions of state regulations. Those being, when new water mains and new sanitary sewers are installed, they shall be installed no closer to each other than nine feet. Where this cannot be achieved, the sanitary sewer shall be constructed of pressure type pipe with watertight joints as used in water main construction. In no cases shall the outside of pipes be closer than four feet.

4. Minimum cover shall be 3.5 feet; exceptions authorized by Engineering shall have concrete protection. In general, the minimum depth for sewer to serve given property with a 4-inch lateral shall be 3-feet plus 2% times the length of the house lateral (the distance from the sewer to the center of the house). Thus, for a house 135 feet from the sewer, the depth would be 3-feet plus 2% x 135 feet = 3.0 plus 2.7 = 5.7 feet. The depth of the flow line of the sewer should then be at least 5.7 feet below the elevation of the ground at the point where the service enters the house. Profiles of the ground line 20-feet past the building line will be required to verify that this criteria is met. On lines deeper than 12 feet, a parallel sewer line will be required when laterals are to be attached. This requirement should be discussed with the Engineer.

5. Materials for Sewer Lines – The material used for the sanitary sewer shall be designed for a minimum structural life cycle of 50 years. If the pipe material will deteriorate when subjected to corrosive conditions, the Engineer shall provide for an acceptable corrosion resistant liner or provide calculation and data that demonstrated that the design and operational characteristics will provide for the minimum life cycle.
 - a. All sewer pipe shall be PVC (SDR 35) complying with ASTM 3034 or F794 with a cell classification of 12454b or c, green in color. For mains within nine feet of a water line, or deeper than 12 feet, SDR 26 PVC pressure pipe conforming to ASTM D2241/D3139 shall be used, green in color.

 - b. Reinforced Concrete Pipe is allowed only on a case by case basis and then only, on lines larger than 30 inches in diameter. If the proposed project contains reinforced concrete pipe, the Engineer shall perform an engineering analysis which shows that pipe is adequate to withstand the designed loads. The Engineer shall, as a minimum, consider trench, depth of cover, effect of water table, etc. when analyzing the pipe. Copies of the analysis must be provided to the City of Carrollton within five (5) days of written request from the city. The City of Carrollton will issue written approval for use of RCP on those projects where it is proposed.

- c. Vitrified clay pipe will not be allowed in the City of Carrollton.
 - d. Sewer pipe shall conform to the Specifications and/or Special Provisions.
 - e. Sewer pipe joint materials shall have resilient properties, conforming to the Specifications and/or Special Provisions.
- 6. Railroad, State Highway and creek crossings, etc., shall be as approved by Engineering.
 - 7. No sewer line shall be located nearer than five feet from any tree or structure.
 - 8. Sanitary sewers will not be allowed in alleys unless approved by Engineering.
 - 9. Larger lines shall not flow into smaller lines unless approved by Engineering.
10. Curved Sewers
- a. Horizontal curvature may be by joint deflection or pipe flexure but not both. The Engineer must specify on the plans the method of deflection allowed and the allowable radius or joint deflection for each pipe size.
 - b. No vertical curves will be allowed.
 - c. When pipe flexure is used, the minimum radius of curvature shall be equal to that recommended by the pipe manufacturer or $300 \cdot D_o$, where D_o is the average outside diameter of the pipe in inches, which ever is greater. The Engineer shall note on the plans that, when using pipe flexure, all joints are to remain fully seated.
 - d. If joint deflection will be used to provide horizontal curvature, the allowable deflection shall be 5° or 80% of the manufacturer's recommended maximum joint deflection, or 80% of the National Reference Standard maximum recommended joint reflection, which ever is less. When joint deflection is used the Engineer must specify the size of mandrel used for deflection testing. The mandrel shall be sized to verify that the maximum joint deflection has not been exceeded.
 - e. Horizontal curves shall match change in street direction as near as possible, but will not be allowed across residential single family and duplex lots.
 - f. Slopes on curved sewers shall be a minimum of 3% greater than the corresponding minimum slope of sewers on a straight line.
 - g. Manholes shall be located on curved sewers at the P.C. and P.T. of the curve and at a maximum spacing of 300 feet along the curve.
11. Manholes and Cleanouts:
- a. The sizes and locations of manholes, wyes, bends, tap connections, cleanouts, etc., shall be designated by Engineering. In general, manholes shall be placed at all four-

- way connections and three-way connections, changes in grade and direction, and the maximum spacing 500 feet.
- b. The diameter of a manhole constructed over the center of a sewer should vary with the size of the sewer. For lines 27 inches and smaller, manholes shall be 5.0 foot minimum diameter; for 30" and 36" – 6 foot minimum diameter.
 - c. In Flood Plains, sealed manholes "Type S" shall be used to prevent the entrance of storm water. Rim Elevation of these manholes shall be two feet above the surrounding ground. Where more than three manholes in sequence are to be bolted and gasketed, every third manhole shall be vented above the 100-year floodplain elevation. The Engineer shall provide the elevation of the 100-year flood. Sealed manholes shall also be used in all areas subject to carrying drainage flow or in drainage ways.
 - d. Clean-outs shall be placed on the ends of all lines. Drop manholes shall be required when the inflow elevation is more than 18-inches above the outflow elevation. All drops shall be located outside the manhole. Construct manholes at each end of lines that are installed by other than open cut and at each end of aerial crossing lines.
 - e. Where unequal size pipes enter a manhole, the crown of the pipes should be set at the same elevation.
 - f. In order to provide access for sewer lines for cleaning, manholes and/or cleanouts shall be so located that 250 feet of sewer rod can reach any point in the line. Cleanouts may be located at the end of lines only.
12. The sizes and locations of laterals shall be as designated by Engineering. In general, for single family dwellings, the lateral size shall be 4" minimum; for multiple units, apartments, local retail and commercial – 6" minimum; for manufacturing and industrial, the size should be 8" or larger as required. House laterals usually come out 10 feet downstream from the center of the lot and shall have a 10-foot lateral separation from the water service. Manholes will be required on 6-inch and larger laterals where they connect to the main line. Laterals will not be attached to sewer mains that are deeper than 12 feet. A minimum of one lateral per building shall be required. Also, a minimum of one lateral per residential lot shall be required. Duplexes shall have one 6" lateral with appropriately placed cleanouts.
13. Construction Staking – For subdivisions, line and grade stakes for construction shall be furnished by the developer's Engineer. All property lines and corners must be properly staked to insure correct alignment. The city will not be liable for improper alignment or delay of any kind caused by improper or inadequate surveys by the developer or by interference of other utilities.

SECTION C – FORM OF PLANS

1. Plans shall be clear, legible, and neatly drawn on bordered sheets, either 24" x 36" or 22" x 34". Each sheet shall clearly display the Texas Professional Engineer's seal of the Engineer under whose direction the plans were designed. A title block in the lower right-hand corner shall be filled in to include: (1) Project name; (2) Engineer's name, address, and telephone number
2. The plan sheet should be drawn so that the north arrow points to the top or to the left side of the sheet. It is important that the plan show sufficient surrounding streets, lots, and property lines so the existing water and sewer may be adequately shown and so that proper consideration may be given to future extensions. Proposed water and sewer lines shall be stubbed out to the addition extremities in order that future extensions may be made with a minimum of expense and inconvenience. Unless it would make the plan very difficult to read, both water and sewer lines should be shown on the same sheet. The lines on the profile sheet shall be drawn in the same direction as on the plan. Lettering shall be oriented to be read upward or to the left.
3. On large additions or layouts requiring the use of more than six sheets (total of plan & profile), key sheets may be required on a scale of 1" = 400' or 1" = 1000', as designated by Engineering. They shall show the overall layout with the specific project clearly indicated with reference to individual sheets.
4. The use of "off-standard" scales will not be permitted. A plan shall be drawn to scales of 1" = 100', 1"=40', or 1" = 20'. Subdivision plans for water and sewer that do not involve great detail should be drawn on a scale of 1" = 100'. These may be on plan-profile sheets or the "plan" may be drawn with the profiles on full profile sheet. Plans in and along creeks, heavily wooded sections, streets with numerous utilities, or as may be required to produce a clean and legible drawing, shall be drawn on plan-profile sheets or separate plan and profile sheets on a scale 1" = 40'. If the plan is in an extremely congested area, a scale of 1" = 20' may be necessary and will be permitted. All profiles shall be drawn on a vertical scale as required for clarity, and the horizontal scale shall be the same as for the plan unless otherwise directed by Engineering.
5. *Sewer Data to be included on Plan Sheet:* The plan shall show the existing and proposed water and sewer lines and all appurtenances thereto. The plan should also have the storm sewer system dashed in. All lines shall be numbered, lettered or otherwise designated on both plan and profile sheets. All lines shall show sizes and direction of flow on both plan and profile sheets. Stationing shall be shown to the nearest 0.1 foot and each new line shall begin at 0+00 at the outlet and increase up the sewer. Station pluses at all junctions of sewers, horizontal P.C.'s and P.T.'s, bends, angle points, wyes, cleanouts, manholes, the centerlines of all cross streets and railroads, and all crossing utilities, etc., shall be shown on both plan and profile. The degree of angles and horizontal curve data shall be shown on the plan only. Minimum Radius for sanitary sewer mains is 200 feet. Sewer laterals shall be shown at a location most convenient to serve the property. Sewer laterals will usually be near the center of the lot, either at the street or alley. If the lateral is to be adjacent to the

water service, then show the lateral 10 feet downstream. The location shall be designated on the plans.

6. *Sewer Data to be included on the Profile Sheet:* The data for the profile sheet shall be obtained by running a line of levels along the actual route and by taking any other necessary observations. Profiles shall show the elevations to the nearest 0.1 foot of the ground at the centerline of the sewer, and to the right and left of the centerline of the sewer at the location of the approximate center of the proposed houses or buildings to be served, and the approved street or alley grade. Profiles shall also show the sewer pipe, manholes, cleanouts, etc. The size of the sewer, the direction of the flow, and the grade to the nearest 0.01 foot shall be indicated just over the “pipe” and the total linear footage of line, size, kind of pipe, and type of embedment or encasement shown below the “pipe”. All of the information pertaining to the horizontal data, station pluses, appurtenances to be built, etc., is usually shown just above the ground line, whereas, the flow line (invert) elevations are shown below the pipe. Elevations of crossing and parallel utilities shall be shown. All invert elevations shall be shown to the nearest 0.01 foot. Invert elevations shall be recorded at all junctions (all lines-in and out), at grade breaks, the ends of lines, or other points as requested by Engineering. Benchmarks used shall also be clearly shown, giving the descriptive locations and elevations. Elevations must be from sea level datum, not assumed. All existing water, sewer, gas, storm sewer, telephone, power, and other utilities parallel to or crossing the proposed sewer or water line shall be adequately designated as to size, type, and location. Drainage area maps and capacity calculations for mains 10" and larger will be required.

11. *Data to be included for Water Plan and Profile:* For water lines in new subdivisions, very little data need to be included. Indicate the location of any existing valves required for shut-down purposes and of any tees, ends, etc., to be tied into. Indicate clearly the sizes of the lines to be installed, and all proposed valves, fire hydrants, tees, crosses, bends, reducers, plugs, sleeves, wet connections, tap connections, creek, railroad or highway crossings, tunnels, meter boxes, valve vaults, and other appurtenances at each intersection or as required. Where the pipe is to be laid around a curve, the curve data on the plat is usually sufficient unless otherwise request. The size and type of services and the material, type of joint, and class of pipe maybe indicated by adequate notation in the lower left or right hand corners of the plan sheet. Water services and meter boxes shall be indicated and shall be located at or near the center of the front of each lot. All water lines over 12" shall be profiled following the general procedures as outlined for sewers.

A checklist has been provided on the following pages to aid the design engineer in addressing these items although it may not be all-inclusive.

SECTION D – SYMBOLS

All plans drawn by engineers for the city shall be as nearly alike as possible; therefore, standard symbols and lines will be on all plans. These symbols are shown on the following pages.

EXHIBIT A**SANITARY SEWER DAILY FLOW CALCULATIONS****Apartment Sanitary Sewer Flow**

100 gal. x 0.75 = 75 gal. per day per person

22 units per acre with 2.5 persons per unit

Calculations (75) (22) (2.5) = 4,125 gallons per day per acre

Office Sanitary Sewer Flow

3100 parking spaces for 34.7 acres

One person per parking space

20 gallons per person per day

3100 spaces/34.7 ac.= 89.33 persons per acre (20 gal.) = 1,786.7 or 1,790 gal. per day per acre.

Residential Sanitary Sewer Flow

100 gallons per person per day

6 units per acre

3.1 persons per unit

(100) (6) (3.1) = 1860 gallons per acre per day

Hospital Sanitary Sewer Flow

200 gallons per day per bed

Nursing Home Sanitary Sewer Flow

90 gallons per day per bed

Patio Home Sanitary Sewer flow

100 gallons per person per day

10 units per acre

3.1 persons per unit

(100) (10) (3.1) = 3,100 gallons per day/acre

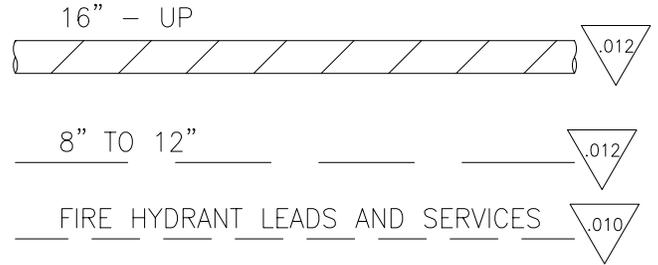
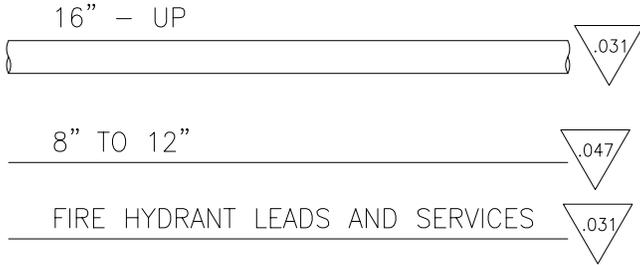
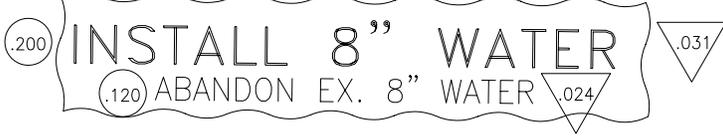
A peaking factor of 4 shall be used on all calculations for sanitary sewer sizing.

PLAN SYMBOLS

WATER MAINS

PROPOSED WATER MAINS

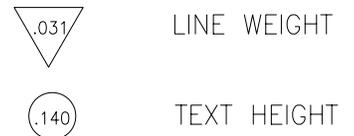
EXISTING WATER MAINS



FIRE HYDRANT	●	▽.031
VALVE	T	▽.031
BENDS/FITTINGS	⊥	▽.024
TAPPING SLEEVE & VALVE	⊥	▽.024
CUT & PLUG	//	▽.024
REDUCER	▶	▽.024
WATER METER	⊗	▽.020

FIRE HYDRANT	○	▽.012
VALVE	T	▽.012
BENDS/FITTINGS	⊥	▽.012
CUT & PLUG	//	▽.012
REDUCER	▶	▽.012
WATER METER	⊗	▽.012

LEGEND



PLAN SYMBOLS

SCALE: N.T.S.
DATE:
SHEET: 1 OF 4

ENGINEERING
DEPARTMENT

PLAN SYMBOLS SEWER LINES

PROPOSED SEWER LINES

EXISTING SEWER LINES

(.200) **INSTALL 8" SEWER** (line weight: .031)
 (.120) **ABANDON EX. 8" SEWER** (line weight: .024)

15" - UP (line weight: .031)

8" TO 12" (line weight: .047)

LATERALS AND SERVICES (line weight: .031)

16" - UP (line weight: .012)

8" TO 12" (line weight: .012)

FIRE HYDRANT LEADS AND SERVICES (line weight: .010)

MANHOLE (line weight: .047)

CLEANOUT (line weight: .024)

REMOVE/REPLACE MANHOLE (line weight: .031)

MANHOLE (line weight: .012)

CLEANOUT (line weight: .012)

LEGEND

(.031) LINE WEIGHT

(.140) TEXT HEIGHT



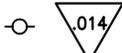
PLAN SYMBOLS

SCALE: N.T.S.
 DATE:
 SHEET: 2 OF 4

ENGINEERING
 DEPARTMENT

EXISTING ROW		.024
PROPOSED ROW		.031
EASEMENT		.012
PROPERTY LINE		.020
ASPHALT PAVEMENT		.012
CONCRETE PAVEMENT		.012
STORM SEWER		.010
GAS LINE		.010
UNDERGROUND POWER		.010
UNDERGROUND TELEPHONE		.010
UNDERGROUND CABLE TV		.010
FENCE		.012
EXIST. CONTOUR		.031
PROP. CONTOUR		.031
SAWCUT		.020

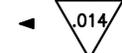
POWER POLES



SPRINKLER VALVE



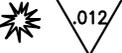
GUYWIRES



SIGN



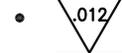
BUSH



TRAFFIC BOX



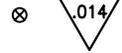
IRON PIN FOUND/SET



SPRINKLER



LIGHTPOLE



GAS METER



LEGEND
LINE WEIGHT



CARROLLTON

PLAN SYMBOLS

SCALE: N.T.S.
DATE:
SHEET: 3 OF 4

ENGINEERING
DEPARTMENT

PLAN SYMBOLS LABELS

LEGEND



LINE WEIGHT



TEXT HEIGHT

STREET NAMES	JOSEY LANE
SUBDIVISION	ARBOR CREEK PHASE 1
LOT NUMBERS	LOT 4
STATIONS	0+00
MATCHLINE TEXT	MATCHLINE STA. 5+00
DESIGN NOTES	FURNISH & INSTALL:
GRADE TEXT	8" ON 1.00%
PROFILE ELEVATION	510



CITY OF CARROLLTON, TEXAS

CONSULTANT LOGO AREA

WATER MAIN REPLACEMENT 02-2W

ARBOR CREEK DRIVE

SPURWOOD DRIVE TO HEBRON PARKWAY



SCALE: 1" = 40'

MARCH, 2003

REVISED:

SHEET

3

OF

8

DESIGN:

DRAWN:

DWG FILE:



CARROLLTON

PLAN SYMBOLS

SCALE: N.T.S.
DATE:
SHEET: 4 OF 4

ENGINEERING
DEPARTMENT

City of Carrollton
Engineering Department

GENERAL DESIGN STANDARDS

PART B

Standard Details

February, 2007

STANDARD DETAIL INDEX

SUBJECT	PAGE
Paving Details	
Street Intersection Dimension Control	P-1
Lane Standards	P-2
Miscellaneous Street Layout Details	P-3
Median Opening Locations	P-4
Alley Paving Dimensional Control	P-5
Residential Alley Paving Details	P-6
Left Turn Lane at Driveway	P-7
Parabolic Paving Heights	P-8
Curb Details	P-9
Street Intersection Jointing Details	P-10
Construction and Contraction Joint Details	P-11
Expansion Joint Details	P-12
Roadway Tee Intersection/Header Detail	P-13
Typical Railroad Crossing Header Detail	P-14
Commercial Drive Approach Detail	P-15
Residential Drive Approach Detail	P-16
Sidewalk Details	P-17
Barrier Free Ramps	P-18
Median Nose Dimensions	P-19
Fire Lane Paving Details	P-20
Conduit/Junction Box Layout for Street Lighting	P-21
Pavement Marking Details	P-22
Traffic Island Detail	P-23
Drainage Details	
Curb Line Inlet	D-1
"Y" Type Inlet	D-2
Storm Drain Manhole	D-3
Storm Drain Pipe Embedment	D-4
Subsurface Drainage Detail	D-5
Curbed Flume Detail	D-6
Inlet Protection Detail	D-7
General Utility Details	
Utility Location Plan (street)	U-1
Utility Location Plan (alley)	U-2
Utility Installation Bore Details	U-3
Street Cut Repairs	U-4
Offsite Utilities Control Marker	U-5

SUBJECT	PAGE
Water Details	
Typical Gate Valve Installation	W-1
Typical Butterfly Valve Detail	W-2
Air and Vacuum Release Valve Assembly	W-3
Blow Off Valve Details	W-4
Typical Fire Hydrant Installation Details	W-5
Water Main Pipe Embedment and Backfill	W-6
Typical Water Service Assembly	W-7
Cathodic Protection Details	W-8
Offset or Lowering of Water Main Thrust Harness Details	W-9
Crossing Utility Pipe Support	W-10
Meter Vault Installation	W-11
Sanitary Sewer Details	
Standard Precast Pipe Manhole	S-1
Standard Cast-In-Place Manhole	S-2
Drop Manhole Detail	S-3
Vented Manhole Detail	S-4
Manhole Abandonment Detail	S-5
Standard Manhole Lid and Frame	S-6
Pressure Type Manhole Lid and Frame	S-7
Sanitary Sewer Cleanout Assembly	S-8
Sanitary Sewer Service Connection Detail	S-9
Deep Cut Sanitary Sewer Connection	S-10
Residential Cleanout Detail	S-11
Aerial Crossing Detail	S-12
Sanitary Sewer Main Pipe Embedment Detail	S-13
Wastewater Sample Station Detail	S-14
Miscellaneous Details	
Capital Improvements Project Sign	M-1
Corner Survey Monument	M-2
Standard Retaining Wall Details	M-3
Brick Screening Wall Details	M-4
Private Concrete Screening Wall Details	M-5
Wood Screen Fence	M-6
Pedestrian Guardrail Details	M-7
Paving Stone Installation at Median Noses	M-8
Tree Planting Detail	M-9
Tree Root Barrier Detail	M-10
Irrigation Details	M-11
Underground Storage Tank Fluid Leak Detection System	M-12
Street Lighting Details	M-13
Signal Controller Foundation Details	M-14
Signal Pole Foundation Details	M-15
Guardrail Details	M-16