

ORDINANCE NO. 2015

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF KELLER, TEXAS, TO AMEND THE CITY OF KELLER UNIFIED DEVELOPMENT CODE, ADOPTED BY ORDINANCE NO. 1746 DATED JULY 7, 2015, BY AMENDING ARTICLE 5 - SUBDIVISION DESIGN; SECTION 5.24 – DESIGN STANDARDS, RELATING TO EXISTING FIRE LANE PAVEMENT REGULATIONS; AUTHORIZING PUBLICATION; PROVIDING FOR PENALTIES; AND ESTABLISHING AN EFFECTIVE DATE.

WHEREAS, the City Council of the City of Keller, Texas, wishes to amend the Unified Development Code (UDC) to modify Fire Lane Pavement requirements to permit testing of existing pavement for potential use as fire lane; and

WHEREAS, notice of a public hearing before the Planning and Zoning Commission was published on April 17, 2021, in the Fort Worth Star-Telegram newspaper of general circulation in Keller at least ten (10) days before such hearing; and

WHEREAS, at the April 27, 2021 Planning and Zoning Commission Meeting, the Commission recommended approval by a vote of 7 – 0; and

WHEREAS, notice of a public hearing before the City Council was published on April 30, 2021, in the Fort Worth Star-Telegram newspaper of general circulation in Keller at least fifteen (15) days before such hearing; and

WHEREAS, the City Council finds that the proposed amendment furthers the purpose of the Unified Development Code;

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF KELLER, TEXAS:

Section 1: THAT, the above findings are hereby found to be true and correct and are incorporated herein in their entirety.

Section 2: THAT, in accordance with the Unified Development Code, the City Council of the City of Keller, Texas hereby authorizes approval to amend the City of Keller Unified Development Code, adopted by Ordinance No. 1746 dated July 7, 2015, by amending Article 5 - Subdivision Design; Section 5.24 – Design Standards; relating to existing fire lane pavement regulations, authorizing publication; providing for penalties; and establishing an effective date, in the City of Keller, Tarrant County, Texas, with the proposal attached hereto as Exhibit “A” and incorporated herein, as it fully set forth.

Section 3: THAT, any person, firm, or corporation violating any of the provisions of this Ordinance, as read together with the Unified Development Code and

accompanying map thereto, shall be guilty of a misdemeanor and upon final conviction therefore shall be fined in a sum not to exceed Two Thousand Dollars (\$2,000.00). Each and every day such violation continues shall constitute a separate offense and shall be punishable as such hereunder.

Section 4: THAT, the City Secretary is hereby authorized and directed to cause publication of the descriptive caption and penalty clause hereof as an alternative method of publication provided by law.

AND IT IS SO ORDAINED.

Passed and approved by a vote of 7 to 0 on this the 18th day of May 2021.

CITY OF KELLER, TEXAS

BY: _____
Armin R. Mizani, Mayor

ATTEST:

Kelly Ballard, City Secretary

Approved as to Form and Legality:

L. Stanton Lowry, City Attorney

Section 5.16 Fire Protection

A. *General Provisions.*

1. The Fire Marshal of the City of Keller will review all plans and specifications of all proposed commercial and residential development in the City and will determine whether or not adequate fire protection may be afforded the building or buildings situated or proposed to be situated on such property with existing or proposed fire hydrants, water lines **and fire lanes**.
2. If, in the opinion of the Fire Chief, adequate fire protection requires additional fire hydrants and water lines to serve proposed developments, they will direct the owner of the property, in writing, to locate at pre-designated positions on the property a fire hydrant or hydrants and adequate water lines to provide adequate fire protection at the owner's expense. The location and number of fire hydrants and water lines shall be situated as to afford adequate fire protection to all buildings located or proposed to be located on the property. Such installation to be completed in such reasonable period of time as the Fire Chief may direct.

B. *Fire Hydrant Location and Coverage Requirements.*

1. *Commercial and Industrial Areas.*

- a. Fire hydrants shall be located no more than a five hundred foot (500') truck hose lay distance to all points of any structure or combustible storage area on the lot.
- b. Fire hydrants located on the opposite side of a street, designated as four lanes or larger on the current City Thoroughfare Plan, shall not be considered acceptable for meeting hydrant coverage requirements.
- c. Fire hydrants shall be positioned to allow truck hose lays to follow normal traffic access to the site.
- d. Fire hydrants shall be spaced at no more than three hundred feet (300') intervals.

2. *Residential Areas.*

- a. Fire hydrants shall be placed on block corners or near the center of the block to place every structure within a five hundred foot (500') truck hose lay distance from fire hydrant coverage.
- b. Fire hydrants located on the opposite side of a street, designated as four lanes or larger on the current City Thoroughfare Plan, shall not be considered acceptable for meeting hydrant coverage requirements.
- c. Fire hydrants shall be positioned to allow truck hose lays to follow normal traffic access to the site.
- d. Fire hydrants shall be spaced at no more than five hundred feet (500') intervals.

C. *Fire Hydrants Specifications.* All fire hydrants must meet required City of Keller Standard Fire Hydrant Specifications.

1. All fire hydrants shall have one (1) 5" Hydra-Storz pumper connection and two (2) 2.5" hose outlets with the National Standard hose threads; shall have a main barrel valve opening of not less than 5.25"; shall be placed on mains of not less than six inches (6") in diameter. Six-inch (6") gate valves shall be placed on all fire hydrant leads. All fire hydrants shall have a valve at the main with flange-to-flange fittings.
2. All fire hydrants shall be of a "break-away" design in accordance with City of Keller Standard Fire Hydrant Specifications.

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3. Each hydrant shall have a minimum of two primer coats. The final coat of paint on the body of all hydrants shall be a silver color of an approved aluminum paint.
- D. *Fire Protection Distribution Systems.* Water distribution systems shall be of sufficient size to provide adequate water for fire protection to the development and shall conform to the City's Master Water Distribution Plan.
1. *Residential Areas.*
 - a. *Sizes and Allowable Dead End Lengths.* In residential areas the minimum water line size shall be eight inches (8"). Dead end lines over three hundred feet (300') and up to six hundred feet (600') in length shall be ten inches (10") minimum. Dead end lines over six hundred feet (600') in length will not be allowed. Dead end lines shall terminate at a fire hydrant that shall be installed for maintenance purposes and may not necessarily be considered for fire hydrant density as required. Flush hydrants may be installed in lieu of hydrants at terminating points of dead end lines for maintenance purposes only.
 - b. *Valves.* Additional isolation valves may be required to be installed depending upon the configuration of the system as determined by the City.
 - c. *Construction Standards.* All water line construction shall conform to construction standards located in Design Standards and Technical Construction Standards of this UDC.
 2. *Commercial Areas.*
 - a. *Sizes and Allowable Dead End Lengths.* In commercial areas the minimum water line size shall be eight inches (8"). Dead end lines over three hundred feet (300') and up to six hundred feet (600') in length shall be ten inches (10") minimum. Dead end lines over six hundred feet (600') in length will not be allowed. Dead end lines shall terminate at a fire hydrant that shall be installed for maintenance purposes and may not necessarily be considered for fire hydrant density as required. Flush hydrants may be installed in lieu of hydrants at terminating points of dead end lines for maintenance purposes only.
 - b. *Valves.* Additional isolation valves may be required to be installed depending upon the configuration of the system as determined by the City.
 - c. *Construction Standards.* All water line construction shall conform to construction standards located in Design Standards and Technical Construction Standards of this UDC.
- E. ***Fire Lanes.* All new fire lanes shall be constructed in accordance with the specifications as set forth in the Design Standards and Technical Construction Standards of this UDC (§ 5.24 (A) (2) (b) (2) (g)). Existing pavement and sub-grade proposed for fire lane use shall be tested by an accredited laboratory to ensure performance specifications sufficient for supporting a minimum 85,000 ilb gross vehicle weight. These Test results shall be documented by a report signed and sealed by an engineer licensed in Texas.**

Section 5.24 Design Standards

Approved By City Council

Ordinance # 2015

Date: 5/18/2021

A. *Design Standards.*

1. *Construction Plans.*

- a. *Plan Order.* A civil construction plan submittal shall meet the following general sheet requirements and order.

- 1) Cover Sheet with Vicinity Map (to include project title, legal description, city's project number, and date)
- 2) Site Plan (copy of approved site plan for non-residential projects)
- 3) Dimensional Control Plan
- 4) Paving Plan and Profile
- 5) Grading Plan
- 6) Drainage Area Map
- 7) Storm Sewer Layout
- 8) Storm Sewer Plan and Profile
- 9) Water Layout
- 10) Water Plan and Profile
- 11) Sanitary Sewer Layout
- 12) Sanitary Sewer Plan and Profile
- 13) Storm Water Pollution Prevention Plan (Erosion Control Plan)
- 14) Tree Protection Plan
- 15) Street Sign and Street Light Plan (plan view of development showing the location for all permanent street signs, traffic control signs, and street lights)
- 16) Traffic Control Plan (to be included for all proposed temporary street closures, existing street connections, and open cut utility crossings of existing streets)
- 17) Standard Construction Details

Additional plan sheets may be required per the City of Keller Unified Development Code.

Three (3) copies of complete Construction Plans shall be submitted with the Final Plat.

Construction plans must be 100% complete at the time of submittal. Any incomplete sets of construction plans may be returned without City review comments.

b. *Plan Layout.*

- 1) The Construction Plans shall be submitted on standard 22" x 34" sheets.
- 2) Each sheet of the Construction Plans shall include north arrow, scale, date, and benchmark description to sea level datum. Scales shall be 1 inch equal 20, 40, or 50 feet horizontally and 1 inch equal 2, 4, or 5, feet vertically.
- 3) Each sheet shall bear the seal and signature of the Professional Engineer licensed in the State of Texas who prepared the plans (Project Engineer).

- 4) Each sheet of the Construction Plans shall contain a title block, including space for the notation of revisions. This space is to be completed with each revision to the plan sheet and shall clearly note the nature of the revision and the date that the revision was made.
- 5) Include a signature block for a representative of the City of Keller on each plan sheet in the lower right hand portion of the sheet. The signature block should read "Reviewed by the City of Keller and Released for Construction" with a separate line for "Date: _____" and another line for a signature by "Director of Public Works / City Engineer".
- 6) On the Cover Sheet, the project title, legal description, and City's project number shall be placed vertically along the right border in small print.

2. *Street System Improvements.*

- a. *General.* The purpose of this section is to provide a set of minimum design standards to be used in the designing of roadways in the City of Keller. These guidelines will be used by consulting engineers employed by the City and engineers for private developments in the City. Each sheet of the plans and profiles will bear the seal, date, and signature of the licensed professional civil engineer who prepared them. Unusual circumstances or special designs requiring a variance from the standards in this manual may be approved by the Director of Public Works or City Engineer. The project engineer shall also refer to the City of Keller Master Thoroughfare Plan and Unified Development Code for additional roadway design criteria not covered in this document. Additionally, any roadway design criteria not addressed in these documents shall conform with the latest edition of AASHTO's Geometric Design of Highways and Streets and the Manual on Uniform Traffic Control Devices (MUTCD) published by the Texas Department of Transportation.
- b. *Streets.* The scope of this section includes the various design elements, criteria, standards and instructions required to prepare paving plans for the City of Keller Department of Public Works. These guidelines should result in the construction of safe, economical streets and thoroughfares.
 - 1) *Classification of Streets.* As described in the Master Thoroughfare Plan, the classifications of roadways in the City of Keller are as follows:
 - a) Arterial 6-Lane Divided (A6D)
 - b) Arterial 4-Lane Divided (A4D)
 - c) Collector 4-Lane Undivided (C4U)
 - d) Collector 3-Lane Undivided (C3U)
 - e) Collector 2-Lane Undivided (C2U)
 - f) Local /Residential Streets.
 - g) Rural Road.

Each street is made up of elements which are related to the use of that particular facility. These elements include right-of-way, pavement width, median width if required, arrangement of traffic lanes and parking lanes, curb radii at intersections and other characteristics. Table No. 1 is to be used in the design of the various classifications of streets in Keller.

Table No. 1
MINIMUM DESIGN STREET STANDARDS

DESIGN ELEMENT	Roadway Type						
	A6D	A4D	C4U	C3U	C2U	Local/Residential	Rural
Number of Traffic Lanes	6	4	4	3	**2	2	2
Lane Width (ft)	12/14.5	12/14.5	14/12	14/15	14/8***	15	12
Curb Offset(ft)	Remove this line altogether						
Right-of-Way Width (ft)	125	100	80	70	70	50	60
Design Speed (m.p.h)	50	50	40	35	35	30	****
Grade (percent)	0.65-6.0	0.65-6.0	0.65-7.5	0.65-10	0.65-10	0.65-10	****
Horizontal Curve Radius (ft)	800	800	400	400	400	200	****
Vertical Clearance (ft)	16.5	16.5	16.5	16.5	16.5	16.5	****
Lateral Clearance (ft)	Remove this line altogether						
Signal Spacing (ft)	1600	1600	1200	N/A	N/A	N/A	****
Cross Street Access (ft)	450	450	300	300	200	200	****
Driveway Spacing (ft)	50	50	50	50	50	50	****
Driveway Return Radius (ft)	30	30	25	20	20	10	****
Curb Return Radius (ft)	75	75	50	40	40	30	****
Right-of-Way Corner Clips (ft)	15×15	15×15	15×15	15×15	15×15		****
Median Opening Distance (ft)	600	600	N/A	N/A	N/A		****
Median Width (ft)	18	18	N/A	*14	N/A	N/A	****
Left Turn Storage (ft)	275	200	N/A	N/A	N/A	N/A	****
Right Turn Storage (ft)	150	150	N/A	N/A	N/A	N/A	****

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Capacity (LOS "C-D") (veh/day)	34,500	23,00	17,000	12,500	8,500	N/A	****
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* Two-way Left Turn Lane

** Allows on Street Parking

*** Parking Lanes

**** Should match the minimum design criteria for the proposed future Roadway Type.

2) *Geometric Design.*

- a) *General.* Geometrics of city streets may be defined as the geometry of the curbs or pavement areas which governs the movement of traffic within the confines of the rights-of-way. Included in the geometrics are the pavement, width, degree of curvature, width of traffic lanes, parking lanes, or turning lanes, median width separating opposing traffic lanes, median nose radii, curb radii at street intersections, crown height, cross fall, geometric shapes of islands separating traffic movements and other features. Since city streets are differentiated by their functions and location, there is also a variance in the geometry which describes the path vehicular traffic should follow.
- b) *Design Speed.* The design speed is a primary factor in the horizontal and vertical alignment on city streets and thoroughfares. Design features such as curvature, super-elevation, radii for turning movements and sight distance are directly related to the design speed. The design speed also affects features such as lane widths, pavement width, pavement cross-fall, pavement crown, and clearances.

The design speed is defined as the approximate maximum speed that can be maintained safely by a vehicle over a given section of road when conditions are so favorable that the design features of the roadway govern. The speed limit or posted speed is the maximum legal speed set by local authorities for a certain roadway or area. The design speed should never be less than the likely legal speed limit for arterials and collectors.

The various street and thoroughfare classifications, which make up the system within the City of Keller, require different design speeds according to their use and location. Refer to Table No. 1 for design speeds for each roadway classification. Lower design speeds will be permitted for all classifications for unusual conditions, terrain or alignment.

- c) *Horizontal Alignment.* The horizontal geometrics of the streets and thoroughfares include the segment of geometric design associated with the alignment, intersections, pavement widths, and related geometric elements. The various classifications, utilizing the design speed as a control, must have certain horizontal and vertical geometrics to provide a safe economical facility for use by the public.
 - i) *Horizontal Curves and Super-elevation.* The alignment of the streets and thoroughfares is usually determined by the alignment of the existing right-of-way or structures which cannot be relocated. Changes in the direction of a street or thoroughfare are minimized by constructing a simple curve having a radius which is compatible with the speed of vehicular traffic. To increase the safety and reduce discomfort to drivers traversing a curved portion of a street or thoroughfare, the pavement may be super-elevated.

Curvature in the alignment of arterials is allowed under certain conditions, but the greater traffic volume and the higher vehicle speeds which accompany these thoroughfares tend to increase the number of accidents when curving of alignment occurs. Curves in the alignment of minor streets usually provide aesthetic value to residential neighborhoods without affecting the orderly flow of traffic or safety.

A recommended minimum radius of horizontal curvature for different street types is shown in Table No. 1. These standards are based on traffic consisting of typical present day automobiles operating under optimum weather conditions. There are other important considerations in the design of curves on thoroughfares including the location of intersecting streets, drives, bridges, and other topographic features.

Minor residential streets intersecting a collector street or major street will have a tangent section of centerline at least fifty feet (50') in length measured from the right-of-way line of the collector or major street; however, no such tangent is required when the minor street curve has a centerline radius greater than four hundred feet (400') with the center located on the collector street or major street right-of-way line. Within a reverse curve, there will be a tangent section of centerline not less than one hundred feet (100') long.

- ii) *Turning Lanes.* Turning lanes shall conform to the standards outlined in Section 5.08 of this Unified Development Code.
- iii) *Street Intersections.* The intersection at grade of all thoroughfares will be at or near an angle of ninety degrees (90°). Streets shall intersect at no less than an eighty degree (80°) angle.

Curb radii required for intersections at ninety degrees (90°) are specified in Table No. 1. The radii required for intersections at less than ninety degrees (90°) will be determined using the design data for various vehicles as shown in Table No. 2.

The location of any median nose will be so located that traffic will clear it while making a left turn. Other considerations include adequate clearance between the median nose and through traffic on the intersecting thoroughfare and location of the median nose to properly clear the pedestrian crosswalks. Reference the City of Keller Standard Construction Details.

Table No. 2
DESIGN VEHICLE CRITERIA

INTERSECTING STREETS	PASSENGER (P)	SINGLE UNIT TRUCK (SU)	TRACTOR SEMI-TRAILER COMBINATION (WB-50)
Local with Local	X		
Local with Collector		X	
Local with Arterial		X	
Collector with Collector			X
Arterial with Collector			X
Arterial with Arterial			X
Fire Lane and Alley Alignment		X	

Refer to AASHTO's *Geometric Design of Highways and Street* for design vehicle information and figures.

- d) *Vertical Alignment.* The vertical alignment of all thoroughfares should be designed to insure the safe operation of vehicles by the traveling public and should allow easy access to adjacent property.
- i) *Street Grades.* The intersection design of two (2) thoroughfares will include grades which will result in a plane surface or at least a surface which approximates a plane surface. A vehicle traveling on either thoroughfare should be able to traverse the intersection at the design speed without discomfort to accomplish a smooth transition, crossfall toward the median of one lane of each thoroughfare may be required. A storm drainage inlet may also be required in the median.

In presenting the grades of intersecting thoroughfares in the paving plans, profiles of all four (4) curbs of a thoroughfare will be shown as a continuous grade through the intersection of the other thoroughfare.

- **Minimum Grades.** Minimum longitudinal grades for streets and thoroughfares are required to ensure proper flow of surface drainage toward inlets. The minimum grade required for all roadways shall be 0.65 percent. All valley gutters should be a minimum of eight feet (8') wide and constructed of reinforced concrete and will have a minimum grade of 0.65 percent
- **Maximum Grades.** Maximum longitudinal grades will be compatible with the type of facility and the accompanying characteristics including the design speed, traffic conditions and sight distance.

Collectors and arterials must move large volumes of traffic at faster speeds, and flatter grades will better accommodate these characteristics. Truck and bus traffic on these type facilities often controls traffic movement, particularly if steep grades prevent normal speeds. The normal maximum street grades allowed for Keller streets are specified in Table No. 1. Steeper grades may be permitted for short lengths where required by topographical features or restricted alignment if approved by the Director of Public Works or City Engineer.

- **Cross Fall.** On undivided streets, the maximum difference in curb elevations will not exceed five-tenths of a foot (0.5'). On divided streets, cross slope of the traffic lanes will be ¼-inch per foot minimum and ½-inch per foot maximum.
- ii) *Vertical Curves.* When two (2) longitudinal street grades intersect at a point of vertical intersection (PVI) and the algebraic difference in the grades is one percent (1.0%) or greater, a vertical curve is required. Vertical curves are utilized in roadway design to affect a gradual change between tangent grades and should result in a design which is safe, comfortable in operation, pleasing in appearance, and adequate for drainage. The vertical curve will be formed by a simple parabola and may be a crest vertical curve or a sag vertical curve.
- iii) *Stopping Sight Distance.*

- Crest Vertical Curve. When a vertical curve is required, it must not interfere with the ability of drivers to see a length of street ahead, should they be required to suddenly stop. This length of street, called the stopping sight distance, should be of sufficient length to enable a person in a vehicle having a height of eye of three and three quarters feet (3.75') above the pavement and traveling at or near design speed to stop, before reaching an object in his path five tenths foot (0.5') in height.

The minimum stopping sight distance is the sum of two (2) distances; one, the distance traversed by a vehicle from the instant the driver sights an object for which a stop is necessary, to the instant the brakes are applied; and the other, the distance required to stop the vehicle after the brake application begins.

The minimum safe stopping sight distances for the City of Keller street types are shown in Table No. 3. These sight distances are based on each design speed shown and on wet pavement. The minimum length of crest vertical curve required for the safe stopping sight distance of each street type may be calculated using the formula $L = KA$ and the values of K for a crest vertical curve are also shown in Table No. 3.

Table No. 3
MINIMUM LENGTH OF A VERTICAL CURVE

CREST VERTICAL CURVE	SAG VERTICAL CURVE
$L = KA$ where: L = minimum length vertical curve required for safe stopping sight distance; K = horizontal distance in feet required to effect a one percent change in gradient; and, A = algebraic difference in grade.	$L = KA$ where: L = minimum length vertical curve required for comfort; K = horizontal distance in feet required to effect a one percent change in gradient; and, A = algebraic difference in grade.

Table No. 3 (Continued)

STREET CLASSIFICATION	DESIGN SPEED (MPH)	SAFE STOPPING SIGHT DISTANCE (FT)	NORMAL CREST VERTICAL CURVE K (FT)	NORMAL SAG VERTICAL CURVE K (FT)
Arterial (A6D)	50	425	84	96
Arterial (A4D)	50	425	84	96
Collector (C4U)	40	305	44	64
Collector (C3U)	35	250	29	49
Collector (C2U)	35	250	29	49
Local/Residential	30	200	19	37

Based on *Geometric Design of Highways and Streets (2001)* by AASHTO

Approved By City Council**Ordinance #** 2015**Date:** 5/18/2021

- **Sag Vertical Curve.** When a sag vertical curve is required, the vertical curve will be of sufficient length to provide a comfortable ride during the change in vertical direction. The minimum length of sag vertical curve required to provide a comfortable ride may be calculated using the formula $L = KA$ and the values of K for a sag vertical curve are shown in Table No. 3.
- **Sight Distance at Intersections.** An important consideration in the design of thoroughfares is the vehicle attempting to cross the thoroughfare from the side street or drive. The operator of the vehicle attempting to cross should have an unobstructed view of the whole intersection and a length of the thoroughfare to be crossed sufficient to permit control of the vehicle to avoid collisions. The minimum sight distance considered safe under various assumptions of physical conditions and driver behavior is related directly to vehicle speeds and to the resultant distance traversed during perception and reaction time and during braking. This sight distance, which is termed intersection sight distance, can be calculated for different thoroughfares and for various grades upwards and downward. Intersection sight distances are shown in Table No. 4. Figure No. 1 shows the method for measuring the intersection sight distance.

Table No. 4
SIGHT DISTANCES
(see Figure No. 1)

DESIGN SPEED (MPH)	STOPPING SIGHT DISTANCE (FT)	THOROUGHFARE CLASSIFICATION	INTERSECTING SIGHT DISTANCE (FT)	
			NEAR SIDE	FAR SIDE
30	200	Local/Residential	290	335
35	250	Collector - (C2U)	335	390
35	250	Collector - (C3U)	335	390
40	305	Collector - (C4U)	385	445
50	425	Arterial - (A4D)	480	555
50	425	Arterial - (A6D)	480	555

Based on Geometric Design of Highways and Streets (2001), by AASHTO

Table No. 4 (Continued):

DESIGN SPEED (MPH)	UPGRADES (DECREASE FEET)			DOWNGRADES (INCREASE FEET)		
	3	6	10	3	6	10
25	5	10	15	5	15	25
30	10	15	20	10	20	30
35	15	20	--	15	25	--
40	20	25	--	20	35	--

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(Supp. No. 33, Update 1)

45	25	30	--	25	50	--
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Approved By City Council

Ordinance # 2015

Date: 5/18/2021

- iv) *Intersection Grades.* The grade of an intersecting street with the principal street gutter should not be generally more than four percent (4%) either up or down within the first twenty feet (20') beyond the curb line of the principal street except that in very hilly terrain a maximum intersecting grade of six percent (6%) can be considered. Grade changes of one percent (1%) or more require vertical curves.
- e) *Openings.* The following standards for median and curb openings are established to facilitate traffic movement and promote traffic safety. Additional standards are found in the Master Thoroughfare Plan, Unified Development Code and Standard Construction Details. Figure No. 2 shows typical values for distances and angles required for openings.
 - i) *Median Openings.* Median openings will normally be permitted at all intersections with dedicated City of Keller Streets. Exceptions would be at certain minor streets where, due to unusual conditions, a hazardous situation would result. Normal spacing between median openings should be no more than 1,200 feet.

Mid-block median openings or other openings with left turns permitted into adjacent property will not normally be permitted unless all the following conditions exist:

- The property to be served is a significant traffic generator with demonstrated or projected trip generation of not less than two hundred fifty (250) vehicles in a twelve (12)-hour period.
- The edge of the median opening is not less than four hundred feet (400') from the edge of an intersection with a collector or arterial thoroughfare.
- The median width is sufficient to permit the construction of a left turn storage lane.

Median openings will not be permitted in left turn storage lanes. Wherever possible, median openings should serve both sides of a thoroughfare.

- ii) *Driveway and Curb Openings.* Design of driveway and curb openings shall be as specified in Section 5.07 of this Unified Development Code.

Driveway return radii shall meet the design vehicle requirements as specified in Table No. 2 or as shown in Table No. 1, whichever is more restrictive.

In all cases, driveway locations must conform to minimum safe sight distance and stopping sight distance standards.

Driveway approaches shall not be located in street intersections or at established pedestrian crossings.

Driveways shall be kept at a minimum of five feet (5') away from obstructions such as street light posts, fire hydrants, traffic signals, etc.

Driveway approaches shall not occupy more than forty percent (40%) of the frontage of a lot or tract.

Minimum distances of driveways from intersections shall be as specified in Figure No. 3 or Section 5.07 of this Unified Development Code, whichever is more restrictive.

All driveway approaches shall be constructed six inches (6") thick with No. 4 rebar on eighteen-inch (18") centers each way. Concrete for approaches to have three thousand six hundred (3,600) p.s.i compressive strength at twenty-eight (28) days (minimum).

iii) *Drive Approach on Rural Roads.*

- **Culvert Size** - The developer/property owner shall provide a drainage study by a Professional Engineer licensed in the State of Texas that determines the size of culvert needed. The minimum culvert pipe size shall be 18" diameter. The ends of all culvert pipes shall be cut at a 6:1 slope and require a reinforced concrete sloping headwall.
- **Radius** - Driveways shall be constructed with the return curbs joining the edge of pavement at the street with a minimum ten-foot (10') radius.
- **Slope** - The maximum slope from the edge of driveway to the top of the culvert pipe shall be 4:1. The sloped area around the end of the culvert pipe headwall shall be sodded or hydro-mulched to resist erosion.
- **Cross Slope** - The minimum cross slope on the drive shall be 1/8 inch per foot. The minimum longitudinal slope between the existing pavement edge at the street and the valley over the culvert pipe shall be ¼ inch per foot down and away from the street.
- **Maintenance** - Future maintenance of the drive approach and culvert pipe is the responsibility of the property owner.
- **Grading** - During the drive approach installation, all ditch grading upstream and downstream of the proposed driveway culvert is the responsibility of the property owner.

f) *Driveway and Alley Grades.*

- i) *Driveway Grades.* The normal driveway grade within the street right-of-way is set at one-quarter inch per foot rise above the top of curb to the property line. The minimum elevation of a driveway at the right-of-way line is two and one half inches (2.5") above the top of curb. Barrier free sidewalk construction requires a maximum driveway grade as grade measured from the gutter of eight percent (8%).

Where driveway construction or reconstruction must occur off the street right-of-way, the usual maximum grade is fourteen percent (14%). The maximum change in grade without vertical curve is twelve percent (12%) for any ten feet (10') in distance. Driveways should be profiled for a distance of at least twenty-five feet (25') outside the right-of-way to ensure adequate replacement design.

Due to state laws requiring barrier free construction of sidewalks, steps or other abrupt changes in sidewalk grades are prohibited at driveways.

Approved By City Council
Ordinance # 2015
Date: 5/18/2021

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Ordinance # 2015

Date: 5/18/2021

- ii) *Alley Grades.* The minimum width of residential alleys in the City of Keller is fifteen feet (15') of pavement with a right-of-way of twenty feet (20'). Alleys are constructed with a 5-inch inverted crown for drainage. The maximum grades for alleys are eight percent (8%) within thirty feet (30') of an intersection with a street and fourteen percent (14%) elsewhere, unless otherwise approved by the Director of Public Works or City Engineer. The minimum grade for alleys is six and one-half tenths percent (0.65%). Changes in grade, including intersections with streets, may not exceed three percent (3%) without providing vertical curves.
- g) *Pavement Design.* All streets will be constructed of reinforced Class 'C' concrete with the minimum strength and thickness as shown in **Table No. 6 5** of this section. **Table No. 6 5** also calls for a minimum amount of lime or cement to be mixed with the subgrade soils for stabilization. A geotechnical investigation to determine the level of lime or cement to be added for soil stabilization may be required if deemed necessary by the Director of Public Works **or designee**. The Developer or Contractor will be responsible for all costs associated with this geotechnical investigation and tests.

Standard pavement sections are established and are included in this manual in Table **No. 6 5**, "Minimum Standard Street Pavement Design." Unusual design conditions may be encountered which will preclude the use of Table **No. 6 5**. The proposed pavement will be designed in accordance with the geotechnical investigation or Table **No. 6-5**, whichever is more restrictive.

Table No. 5
MINIMUM STANDARD STREET PAVEMENT DESIGN

TYPE OF STREET	CONCRETE THICKNESS (IN)	COMPRESSIVE PAVEMENT STRENGTH AT 28 DAYS (PSI)	REBAR SIZE AND SPACING	MINIMUM SUBGRADE TREATMENT *
Alley	6	3,600	No. 3 18" longitudinal 12" traverse	6" lime or cement treated material
Driveway (Commercial Drive and Residential Approaches)	6	3,600	No. 3 18" longitudinal 18" traverse	6" lime or cement treated material
Fire Lanes	7	3,600	No. 4 18" longitudinal 18" traverse	8" lime or cement treated material
Residential (local)	6	3,600	No. 3 18" longitudinal 18" traverse	6" lime or cement treated material

Collector	7	3,600	No. 4 18" longitudinal 18" traverse	8" lime or cement treated material
Arterial	8	3,600	No. 4 18" longitudinal 18" traverse	9" lime or cement treated material

* Site specific per geotechnical report, subject of review and approval by the Public Works Director.

Approved By City Council

Ordinance # 2015

Date: 5/18/2021

The developer or contractor will be required to furnish a geotechnical report indicating soil tests on the subgrade soils at four hundred foot (400') intervals, or more frequently if material changes are encountered. Such data will include, but is not necessarily limited to Liquid Limit, Plasticity Index (P.I.), and Percent Passing No. 200 sieve. All soil tests will be performed by an independent testing laboratory, approved by the City of Keller, at the developer's or contractor's expense.

All subgrade soils will be stabilized with lime or cement treated base material to at least one foot behind the proposed curb, regardless of the type of soil encountered. The amount and type of stabilization will be in accordance with the geotechnical investigation recommendation or as shown in **Table No. 6 5**, whichever is more restrictive. Subgrade stabilization of residential driveways is recommended but shall be considered optional and the decision to comply with this recommendation shall be at the discretion of the builder or developer.

The street curb will not be more than six inches (6") wide at the top and seven and one-half inches (7-1/2") wide at the base and six inches (6") high. The gutter will be a minimum of twenty-four inches (24") wide. Mountable curbs do not create an acceptable side roadway barrier and will not be allowed.

All new fire lanes shall be designed and constructed in accordance with the geotechnical investigation or per the specifications set forth in Table 5, whichever is more restrictive. Existing pavement and subgrade proposed for fire lane use shall be tested for compressive strength and performance specifications sufficient for supporting a minimum 85,000 pound gross vehicle weight. These test results shall be documented by a report signed and sealed by an engineer licensed in Texas.

h) *Sidewalks.*

- i) The purpose of the public sidewalk is to provide a safe area for pedestrians to walk. The City of Keller requires that sidewalks be constructed with the paving of streets or when building construction occurs, in all residential areas and wherever pedestrian traffic may be generated and that all sidewalks conform to state laws for barrier free construction. Refer to Section 5.06 of this Unified Development Code and the Standard Construction Details for design requirements not covered in this section.
- ii) Concrete sidewalks will have a thickness of not less than four inches (4") and will be constructed of three thousand six hundred pounds per square inch (3,600 psi) compressive strength concrete on both sides of all streets and thoroughfares. Sidewalks will be constructed within the right-of-way

and will extend along the street frontage including the side corner lots and block ends.

All concrete for sidewalks will be placed on a two-inch (2") sand cushion and will be reinforced with a minimum of No. 3 rebar on eighteen-inch (18") centers each way.

iii) All sidewalk intersections with street curbs shall be constructed so as to provide a curb ramp that complies with the Architectural Barriers Act. Barrier free curb ramps shall be provided for access to the street. The following specifications shall apply:

- Ramp to be a minimum four feet (4') in width.
- Ramp to be constructed with Class "C" concrete.
- Minimum ramp concrete thickness shall be six inches (6").
- #3 bars shall be used for reinforcement on eighteen-inch (18") centers both ways.
- Curb return shall match existing curb height of the street and taper to the connecting walk with a 1-foot radius.
- Street shall be blocked out (max. twelve (12") inches) and dowels installed.
- Saw joints shall be made one and a half (1 ½") inch minimum depth and sealed with silicone joint sealant material.

iv) *Surface of walk shall be coarse and ribbed to provide extra traction.* Where the above specifications do not apply or do not have jurisdiction, refer to the specifications in the American Disabilities Act (ADA).

i) *Trails.*

- i) The purpose of the public trail is to provide a safe area for recreational walking, jogging, biking, and in some cases, equestrian use. The City of Keller requires that trails be constructed when building construction occurs on sites that have trails in accordance with the Parks and Trails Master Plan. Refer to Section 5.06 of this Unified Development Code and the Standard Construction Details for design requirements not covered in this section.
- ii) Concrete trails will have a thickness of not less than six inches (6") and will be constructed of three thousand six hundred pounds per square inch (3,600 psi) compressive strength concrete. Trails will be constructed within dedicated right-of-way and will extend the length of the property, in accordance with the Parks and Trails Master Plan.

All concrete for trails will be placed on a two-inch (2") sand cushion and will be reinforced with a minimum of No. 3 rebar on eighteen-inch (18") centers each way.

iii) All trail intersections with street curbs shall be constructed so as to provide a curb ramp that complies with the Architectural Barriers Act. Barrier free curb ramps shall be provided for access to the street. The following specifications shall apply:

Approved By City Council

Ordinance # 2015

Date: 5/18/2021

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- Ramp shall match the width of the trail.
 - Ramp to be constructed with Class "C" concrete.
 - Minimum ramp concrete thickness shall be six inches (6").
 - #3 bars shall be used for reinforcement on eighteen-inch (18") centers both ways.
 - Curb return shall match existing curb height of the street and taper to the connecting trail with a one (1)-foot radius.
 - Street shall be blocked out (max. twelve (12") inches) and dowels installed.
 - Saw joints shall be made one and a half (1-½") inch minimum depth and sealed with silicone joint sealant material.

iv) Surface of trail shall be coarse and ribbed to provide extra traction.

Where the above specifications do not apply or do not have jurisdiction, refer

Approved By City Council

Ordinance # 2015

Date: 5/18/2021