

## SECTION 5200 - STREETS

### CITY OF LEE'S SUMMIT, MISSOURI DESIGN CRITERIA

These criteria shall be adhered to for the design of all streets within the City of Lee's Summit, Missouri and shall supersede KC Metro Chapter APWA Section 5200.

#### SECTION 5201 GENERAL

**5201.1 Introduction:** The purpose of these criteria is to provide uniform procedures for designing and checking the design of streets in Lee's Summit, Missouri. Specific criteria have been developed and are applicable to the types of conditions ordinarily encountered in local urban areas. Other special situations may be encountered that require added criteria or more complex design than included herein.

**5201.2 Definitions:** Refer to Section 1003.

#### **5201.3 Abbreviations:**

AASHTO	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
AMC	City of Lee's Summit Access Management Code
APWA	American Public Works Association
ASTM	American Society for Testing and Materials
FHWA	U. S. Department of Transportation/Federal Highway Administration
MUTCD	Manual of Uniform Traffic Control Devices
NGVD	National Geodetic Vertical Datum
ITE	Institute of Transportation Engineers
R/W	Right-of-Way

**5201.4 Governing Criteria:** Design shall be in accordance with the latest edition of the following publications and the current interim supplements thereto except as modified herein or modified for the specific project:

- A. Policy on Geometric Design of Highways and Streets, AASHTO.
- B. Manual on Uniform Traffic Control Devices for Streets and Highways, FHWA.
- C. Roadside Design Guide, AASHTO.
- D. Design of Pavement Structures, AASHTO.

## **SECTION 5202 FUNCTIONAL CLASSIFICATION OF STREETS:**

Refer to the City of Lee's Summit Access Management Code for information regarding the functional classification of streets.

## **SECTION 5203 GENERAL STREET DESIGN CRITERIA:**

- 5203.1** **Design Criteria:** This section governs the general design requirements for streets by classification. See Table LS-1 in Section 5205. All street design is subject to approval by the City of Lee's Summit, Missouri.
- 5203.2** **Modifications:** Design variances shall be in accordance with Section 1002 of this manual.
- 5203.3** **Cross Slopes:** The finished cross slopes within the limits of the right-of-way shall be between one quarter (1/4) inch vertical to one (1) foot horizontal (2%), minimum, to one-half (1/2) inch vertical to one (1) foot horizontal (4%), maximum, except for sidewalks which must meet ADA requirements.  
Outside of paved areas along roadways: fore slopes shall be 4:1 maximum and back slopes shall be 3:1 maximum; 4:1 or flatter is desired.
- 5203.4** **Tangent Length:** No tangent length shall be required between reverse curves for residential access and residential local streets. The minimum tangent length between reverse curves shall be 100 feet for collector streets and commercial/industrial local streets. Major and minor arterial streets shall comply with current AASHTO guidelines.
- 5203.5** **Street Intersection Spacing:** Refer to the City of Lee's Summit Access Management Code for information regarding the alignment and spacing of intersections.
- 5203.6** **Intersection Angle:** It is desirable for all intersections to meet at approximately a 90° angle. Skewed intersections should be avoided and in no case should the angle be less than 80°.

**5203.7** **Intersecting Minor/Major Arterial Streets:** Where any minor or major arterial streets intersect each other, the crowns of both streets shall be uniformly transitioned into a plane at the intersection. Changes from one cross slope to another should be gradual.

**5203.8** **Curb Radii:** When two streets of different classification intersect, the higher classification street shall govern the curb radii dimension listed in Section 5203.1. Equivalent three-center compound curves may be used in lieu of a single radius curve if the design vehicle can be accommodated. Curb ends ~~facing the flow of traffic~~ shall have a five-foot taper from full height to matching existing condition.

**5203.9** **Sight Distance at Intersecting Streets:** Refer to the City of Lee's Summit Access Management Code for minimum intersection sight distances. The Engineer shall submit calculations for intersection sight distances to the City for review and concurrence at each stop, yield, or uncontrolled intersection approach.

**5203.10** **Considerations for Connection to Existing and Future Streets:** Consideration shall be given to the horizontal and vertical alignment of roadways where they connect to existing streets or where roadways may be extended in the future. Where a new street is to connect to an existing street the entire width of the existing pavement shall be saw cut to its full depth, and:

A. Existing Asphalt Street: All deteriorated or cracked asphalt within five feet of the connection point shall be removed to a point where sound material is found.

B. Existing Concrete Street: All deteriorated or cracked concrete shall be removed to the joint closest to the nearest pavement joint outside the cracked or deteriorated area.

**5203.11** **Pavement Sections:** The minimum pavement thicknesses shown in Tables LS-2 and LS-3 apply to Residential streets (Access, Local, and Collector) and Commercial/Industrial streets (Local and Collector). For Arterial streets a pavement design shall be completed by a professional engineer and shall be based upon project specific traffic and geotechnical engineering studies. Geotechnical reports shall be prepared by a civil engineer specializing in the field of geotechnical engineering and registered in the state of Missouri. Traffic studies shall be prepared in accordance with the qualifications in the Access Management Code.

A. Pavement Design Standards: Pavement thicknesses shall be designed in general accordance with AASHTO's *Guide for Design of Pavement Structures, 1993*.

1. Minimum AASHTO pavement design parameters for arterial streets are as follows:

- a. Design Life: 35-years
- b. ADT: Based upon traffic study
- c. Truck Traffic: Percentage of truck traffic shall be based upon traffic study

- d. Subgrade Support: CBR and k values shall be determined by the project specific geotechnical report
  - e. Stabilized Subgrade: Stabilized subgrade shall not be used as the subgrade soil strength. It shall be treated as “sub-base” layer, and the underlying native soils shall be used for subgrade values
  - f. Terminal Serviceability ( $p_t$ ): 2.5
  - g. Reliability: 95% ( $Z_R = -1.645$ ).
2. The pavement design report must show all the actual parameters used for the design, as well as the design method used.
  3. Arterial street pavements shall include stabilized subgrade. Subgrade stabilization shall be (a) chemically treated subgrade or (b) geogrid / geotextile-reinforced aggregate base.
  4. Arterial Street Widening – No Pavement Design required
    - a. Asphalt pavements – The widened pavement shall use the crushed aggregate option for subgrade stabilization. Widening of asphalt sections shall have a minimum of 10 inches of asphalt or match the existing pavement section, whichever is greater and widening of concrete sections shall match the existing.
    - b. Concrete pavements – The widened pavement shall use the crushed aggregate option for subgrade stabilization. Widening of concrete sections shall match the existing pavement section.
  5. Concrete pavement joint details and joint layout patterns, dowelling and tie bar layout shall be designed and included in the engineering plans. The residential local/access and residential collector pavement do not require dowels at the transverse joints but do require tie bars along longitudinal joints.

**5203.12 Pavement Transitions:** Reduction in pavement width in the direction of traffic flow shall be accomplished by a taper. The minimum length for merging taper shall be determined by the formula  $L=WxSxS/60$  where posted speeds are 45 mph or less. The formula  $L=WxS$  should be used for roadways having a posted speed limit greater than 45 mph. Under either formula, L=taper length in feet, W=width of the transition in feet, and S=design speed in mph.

**5203.13 Cul-de-sacs:** At locations where streets are to be terminated and a vehicular connection between adjacent streets is not required, the termination shall be a cul-de-sac. Such cul-de-sac shall be constructed with a minimum radius of 39 feet to the back of curb if there are no islands located in the cul-de-sac. At the end of a cul-de-sac, the minimum design speed = 10 mph, with corresponding minimum horizontal radius = 39 feet, minimum stopping sight distance = 75 feet; minimum K Crest = 3 along centerline, and minimum K Sag = 5 (2 w/ lighting) along centerline. The minimum grade in cul-de-sacs shall be 2.0% along centerline and 2.0% for all other slopes. The maximum grade in cul-de-sacs shall be 6% along centerline and 2.0% for all other slopes.

**5203.14 Temporary Turn-Arounds:** At locations where streets will be temporarily terminated and which will be extended at a later date, and said street extends beyond the intersection of an adjacent street more than 150 feet, a temporary cul-de-sac shall be constructed with a minimum radius of thirty-five (35) feet. The temporary cul-de-sac shall be constructed of asphaltic concrete with a minimum depth of eight inches. Curb and gutter will not be required. The cul-de-sac shall be constructed within the limits of a temporary easement.

Temporary Turn-Arounds shall be located so that they do not interfere with permanent development. They should normally be located on property adjacent to the property to be served. For new subdivision plats, they should be located on property beyond the limits of the plat.

**5203.15 Driveways:**

- A. All driveway approaches within public right of way shall be concrete in accordance with Section 2300.
- B. Driveways shall attain a minimum elevation of six inches above the gutter elevation within the right-of-way with a maximum grade of 8%. The algebraic difference in grades at the right-of-way on crest drives shall be 8% maximum and on sag drives shall be 12% maximum. The maximum recommended driveway grade outside the right-of-way is 15%.
- C. Driveways shall be spaced and aligned in accordance with the City of Lee's Summit Access Management Code (AMC).

**5203.16 Access for the Disabled:** Refer to Section 5300 of this Manual for design criteria and guidance for Accessible Routes

**5203.17 Street Lighting:** All street lighting shall be designed in accordance with Section 5800 of the Lee's Summit Design and Construction Manual.

**5203.18 Storm Drainage:** All storm drainage shall be designed in accordance with Section 5600 of the APWA design criteria.

**5203.19 Underdrains:** Underdrains shall be required at all low points, cut-fill transitions lines, exposed rock ledges intersecting subgrade, and other locations that have known or expected subsurface moisture problems.

**5203.20 Erosion Control within R/W Limits:** As a minimum, all grass areas in the R/W shall be seeded and mulched to control erosion on to the roadway. All construction projects that have exposed grading require temporary erosion control measures. Temporary erosion control must be approved by the City Engineer.

**5203.21** **Survey Monument Boxes:** Monument boxes shall be installed at all quarter section corners involved in the street construction. The monument boxes shall be set by a Registered Land Surveyor licensed in the state of Missouri.

**5203.22** **Traffic Impact Studies:** Refer to the City of Lee’s Summit Access Management Code for information regarding traffic impact studies.

**5203.23** **Obstructions:** Rigid structures such as poles, signs and hydrants shall be placed a minimum horizontal distance of 1.5 feet from the back of curb to edge of obstruction. When required, guardrail and barricades shall be installed in accordance with the AASHTO Roadside Design Guide or city policy. Vertical clearance of 14.5 feet shall be provided. Along sidewalks, a minimum vertical clearance of seven feet shall be provided.

**5203.24** **Traffic Signals:** All Traffic Signals shall be designed in accordance with Section 5900 of the Lee’s Summit Design and Construction Manual.

**5203.25** **Roundabouts:** These criteria shall be adhered to for the design of all roundabouts to be constructed within the City of Lee’s Summit, Missouri.

**A. Design Criteria:** Roundabout design shall be in accordance with the latest edition of AASHTO, FHWA Roundabout Design Guide, and MUTCD.

**1 Codes and Standards:** These criteria are established to provide uniform procedures to aid the design engineer in preparing improvement plans for projects in the City of Lee’s Summit. These criteria are not intended to be an ironclad set of rules that restrict the design engineer from utilizing innovative design; however, they may be modified only with prior authorization of the City Engineer.

**2 Roundabout Design:** This section outlines several basic requirements for roundabouts:

<b>ROUNDBOUT DESIGN CRITERIA TABLE</b>			
	Single Lane (Compact)	Single Lane (Suburban)	Multi-Lane (Suburban)
Roadway Classification	Residential Local/Access	Collector Arterial	Arterial
Design Speed	15 mph	20 mph	25 mph

Design Vehicle 1	P	BUS	BUS
Design Vehicle 2	BUS	WB-50	WB-67
Inscribed Diameter	90'-120'	120'-150'	150'-220'

- a. Crosswalks shall be ADA compliant, 10 feet wide, cut through the splitter island, and be located at least 25 feet behind the yield line.
- b. Splitter islands shall be at least 50 feet long and have a barrier curb with a mountable nose at the approach.
- c. Mountable curb, i.e. CG-2 or modified CG-1 with 3" 1:1 vertical face, shall be used around the truck apron adjacent to the circulating lane.
- d. Barrier curb shall be used around the truck apron adjacent to the central island.
- e. Approach alignment should be radial. A slight left offset is permitted with approval of the City Engineer. A right offset is prohibited.
- f. Equal spacing between entries is desired, except that roundabouts with three entries should have angles as close to 90 degrees as possible.
- g. Approach flare should be at least 80 feet long.
- h. On-street parking shall be prohibited within 50 feet of the splitter island.
- i. Entry lane widths should range from 14 feet to 16 feet.
- j. Circulatory lane width is generally as wide as the maximum entry width (but no more than 120% of the entry) and shall remain constant throughout the roundabout. Circulatory lane widths generally decrease as the size of the inscribed diameter increases (i.e. single lane roundabouts may have a circulating lane width of 16 feet while multi-lane roundabouts may have a circulating lane width of 14 feet).
- k. The exit lane should be as wide as or wider than the circulating lane.
- l. Truck aprons, when used, should be 3 feet to 13 feet wide having a cross slope of 3%-4% away from the central island. The apron shall be constructed of colored and/or textured paving materials to differentiate it from the roadway. The truck apron shall be permeable and contain an under drain system so that excessive runoff does not cross the travel lanes.
- m. A landscape strip shall be provided between the curb and sidewalk/multi-use trail. The landscape strip shall have a minimum width of 2 feet and preferred minimum width of 5 feet.

**B. DESIGN PROCESS:** Roundabout design is an iterative process requiring the designer to consider operational and safety effects of the geometric elements. The recommended process for designing a roundabout is generally as follows:

1. Identify the intersection context. The intersection context includes roadway classification and typical section, environment in which the roundabout will be located (residential, commercial, green field, retrofit, etc.), and the type of adjacent traffic control along the corridor (single-lane roundabouts, multi-lane roundabouts, signals, and stop control).
2. Establish the design vehicle. See Roundabout Design Criteria Table in this section. Design Vehicle 1 should be able to navigate any movement within the roundabout without using the truck apron and shall maintain full lane control. Design Vehicle 2 should be able to navigate any movement within the roundabout while using the truck apron.
3. Perform operational analysis to determine the number of lanes required. The number of lanes (entry, exit, and circulatory) should be kept to a minimum while accommodating an acceptable level of service.
4. Prepare and submit a conceptual design. A scale of 1"=50' is preferred.
5. Check that the design vehicle(s) can be accommodated for all movements at all legs of the roundabout. The vehicle path shall maintain a minimum 2-foot clearance between the tire track and the curb. Drawings shall be submitted illustrating each vehicle path.
6. Check the design speeds of all movements at all legs of the roundabout for Design Vehicle 1. See Roundabout Design Criteria Table in this section for typical design speeds. Provide a summary of design speeds calculated for each of the five curves to include approach, curve, radius, speed, and speed differential information.
  - a. The entry speed should not exceed the design speed.
  - b. The exit speed should be higher than the entry and circulating speeds.
  - c. Speed differentials should not exceed 6 mph and shall not exceed 12 mph.
7. Check sight distance. Submit a drawing showing that adequate stopping sight distance is provided. This drawing shall include vertical and horizontal clearance, for each approach, exit crosswalk, and circulating lane. Submit a drawing showing that adequate intersection sight distance is provided, including vertical and horizontal clearance, for each vehicle entry conflict with entering stream and circulating stream.
8. Reiterate the process until a concept plan is approved by the City Engineer.

**5203.26** **Other Design Criteria:** Design criteria not covered by this document shall be in accordance with the most current edition of A Policy on Geometric Design of Highways and Streets by the American Association of State Highway and Transportation Officials (AASHTO) or other AASHTO design guides.

## **SECTION 5204 GENERAL PLAN REQUIREMENTS:**

**5204.1** **Scope:** This section governs the preparation of plans for street projects.

**5204.2** **General:** The plans shall include all information necessary to build and check the design of streets and related appurtenances. The plans shall be arranged as required by the City Engineer. Applicable standard plans shall be included by reference to standard plan number and title. Plans shall be sealed by a Registered Professional Engineer in the state of Missouri.

**5204.3** **Scales:** Plans shall be drawn at the following minimum scales. Larger scales may be needed to clearly present the design. Bar scales shall be shown on each sheet for each scale.

Plan:	1 inch = 20 feet (preferred), 1 inch = 50 feet (minimum)
Profile:	
Vertical:	1 inch = 5 feet (preferred), 1 inch = 10 feet (minimum)
Horizontal:	Scale Shall Match Plan Scale
Drainage Area Map:	
On Site:	1 inch = 200 feet
Off Site:	1 inch = 1,000 feet
Structural Plans:	1 inch = 1 foot
Graphic Drawings:	Standard Engineering (scale varies)

**5204.4** **Sheet Sizes:** Full-sized plan sheets shall be 22 inches by 34 inches. Half-sized plan sheets shall be 11 inches by 17 inches. Plan and profile shall be drawn on combined or separate plan and profile sheets to minimum scales shown in Paragraph 5204.3.

**5204.5** **Types of Sheets in Plans: The plans shall generally consist of:**

1. Title Sheet
2. General Notes and Quantities
3. General Layout Sheets
4. Plan and Profile Sheets
5. Drainage Area Map
6. Storm Water Sheets
7. Traffic Signal Plans
8. Lighting Plans
9. Utility Plan and Profile Sheets
10. Erosion Control Plans

11. Pavement Marking Plans
12. Signing Plans
13. Traffic Control Plans
14. Standard and Special Detail Sheets
15. Curb Ramp Detail Sheets
16. Cross-Section Sheets

Each sheet shall contain a sheet number, including the individual sheet number and the total number of sheets, proper project identification and date. The engineer's seal shall appear on each sheet per state licensing requirements.

**5204.6 Minimum Required Information for Title Sheet:**

1. Name of project.
2. Project number (where applicable).
3. Index of sheets included in plans.
4. A location map adequately showing project location in relation to major streets with north arrow and scale.
5. Signature block for city approval.
6. The project control bench marks shall be identified as to location and elevation per NGVD datum. A minimum of two (2) bench marks are required for any project (may be shown on an optional Project Control Sheet inserted directly after the Title Sheet).
7. Name, address and telephone number of the consulting engineer and owner/developer as well as signature block for the owner/developer.
8. List containing name and telephone number of each utility company and the State One-Call System.
9. A legend of symbols shall be shown that applies to all sheets (may be shown on an optional General Notes Sheet(s) inserted directly after the Title Sheet).
10. Design speed, posted speed and expected ADT numbers plus other traffic information as required by the City Traffic Engineer.
11. Engineer's seal, signed and dated.

**5204.7 Minimum Required Information for General Layout Sheet(s):**

1. General Notes: Minor construction notes shall appear on the proper plan and profile sheet.
2. North arrow and bar scale. Scale of the general layout map shall be one (1) inch equals one hundred (100) feet.

3. Layout shall include name of subdivision, block designation (if any), lot designation or proposed block and lots, all street names, street alignment with back of curb lines, and an accurate tie to at least one quarter section corner and at least one additional physical permanent feature. An unplatted tract shall have an accurate tie to at least two (2) quarter section corners.
4. Boundary line of project area.
5. Schematic layout of existing conditions and proposed improvements shall be shown; including but not limited to: all proposed streets, sidewalks and utility improvements including storm drainage, sanitary sewers, water lines, street lights, traffic signals, etc.
7. Typical street sections.

**5204.8 Minimum Required Information for Plan and Profile Sheets:**

1. North arrows and bar scale.
2. Elevation and location of all applicable benchmarks per NGVD datum.
3. Existing and proposed streets with names and pavement widths.
4. Property lines properly identified as to existing or proposed lot, block and subdivision. Survey base line with adequate ties to land lines.
5. All existing and proposed utilities such as power, gas, oil, water, telephone, sewer, and other items shall be properly located in conformance with the best information available in the records of the owner of such facilities, or field location, and identified as to size, type, owner, and material.
6. All existing and known proposed improvements within 50 feet each side of right-of-way and 200 feet beyond the project limits shall be shown at the proper locations. This shall include, but is not limited to, existing items as paved streets, curb and gutters, driveways, culverts, fire hydrants, utility poles, trees, shrubs, fences, walls, houses, and shall be identified as to type, size, material, etc. as may be applicable.
7. All existing and proposed permanent and temporary easements and right-of-way information, including ownership shall be shown on the plans.
8. Locations and widths of existing and proposed sidewalks and multi-use trails.
9. Horizontal curve data and vertical curve data (K value, stopping sight distance, intersection sight distance, length of curve, curve delta, curve tangent length, middle ordinate, PC, PT, PI, PVI, PRC, etc.).
10. Center line stations shall be marked at 100-foot intervals and at other pertinent points.
11. Top back of curb elevations shall be shown at maximum increments of 15 feet or quarter points, whichever is less, along the curb returns at street intersections. Points for curb opening to curb ramps will shown location and elevations of opening to be installed during curb placement.

12. Location and type of ADA ramps in plan view.
13. Profile shall show existing grade as a dashed line, proposed finish grades or established street grades by solid lines.
14. Storm sewer criteria shall be in accordance with the City of Lee's Summit Design and Construction Manual.
15. Elevations shall be shown on the profile at a minimum interval equal to the horizontal scale for tangents and half the horizontal scale for curves. Elevations shall also be shown for all other pertinent points.
16. Approximate grading limits.
17. Location of test borings if taken.
18. For residential development, finished contours shall be shown on street plan sheets. The finished contours shall be screened or gray-scaled.

**5204.9 Minimum Required Information for Cross-Section Sheets:**

1. Street cross section at each station showing existing grade by dashed lines and proposed grade by a solid line. Cross sections to show existing grade lines a minimum of ten (10) feet beyond the right-of-way lines or grading limit, whichever is further. The center line and right-of-way limits shall be shown along with the proposed improvements.
2. Center line elevation of top of pavement.
3. Center line cross sections shall be shown at all intersecting streets and driveways.
4. Location of existing and proposed underground utilities.
6. Additional cross sections shall be shown as required to clearly describe the extent of grading operations.
7. For residential development, a mass grading plan shall be required in lieu of cross sections.

**5204.10 Minimum Required Information for Standard and Special Detail Sheets:** Detail sheets shall be included to show all details of appurtenances, materials, and construction. Details shall conform to the requirements of the City and are to be drawn clearly and neatly with proper identifications, dimensions, materials and other information necessary to insure the desired construction.

**5204.11 Minimum Required Information for Curb Ramp Detail Sheets:** See Section 5304

**5204.12 Minimum Required Information for Traffic Control Plans:**

1. Limits of any road closures, sidewalk closures, or multi-use trail closures shall be shown along with the traffic control devices used to effect the closure. Any closure restrictions, speed limit, length of time, etc. shall be indicated on the plans.

2. Detour plan shall be designed for traffic affected by closures. Detour signing used in the detour route shall be included in the detour plan.
3. Typical lane closure or lane shift plans including taper lengths and spacing of all channelizing devices. Types and spacing of all traffic control signs and markings shall be shown.
4. A traffic control plan shall be prepared for each phase of construction.
5. All traffic control shall be designed using the traffic control devices and application principals contained in the MUTCD.

**SECTION 5205 FIGURES:**

TABLE LS-1: GENERAL STREET DESIGN CRITERIA

TABLE LS-2: MINIMUM ASPHALT PAVEMENT THICKNESSES

TABLE LS-3: MINIMUM PCC PAVEMENT THICKNESSES

**TABLE LS-1: GENERAL STREET DESIGN CRITERIA**

	<b>Major Arterial</b>	<b>Minor Arterial</b>	<b>Commercial/Industrial Collector</b>	<b>Residential Collector</b>	<b>Commercial/Industrial Local</b>	<b>Residential Local</b>	<b>Residential Access</b>
<b>Number of Through Traffic Lanes</b>	2 – 7	2 – 5	2 – 3	2 – 3	2	2	2
<b>Minimum Width of Travel Lanes (1) (Excludes Curb &amp; Gutter)</b>	11 – 12 ft.	11 – 12 ft.	12 ft.	12 ft.	12 ft.	12 ft.	10.5 ft.-12 ft.
<b>Number of Parking Lanes</b>	0	0	0	0 – 2	0 – 2	0 – 2	0 - 2
<b>Width of Parking Lanes</b>	0	0	0	8 ft.	8 ft.	8 ft.	8 ft.
<b>Right-of-Way Width (2)</b>	100 – 140 ft.	80 – 100 ft.	60 – 80 ft.	60 ft.	50 - 60 ft.	50 ft.	50 ft.
<b>Design Speed (3)</b>	40 – 45 mph	35 – 45 mph	35 mph	30 mph	25 mph	25 mph	25 mph
<b>Stopping Sight Distance (4)</b>	305 - 360 ft.	305 - 360 ft.	250 ft.	200 ft.	155 ft.	155 ft.	155 ft.
<b>Minimum K Crest Vertical Curve (5)</b>	44 - 84	44 - 84	29	19	12	12	12
<b>Minimum K Sag Vertical Curve (5)</b>	64 - 96 (55 with lighting)	64 - 96 (40 with lighting)	49 (27 with lighting)	37 (20 with lighting)	30 (17 with lighting)	26 (14 with lighting)	20 (11 with lighting)
<b>Minimum Radii for Horizontal Curves (6)</b>	---	---	510	335	200	200	200
<b>Sidewalks (7)</b>	2	2	2	2	2	1 – 2	1 – 2

	<b>Major Arterial</b>	<b>Minor Arterial</b>	<b>Commercial/ Industrial Collector</b>	<b>Residential Collector</b>	<b>Commercial/ Industrial Local</b>	<b>Residential Local</b>	<b>Residential Access</b>
<b>Minimum Distance Between Sidewalk/Path and Right of Way line</b>	3 ft.	3 ft.	1 ft.	1 ft.	1 ft.	1 ft.	1 ft.
<b>Maximum Grade</b>	6%	7%	6%	8%	6%	10%	12%
<b>Minimum Grade</b>	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
<b>Minimum Curb Return Radius (8)</b>	35 ft	35 ft	35 ft	30 ft	35 ft	25 ft	25 ft
<b>Maximum Grade at Intersection with Stop</b>	---	---	---	3% (within 75 ft)	3% (within 75 ft)	5% (within 50 ft)	5% (within 25 ft)
<b>Minimum Grade Across Intersections</b>	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%

**NOTES:**

- (1) The minimum width of travel lanes may be reduced to 11 feet when approved by the City Engineer. The 10.5 feet lane width for residential access streets shall only be used in a planned development where a minimum of four off-street parking spaces are provided for each dwelling unit. Wider lanes may be required as determined by the City Engineer, based on design vehicle or adopted master planning documents.
- (2) Consideration should be given to providing a minimum 15 foot wide utility easement along each side of the right-of-way for residential access streets and 10 foot wide easements for all other streets
- (3) Lower design speed, with corresponding horizontal curve, vertical curve, and intersection sight distance design criteria may be used under special conditions when approved by the City Engineer.
- (4) Stopping Site Distance in table is for level roadways. Additional distance will be required on downgrades. Refer to minimum desired Intersection Site Distance in AASTHO “Greenbook” for intersections. Greater distance between the two (intersection / stopping ) sight distances shall govern.

- (5) Minimum K values for crest and sag vertical curves shall be in accordance with AASHTO – A Policy on Geometric Design of Highways and Streets. Minimum K values for sag vertical curves shall accommodate unlit roadways. . K values shall not exceed 167 for crest or sag conditions.
- (6) The minimum radii shown are based on the AASHTO design for low-speed urban streets with no superelevation. Superelevation can only be used when approved by the City Engineer. Minimum horizontal radii for arterial streets must be approved by the City Engineer.
- (7) Sidewalk may be replaced by Shared Use Path along streets as determined by City Engineer, based upon adopted master planning documents.
- (8) Radius measured to the back of curb. Radius should not exceed 50 feet. Radii in table are minimums. Radius shall be increased as needed to accommodate the design vehicle(s), as determined by the City Engineer.

**TABLE LS-2: MINIMUM ASPHALT PAVEMENT THICKNESSES**

<b>Street Classification</b>	<b>Pavement Option</b>	<b>AC Surface (in.)</b>	<b>AC Base (in.)</b>	<b>Aggregate Base (in.)</b>	<b>Chemical Subgrade Stabilization (in.)</b>	<b>Geogrid / Geotextile<sup>(1)</sup></b>
<b>Residential Local/Access</b>	A	2	4	6	6	--
	B	2	4	10	--	Geogrid / Geotextile
<b>Residential Collector</b>	A	2	5.5	6	9	--
	B	2	5.5	12	--	Geogrid / Geotextile
<b>Commercial Industrial Local/Collector</b>	A	2	7.5	6	9	--
	B	2	7.5	12	--	Geogrid / Geotextile

**Notes:**

**(1) Geogrid shall be polypropylene material and Geotextile shall be woven, polypropylene as shown in the City’s Approved Products List**

**TABLE LS-3: MINIMUM PCC PAVEMENT THICKNESSES**

<b>Street Classification</b>	<b>Pavement Option</b>	<b>PCC (in.)</b>	<b>Aggregate Base (in.)</b>	<b>Chemical Subgrade Stabilization (in.)</b>	<b>Geogrid / Geotextile<sup>(1)</sup></b>
<b>Residential Local/Access</b>	A	6	4	--	--
<b>Residential Collector</b>	A	6	4	6	--
	B	6	6	--	Geogrid
<b>Commercial Industrial Local/Collector</b>	A	8	4	9	--
	B	8	6	--	Geogrid

**Notes:**

**(1) Geogrid shall be polypropylene material and Geotextile shall be woven, polypropylene as shown in the City's Approved Products List**