Article 23

MASTER TRANSPORTATION PLAN

REVISION ADOPTED: December 11, 2018

CASE NUMBER: MTP180501

ORDINANCE NO. 10569-2018

ARTICLE 23: MASTER TRANSPORTATION PLAN

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SECTION 1 - GENERAL

23.1.1 The Master Transportation Plan is designed and developed to provide a sound structural framework for future growth and development. This plan coordinates the use of streets and on-road bicycle routes. It is a guide used to coordinate individual developments in the City of Grand Prairie to the overall community. The plan encourages the creation of neighborhoods, minimizing traffic movement through those neighborhoods, providing alternative modes of transportation and providing high capacity routes for moving regional traffic to and from the City. The plan establishes right-of-way, pavement, recommended alignment, intersection standards and on-street bicycle routes based on forecasted future traffic volumes and economic development. These volumes are based on a level of service the City wishes to provide. The developed plan also creates a comprehensive concept around which all agencies responsible for thoroughfare development can coordinate their individual efforts. The Master Transportation Plan addresses the need for multimodal transportation and streets to provide greater, more convenient accessibility to all parts of the City and to the adjacent metropolitan area. The traffic and transportation design data and policies contained in this document provide required standards and criteria for issues frequently encountered in land development. These standards and criteria are intended to insure consistent design practices in new development or the redevelopment of land in Grand Prairie and its extra-territorial jurisdiction.

23.1.2 In addition to this written document, the Master Transportation Plan, The City of Grand Prairie also maintains the Thoroughfare Map that shows the street classification in a graphical format. The Thoroughfare Map is contained in an Appendix to the Unified Development Code.

SECTION 2 - PLAN OBJECTIVES

23.2.1 The City of Grand Prairie Master Transportation Plan was developed by combining and inter-relating the existing roadway system, programming improvements and projected demands of the roadway system.

23.2.2 The basis for the plan and associated network was the Mater Transportation Plan adopted on February 15, 2011 by the City Council and followed by the Grand Prairie Master Thoroughfare Plan Map adopted by City Council on February 17, 2015. As the City of Grand Prairie has grown in population, employment and density there is a growing need to address additional transportation issues.

23.2.3 In past years, the City undertook a sector-focused planning process. As each sector was addressed, goals, objectives and policies were developed to address transportation issues within that sector, as well as transportation issues that affected the entire City. These issues were met with the issuance of the Grand Prairie Thoroughfare Plan. This document amends and supersedes the existing Grand Prairie Thoroughfare Plan, unifies the transportation components of the original individual sector plans and addresses multimodal requirements into an overall Master Transportation Plan for the City of Grand Prairie.

SECTION 3 - EXISTING CONDITIONS

23.3.1 The centralized location of Grand Prairie within the Dallas/Fort Worth metropolitan area makes it essential that consideration be given to the impact of regional traffic on the City's thoroughfare network. With this in mind, the Grand Prairie Master Transportation Plan has been designed within the general framework of the regional thoroughfare system. The integration of the various plans has been done through coordination with the North Central Texas Council of Governments' (NCTCOG) Metropolitan Transportation Plan (MTP).

23.3.2 The elements of the existing regional network that directly influence Grand Prairie include two east-west freeways, Interstate 30 and Interstate 20. These freeways provide the primary access routes between Dallas and Fort Worth and are among the most heavily traveled roads of the regional network – each carrying over 190,000 vehicles per day through Grand Prairie. The frontage roads along these two freeways provide the regional interface with the local roadway network for origins and destinations in the city.

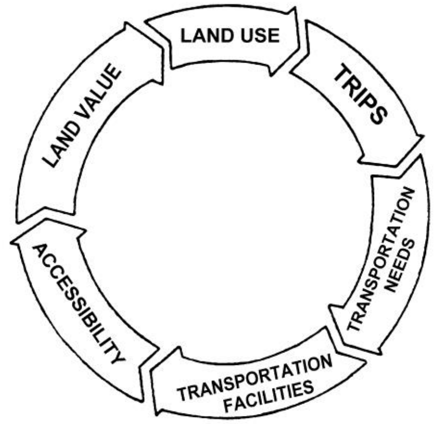
23.3.3 State Highway 161, a north-south toll road with free frontage roads, extends from Interstate 20 on the south to north of the City's northern boundary with Irving and extends through the northern cities of the Metroplex as the President George Bush Turnpike and connects back to IH 30 in Garland/Mesquite. Though the segment between IH 20 and IH 30 was constructed as a limited access highway only a few years ago, it currently carries about 120,000 vehicles per day. The ease of access to and from the region from this corridor has spurred growth of employment, population and density in the SH 161 corridor in Grand Prairie.

23.3.4 Another element of the regional thoroughfare network that influences Grand Prairie is State Highway 360. This north-south freeway, just west of the city limits, provides interchanges with SH 183, IH 30, IH 20 and most recently to US 287, with plans to extend it southward to US 67. The roadway serves a significant amount of commercial and industrial uses along this length, and currently carries about 200,000 vehicles per day. Plans are underway to replace the existing clover leaf interchange with a direct interchange with Interstate 30. With a completion date of 2020, the new roadway configuration will have a significant impact on freeway operations in Grand Prairie.

23.3.5 US 287 passes northwest to southeast through the southern sector of Grand Prairie and is experiencing ever-increasing volumes, for which TxDOT is incrementally building US 287 as a freeway section with grade separated interchanges and frontage roads, most recently at SH 360.

23.3.6 While regional traffic is a significant portion of traffic on highways in Grand Prairie, due to the city's central location within the metroplex, traffic that either begins or ends its trip within a community traditionally represents the majority of trips on the highway in the urban area. Land use and transportation are interrelated; policies and decisions for one needs to consider the other. In the long-term, a balance needs to be established between transportation and land use to better accommodate future growth and development.

23.3.7 The basic relationship between land uses and transportation facilities are illustrated in the figure at right. Continued operation of the cycle leads to more intensive land uses on more expensive land with greater transportation demands. If not properly managed, the cycle may lead to deficiencies in and culminate in breakdowns within the transportation system. The land use/transportation cycle shows that it is vital for transportation facilities to be monitored and protected from functional obsolescence.



SECTION 4 - ROADWAY CLASSIFICATION

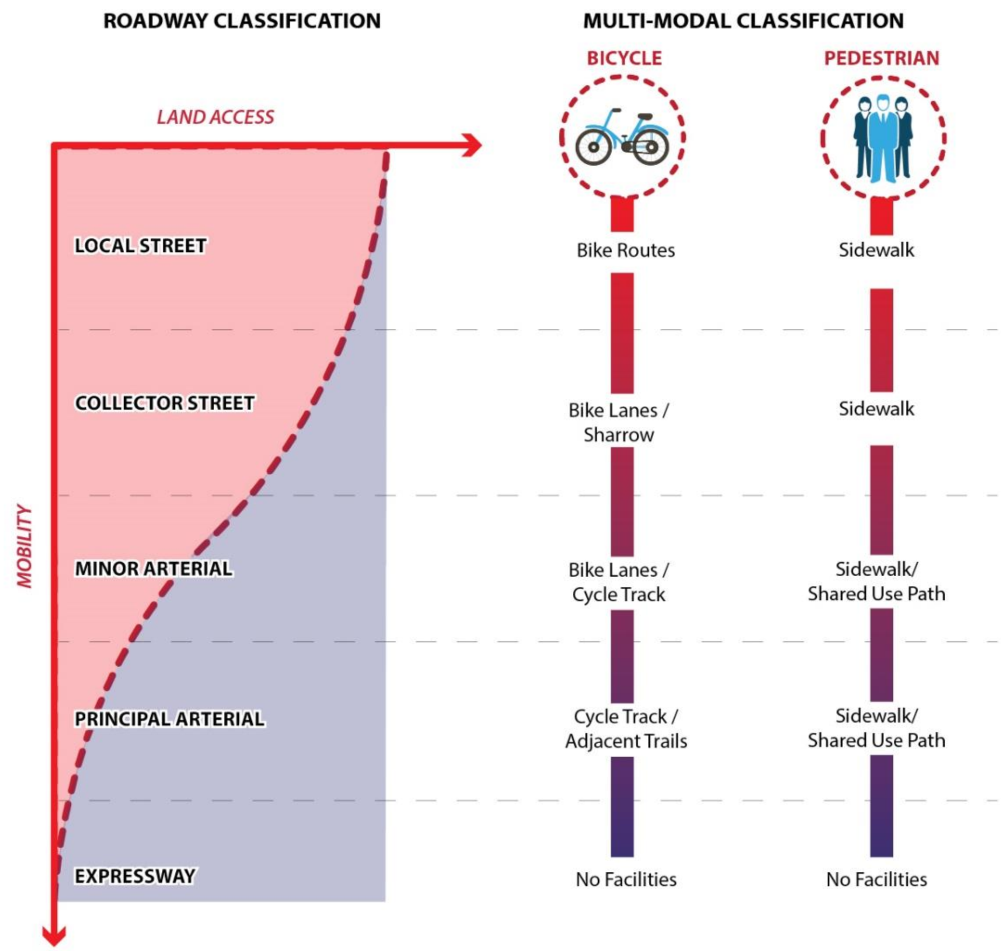
23.4.1 To prevent functional obsolescence of the transportation facilities referenced in the land use/transportation cycle, a hierarchical system that defines the role of each street needs to be established. This functional classification in turn translates into physical design features concerning cross section, vertical and horizontal alignment standards, pavement width, access management, multimodal accommodations, etc.

23.4.2 The commonly used functional classification consists of a hierarchy of streets that range from those that facilitate areawide traffic movement to those that provide local mobility and access to adjacent properties. Figure 1 illustrates the relationship between access and mobility. Mobility refers to the movement of traffic, both in terms of speed and capacity, while access refers to the accessibility of adjacent properties from the particular street. Local and collector streets provide the most access to adjacent properties, but are limited in terms of speed and capacity; arterials provide a greater mobility, but limited land use access. With this in mind, streets that carry a higher volume of traffic, such as a principal arterial, should have a limited number of intersections and curb cuts in order to minimize the friction between faster and slower traffic movements.

23.4.3 Transit, bicycle, and pedestrian modes also have facility/service types that are most suited for each mode of travel along the various street type classifications. They are shown relationally for each classification in Figure 1. In addition, multi-use paths in separate right-of-way are another type of facility that can provide transportation utility as well as recreational uses.

23.4.4 Application of functional classification and design principals lead to an optimized circulation system. Major advantages include: preservation of residential neighborhoods, long-term stability in land use patterns and value of commercial properties, fewer traffic accidents, and a decreased proportion of urban land devoted to streets. In areas developed in accordance with functional circulation concepts, approximately 20 percent of the urban land is devoted to streets, including arterials, while in a typical gridiron system, 30 percent or more is tied up in streets.

Figure 1. Land Use Access and Mobility for Roadway Classifications



23.4.5 ***Freeway/Tollway:*** The freeway or tollway, also called highway, is the highest capacity thoroughfare in the transportation system, and are typically constructed and managed by TxDOT or NTTA. This thoroughfare usually has full or partial control of access from the adjacent land and streets. Interchange with the crossing street network is typically restricted to principal and minor arterials, typically one mile or more apart, and land adjacent to the freeway is usually accessed by a parallel frontage road that is separated from the main freeway lanes. All thoroughfare crossings are typically grade separated.

23.4.6 ***Principal Arterial:*** A network of principal arterials serves intra-urban and sub-regional traffic and can relieve short trips from overloading the nearby system of highways, while also serving as the conduits between local traffic and the regional highway network. The primary function of the principal arterial is to provide for continuity and high-volume traffic movement between major traffic centers (neighborhoods, commercial centers, etc.). These thoroughfares are usually spaced at approximately one (1) mile intervals, unless terrain or barriers create a need for greater or lesser spacing. The minimum principal arterial cross section contains two moving traffic lanes in any one direction. Since these thoroughfares do carry high volumes of traffic, it is essential that they have continuous alignment and have minimal deterrents to the effectiveness of traffic flow. The two directions along principal arterial roadways are normally divided by a raised median and.

provide left turn lanes that are separated from the oncoming traffic lanes. This treatment minimizes the points of conflict along the roadway and thus reduces the crash potential and maintains a high quality of traffic flow. Some principal arterials consist of a pair of one-way streets.

23.4.7 ***Minor Arterial:*** The primary function of the minor arterial thoroughfare is to provide continuity and effective traffic movement between major traffic centers within the city and connecting to adjacent cities. It generally collects and distributes traffic from lower classified streets onto principal arterials but, due to principal arterial spacing and capacity, may also function as major thoroughfares in limited portions of the City. In the absence of collector streets, minor arterials may also function as neighborhood collector streets, though this is typically not desirable except for higher density multi-family developments. Minor arterials typically provide a minimum of four moving lanes of traffic and left turn movements can be accommodated through the use of continuous left-turn lanes in areas with frequent driveways, unsignalized street intersections, and/or low left turn volumes. A minimum right-of-way of 70 feet is required for minor arterials; the maximum requirement is 100 feet.

23.4.8 ***Collector, Residential:*** A collector street's primary function is to collect and distribute traffic from local access streets to the arterial system. This thoroughfare type is usually positioned to not attract through traffic movements beyond one or at most two arterial streets. Collector streets should align across arterial streets to facilitate local mobility but can be interrupted near the center of the neighborhood so that they are not useful for longer trips. The collector street may also be used as a local street internal to multi-family residential areas, as well as an access route to elementary schools and neighborhood playgrounds.

23.4.9 ***Collector, Commercial:*** The collector is also used as the internal street system for commercial and/or industrial developments. In these types of developments, pavement widths are wider than for residential development and pavement design can be more robust to accommodate a higher percentage of truck traffic. Two moving lanes of traffic, plus any on-street parking are the minimum pavement requirements for a collector street in a commercial area.

23.4.10 ***Local Residential, Urban:*** The function of the local street is to provide access within residential areas and to collector streets. Only vehicles having an origin or destination on the local street are usually attracted to it. With the exception of delivery trucks, trucks are normally prohibited from using local streets as routes to their final destination. Local streets typically provide two moving lanes of traffic and allow parking along the street.

23.4.11 ***Local Residential, Rural***: The rural street design standard is used in areas exhibiting a rural setting with very low development density. Environmentally sensitive or topographically constrained areas with one acre or larger residential lots are usually suitable for this type of street standard.

SECTION 5 - LEVELS OF SERVICE

23.5.1 The purpose of a thoroughfare system is to accommodate the movement of people and goods at an acceptable service level on an appropriate classification of facility that suits the context of its surrounding land uses. The maximum amount of traffic that can be processed along a roadway is generally considered the capacity of that roadway. The capacity of a street is its ability to accommodate a stream of moving vehicles, measured as a flow rate, and is typically expressed in terms of vehicles per hour. The capacity of non-highway roadways can be affected by geometric configuration, operational controls, and environmental elements, including the following factors.

(a) *Signalized intersections.* The operation of frequent signalized intersections and the extent of progressive signal timing will usually be the principal determination of arterial capacities.
(b) *Un-signalized intersections and driveway curb cuts.* Turning movements and crossing volumes can reduce arterial capacity.
(c) *Curb parking or loading.* The entering and exiting activity of parked and dwelling vehicles can intermittently interrupt traffic movement and reduces arterial capacity and the presence of parked cars along the roadway edge tends to reduce travel speeds.
(d) *Lane configuration and width.* Lane widths of less than 11 feet tend to reduce travel speeds along a roadway, especially in the presence of significant percentage of heavy vehicles.
(e) *Turning traffic*. Left-turn and, to a lesser extent, right-turn movements impede the flow of through traffic; these movements are often provided separate turn lanes at key locations.
(f) *One-way operation.* One-way operation is generally more efficient than two-way operation as left-turn conflicts are eliminated, and it is easier to attain traffic signal progression.
(g) *Heavy Vehicles.* Heavy duty vehicles (trucks and buses) take up more space on the roadway and have lower performance characteristics than typical passenger vehicles.
(h) *Pedestrians.* Street crossings with high pedestrian volumes interrupt intersection-turning movements. Standard pedestrian walking speeds effect signal phase and cycle lengths.

23.5.2 The service quality of a thoroughfare is usually related to the rate of traffic flow in comparison to the capacity of the street, though other measures include actual versus free flow travel speeds. This service quality is traditionally described as the level-of-service (LOS) of the roadway. LOS is a qualitative measure of traffic congestion that represents the collective factors of speed, travel time, traffic interruptions, freedom to maneuver, safety, driver comfort and convenience, and operating costs provided by a thoroughfare under a specific traffic volume condition.

23.5.3 To facilitate a common understanding and consistent comparisons of the various levels of traffic congestion, LOS concepts have been derived nationally, based upon research. The Highway Capacity Manual (HCM) and AASHTO Geometric Design of Highways and Streets ("Green Book"), use letters A through F to classify level of service to represent increasing levels of vehicle density, degrading travel speeds and increasing values of delay. Two types of traffic flow can be defined for the quality of their traffic level of service: (1) <u>uninterrupted</u> flow along highways and long segments of arterial roadways, and (2) <u>interrupted</u> flow along arterial and collector roadways in an urban setting.

23.5.4 ***Uninterrupted Flow LOS***. The flow along highways and longer arterials with few traffic signals are characterized as uninterrupted flow. Level of service is compared based upon the density of vehicles in the traffic flow and the ability to maintain posted speed limits.

LOS A: free flow. Traffic flows at or above the posted speed limit and motorists have complete mobility between lanes. Motorists have a high level of physical and psychological comfort. LOS A generally occurs late at night in urban areas and frequently in rural areas.

LOS B: reasonably free flow. Posted speeds or higher are maintained, though maneuverability within the traffic stream is slightly restricted. Motorists still have a high level of physical and psychological comfort. LOS A and LOS B are typically considered together as very high levels of service that utilize less than 45% of the facility's capacity.

LOS C: stable flow, at or near free flow. Ability to maneuver through lanes is noticeably restricted and lane changes require more driver awareness. Most experienced drivers are comfortable, roads remain safely below but close to capacity, and traffic can travel at posted speeds. The threshold of LOS C to LOS D occurs at about 65% of the facility capacity.

LOS D: approaching unstable flow. Speeds slightly decrease as traffic volume slightly increases. Freedom to maneuver within the traffic stream is much more limited and driver comfort levels decrease. It is a common threshold for least desired operation for highways during peak hours, as attaining LOS C would require prohibitive cost and societal impact in bypass roads and lane additions. Facilities operating at LOS D utilize up to about 80% of the facility capacity.

LOS E: unstable flow, operating at capacity. Flow becomes irregular and speed varies rapidly because there are virtually no usable gaps to maneuver in the traffic stream and speeds rarely reach the posted limit. Any disruption to traffic flow, such as merging ramp traffic or lane changes, will create a shock wave greatly affecting traffic operations, and any incident will create serious delays. Driver level of comfort becomes poor. This is a common standard in larger urban areas, where some roadway congestion is inevitable.

LOS F: forced or breakdown flow. Every vehicle moves in lockstep with the vehicle in front of it, with frequent slowing required. Travel time cannot be predicted, with generally more demand than capacity. A road in a constant traffic jam is at this LOS.

23.5.5 ***Interrupted Flow LOS***. The Level of Service for most arterial and collector roadways in the urbanized area will typically be defined by the quality of traffic flow through its intersections with other roadways. The HCM defines LOS for signalized and unsignalized intersections as a function of the average vehicle control delay at the intersection. LOS may be calculated per movement, per approach of for the entire intersection for any intersection configuration. Table 1 presents the values of average delay per vehicle at intersections for each level of service for various types of intersection control. Delays at intersections are often determined using traffic modeling software, such as Synchro, to evaluate the interaction of intersection turning movement volumes and other nearby intersections along the roadway.

Table 1. Level of Service Values of Control Delay at Intersections

Level of Service Values of Control Delay at Intersections			
LOS	Signalized Intersection	Unsignalized Intersection	Roundabout Intersection
A	< 10 seconds/vehicle	< 10 seconds/vehicle	< 10 seconds/vehicle
B	10-20 seconds/vehicle	10-15 seconds/vehicle	10-15 seconds/vehicle
C	20-35 seconds/vehicle	15-25 seconds/vehicle	15-25 seconds/vehicle
D	35-55 seconds/vehicle	25-35 seconds/vehicle	25-35 seconds/vehicle
E	55-80 seconds/vehicle	35-50 seconds/vehicle	35-50 seconds/vehicle
F	> 80 seconds/vehicle	> 50 seconds/vehicle	> 50 seconds/vehicle
Source: HCM 2010, Exhibit 18-4 and Exhibit 21-1			

23.5.6 ***Multimodal LOS***. The 2010 HCM incorporates tools for multimodal analysis of urban streets to encourage users to consider the needs of all travelers. Stand-alone chapters for the bicycle, pedestrian, and transit have been eliminated, and methods applicable to them have been incorporated into the analyses of the various roadway facilities. The primary basis for the new multimodal procedures is National Cooperative Highway Research Program (NCHRP) Report 616: Multimodal Level of Service Analysis for Urban Streets. This research developed and calibrated a method for evaluating the multimodal LOS (MMLOS) provided by different urban street designs and operations. This method is designed for evaluating street operations in a more holistic manner is often called “complete streets,” “context-sensitive design’ and “smart growth” from the perspective of all users of the street. It is used to evaluate the tradeoffs of various street designs in terms of their effects on the perception of auto drivers, transit passengers, bicyclists, and pedestrians of the quality of service provided by the street.

23.5.7 ***Acceptable Peak Hour LOS***. LOS C operations during peak hours along arterial roadways is the city standard as the worst operating performance for a roadway and at intersections because it infers a suitable investment in pavement and a reasonable amount of delay for travel along the corridor. Intersection operations at LOS D may be considered acceptable under constrained conditions upon approval of Transportation Services Director as the lowest tolerable performance during a peak hour operation and is an indication of conditions that should be evaluated for improvement before the roadway LOS worsens and induces undesirable LOS and delay.

23.5.8 **Right-Sizing.** During peak hours, LOS A and B are indications of streets operating at well below capacity; for arterial streets, operations at LOS A and B during peak hours is an indication of a street that could be modified to create other opportunities for enhanced bicycle and/or pedestrian accommodations. A traffic study should be performed to determine if there is an opportunity and need for a particular segment of roadway to have one or more lanes narrowed or pavement reallocated to other uses within the street right-of-way, often called “right-sizing” or “road diet”. Any adjustment to the existing roadway or that envisioned in the Thoroughfare Plan should consider the projected volumes along the roadway corridor as well as the potential for increased use of alternate modes such as biking, walking that could be encouraged along the corridor.

23.5.9 ***Theoretical Capacity*.** The theoretical capacity of a roadway typically occurs near a point of traffic flow inefficiency, when any amount of additional vehicles per hour would reduce the traffic travel speed such that the net traffic flow rate would begin to diminish. In the A through F designation of levels of service, the maximum throughput capacity of a roadway typically occurs near the threshold of LOS E to LOS F, where traffic operations become unstable. Each roadway will have a traffic carrying capacity unique to its prevailing operational conditions of lane widths, cross streets, driveways, heavy vehicle percentage and other factors, which can be evaluated using traffic models currently available. However, some general roadway capacity characteristics are employed for planning purposes.

23.5.10 ***Planning Level Capacity***. Planning level hourly capacities, in terms of vehicles per hour, are described below for the types of City roadway classifications. The term "Divided" indicates turning movements and conflict points are managed by raised medians, which improve traffic safety and operations along the roadway. Though the "theoretical" capacity of the roadway to process vehicles occurs at LOS E, it is often desirable to plan for capacity operations at a better level of service, typically LOS D for peak hour operations. Thus, factors have been derived to calculate the capacity of operations at those levels of service. It should be noted that these capacity estimates for the facility are total for all lanes in all directions, and that traffic will rarely be able to use all of the available capacity in both directions during the peak hours of the day.

Table 2. Capacity Estimates for Roadway Classifications

	Capacity at LOS E, vehicles per hour per lane (vphpl)			
	Principal Arterial	Minor Arterial	Collector Street	Local Street
Divided	925 *	900 *	---	---
Undivided	875 *	825 *	525 *	425

Capacity Adjustment Factors by Desired Lowest Level of Service	
Factor to LOS E/F threshold	1.00 *
Factor to LOS D/E threshold	0.80 *
Factor to LOS C/D threshold	0.65 *

Classification Code	Number of Lanes	(D)ivided (U)ndivided	Hourly Capacity, vehicles per hour (vph)			
			LOS E per lane	LOS E total both directions	LOS D total both directions	LOS C total both directions
R2U	2	U	525	1,050	840	683
L2U	1	U	425	425	340	276
C2U	2	U	525	1,050	840	683
M3U, 2-way	2	U	850	1,700	1,360	1,105
M4U	4	U	825	3,300	2,640	2,145
M5U	4	U	850	3,400	2.720	2,210
P3U, 1-way	3	U	900	2,700	2,160	1,755
P4D	4	D	925	3,700	2,960	2,405
P6D	6	D	925	5,550	4,440	3,575
P7U	6	U	875	5,250	4,200	3,413

* Source: NCTCOG Regional Travel Demand Model Description, 2000 and 2009

23.5.11 ***Daily Traffic Capacity***. Planning level daily capacities can also be estimated, in terms of vehicles per day, but should consider the reality of peak and off-peak travel patterns characteristic of the roadway and its adjacent land uses. Average daily traffic (ADT) counts collected for a 24-hour period and can be used to calculate the percentage of the daily traffic that occurs during the peak hour of the day, typically called the K-factor, which usually falls in the range of 8% to 15% of ADT. A lower K-factor represents traffic that is more spread out during the day and would be able to accommodate more total traffic during a day, while a higher K-factor represents traffic that has a higher proportion of daily traffic occurring during the peak hours of the day. The City of Grand Prairie uses a K-Factor of 10% for estimating daily capacity of a roadway. Table 3 compiles the daily capacity estimates by facility type for LOS C, D and E, with LOS C being the standard for the City of Grand Prairie. As with the hourly capacity estimates by facility type, these capacity estimates for the facility are total for all through lanes and represent a total daily capacity for both directions of the roadway, if two-way. Notably, traffic will rarely be able to use all of the available capacity in both directions during all hours of the day.

Table 3. Daily Capacity Estimates

Classification Code	Number of Lanes	(U)ndivided/ (D)ivided	Daily Capacity at LOS E Vehicles Per Day (VPD)	Daily Capacity at LOS D Vehicles Per Day (VPD)	Daily Capacity at LOS C Vehicles Per Day (VPD)
			K = 10%	K = 10%	K = 10%
R2U	2	U	10,500	8,400	6,825
L2U	1	U	4,250	3,400	2,762
C2U	2	U	10,500	8,400	6,825
M3U	2	U	17,000	13,600	11,050
M4U	4	U	33,000	26,400	21,450
M5U	4	U	34,000	27,200	22,100
P3U	3	U	27,000	21,600	17,550
P4D	4	D	37,000	29,600	24,050
P6D	6	D	55,500	44,400	36,075
P7U	6	U	52,500	42,000	34,125

SECTION 6 - INTERSECTION DESIGN

23.6.1 The successful operation of urban streets largely depends on the design of at-grade intersections. At grade intersections typically accommodate all through and turning movements where many of the most critical problems of traffic operation, capacity and safety occur.

23.6.2 There are several main objectives in designing intersections, including safety, efficiency, and driver convenience and are as follows:

(a) To reduce the severity of potential conflicts and make it easier for drivers to maneuver the vehicles.

(b) The design should fit the natural transitional paths and operating characteristics of drivers and vehicles. Smooth transitions should be provided for changes in direction.

(c) Grades should be relatively flat for each direction passing through the intersection, to the extent feasible based upon the grades of the approaching roadways.

(d) Sight distance should be sufficient to enable drivers to prepare for and avoid potential conflicts.

(e) On arterial and collector streets, intersections should be evenly spaced to the greatest extent possible. Such an arrangement enhances the synchronization of signals, increases driver comfort, improves traffic operation and reduces fuel consumption.

(f) Roundabouts should be considered for all new minor arterial to minor arterial, collector to collector, or minor arterial to collector intersections. Mini-roundabouts may be considered for local to local street intersections for traffic calming or aesthetic purposes. Retrofits of roundabouts into existing such intersections should be considered given existing conditions at the corners.

23.6.3 Traffic control, signs and pavement markings for intersections should be consistent with the guidelines contained in the most recent edition of the Texas Manual on Uniform Traffic Control Devices (MUTCD).

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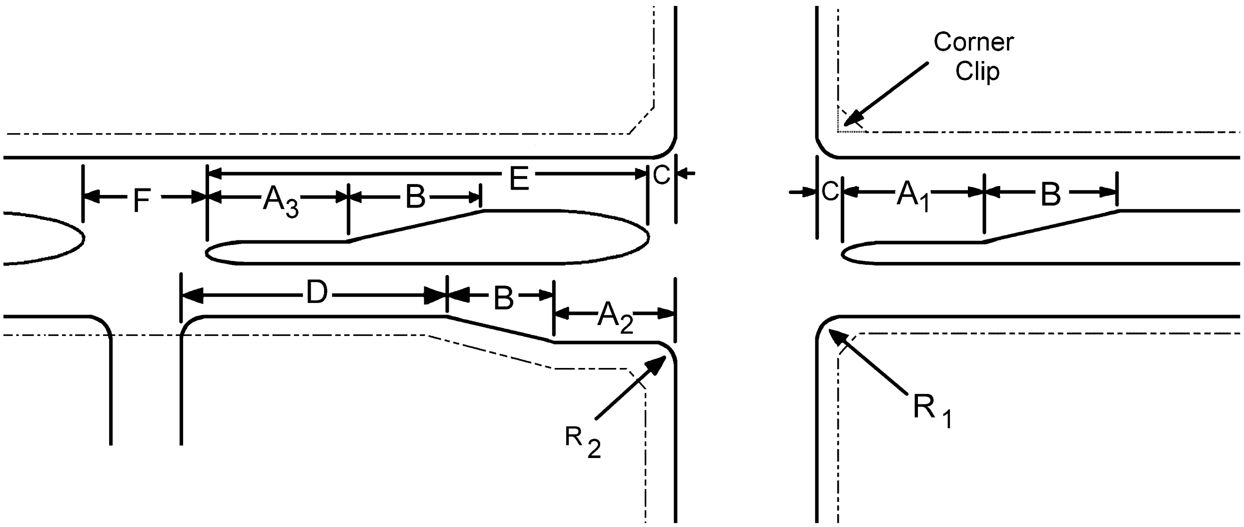
23.6.4 ***Typical Intersection Design Diagram:***



	A_1*	A_1^{+}	$A_1^{\#}$	A_2*	A_3	B	C	D	E	F	R_1	R_2	Corner Clip
P3U				**150’**				**330’**			**40’**	**40’**	**25’ x 25’**
P6D	**275’**	**150’**	**100’**	**150’**	**150’**	**150’**	***20’***	**330’**	**600’**	**60’**	**50’**	**50’**	**25’ x 25’**
P4D	**200’**	**150’**	**100’**	**150’**	**150’**	**150’**	***20’***	**330’**	**600’**	**60’**	**50’**	**50’**	**25’ x 25’**
P7U	**275’**	**150’**	**100’**	**150’**	**150’**	**150’**		**330’**			**50’**	**50’**	**25’ x 25’**
M5U	**200’**	**150’**	**100’**	**150’**	**150’**	**150’**		**330’**			***@50’ 40’***	***@50’ 40’***	**20’ x 20’**
M4U	**150’**	**150’**	**100’**	**150’**	**150’**	**150’**		**300’**			***@50’ 40’***	***@50’ 40’***	**20’ x 20’**
M3U	**275’**	**150’**	**100’**	**150’**	**150’**	**150’**		**330’**			***@50’ 40’***	***@50’ 40’***	**20’ x 20’**
C2U	**100’**	**150’**	**100’**	**100’**	**150’**	**150’**		**270’**			**40’**	**40’**	**15’ x 15’**
L2U											**25’**	**25’**	**10’ x 10’**
LU											**25’**	**25’**	**10’ x 10’**
RU											**25’**	**25’**	**10’ x 10’**

Notes:

*: Minimum length when an Intersecting Street is a Principle or Major Arterial
+: Minimum length when an Intersecting Street is a Collector or a Rural Road or a major driveway
#: Minimum length when an Intersecting Street is a Local Street
**: For Dual Left-Turn Standards, Consult Traffic Engineering Division
@: Use in industrial areas with large truck movements

A1, A2 or A3 may be Increased to Allow for Stacking Truck Traffic
Corner Clip Based on 90 Degree Intersection, may be Adjusted for Angled Intersection
Radius and Corner Clip are Based on the Highest Classification Street at an Intersection
These criteria may be considered for use for an intersection at a major driveway

23.6.5 ***Typical Intersection Sight Distance Requirements:***
Line of sight assessments are addressed in Section 9.5 of the AASHTO A Policy for Geometric Design of Highways and Streets, and this reference should be used for detailed assessments. Analysis of line of sight considers the speed on the roadway to calculate a stopping sight distance (SSD) and is normally used for travel along a roadway to observe an object in the travel path or when approaching side streets or driveways. According to Section 9.5, the SSD is usually sufficient for traffic on the major street as the "clear" line of sight distance needed to stop to avoid collision with another object.

Section 9.5 of A Policy for Geometric Design of Highways and Streets also indicates recommended line of sight distances for the side street or driveway approaches and establishes another sight distance criterion called the Intersection Sight Distance (ISD), measured along the leg of the major street from the vehicle's stopped position on the side street or driveway. In Section 9.5, procedures are provided for calculating sight distances at intersections for the following cases, which consider the acceptable gap in opposing traffic needed for a vehicle to execute the designated maneuver:

Case A – Intersections with no control
Case B – Intersections with Stop Control on the Minor Road
    Case B1 – Left turn from the Minor Road
    Case B2 – Right turn from the Minor Road
    Case B3 – Crossing maneuver from the Minor Road
Case C – Intersections with Yield Control on the Minor Road
    Case C1 – Crossing maneuver from the Minor Road
    Case C2 – Left or right turn from the Minor Road
Case D – Intersections with Traffic Signal Control
Case E – Intersections with All-Way-Stop Control
Case F – Left Turns from the Major Road

A summary tabulation of SSD and ISD value for various posted speed limits along the major street for two of the more common movements of concern for sight lines, Case B1 and B2, for passenger car maneuvers are shown in Table 4.

The assessment of whether the actual line of sight on the roadway meets the required ISD is measured as shown in Figure 2. Intersection Line of Sight Assessment Diagram. Measurement of the actual line of sight is based on a vehicle stopped behind a stop bar or crosswalk (minimum 15' from curb line) at the intersection to a vehicle in the near travel lane. Typically, no planting taller than 2 feet above the ground or tree limbs that hang down lower than 9 feet above the ground should be allowed to constrain the ISD, though tree trucks, light poles and traffic control supports are allowed. Major street curvature and median plantings should be considered when evaluating the design of the major street and any improvements.

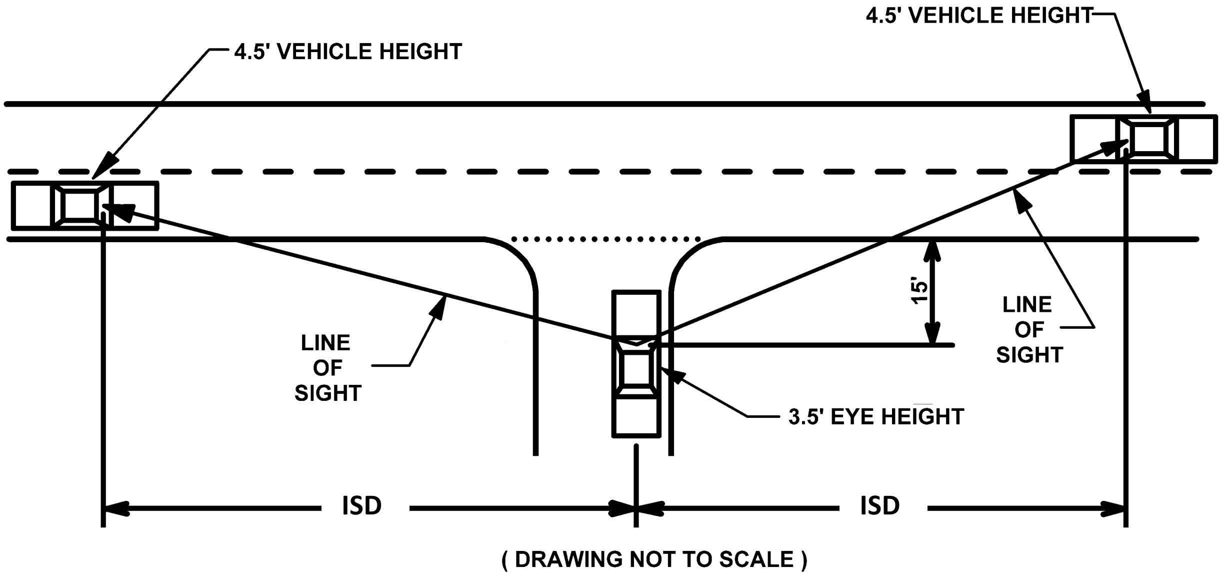


Figure 2. Intersection Line of Sight Assessment Diagram

Table 4. Example SSD and ISD Requirements by Roadway Speeds

Design Speed (MPH)	Intersection Sight Distance, ISD (Feet)	
	Case B1 Minor Street Left Turn	Case B2 Minor Street Right Turn
20	225	195
25	280	240
30	335	290
35	390	335
40	445	385
45	500	430
50	555	480
55	610	530
60	665	575

Source: AASHTO 2011 A Policy on Geometric Design of Highways and Street. ISD values are for passenger cars on less than 3% grade turning onto a 2-lane roadway with no median. For other conditions, the assessment of the Time Gap for each case should be assessed and the condition-appropriate ISD calculated.

23.6.6 ***Roundabout Elements*.** Roundabouts are a type of intersection characterized by a generally circular shape, yield control on entry, and geometric features that create a low-speed environment through the intersection. Modern roundabouts have been demonstrated to provide a number of safety, operational, and other benefits when compared to other types of intersections. On projects that construct new or improved intersections on collector or minor arterial roadways, the modern roundabout should be examined as an alternative to all-way stops or traffic signal control. The design principles and parameters for roundabouts are described in detail in the National Cooperative Highway Research Program (NCHRP) Report 672: Roundabouts: An Informational Guide – Second Edition.

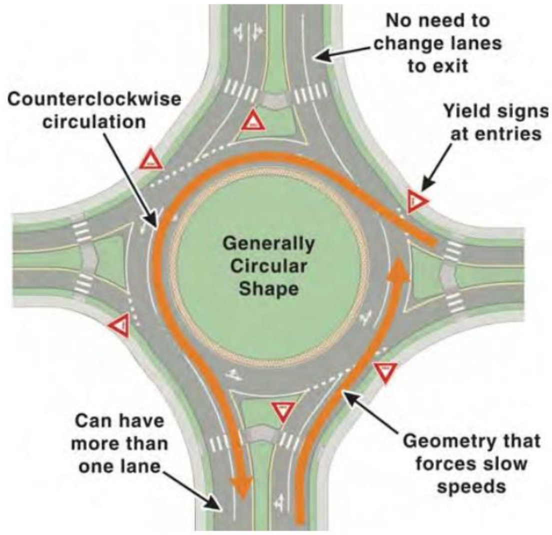


Figure 3. Illustration of Roundabout Elements
Source: FHWA

Roundabout Size. The size of a roundabout, typically measured by its inscribed circle diameter (outside to outside of pavement) is determined by a number of design objectives, including: traffic movements through the intersection, design speed, path alignment, and design vehicle. Smaller size roundabouts can be used for some local street or collector street intersections where the design vehicle may be a fire truck or single-unit truck. Larger inscribed circle diameters generally provide increased flexibility for the entry design to meet design criteria (e.g., speed, adequate visibility to the left, etc.) while accommodating large design vehicles. Table 4 provides common ranges of inscribed circle diameters for various roundabout categories and typical design vehicles. Neighborhood traffic circles, often called mini-roundabouts, are typically built at the intersections of local streets for reasons of traffic calming and/or aesthetics. Needed right-of-way would include the roundabout pavement plus space for sidewalks, buffer and utilities.

Table 5. Common Inscribed Circle Diameter Ranges

Roundabout Configuration	Typical Design Vehicle	Inscribed Circle Diameter Range*
Mini-Roundabout	SU-30	45 to 90 ft
Single to Double Lane Roundabout	B-40	90 to 150 ft
	WB-50	105 to 150 ft
	WB-67	130 to 180 ft
* Assumes 90-degree angles between entries and no more than four legs Source: Roundabouts: An Informational Guide, FHWA		

Roundabout Central Islands. The central island of a roundabout is the raised, mainly non-traversable area surrounded by the circulatory roadway. It may also include a traversable truck apron. The island is typically landscaped for aesthetic reasons and to enhance driver recognition of the roundabout upon approach. The size of the central island plays a key role in determining the amount of deflection imposed on the through vehicle's path. However, its diameter is dependent upon the inscribed circle diameter and the required circulatory roadway width. Roundabouts in rural environments typically need larger central islands than urban roundabouts to enhance their visibility, accommodate larger design vehicles, enable better approach geometry to be designed in the transition from higher speeds, and be more forgiving to errant vehicles.

SECTION 7 - DESIGN CRITERIA

23.7.1 This section of the plan addresses the visible pattern of the roadway rather than with the structural features of the pavement. It involves those elements and dimensions that have a direct bearing on driver behavior and traffic performance. The various design controls, criteria, and elements presented in this section shall be used to design each roadway to accommodate the expected traffic volume and provide consistency in traffic operations.

23.7.2 ***Sidewalks:*** Sidewalks are installed on public right-of-way in the parkway or easement and must have a maximum 2% cross-slope toward the street and a minimum of 1% cross slope to facilitate drainage. New sidewalks should be a minimum of 5 feet in width and the longitudinal grade along the sidewalk should not exceed 5% unless the grade of the adjacent roadway requires otherwise. All new sidewalks should be accessible by persons with mobility impairments, in compliance with the Americans with Disabilities Act. Pedestrian crossings of streets should be provided with accessible ramps. Crosswalks should be marked across arterial streets.

23.7.3 ***Bicycle Accommodations***: There are various configurations of facilities that can be provided to accommodate bicycling within the street right of way, as described further in Section 12 - On-Street Bike Plan of this Master Transportation Plan.

23.7.4 ***Lane Widths:*** Driving lane widths are generally to be in the range of 11 feet to 12 feet, but not less than 10 feet in width. For higher speed, higher capacity principal arterial roadways, 12-foot wide travel lanes are preferred.

23.7.5 ***On-Street Parking:*** Generally, parking lanes are incompatible with arterial traffic, though acceptable in a Downtown area. Therefore, provisions for parking lanes have been made only on collector and local streets. Where parking lanes are required, a minimum width of 8 feet, but not more than 9 feet is recommended for such lanes.

23.7.6 ***Right-of-way (R.O.W.) Width:*** Right-of-way width is generally determined by the pavement section required to perform the function and carry the traffic for which the thoroughfare is designed to accommodate, plus provisions beyond the pavement for sidewalks, utility locations, drainage and safety areas.

23.7.7 ***Design Speed:*** The design speed is the maximum safe speed maintainable over a specified section of street. It is a design standard based on geometric design elements, terrain, land use to be served, roadway type, anticipated traffic volumes and economic factors. Design speed does not reflect what speed should be used for a particular roadway type. Design speeds are generally higher than speed limits.

23.7.8 ***Vertical Grades:*** Maximum grades are determined by the effect of grades on truck speeds, design, functional classification of the roadway and general terrain of the area. Driving performance of vehicles with respect to grades varies greatly. Most cars are equipped with sufficient power to ascend grades up to 7 and 8 percent without noticeable reduction in speed. Trucks are more affected by grades as are bicyclists and the maximum grades are established to address this concern.

23.7.9 ***Stopping Sight Distance:*** Refer to Section 23.6.5 for sight distance requirements. The length of roadway visible from the driver's view (approximately 3.5 feet above the ground) to an object height of 3.5 feet is referred to as sight distance. It is composed of two parts: (1) brake reaction distance, the distance in which the vehicle travels from the time the driver sights an object to the time the brakes are applied, and (2) braking distance, the distance required for the vehicle to stop after the brakes are applied. Stopping sight distance should be adequate at every point along a roadway for drivers to come to a safe stop before reaching the object.

23.7.10 ***Horizontal Curvature:*** Horizontal curvature of roadways requires the use of circular curves to form smooth transitions from one straight roadway section to another. Criteria for determining the maximum allowable limits of horizontal curves are based on the laws of mechanics and consider factors such as the practical limitations of super elevation and friction factors representative of pavement surfaces.

23.7.11 ***Vertical Clearance:*** Criteria of the State Department of Highways and Public Transportation require a minimum of 16.5 feet of vertical clearance. Vertical clearance for all new roadways crossing under bridges should be a minimum of 17 to consider future roadway resurfacing which would decrease the clearance provided.

23.7.12 ***Median Openings:*** An important design feature for an urban arterial is the location of median openings. Each median opening should be evaluated based on roadway flow and capacity. Median openings need to be at least 600' apart (nose to nose).

23.7.13 ***Median Widths:*** The width of medians will vary based on right-of-way limitations, future roadway expansion, and other such factors. The general practice is to use 16-foot wide raised medians in urban areas. This permits the construction of 12-foot left-turn lanes for channelization, while leaving 4 feet for buffer between oncoming traffic.

23.7.14 ***Parkway Widths:*** Parkways are the area between the edge of the roadway and the edge of the street right of way and in urban areas cover a wide range of widths with minimums of approximately 8 feet. Parkways can contribute to the capacity and efficiency of a roadway by providing a clear zone for needed roadway edge utilities and provisions. Sidewalks and utilities are typically situated within the parkway of a thoroughfare, typically with a 3-foot wide green space buffer between the sidewalk and the roadway.

23.7.15 ***Easements:*** Easements are a privilege of right of use or enjoyment granted on, above, under, or across a particular tract of land by one owner to another or to the public, such as for utility access or sidewalks. Normally, no above ground construction may take place on or over an easement except for paving, landscaping, or fencing. However, since the easement is only a privilege of right of use, the property owner continues to own the land the easement is located on, and as such, the rights associated with the ownership of that property are still applicable. (i.e. the ability to sell the property. The ability to incorporate the acreage of the property into the floor area ratio of the site, etc.)

SECTION 8 - DESIGN STANDARDS

23.8.1 The following section in conjunction with the Thoroughfare Map provides design standards for all thoroughfares within the city limits of Grand Prairie and within its extraterritorial jurisdiction. Two types of standards are shown for each street type. There are recommended and a minimum standard presented. Where practicable, the recommended standards should be used in the design of streets. The following street types are addressed in this portion of the plan.

23.8.3 All above ground obstructions, regardless of the height above the ground, must be a minimum of 4' from the back of the curb. Obstructions include, but are not limited to poles, wires, signs or boxes.

23.8.4 Consult the State Department of Highway and Public Transportation Design Manual for highway and frontage road design standards.

23.8.5 Arterial and collector streets are required to provide a minimum 100' tangent section between reverse curves and conform to the sight distance requirements.

23.8.6 Streets that have off-set intersections must have a minimum of 250' distance from centerline to centerline

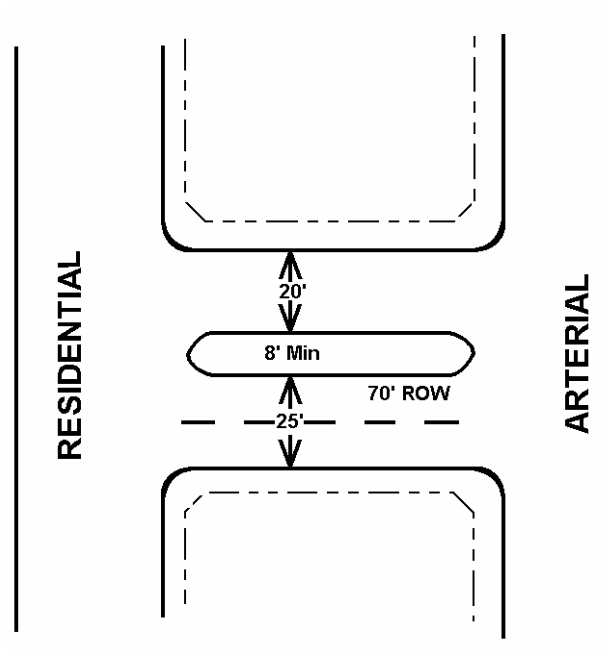
23.8.7 Deviation that is less than the Standard criteria must be approved by the City of Grand Prairie Traffic Engineer or Director of Transportation Services.

23.8.8 When reverse curves are designed into a roadway the stopping sight distance must be maintained throughout the section.

23.8.9 Properties along divided or one-way roadways are required to provide a 24' cross access easement across the property to adjacent properties.

23.8.10 Residential subdivisions should be designed and constructed with only collector type streets or arterials intersecting with an arterial. There are two (2) alternatives when a residential street must intersect an arterial street, as shown in Figure 4. The preferred method is Alternative "A" below. Alternative "A" allows a connection from a local residential street to an arterial street with a short local street segment with a 70' Right-Of-Way that provides a 20' entrance lane into the subdivision and 2-12' exit lanes separated by a minimum 8' wide median. With the less preferred Alternative "B", the residential street will flare out to a 37' paving section at the intersection with the flared section having a taper using the table below with a minimum of 100' length of 37' paving.

Alternative A:



Alternative B:

Residential Street Width (W) in Feet	Taper Length (T) in Feet	Stacking Distance (S) in Feet
24	100	100
27	75	100
31	45	100

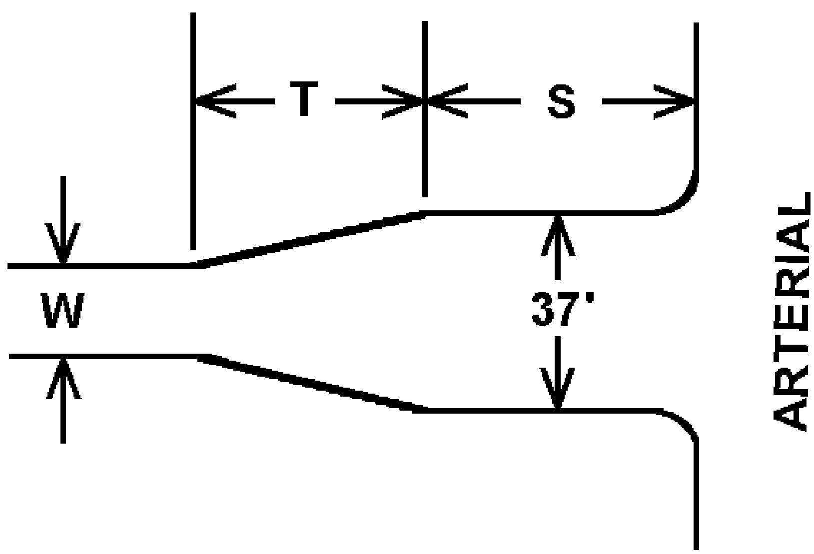


Figure 4. Possible Connection of a Local Residential Street Directly to an Arterial

SECTION 9 – ROADWAY TYPICAL CROSS SECTIONS

23.9.1 ***Summary of Roadway Attributes by Classification*.** Table 6 lists an overview of the sectional attributes of the various roadway classifications.

23.9.2 ***Roadway Classifications*.** The Master Thoroughfare Plan Map shows the classifications of the major roadways in the City of Grand Prairie. Roads not assigned a classification on the Master Thoroughfare Plan map are classified as Local Roadways.

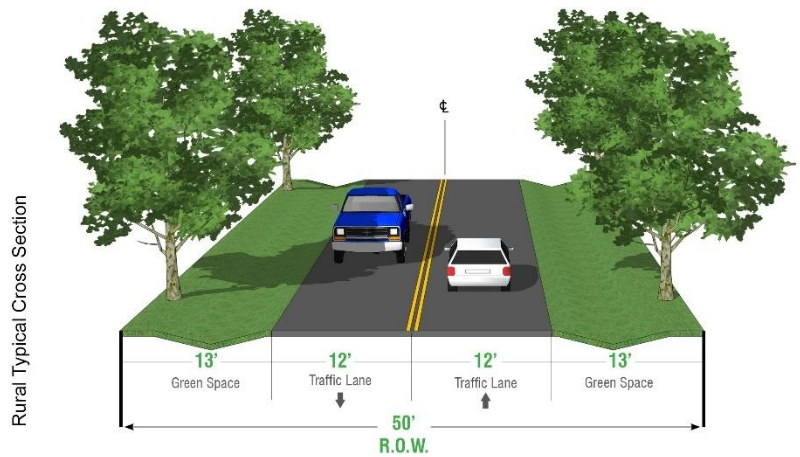
Table 6. Overview of Thoroughfare Attributes by Functional Classification

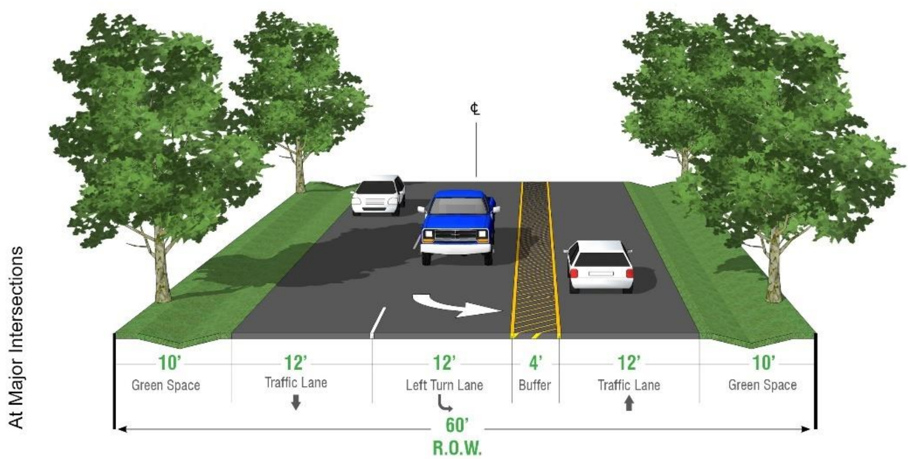
Typical Attribute	Functional Classification				
	Freeway/Expwy	Principal Arterial	Minor Arterial	Collector	Local
Spacing	2 to 10 miles	1 to 2 miles	1/4 to 1 mile	1/4 to 1/2 mile	100 to 500 ft
Facility Length	Over 15 miles	5 to 15 miles	1 to 5 miles	0.25 to 1 mile	< 0.25 mile
Typ. Traffic, vpd	80,000 +	35,000-80,000	10,000-35,000	2,000-10,000	< 2,000
Right-of-Way	300 to 500 feet	100 to 120 ft.	70 to 100 ft.	60 to 70 feet	50 to 60 feet
# of Lanes	Main + Srvc Rds	4 to 6 lanes	3 to 5 lanes	2 to 4 lanes	2 lanes
Lane Width	12’ Min.	12’ Min.	11’ Min	10’ Min.	10’ Min.
Median	Yes	Yes	Yes/No	No	No
Speed Limit	55 to 75 MPH	35 to 55 MPH	30 to 45 MPH	25 to 35 MPH	20 to 30 MPH
Sidewalk, Urban	No	Both sides	Both sides	Both sides	Both sides

23.9.3 ***Lane Widths***. Travel lane widths shall be a minimum of 10 feet. On local streets with traffic volumes less than 500 vehicles per day and parking provided, the two-way width of the travel lane may be less than 20 feet but not less than 11 feet.

23.9.4 ***Sidewalks and Buffer Space***. Roadway typical cross sections are generally shown with a minimum 4’ sidewalk, 1’ from the property line, a 5’ sidewalk is preferred whenever possible. A sidewalk should have a minimum of 3’ buffer space, preferably landscaped, between the edge of the sidewalk and the back of curb. If there is less than 3’ of buffer, the entire area between the sidewalk and the back of curb may be paved.

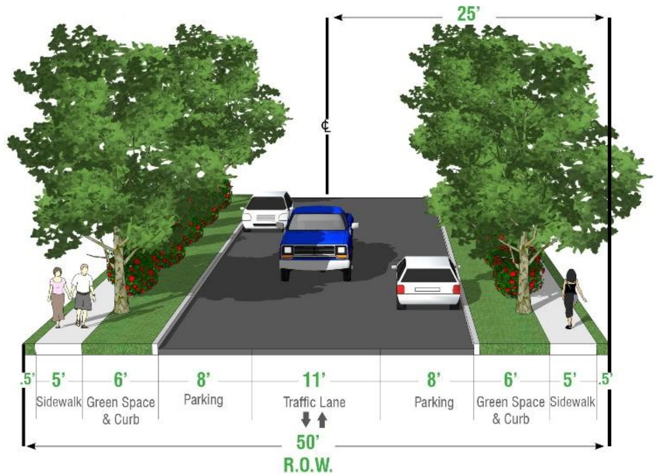
23.9.5 ***Rural Undivided 2-Lane Roadway, R2U***



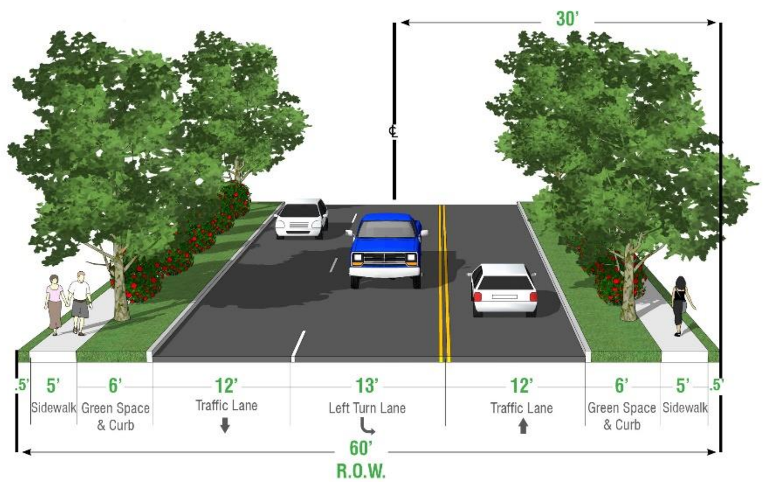


Design Elements (Standard)	***Rural Undivided 2-Lane Roadway, R2U***
Number of Traffic Lanes	2
Lane Width	12 Feet
Paving Width	24 Feet
Right-of-Way Width	50 Feet
Right-of-Way at Major Intersections	100 Feet
Design Speed	30 M.P.H.
Grade	0.5 – 10.0%
Horizontal Curvature	R = 350 Feet
Parking	Not Permitted
Preferred Parcel Size at Corners	According to Zoning

23.9.6 ***Local Street, LU:***



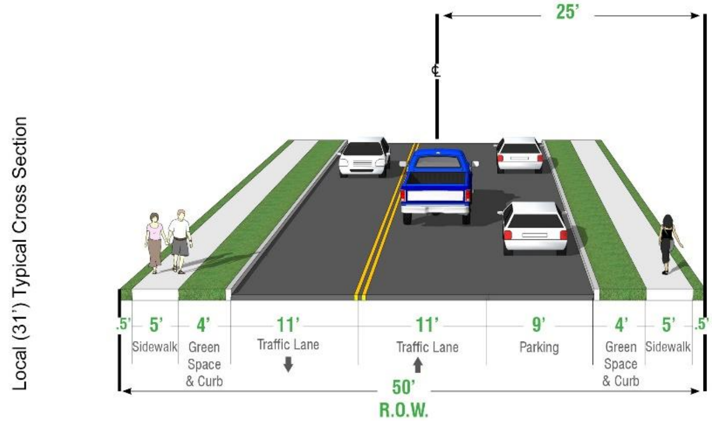
Local (27') Typical Cross Section

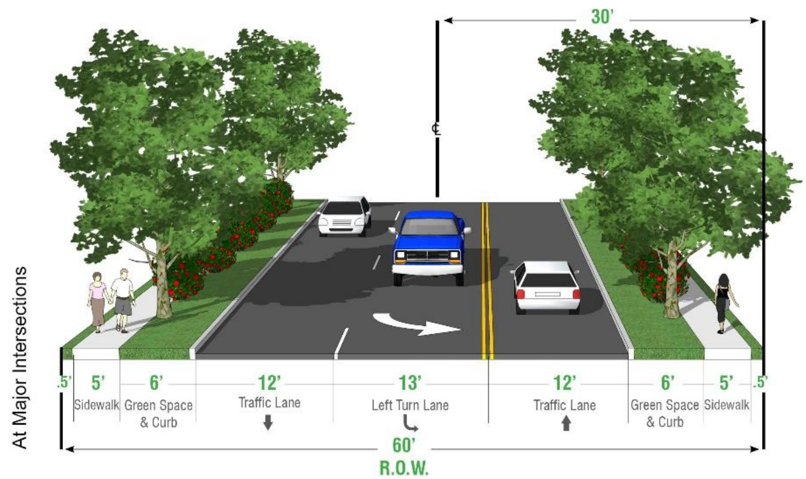


At Major Intersections

Design Elements (Standard)	***LU***
Number of Traffic Lanes	1
Lane Width	11 Feet
Paving Width, curb additional	27 Feet
Right-of-Way Width	50 Feet
Right-of-Way at Major Intersections	60 Feet
Design Speed	25 M.P.H.
Grade	0.5 – 10.0%
Horizontal Curvature	R = 350 Feet
Parking	Permitted
Preferred Parcel Size at Corners	According to Zoning

23.9.7 ***Local Street, L2U:***

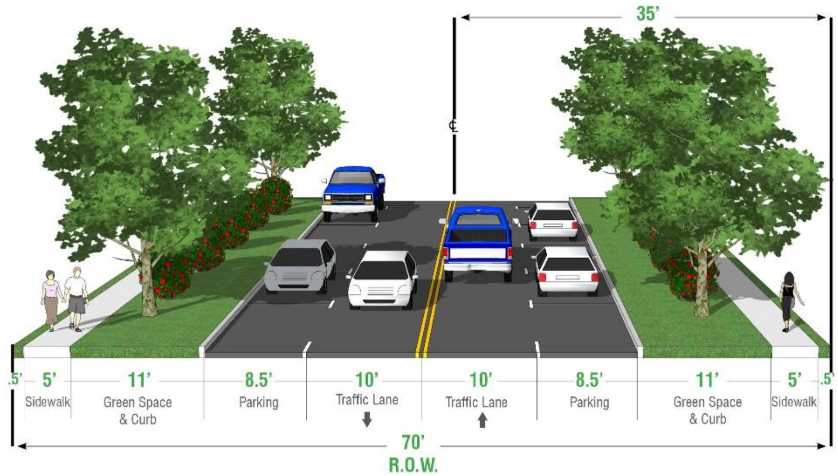




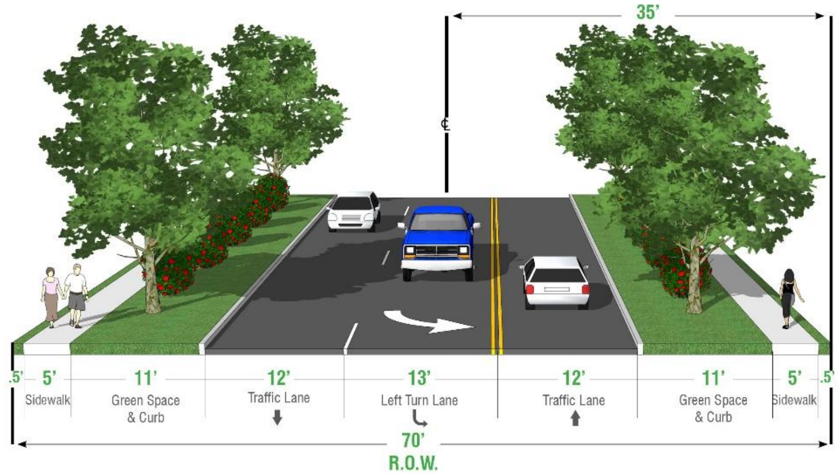
Design Elements (Standard)	*L2U*
Number of Traffic Lanes	2
Lane Width	11 Feet
Paving Width, curb additional	31 Feet
Right-of-Way Width	50 Feet
Right-of-Way at Major Intersections	60 Feet
Spacing	Twice Lot Depth
Grade	0.5 – 10.0%
Horizontal Curvature	R = 350 Feet
Cross Street Access Spacing	150 – 200 Feet
Parking	Permitted
Preferred Parcel Size at Corners	According to Zoning

23.9.8 ***<u>Collectors, C2U (37)</u> These standards apply to residential and non-residential Collectors***

Collector (37') Typical Cross Section

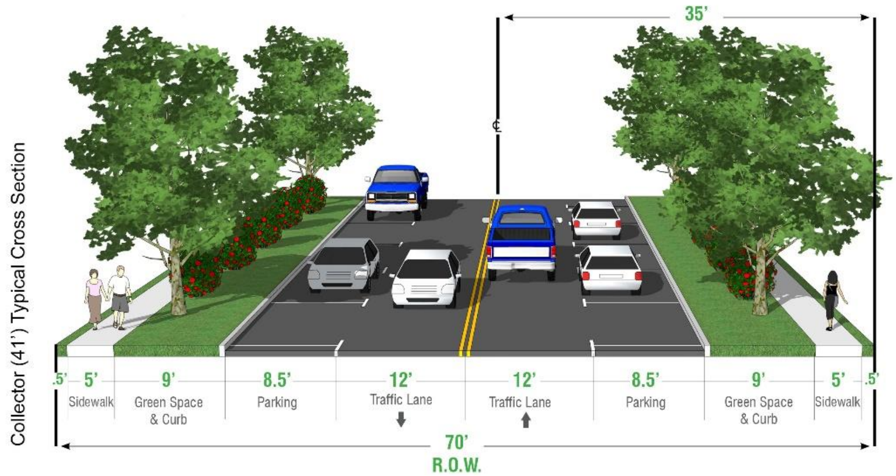


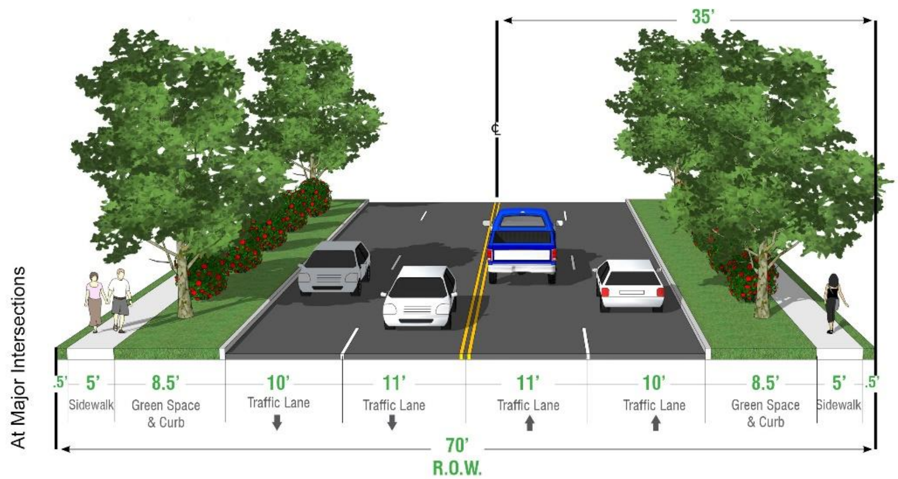
At Major Intersections



Design Elements (Standard)	***C2U***
Number of Traffic Lanes	2
Lane Width	10 Feet
Paving Width, curb additional	37 Feet
Right-of-Way Width	70 Feet
Right-of-Way at Major Intersections	70 Feet
Grade	0.5 – 10.0%
Horizontal Curvature	R = 550 Feet
Parking	Permitted
Preferred Parcel Size at Corners	150 Ft. x 190 Ft. *(If Accessed)*

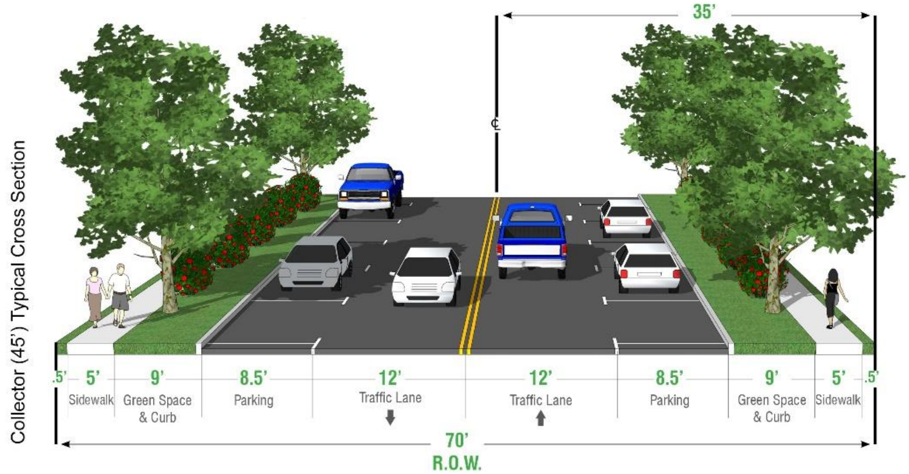
23.9.9 ***<u>Collectors C2U</u> (41) These standards apply to residential and non-residential Collectors***

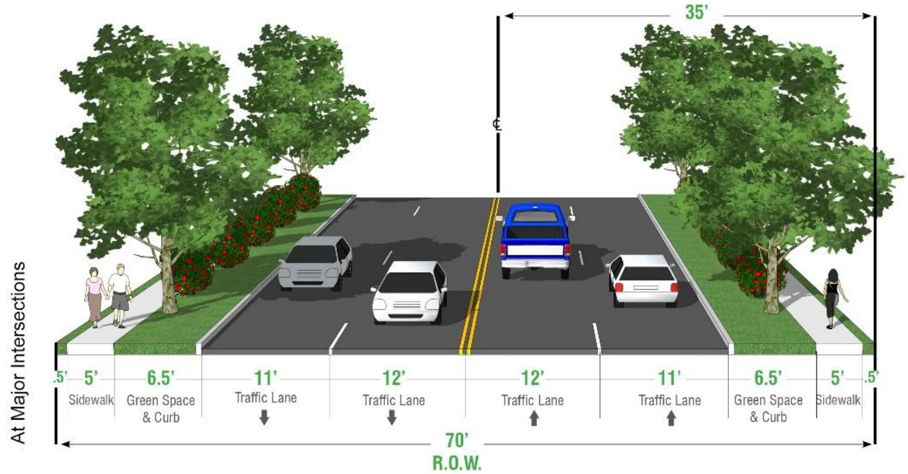




Design Elements (Standard)	***C2U***
Number of Traffic Lanes	2
Lane Width	12 Feet
Paving Width, curb additional	42 Feet
Right-of-Way Width	70 Feet
Right-of-Way at Major Intersections	70 Feet
Grade	0.5 – 10.0%
Horizontal Curvature	R = 550 Feet
Parking	Provided
Preferred Parcel Size at Corners	150 Ft. x 190 Ft. *(If Accessed)*

23.9.10 ***Collectors C2U*** ***(45) These standards apply to residential and non-residential Collectors***

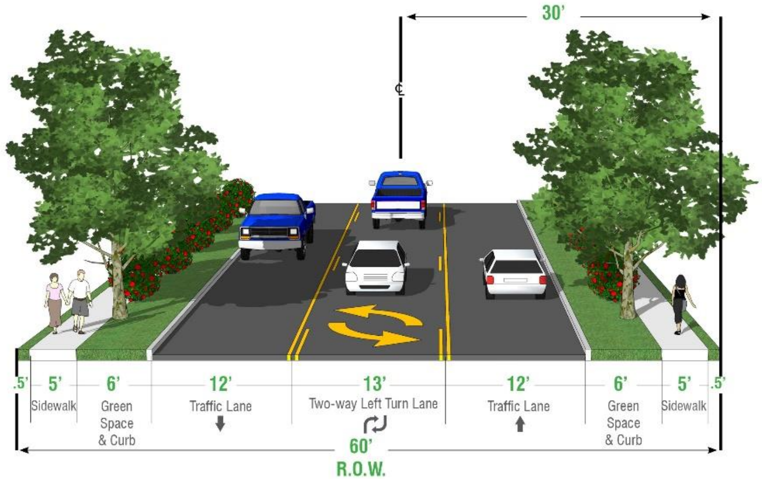




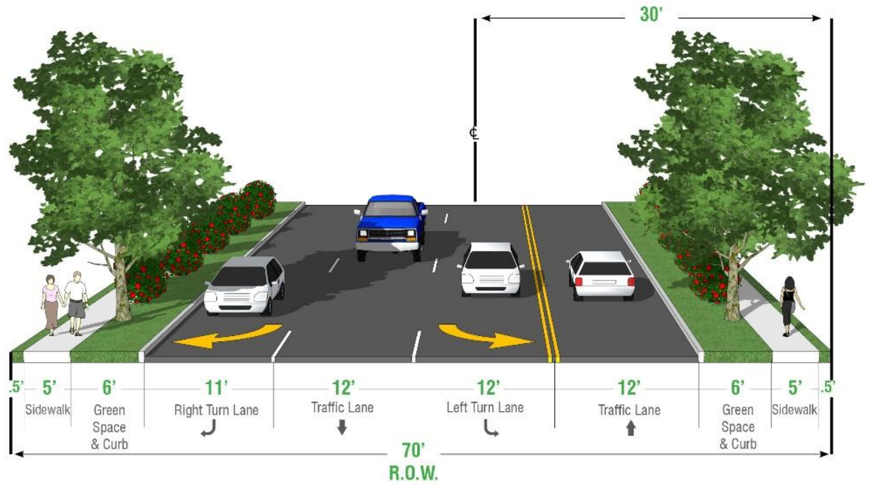
Design Elements (Standard)	***C2U***
Number of Traffic Lanes	2
Lane Width	12 Feet
Paving Width, curb additional	41 Feet
Right-of-Way Width	70 Feet
Right-of-Way at Major Intersections	70 Feet
Grade	0.5 – 10.0%
Horizontal Curvature	R = 550 Feet
Parking	Provided
Preferred Parcel Size at Corners	150 Ft. x 190 Ft. *(If Accessed)*

23.9.11 ***Minor Arterial 3-lane (two-way) Undivided, M3U***

Minor 3-Lane (Two-Way) Undivided Typical Cross Section

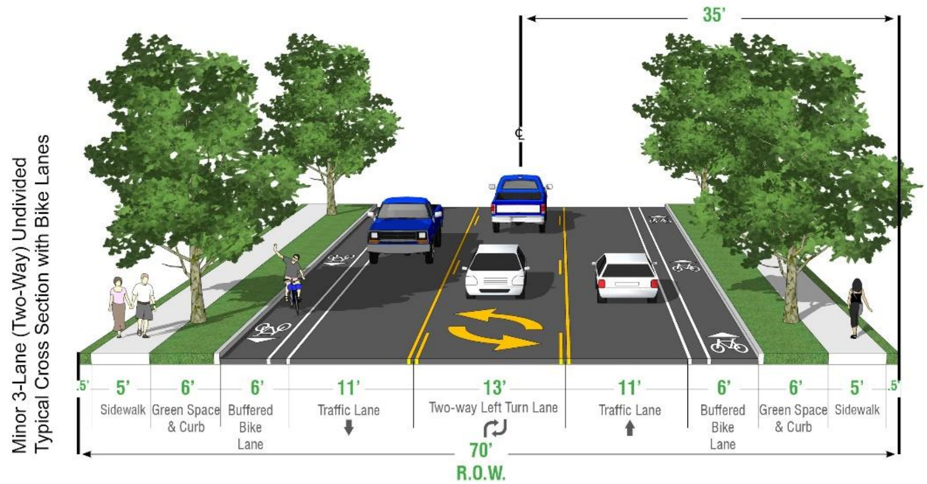


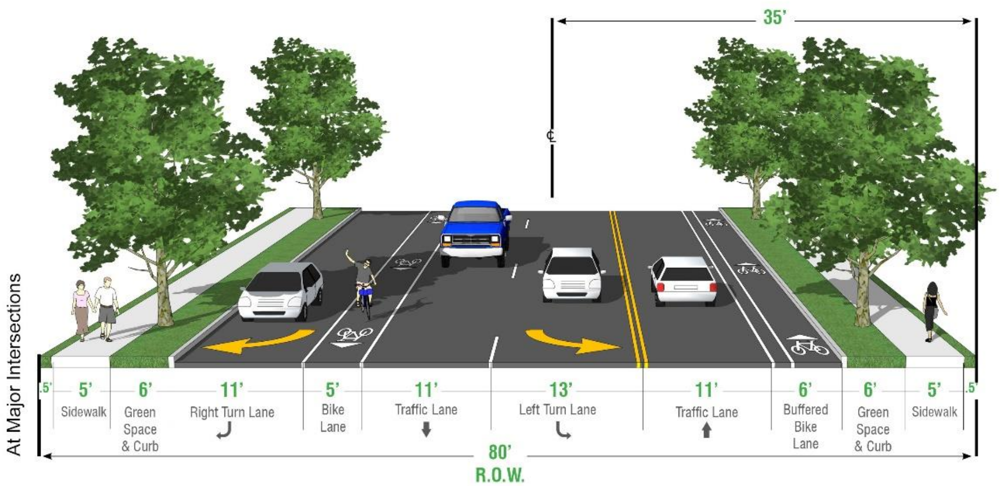
At Major Intersections



Design Elements (Standard)	***M3U (Two-way)***
Number of Traffic Lanes	2
Lane Width	12 Feet
Paving Width, curb additional	37 Feet
Right-of-Way Width	60 Feet
Right-of-Way at Major Intersections	70 Feet
Grade	0.5 – 6.0%
Horizontal Curvature	R = 850 Feet
Signal Spacing	1,600 Feet
Cross Street Access Spacing	600 Feet
Parking	Prohibited
Preferred Parcel Size at Corners	600 Ft. x 600 Ft.

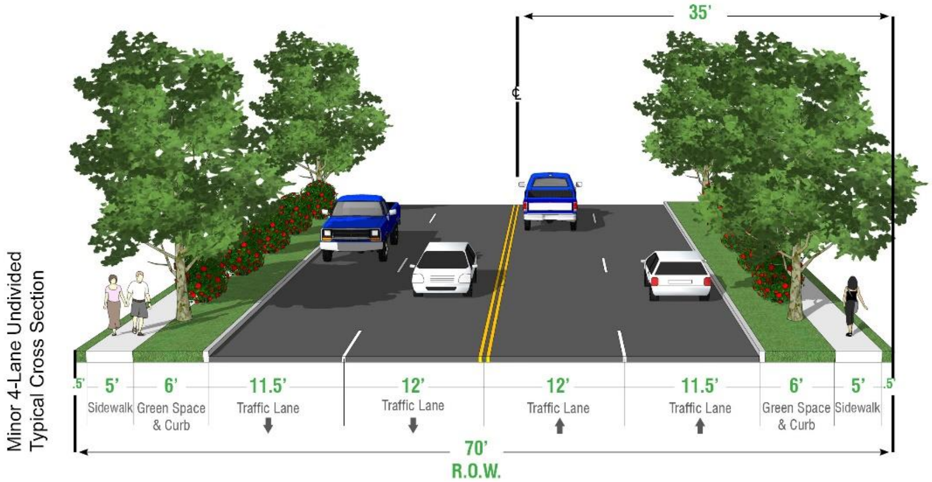
23.9.12 ***Minor Arterial 3-lane (two-way) Undivided with Bike Lanes, M3UB***

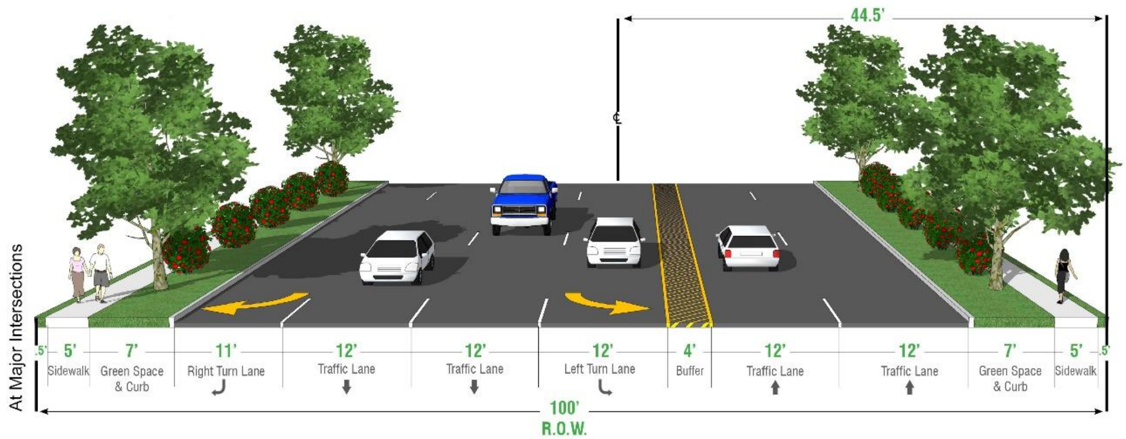




Design Elements (Standard)	*M3UB (Two-way)*
Number of Traffic Lanes	2
Lane Width	11 Feet
Bike Lane Width	6 Feet
Paving Width, curb additional	47 Feet
Right-of-Way Width	60 Feet
Right-of-Way at Major Intersections	80 Feet
Grade	0.5 – 6.0%
Horizontal Curvature	R = 850 Feet
Signal Spacing	1,600 Feet
Cross Street Access Spacing	600 Feet
Parking	Prohibited
Preferred Parcel Size at Corners	600 Ft. x 600 Ft.

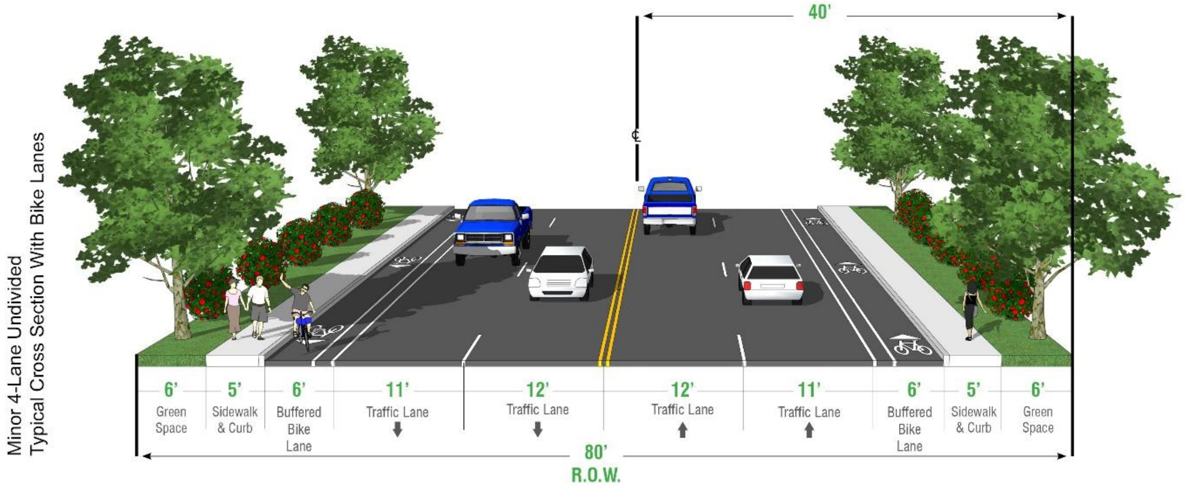
23.9.13 ***Minor Arterial 4-lane Undivided Typical Cross Section, M4U***

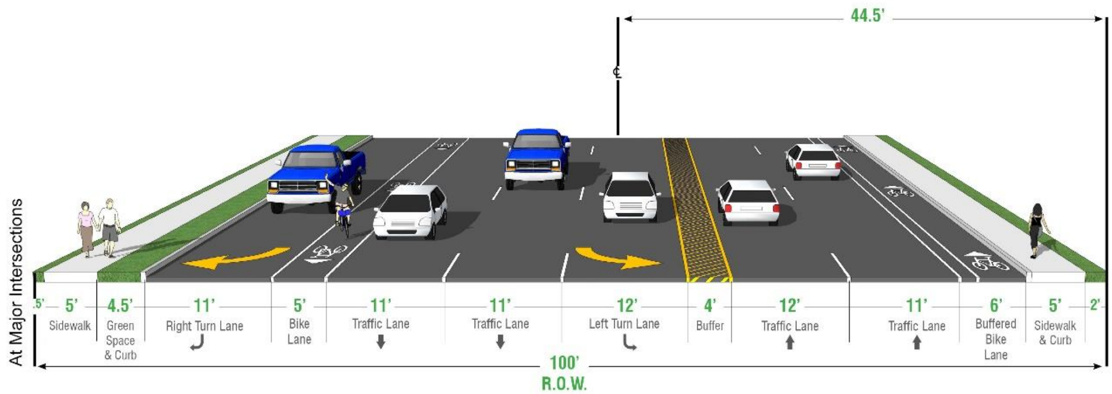




Design Elements (Standard)	***M4U***
Number of Traffic Lanes	4
Lane Width	11.5-12 Feet
Paving Width, curb additional	47 Feet
Right-of-Way Width	70 Feet
Right-of-Way at Major Intersections	100 Feet
Grade	0.5 – 7 ½ %
Horizontal Curvature	R = 775 Feet
Vertical Clearance	17 Feet
Signal Spacing	1,200 Feet
Cross Street Access Spacing	300 Feet
Parking	Prohibited
Preferred Parcel Size at Corners	250 Ft. x 250 Ft.

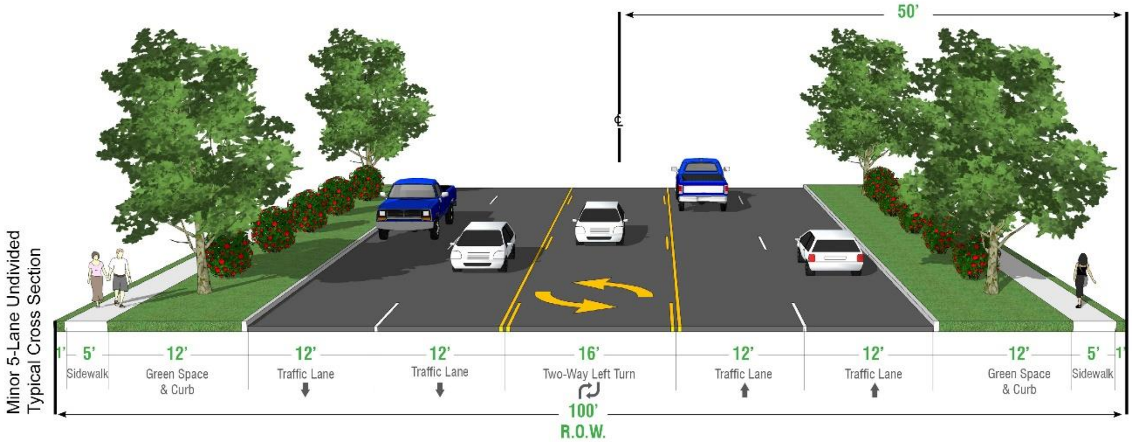
23.9.14 ***Minor Arterial 4-lane Undivided Typical Cross Section with Bike Lanes, M4UB***

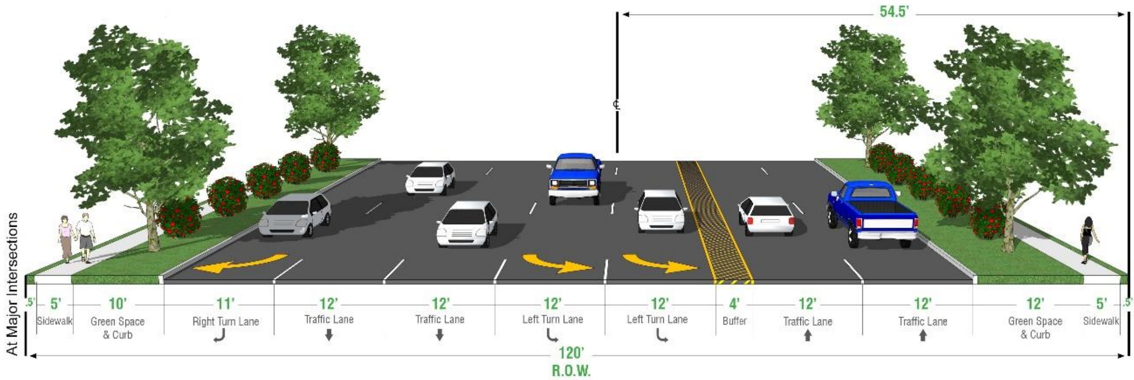




Design Elements (Standard)	***M4UB***
Number of Traffic Lanes	4
Lane Width	11-12 Feet
Bike Lane Width	5-6 Feet
Paving Width, curb additional	58 Feet
Right-of-Way Width	80 Feet
Right-of-Way at Major Intersections	100 Feet
Grade	0.5 – 7 ½ %
Horizontal Curvature	R = 775 Feet
Vertical Clearance	17 Feet
Signal Spacing	1,200 Feet
Cross Street Access Spacing	300 Feet
Parking	Prohibited
Preferred Parcel Size at Corners	250 Ft. x 250 Ft.

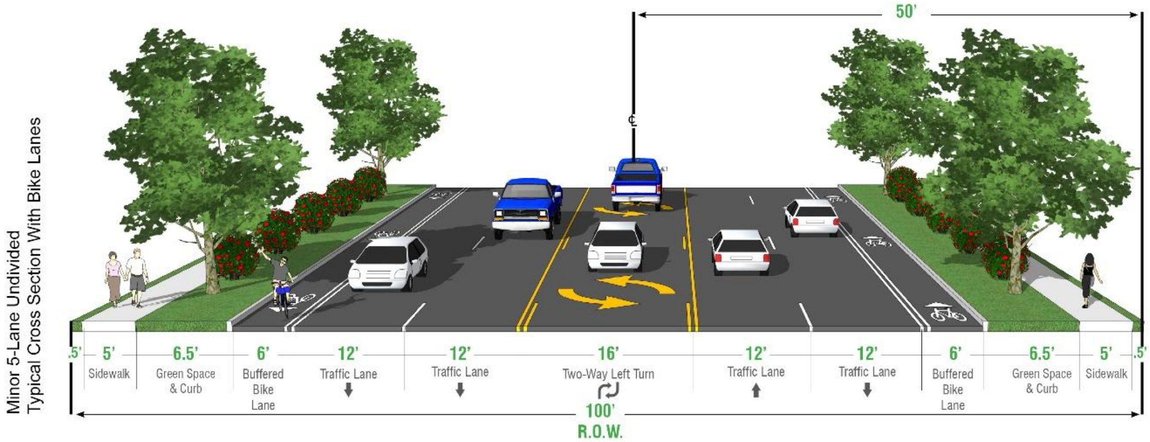
23.9.15 ***Minor Arterial 5-lane Undivided, M5U***

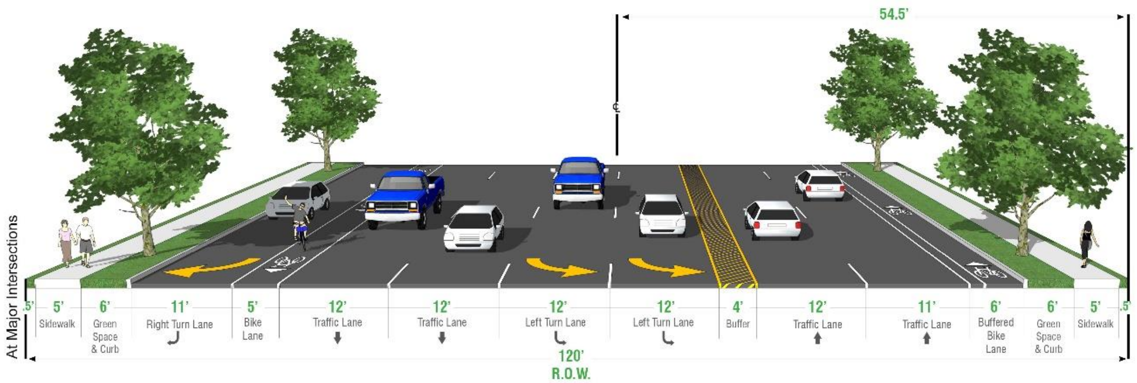




Design Elements (Standard)	***M5U***
Number of Traffic Lanes	5
Lane Width	12 Feet
Left Turn Lane Width	16 Feet
Paving Width	64 Feet
Right-of-Way Width	100 Feet
Right-of-Way at Major Intersections	120 Feet
Grade	0.5 – 6.0%
Horizontal Curvature	R = 1,050 Feet
Vertical Clearance	17 Feet
Signal Spacing	1,600 Feet
Cross Street Access Spacing	600 Feet
Parking	Prohibited
Preferred Parcel Size at Corners	450 Ft. x 450 Ft.

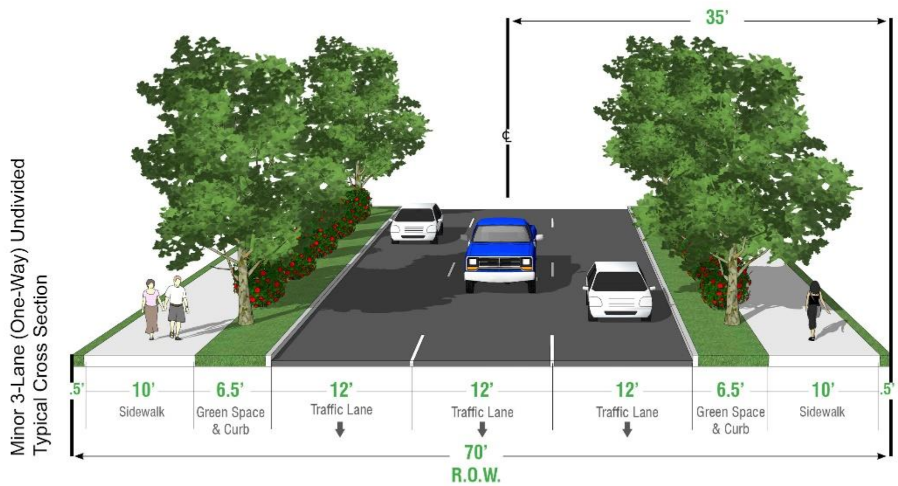
23.9.16 ***Minor Arterial 5-lane Undivided Typical Cross Section with Bike Lanes, M5UB***

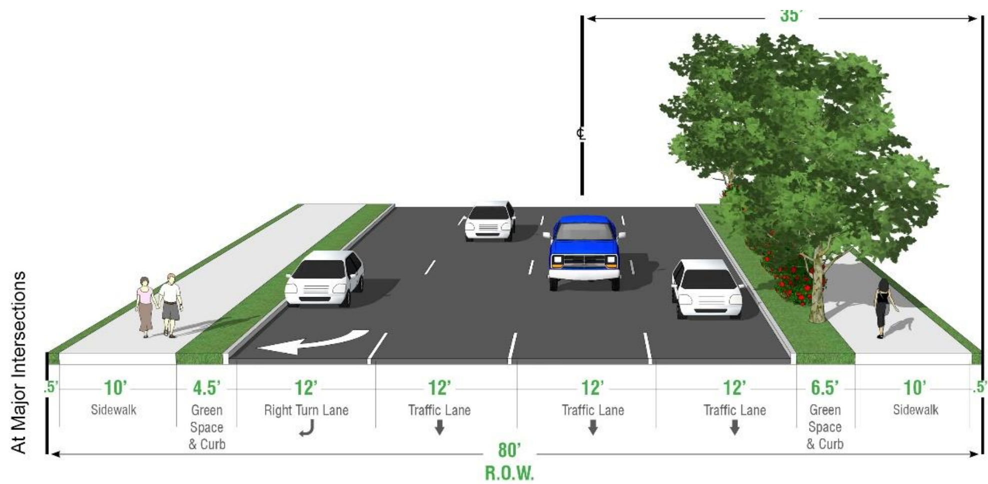




Design Elements (Standard)	***M5UB***
Number of Traffic Lanes	5
Lane Width	12 Feet
Bike Lane Width	5-6 Feet
Left Turn Lane Width	16 Feet
Paving Width, curb additional	76 Feet
Right-of-Way Width	100 Feet
Right-of-Way at Major Intersections	120 Feet
Grade	0.5 – 6.0%
Horizontal Curvature	R = 1,050 Feet
Vertical Clearance	17 Feet
Signal Spacing	1,600 Feet
Cross Street Access Spacing	600 Feet
Parking	Prohibited
Preferred Parcel Size at Corners	450 Ft. x 450 Ft.

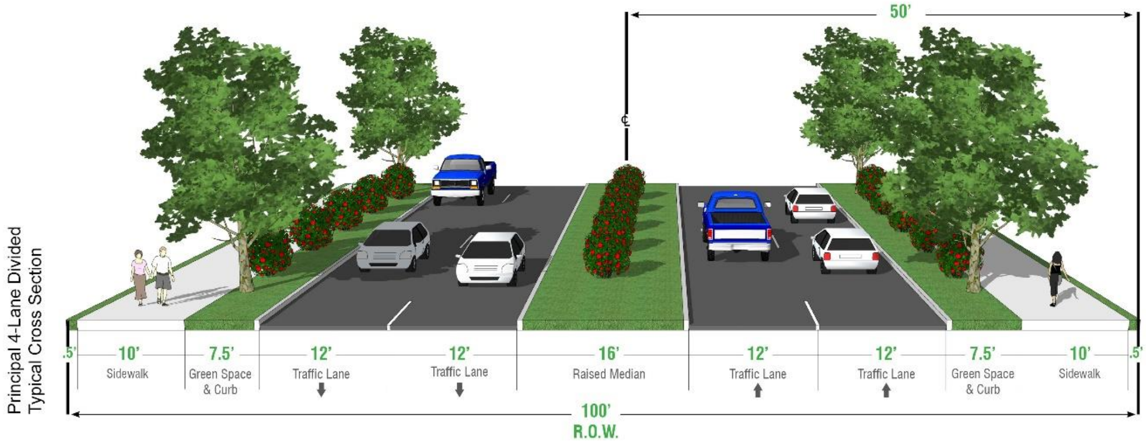
23.9.17 ***Principal Arterial 3-lane (one-way) Undivided Typical Cross Section, P3U***

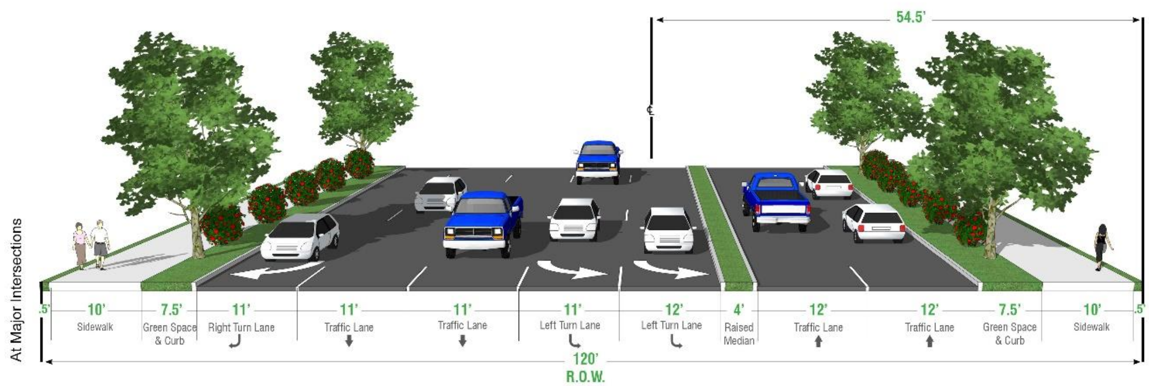




Design Elements (Standard)	***P3U (One-way)***
Number of Traffic Lanes	3
Lane Width	12 Feet
Outside Lane Width	12 Feet
Paving Width, curb additional	36 Feet
Right-of-Way Width	60 Feet
Right-of-Way at Major Intersections	100 Feet
Grade	0.5 – 6.0%
Horizontal Curvature	R = 1,050 Feet
Vertical Clearance	17 Feet
Signal Spacing	1,600 Feet
Cross Street Access Spacing	600 Feet
Parking	Prohibited
Preferred Parcel Size at Corners	600 Ft. x 600 Ft.

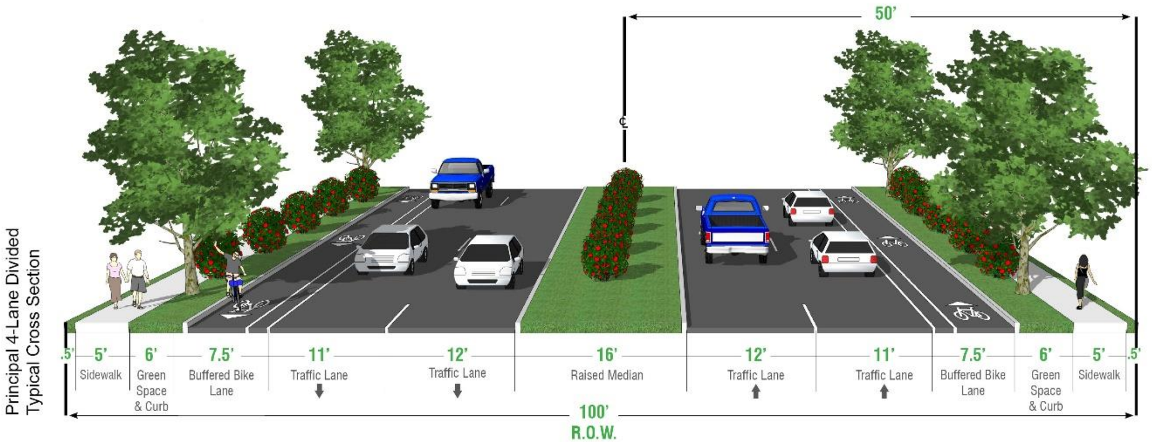
23.9.18 ***Principal Arterial 4-lane Divided Typical Cross Section, P4D***

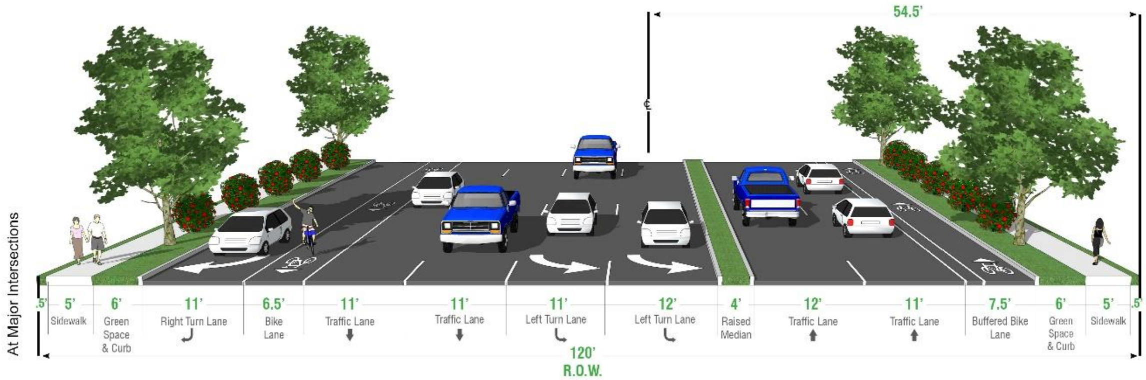




Design Elements (Standard)	***P4D***
Number of Traffic Lanes	4
Lane Width, curb additional	11-12 Feet
Median Width	16 Feet
Median Width at Major Intersections	4 Feet
Right-of-Way Width	100 Feet
Right-of-Way Width at Major Intersections	120 Feet
General Easements	10 Feet
Grade	0.5 – 6.0%
Horizontal Curvature	R = 1,050 Feet
Vertical Clearance	17 Feet
Signal Spacing	1,600 Feet
Cross Street Access Spacing	600 Feet
Parking	Prohibited
Preferred Parcel Size at Corners	600 Ft. x 600 Ft.

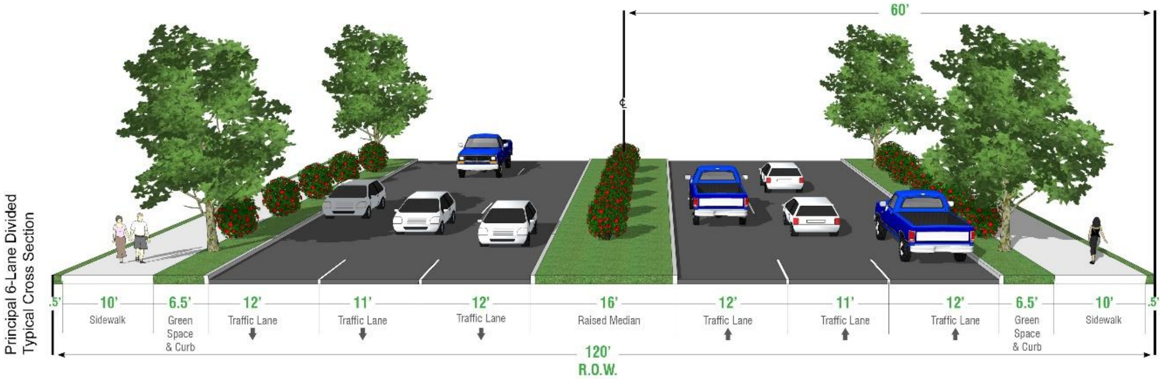
23.9.19 ***Principal Arterial 4-lane Divided Typical Cross Section, P4DB***

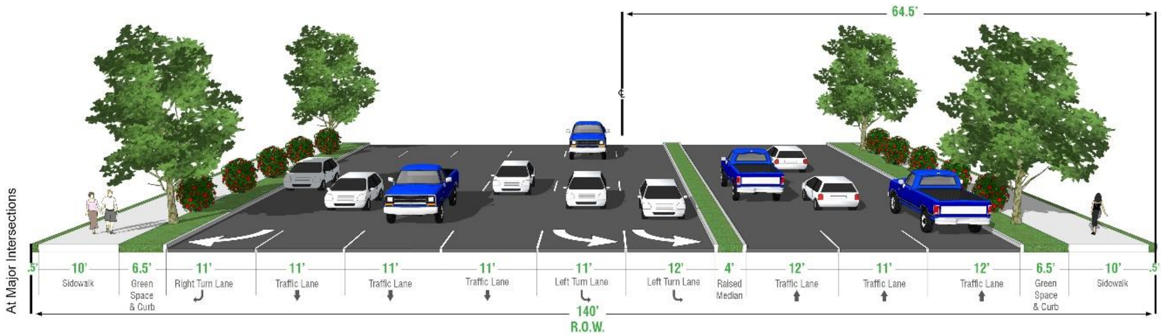




Design Elements (Standard)	***P4D***
Number of Traffic Lanes	4
Lane Width, curb additional	11-12 Feet
Median Width	16 Feet
Median Width at Major Intersections	4 Feet
Right-of-Way Width	100 Feet
Right-of-Way Width at Major Intersections	120 Feet
General Easements	10 Feet
Grade	0.5 – 6.0%
Horizontal Curvature	R = 1,050 Feet
Vertical Clearance	17 Feet
Signal Spacing	1,600 Feet
Cross Street Access Spacing	600 Feet
Parking	Prohibited
Preferred Parcel Size at Corners	600 Ft. x 600 Ft.

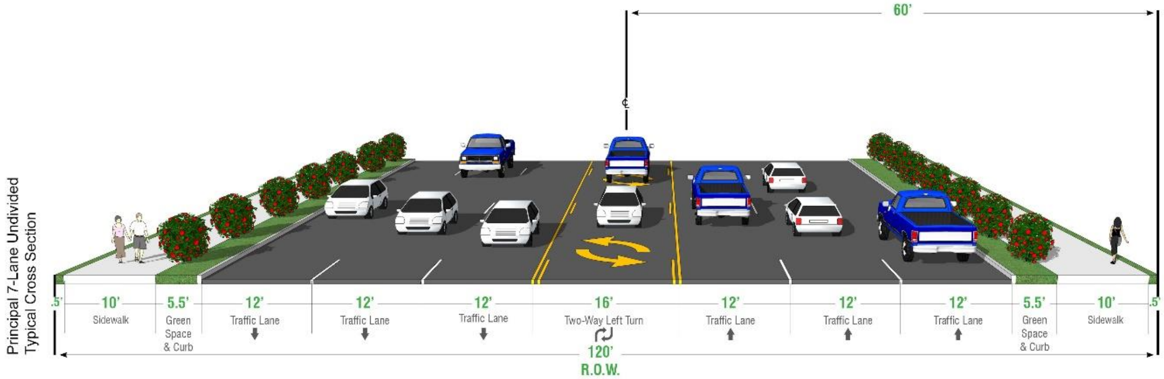
23.9.20 ***Principal Arterial 6-lane Divided Typical Cross Section, P6D***

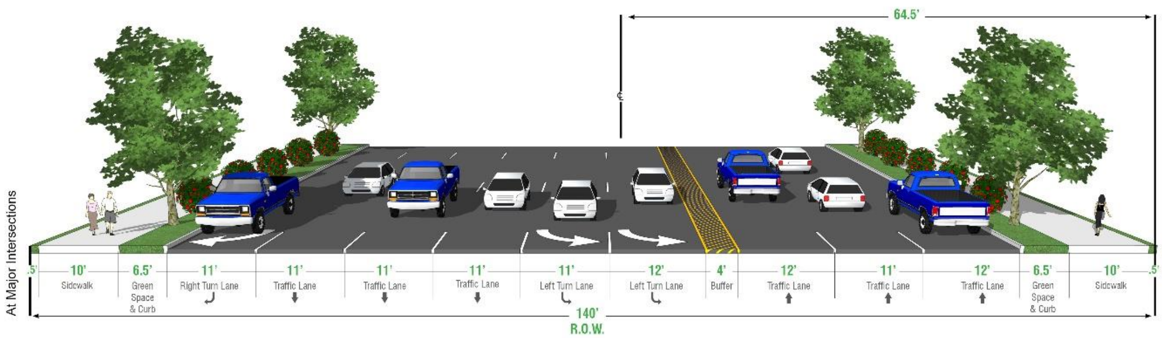




Design Elements (Standard)	***P6D***
Number of Traffic Lanes	6
Lane Width	11-12 Feet
Median Width	16 Feet
Median Width at Major Intersections	4 Feet
Right-of-Way Width	120 Feet
Right-of-Way Width at Major Intersections	140 Feet
Grade	0.5 – 6.0%
Horizontal Curvature	R = 1,050 Feet
Vertical Clearance	17 Feet
Signal Spacing	1,600 Feet
Cross Street Access Spacing	600 Feet
Parking	Prohibited
Preferred Parcel Size at Corners	600 Ft. x 600 Ft.

23.9.21 ***Principal Arterial 7-lane Undivided Typical Cross Section, P7U***





Design Elements (Standard)	***P7U***
Number of Traffic Lanes	7
Lane Width	12 Feet
Left Turn Lane Width	16 Feet
Paving Width	96 Feet
Right-of-Way Width	120 Feet
Right-of-Way Width at Major Intersections	140 Feet
Grade	0.5 – 6.0%
Horizontal Curvature	R = 1,050 Feet
Signal Spacing	1,600 Feet
Cross Street Access Spacing	600 Feet
Parking	Prohibited
Preferred Parcel Size at Corners	600 Ft. x 600 Ft.

SECTION 10 – ACCESS MANAGEMENT

23.10.1 Access management is the regulation of intersections, driveways and median openings to a roadway to balance the needs for access to land uses with the need to maintain roadway safety and mobility. These guidelines control the location, design, spacing of access points and their operation. This is particularly important for major roadways intended to provide efficient service to through-traffic movements.

23.10.2 ***Preserve the Functional Area of Intersections and Interchanges***: The functional area of an intersection or interchange is the area that is critical to its safe and efficient operation. This is the area where motorists are responding to the intersection or interchange, decelerating, and maneuvering into the appropriate lane to stop or complete a turn. Access connections too close to intersections or interchange ramps can cause serious traffic conflicts that result in crashes and congestion. See the Access Management Diagram.

23.10.3 ***Limit the Number of Conflict Points:*** Drivers make more mistakes and are more likely to have collisions when they are presented with the complex driving situations created by numerous conflict points. Conversely, simplifying the driving task contributes to improved traffic operations and fewer collisions. A less complex driving environment is accomplished by limiting the number and type of conflicts between vehicles, vehicles and pedestrians, and vehicles and bicyclists.

23.10.4 ***Promote Intersection Hierarchy***: An efficient transportation network provides appropriate transitions from one classification of roadway to another. For example, freeways connect to arterials through an interchange that is designed for the transition, and arterials are fed by collector streets not local streets. Abiding by this strategy results in a series of intersection types that range from the junction of two major arterial roadways, to a residential driveway connecting to a local street.

23.10.5 ***Limit Direct Access to Major Roadways:*** Roadways that serve higher volumes of areawide through traffic need more access control to preserve their traffic function. Driveways for commercial development along arterials should be minimized to the extent possible, and cross access between properties encourages. Frequent and direct property access is more compatible with the function of minor arterials and collector roadways. Residential properties cannot access an arterial roadway if there is a rural, local or collector roadway adjacent to the property.

23.10.6 ***Remove Turning Vehicles from Through Traffic Lanes:*** Turning lanes allow drivers to decelerate gradually out of the through lane and wait in a protected area for an opportunity to complete a turn. This reduces the severity and duration of conflict between turning vehicles and through traffic and improves the safety and efficiency of roadway intersections.

23.10.7 ***Use Non-traversable Medians to Manage Left-Turn Movements:*** Medians channel turning movements on major roadways to controlled locations. Research has shown that the majority of access-related crashes involve left turns. Therefore, non-traversable medians and other techniques that minimize left turns or reduce the driver workload can be especially effective in improving roadway safety.

23.10.8 Access Management Table

		Residential	***Industrial***	***Commercial***
A	Driveway Throat Width:			
	Local	15' – 28'	40'	30' – 40'
	Collector	15' – 28'	40' – 60' [1]	30' – 40'
	Minor Arterial	N/A	40' – 60' [1]	30' – 60'
	Principal Arterial	N/A	40' – 60' [1]	30' – 60'
r	Driveway Curb Radius			
	Local	5'	30'	20'
	Collector	5'	40'	25'
	Minor Arterial	N/A	40'	30'
	Principal Arterial	N/A	50'	35'
B	Minimum Driveway Spacing Along:			
	Local	15'	110'	70'
	Collector	25'	110'	120'
	Minor Arterial	N/A	160'	170'
	Principal Arterial	N/A	210' [2]	230' [2]
	Driveway Angle	90º	90º	90º
C	Minimum Distance from Driveway to Intersection:			
	Local	50'	100'	100'
	Collector	50'	100'	120'
	Minor Arterial	N/A	175'	150'
	Principal Arterial	N/A	175'	150'
	Maximum Approach Grade:			
	Local / Collector	N/A	6%	6%
	All Others	N/A	6%	6%
	Right Turn Requirement	N/A	6%	6%
	Minimum Approach Length:			
	All Road Classifications	25'	N/A	N/A

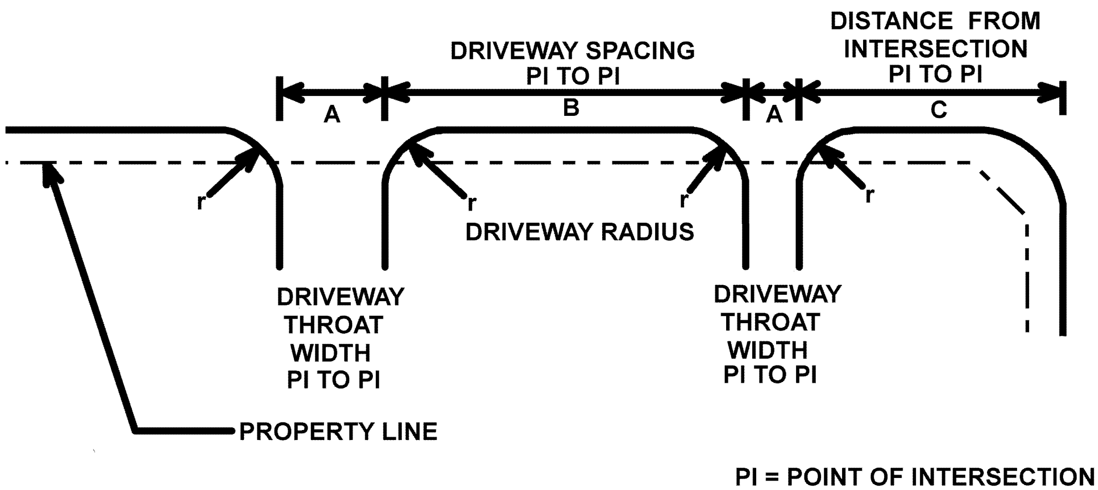
<u>Notes:</u>

[1]: Can be wider based on the site requirements.

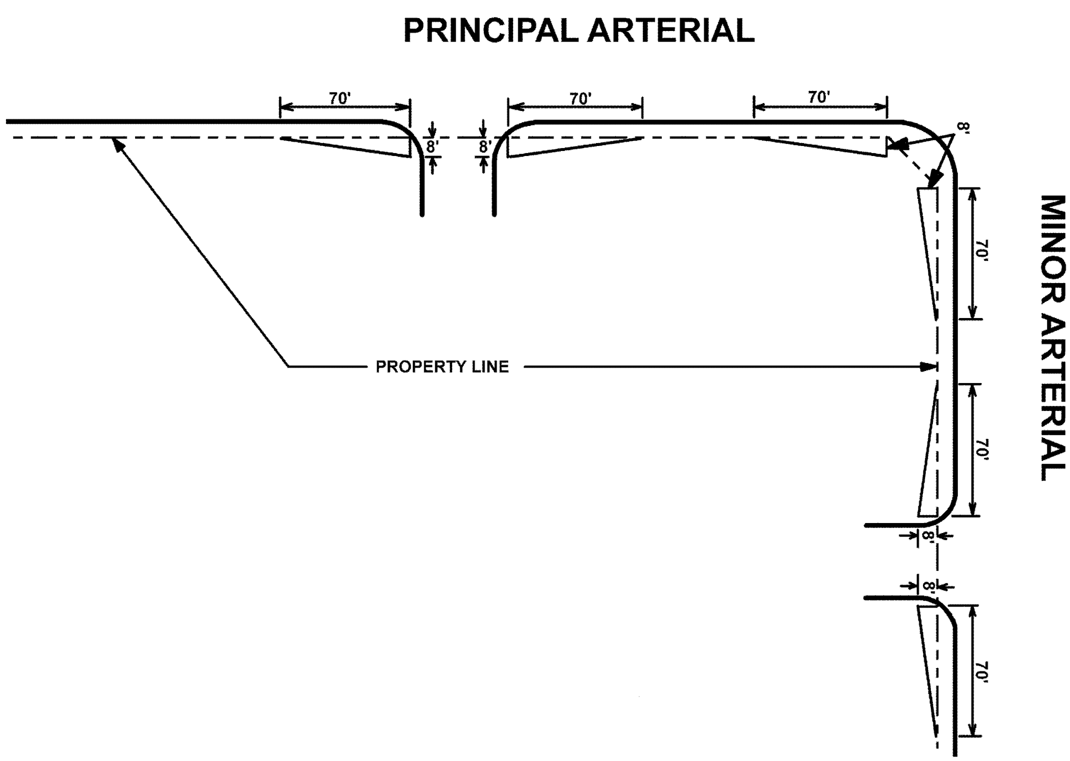
[2]: Driveways should be used jointly at median openings.

- ✓ Based on a speed of 40 MPH.
- ✓ Driveway width plus radius must be contained within the property frontage, between the extended property lines.
- ✓ Frontage roads are considered Principal Arterials for Access Managements purposes. Driveways onto frontage roads require TxDOT approval.

23.10.9 Access Management Diagram



23.10.10 Visibility Triangle (Minor/Principal)



NOTE: *No walls, fences or landscape over 2' tall are allowed in the Visibility Triangle/Easements. The 8'x70' visibility triangle may be increased by the Transportation Director if, under certain circumstances, it is not sufficient to provide enough sight distance as required in Section 23.6.4.*

SECTION 11 – TRAFFIC IMPACT ANALYSIS GUIDELINES

23.11.1 The purpose of a Traffic Impact Analysis (TIA) is to assess the effects of specific development activity on the existing and planned roadway system. It is the intent of this ordinance to make traffic access planning an integral part of the development process.

23.11.2 ***When Traffic Impact Analysis is Required:***

Generally, a traffic study shall be required for any development expected to generate traffic volumes that will significantly impact the capacity or safety of the street system. A Traffic Impact Analysis (TIA) is a comprehensive study of all aspects of a development's probable impacts on the transportation system. This study will analyze how traffic generated by a development relates to traffic on internal and adjacent roadways. The following provides specific situations where a traffic study may be required:

(a) Platting

(1) A TIA shall be required for a development when the expected traffic generation is greater than 2,000 vehicle trips per day (tpd). A trip is considered to be a one-way movement either to or from the site development.

(2) Developments expected to generate less than 2,000 tpd may be required to submit a TIA if the peak hour operation of the development is expected to generate more than 200 vehicle trips per hour (tph).

(3) A TIA will be required for developments that involve more than 100 acres of property unless the development will generate less than 500 tpd.

(4) The TIA shall be submitted no later than the submission of the plat application.

(b) Special Circumstances

A TIA may be required for a development if the Transportation Services Director determines that one or more of the following conditions exist:

(1) Traffic generated from a non-residential development will significantly impact adjacent residential neighborhoods.

(2) Traffic operational impacts such as problems with driveways, left or right turns, signal timing, median openings or sight distance are anticipated. In such cases, the study will only be required to answer questions related to the specific impacts.

(3) Existing traffic problems on adjacent streets are expected to worsen due to traffic generated from and/or street modifications implemented with the new development.

(4) Implementation of the Thoroughfare Development Plan in the area will not occur prior to development of the property.

(5) The proposed land use differs significantly from that contemplated in the adopted Comprehensive Plan.

(6) The internal street or access system is not anticipated to accommodate the expected traffic generation.

(7) Any previous TIA relating to a development that is more than two years old shall be updated for use in consideration of the project impacts prior to approval by the City, unless the City Transportation Services Director determines that conditions have not changed significantly.

(8) A TIA may be required at any stage of development at the discretion of the Transportation Services Director, City Council or the Planning and Zoning Commission.

23.11.3 A TIA that is required of the applicant by the City of Grand Prairie is part of the development review and approval process. The primary responsibility for assessing the traffic impacts associated with a proposed development rest with the applicant. The City serves in a review capacity for this process. Both the City of Grand Prairie and the applicant share responsibility to consider all reasonable solutions in the mitigation of transportation problems identified through the impact study process.

23.11.4 ***Traffic Impact Analysis Responsibilities***

(a) When determined that a TIA will be performed, as described in Section 23.11.2, the applicant shall perform and submit to the City of Grand Prairie Transportation Services Department a TIA performed at a minimum as established in this section.

(b) The study must be prepared under the direction of a licensed professional engineer with experience in Transportation Engineering sufficient to assess traffic impacts. The TIA must be signed and sealed by the directing professional engineer, registered to practice in Texas.

(c) The City of Grand Prairie Transportation Services Department must approve all TIA's before final acceptance. After acceptance of the TIA, the review process will determine further actions.

23.11.5 ***Traffic Impact Analysis Requirements***

(a) Preliminary Meeting
A meeting shall be held between the applicant's TIA engineer and the City Transportation Services Department to discuss the development project, and to establish a base of communication between the City and the applicant's TIA engineer prior to beginning the TIA. This meeting will define the requirements and scope relative to conducting a TIA and ensure that any questions by the applicant's TIA engineer are addressed. Topics for discussion at the meeting would typically include:

- definition of the study area and intersections to be analyzed
- methods for projecting future volumes and conditions to be analyzed
- trip generation and directional distribution methods
- special site related issues, such as length of implementation and need for phasing of impact assessment

(b) TIA Required Elements
In order to provide consistency and to facilitate staff review of TIAs, the following format shall be used for the content of the TIA:

(1) Executive Summary
This is a condensed version of the full TIA and shall be included with all submittals. It contains a brief statement of the TIA, background information, concise analysis and main conclusions and recommendations.

(2) Introduction
Information regarding the applicant, owner, TIA engineer, stage in the TIA submittal process and other overall information as applicable.

(3) Land Use, Site and Study Area Boundaries
A brief description of the size of the land parcel, general terrain features and the location within the City and the region shall be included in this section. In addition, roadways that

provide site access and are in the study area shall be identified. The limits of the study area shall be based on existing and future traffic conditions surrounding the site and will be determined at the preliminary meeting. A vicinity map that shows the site and the study area boundaries, in relation to the surrounding transportation system, shall be included.

(4) Existing and Proposed Site Uses
The existing and proposed zoning of the site shall be identified. In addition, the specific use for the site shall be identified if known, since a variety of uses may be permitted under a zoning category. The TIA shall address traffic impacts for the worst case allowed by zoning.

(5) Existing and Proposed Uses in Study Area
A complete description and map of the existing land uses and zoning in the study area shall be included. In addition, a complete description and map of the assumed future land use shall be provided. Generally, this information can be obtained from the Planning & Zoning Department.

(6) Existing and Proposed Roadways and Intersections in Study Area
A complete description and map of the existing roadways and intersections including geometrics, traffic signal control, and volumes shall be included. It shall also identify improvements contemplated by government agencies and provide the following details:
a) The nature of the improvement project
b) Limits
c) Implementation schedule
d) The agency or funding source responsible

(7) Trip Generation
a) A summary table shall be provided listing each type of existing and proposed land use, building size, average trip generation rates (total daily traffic and a.m./p.m. peaks), and the resultant total trips.
b) Trip generation shall be calculated for the maximum uses allowed under the existing and proposed zoning based on the latest edition of the ITE Trip Generation Manual.
c) In the event that data is not available for the proposed land use, the City shall approve estimated rates. Traffic volume counts for similar existing uses, if no published rates are available. All sources must be cited in the report.
d) The calculation of design hour trips generated by the site will be for the peak hour of the site development or for the peak hour of the adjacent street, whichever is the more critical time period for analysis.

(8) Trip Reductions for Design Hour Volumes
a) Mode Choice – If reasonable alternative modes of transportation are available for trips to be made to and from the site that will not add vehicles onto the roadway, the trip generation values may be reduced by those trips that would be expected to be accommodated by these alternative modes of transportation.
b) Pass-by – Pass-by factors are to be used to reduce the estimated additional total daily traffic to the street serving a proposed development, assuming that the vehicle would have been just passing by and decided to enter the site. They are not to be applied directly to reduce trip generation and turning movement volumes at driveways serving the proposed development. The percentage rates for passerby traffic may be obtained from the latest ITE Trip Generation Manual.

c) Internal capture - Internal trip reduction assumptions will require analytical support to demonstrate how the figures were derived. Other documented rates to account for passerby traffic may be used upon approval by the City.

d) The calculation of design hour volumes used to determine study area impacts shall be based on trip generation and appropriate trip reductions.

(9) Trip Distribution
The estimates for percentage distribution of trips by turning movements to/from the proposed development shall be clearly stated in the report.

(10) Trip Assignment
The direction of approach for site-generated traffic via the area's street system shall be presented in this section. The technical analysis, basic methods, and assumptions used in this work shall be clearly stated. The assumed trip distribution and assignment shall represent the most logically traveled routes for drivers accessing the proposed development. These routes can be determined by observation of travel patterns to existing land uses in the study area.

(11) Existing and Projected Traffic Volumes
The specific time frames to be studied will depend on the individual development. Analysis should include existing conditions, opening year, and horizon year conditions as described below:

a) **Existing:** Analysis based on existing traffic counts and roadway conditions.

b) **Opening Year:** Opening year analysis shall be based on the anticipated earliest completion of the development. The analysis must account for traffic growth from existing volumes and roadway system changes during development of the site. The methodology for developing volume projections for background traffic growth will be determined at the preliminary meeting and the growth rate will be provided by the City. Opening year traffic should consider volumes generated by other known proposed development within the impact study area, for which the city will provide available information. The Opening year analysis should be conducted for the following conditions to reveal expected impacts of the development when it is ready for occupancy:
   a. No-build (without site traffic and related improvements) and
   b. Build (with site traffic and related improvements) conditions.
   c. If a development is to be implemented over many years, the impact analysis should be broken into multiple phases, each with its Opening year for analysis.

c) **Horizon year**: Additional analysis scenario(s) beyond opening year, as much as 5 years from opening of the development, may also be requested based on type, size, and phasing of the development. These time frames will be determined at the preliminary meeting.

d) Design Volume graphics shall be provided showing the following traffic volumes for private access points, intersections and streets:
   a. A.M. peak hour site traffic (in and out) including turning movements.
   b. P.M. peak hour site traffic (in and out) including turning movements.
   c. A.M. peak hour total traffic including site generated traffic (in and out). These volumes should include through and turning movement volumes for Opening and horizon year conditions.

d. P.M. peak hour total traffic including site generated traffic (in and out). These volumes shall include through and turning movement volumes for Opening and horizon year conditions.
e. Any other peak hour which is critical to site traffic and the street system in the study area shall be included in the graphics and with the same information provided for the a.m./p.m. peak hours.

All raw traffic count data (including average daily volumes and peak hour turning movements) and analysis worksheets shall be provided in the appendices of the report.

(12) Capacity Analysis
(a) A capacity analysis for appropriate peak periods shall be conducted for all public streets, intersections and junctions of major driveways with public streets, which are impacted (as designated by the City Traffic Engineer), by the proposed development within the previously defined study boundary.
(b) Capacity analysis will follow the principles established in the latest edition of the Transportation Research Board's Highway Capacity Manual (HCM), unless otherwise directed by the City Traffic Engineer. Capacity will be reported in quantitative terms as expressed in the HCM and in terms of traffic Level of Service.
(c) Capacity analysis will include traffic queuing estimates for all critical applications where the length of queues is a design parameter, e.g., auxiliary turn lanes, and at traffic gates.
(d) All capacity analysis work sheets or output reports from analysis software shall be included in the appendices of the report.

(13) Traffic Signals
The need for new traffic signals shall be based on warrants contained in the Texas Manual on Uniform Traffic Control Devices. A minimum spacing of one-half mile for all signalized intersections shall be maintained, except as allowed by the City Traffic Engineer. This spacing is desirable to achieve optimum speed, capacity, and signal progression.

(14) Traffic Crashes
Traffic accident data may be required for affected street corridors. The study period is typically three years. Accident data summaries may be obtained from the City. Estimates of increased or decreased accident potential shall be evaluated for the proposed development.

(15) Level of Service Determination
A table indicating the level of service for existing, opening year, and horizon year conditions for all streets within the study area shall be included. A table should also be provided comparing the impacted LOS to the resulting LOS after implementation of recommended mitigation measures. Level of Service “C” is the design objective for all movements. Under no circumstances shall the Level of Service be less than “D” unless deemed acceptable for site and non-site traffic by the Transportation Services Director.

(16) Conclusions and Recommendations
This chapter of the report must include a summary of the study findings regarding impacts of the proposed development on the existing and proposed street system.

(a) Roadways and intersections, within the Study Area, that are expected to operate at Level of Service D, E, or F, under traffic conditions including projected traffic plus site-generated traffic must be identified.

(b) In the event that the analysis indicates unsatisfactory levels of service (D, E, or F) or safety problems, a detailed description of proposed improvements to remedy deficiencies shall be included and viable recommendations made for raising the traffic conditions to Level of Service C or better (Level of Service A or B).

(c) Level of Service "C" is the design objective for all movements and under no circumstances will less than Level of Service "D" be deemed acceptable for site and non-site traffic including existing traffic at build-out of the study area.

(d) Assumptions regarding future capacity enhancement recommendations shall be approved by the City. The recommendation section shall include a sketch of each improvement showing pertinent geometric features.

(17) The City Traffic Engineer may require other items be included in the TIA in addition to those listed above.

(18) Submittal
The applicant will provide five (5) copies of the Draft Report for review, and nine (9) copies of the Final Report and a PDF electronic file for submittal. The applicant will provide electronic files of the model run used in the Traffic Impact Analysis for modeling and/or simulation.

Continue to Next Page …

SECTION 12 – ON STREET BIKE PLAN

23.12.1 The City of Grand Prairie City Council initially adopted the On-Street Bike Plan in 2001 with Resolution Number 3750. This plan represents a commitment by the City of Grand Prairie to provide a method for encouraging bicycle usage within the City of Grand Prairie.

23.12.2 On-street bike facilities will be designed and constructed using standards set forth in this Master Transportation Plan. Other sources of planning and design guidance include the American Association of State Highway and Transportation Officials (AASHTO) Guide to the Development of Bicycle Facilities and the National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide. On-street signage for the bicycle routes will use the Texas Manual on Uniform Traffic Control Devices (MUTCD) for standard pavement markings and signage that pertain to bicycle facilities.

23.12.3 New and reconstructed roadways will be designed to accommodate bicycle usage unless the city determines it unwarranted or impractical to do so.

23.12.4 Modifications to existing streets to incorporate bicycling accommodations may utilize designs that deviate from the standards set forth in this Master Transportation Plan, at the discretion of the City Engineer. Existing roadways will be changed whenever possible to accommodate the mixture of motor vehicles and bicycles. Each roadway will be evaluated individually for its potential to accommodate bicycling.

23.12.5 A network of on-street bicycling routes should be master planned to provide connectivity to other bike routes and off-street trails within the City, and those provided or approved by other Cities. Connections will be provided to selected major destinations within the City of Grand Prairie, routes in adjacent Cities and off-street bike trails. The routes should not have any significant barriers or hazards for bicycle usage and will take advantage of local and collector street network to the extent possible.

23.12.6 When working with existing streets and highways, the City of Grand Prairie will investigate the opportunity to make at least minor or marginal improvements such as changes to speed limits or striping.

23.12.7 Whenever it will not interfere or restrict traffic flow, speed limits and “traffic calming” strategies should be established to minimize speed differentials between bicycles and motor vehicles.

23.12.8 ***Bicycle Facility Types and Implementation Guidelines***

There are various configurations of facilities that can be provided to accommodate bicycling within the street right-of-way, including the following.

(a) Shared Lanes – The travel lane can be shared by both motorists and bicyclists on most local streets (typically with less that 500 vehicles per day and speeds not exceeding 25 MPH) and some collectors with low volumes (below 1,500 vehicles per day, total both ways, and speeds not exceeding 30 MPH). Shared lanes can be typical travel lanes or can be as wide as 15 feet to allow both modes to ride side-by-side under busier street conditions. The shared lanes can be provided with a “sharrow” pavement marking, as described in the Texas Manual on

Uniform Traffic Control Devices, to indicate the recommended position of the bicyclist in the shared lane and to further alert motorists to the presence of bicyclists sharing the roadway.

(b) Bicycle Boulevards – Through a collective treatment of traffic calming on shared lanes within neighborhoods and the creation of some bicycle-only connections across arterial roadways and short trail segments connecting neighborhoods, a bicycling corridor can be created that provides continuity for bicycling without encouraging cut-through traffic through neighborhoods.

(c) Advisory Bike Lanes - An advisory bicycle lane is a local roadway striping configuration on a very low volume (lease than 200 vehicles per day) and low speed (25 MPH or less) street which provides for two-way motor vehicle using one 10 to 14-foot wide central travel lane and 4 to 6-foot wide "advisory" bike lanes on either side. The central lane is dedicated to, and shared by, motorists traveling in both directions. Cyclists are given preference in the bike lanes but motorists can move into the bike lanes in order to pass by other road users after yielding to cyclists.

(d) Bike Lanes – On some collector and most minor arterial roadways, a one-way bike lane of at least 5 feet in width may be provided between the traffic lane and the edge of pavement or curb or parking lane to better accommodate bicyclists traveling with traffic. This treatment would be employed when posted speeds are between 35 MPH and 40 MPH and traffic volumes are over 1,000 vehicles per day per lane.

(e) Paved Shoulders – Adding or improving paved shoulders often can be the best way to accommodate bicyclists in rural settings, and they can also extend the service life of the roadway. Paved shoulders should be at least 4 feet wide. Additional shoulder width is recommended for travel speeds over 50 MPH. Rumble strips or raised pavement markers should not be used on shoulders designated for bicycle usage.

(f) Buffered Bike Lanes – On some Minor or Principal arterials, a one-way bike lane of at least 4 feet in width, with a striped buffer lane of between 2 and 5 feet in width between the bike lane and the traffic lane, may be provided to better separation and delineation of bicyclists traveling with traffic. If a buffered bike lane is provided on a principal arterial, it should be at least 5 feet in width, with a striped buffer lane of between 3 and 5 feet in width.

(g) Separated Bike Lanes (also sometimes called "cycle tracks" or "protected bike lanes") – On some minor arterials and some principal arterials, a one-way bike lane of at least 5 feet in width or two-way bike lane of at least 8 feet in width may be provided with a buffer zone to deter motorists from entering the separated bike lane. The buffer zone many consist of a raised island, a striped area with flexible bollards or a parking lane between the bike lane and the traffic lane or other treatment to provide enhanced protection for bicyclists traveling with traffic.

(h) Shared Use Paths (Sidepaths) - On some minor arterials and some principal arterials, a two-way shared-use path of at least 10 feet in width may be provided roughly parallel to the roadway and separated from the travel lanes by at least 5 feet to provide increased separation of bicyclists and motorists. The shared use by bicyclists and pedestrians should be carefully designed and managed. If bike lanes transition in and out of shared use paths, the space allocation between bicyclist and pedestrians should be specifically designated.

(i) Due to high speeds and traffic volumes, frontage roads will not be signed as part of the on-street bicycle route network.

23.12.9 ***On-Street Bicycle Treatment Selection Guidelines***

Selection of bicycling treatments should consider the following parameters.

(a) Connection of Origins and Destinations – For the target user group, apply the bicycle facility that will most encourage those users to ride bicycle. For example, for a Safe Routes to School project, consider the treatment that will provide liner guidance for young bicyclists to ride in a straight line and be predictable, provide a consistent treatment, minimize conflicts with vehicles and pedestrians, and provide a convenient route to and from school that can be visible to casual surveillance.

(b) Accommodation of Local and Regional Recreational and Utilitarian Bicycling – Bicycling for recreation, conditioning and for utilitarian purposes is a popular activity enjoyed by residents of Grand Prairie and adjacent cities. Many bicyclists enjoy riding to, from and along interesting and scenic places, such as along Joe Pool Lake. For these activities, a series of bicycle-friendly roadway and/or trail facilities are sought out by users. Many bicycle riders prefer the long stretches of uninterrupted flow that minor and principal streets provide and are willing to share the road with a certain amount of moderate traffic volumes and speeds.

(c) In February 2018, the Federal Highway Administration (FHWA) published its *Guidebook for Measuring Multimodal Network Connectivity*, which is a guide for transportation planners and analysts on the application of analysis methods and measures to support transportation planning and programming decisions. It describes a five-step analysis process and numerous methods and measures to support a variety of planning decisions.

   a. **Network completeness** – How much of the transportation network is available to bicyclists?
   b. •**Network density** – How dense are the available links and nodes of the bicycle network?
   c. •**Route directness** – How far out of their way do users have to travel to find a facility they can or want to use?
   d. •**Access to destinations** – What destinations can be reached using the transportation network?
   e. •**Network quality** – How does the network support users of varying levels of experience, ages, abilities, and comfort with bicycling?

(d) In December 2017, the National Associations of City Transportation Officials (NACTO) published its *Designing for All Ages & Abilities; Contextual Guidance for High-Comfort Bicycle Facilities*. That document contains a table that provides guidelines for conditions under which various bicycle facility treatments would be applied. Notably, these guidelines are for providing facilities that would be usable for all ages and may present thresholds that are not applicable in all instances.

Contextual Guidance for Selecting All Ages & Abilities Bikeways

Roadway Context				All Ages & Abilities Bicycle Facility
Target Motor Vehicle Speed*	Target Max. Motor Vehicle Volume (ADT)	Motor Vehicle Lanes	Key Operational Considerations	
Any		*Any*	*Any of the following:* high curbside activity, frequent buses, motor vehicle congestion, or turning conflicts‡	**Protected Bicycle Lane**
< 10 mph	Less relevant	No centerline, or single lane one-way	Pedestrians share the roadway	**Shared Street**
≤ 20 mph	≤ 1,000 – 2,000		< 50 motor vehicles per hour in the peak direction at peak hour	**Bicycle Boulevard**
≤ 25 mph	≤ 500 – 1,500			
	≤ 1,500 – 3,000	Single lane each direction, or single lane one-way	Low curbside activity, or low congestion pressure	**Conventional or Buffered Bicycle Lane, or Protected Bicycle Lane**
	≤ 3,000 – 6,000			**Buffered or Protected Bicycle Lane**
	Greater than 6,000			**Protected Bicycle Lane**
	Any	Multiple lanes per direction		
Greater than 26 mph†	≤ 6,000	Single lane each direction	Low curbside activity, or low congestion pressure	**Protected Bicycle Lane, or Reduce Speed**
		Multiple lanes per direction		**Protected Bicycle Lane, or Reduce to Single Lane & Reduce Speed**
	Greater than 6,000	*Any*	*Any*	**Protected Bicycle Lane, or Bicycle Path**
High-speed limited access roadways, natural corridors, or geographic edge conditions with limited conflicts		*Any*	High pedestrian volume	**Bike Path with Separate Walkway or Protected Bicycle Lane**
			Low pedestrian volume	**Shared-Use Path or Protected Bicycle Lane**

* While posted or 85th percentile motor vehicle speed are commonly used design speed targets, 95th percentile speed captures high-end speeding, which causes greater stress to bicyclists and more frequent passing events. Setting target speed based on this threshold results in a higher level of bicycling comfort for the full range of riders.

† Setting 25 mph as a motor vehicle speed threshold for providing protected bikeways is consistent with many cities' traffic safety and Vision Zero policies. However, some cities use a 30 mph posted speed as a threshold for protected bikeways, consistent with providing Level of Traffic Stress level 2 (LTS 2) that can effectively reduce stress and accommodate more types of riders.[18]

‡ Operational factors that lead to bikeway conflicts are reasons to provide protected bike lanes regardless of motor vehicle speed and volume.

Figure 5. ***Contextual Guidance for Selecting High-Comfort Bicycle Facilities,*** **NACTO 2017**

SECTION 13 - ENCROACHMENT OF PUBLIC RIGHT-OF-WAY

23.13.1 This section is enacted for the purpose of regulation the use of city streets and the installation, maintenance and repair of underground and aboveground facilities within the public right-of-way of the City.

23.13.2 ***Definitions:*** *(The following words and phrases shall have the meaning respectively ascribed to them by this section)*

(a) ***Encroach or Encroachment:*** means going upon, over, under, or using any right-of-way in such a manner as to prevent, obstruct, or interfere with the normal use of that right-of-way, including the performance thereon of any of the following acts:

1. Erecting or maintaining any post, sign, pole, bench, mailbox, vending stand, charitable collection structures, fence, guardrail, wall loading platform, pipe, conduit, cable conductor scaffolding, barricade, newspaper stand, banner, sign, merchandise display or other structures or objects on or under the right-of-way. Pole replacements in place will not require written consent of the City Engineer,
2. Placing or leaving on the right-of-way or watercourse any rubbish, brush, earth, rock boulders, cut tree stumps or other material of any nature whatever,
3. Traveling on the right-of-way by any vehicle or combination of vehicles or object of dimension, weight, or other characteristic prohibited by law without receiving a written consent agreement from the City Engineer.
4. Lighting or building a fire within the right-of-way.

(b) ***Right-of-Way:*** means land which by deed, conveyance, agreement, easement, dedication, usage or process of law is reserved for and dedicated to the use of the general public for street or highway purposes which includes public utility, storm drainage, water, sanitary sewer or pedestrian walkway purposes;

(c) ***Watercourse:*** means a channel for the carrying of storm water, including both natural and artificial watercourses.

23.13.3 *Acts requiring written consent of the City Engineer*

No person shall encroach or cause to be made any encroachment of any nature whatever within, upon, over or under the limits of any right-of-way, or make or cause to be made any alteration of any nature within, upon, over or under the right-of-way, or construct, put upon, maintain or leave thereon, or cause to be constructed, put on, maintained or left thereon any obstruction or impediment of any nature whatever, or remove, or set fire thereon, or to place on, over or under such right-of-way any pipeline, conduit, or other fixtures or move over or cause to be moved over the surface of any right-of-way or over any bridge, viaduct, or other structure maintained by the City any vehicles or other object of dimension or weight prohibited by law or having other characteristics capable of damaging the right-of-way, or place any structure, wall, culvert, or similar encroachment or make any excavation or embankment in such a way as to endanger the normal usage or the right-of-way without having first obtained receiving a written consent agreement from the City Engineer as required by this section.

23.13.4 *Exceptions*

This section shall not apply to any officer or employee of the City in the discharge of their official duties, or to any work being performed by any person or persons under contract with the City.

23.13.5 *Emergency Work Authorized*

This chapter shall not prevent any person from maintaining any pipe, conduit, conductor, pole and its related facilities lawfully on or under any public street, as may be necessary for the preservation of life or property when an urgent necessity therefore arises.

23.13.6 *Above ground obstructions*

All above ground obstructions, regardless of the height above the ground, must be a minimum of 4’ from the back of the curb. Obstructions include, but are not limited to poles, wires, signs or boxes

23.13.7 Liability for Damages

The applicant shall be responsible for all liability imposed by law for personal injury or property damage caused by the work permitted and done by applicant under the written consent by the City Engineer, or proximately caused by failure on applicant’s part to perform his obligations under the permit in respect to maintenance. If any claim of such liability is made against the City, its officers, or employees, applicant shall defend, indemnify and hold them, and each of them, harmless against all tort claims, tort liability and tort loss, and in particular from and against all such claims, liability and loss predicated on active or passive negligence of the City resulting directly or indirectly from operations under this consent insofar as permitted by law.

23.13.8 Right of Lawful Use

Any consent granted under this chapter shall be subject to the right of the City, or any other person or persons entitled thereto, to use that part of the public street for any purpose for which it may be lawfully used, and no part of the street shall be unduly obstructed at any time.

23.13.9 Existing Facilities

The applicant shall not interfere with any existing utilities without the written consent of the City Engineer and the utility company or person owning the utility. If it becomes necessary to remove or relocate an existing utility, this shall be done by its owner. No utility owned by the City shall be moved to accommodate the permittee.

23.13.10 Written Consent Agreement

The written consent agreement required by this section shall be issued by the City Engineer or a designated representative subject to the conditions set forth in this section or required by other provisions of law.

23.13.11 Grounds for Refusal

No consent agreement will be approved for constructing or maintaining a loading platform upon or in the right-of-way of a public street or for maintaining therein or thereon a concrete pad, post or structure as a support structure for the placement of a newspaper stand, charitable collection site, or miscellaneous container structures. Consent agreements may also be denied or modifications required for any of the following reasons:

(a) Work as proposed to be constructed creates a hazard to public health, safety and welfare,
(b) Violation to Sections 23.13.15 and 23.13.16 pertaining to the location and placement of newspaper stands, charitable collection and miscellaneous structures,
(c) Violation of any other city code or ordinance.

23.13.12 Relocation or Removal of Encroachments

If any future construction, reconstruction or maintenance work by the City on a public right-of-way requires the relocation, removal or abandonment of installations or encroachments in, on or under the public right-of-way, the applicant owning, controlling, or maintaining such installations or encroachments shall relocate, remove or abandon the same at his sole expense. When removal, relocation or abandonment is required, the City Engineer shall give the permittee a written notice that the installations or encroachment must be moved, relocated or abandoned. If the permittee fails to comply with the instructions, the City may cause the removal, relocation or abandonment of the encroachment at the expense of the permittee.

23.13.13 Mailboxes

All mailboxes must be placed in accordance with the rules and regulations of the United States Post Office Department, but no box shall be so placed within the paved area of a street right-of-way as to endanger the life or safety of the traveling public.

23.13.14 Hedges or Fences

No hedge, fence or similar structure shall be planted or erected in a right-of-way. The intent of this restriction is to keep free a walkway for pedestrian or other lawful public travel without interference by or with vehicular travel. No encroachment of any nature will be permitted or maintained which impedes, obstructs or denies such pedestrian or other lawful travel within the limits of the right-of-way of a public street, or which impairs adequate sight distance for safe pedestrian or vehicular traffic.

23.13.15 Monuments

Any monument of granite, concrete, iron or other lasting material set for the purpose of locating or preserving the lines and/or elevation of any public street or right-of-way, property subdivision, or a precise survey point or reference point shall not be removed or disturbed or caused to be removed or disturbed without first obtaining written permission from the City Engineer, or designated representative, to do so. Replacement of removed or disturbed monuments will be at the expense of the permittee.

23.13.16 Newspaper Stand Structures

Newspaper stand containers may not be located in the City right-of-way. Such structures may be located on hard surfaces within the locations described below:

(a) *Street Zone:* A designated area set back from a public or private dedicated street right-of-way line no closer than 30-feet from said right-of-way line, with such area not being located within a designated fire lane or a designated parking space.

(b) ***Building Zone:*** For non-residential buildings constructed with a building setback of 10-feet or less facing a public or private dedicated street right-of-way, such containers shall be situated within a designated area located against the street facing building wall within 10-feet of the main pedestrian entrance(s) that is (are) built within said street facing wall with the building setback of 10-feet or less. Such containers shall not encroach into said street right-of-way and shall not encompass any part of a designated fire lane or designated parking space.

23.13.17 Charitable Collection and Miscellaneous Structures may not be located in the City right-of-way; must be constructed in compliance with all setbacks and requirements stipulated in Article 6, Table 6, of the Unified Development Code, and may not be located in a designated fire lane or a designated parking space.

End Document