Subdivision, Development & Servicing Bylaw 7900 Transportation Update

The Subdivision, Development & Servicing Bylaw 7900 regulates infrastructure standards for development within Kelowna. It provides guidelines and **design standards** for consultants, contractors, and City staff involved with the delivery of municipal infrastructure. Through this role the Bylaw helps implement the community vision set out in Imagine Kelowna as well as the goals and objectives of the Official Community Plan.

This update focuses on transportation and draws additional guidance from the Transportation Master Plan as well as other provincial and national guidelines.

Bylaw 7900, Schedule 4, Section 4 Transportation

This section in the current bylaw is called Highway. It identifies design standards for Intersection, Walking, Biking and Transit. Including basic geometric requirements such as lane widths and radiuses and accessible letdowns.

V1 – March 2023

Bylaw 7900 Schedule 4 Section 4 - Transportation

4.1 General

This Bylaw shall be used for the design of transportation infrastructure required to support the policies and objectives of the City's Official Community Plan (OCP). Transportation infrastructure includes roads, lanes, sidewalks, pedestrian crossings, active transportation facilities, transit facilities, and all other infrastructure necessary to support the movement of people and goods located within the road right-of-way, along Active Transportation Corridors, or within City-owned properties. This includes infrastructure necessary for pedestrians, cyclists, or other human powered modes, transit, passenger vehicles, emergency vehicles, and commercial or industrial vehicles.

Transportation infrastructure within the City is to be comfortable, convenient, safe, accessible, and attractive for everyone, regardless of age or ability. Complete streets elements such as traffic calming, accessible design, sidewalks, crossings, active transportation, transit infrastructure, and landscaping shall be incorporated within the road right-of-way as appropriate to support adjacent land uses and travel demand. The design of transportation infrastructure shall optimize ease of maintenance, longevity, and life cycle costs while meeting the above objectives.

4.1.1 Transportation Design Standards

The design of transportation infrastructure is context specific and the application of good engineering judgment shall be appropriately employed in each design to address mobility objectives, in addition to the standards contained in this Bylaw. The establishment of appropriate design standards may require consultation and direction from the City Engineer where the provisions of this Bylaw do not adequately address mobility objectives in the context of unique or complex situations.

This Bylaw is not a substitute for sound engineering judgement and discretion is afforded the City Engineer to adapt the standards prescribed herein to suit individual designs on a case-by-case basis in consideration of site constraints, applicable mobility objectives, and City policies. In exercising discretion, the City Engineer may require the Consulting Engineer to submit supporting engineering analysis, including completion of a written Design Brief or Transportation Assessment, for consideration. Transportation designs shall be prepared under the direction of a Consulting Engineer with appropriate and relevant transportation experience, registered with Engineers and Geoscientists of British Columbia.

Where not otherwise specified in this Bylaw, design direction should be taken from the most current versions of the following standard guides, regulations, and legislation:

Federal

TAC (Transportation Association of Canada) - Geometric Design Guide for Canadian Roads;
TAC – Manual of Uniform Traffic Control Devices (MUTCD);
TAC – Canadian Guide to Traffic Calming;
TAC – Canadian Roundabout Design Guide;
TAC – Pedestrian Crossing Control Guide;
TAC – Canadian Road Safety Audit Guide;
TAC – Bikeway Traffic Control Guidelines for Canada;
TAC – Speed Management Guide;
Canadian Standards Association (CSA) Accessible Design for the Built Environment; and
Canadian Highway Bridge Design Code.

Provincial/Regional

Motor Vehicle Act;
Local Government Act;
Community Charter;
BC MOTI (BC Ministry of Transportation and Infrastructure) – BC Supplement to TAC Geometric Design Guide;
BC MOTI – Supplement to Canadian Highway Bridge Code;
BC MOTI – British Columbia Active Transportation Design Guide;
BC MOTI – Traffic Management manual For Work on Roadways;
BC Transit – Infrastructure Design Guidelines;
Master Municipal Construction Documents Design Guidelines;
Master Municipal Construction Documents, Volume II Specifications and Standard Detail Drawings; and
Central Okanagan Region Transit Service Guidelines.

Local

City of Kelowna Official Community Plan Bylaw 123000 (OCP);
City of Kelowna Zoning Bylaw 12375;
Transportation Master Plan (TMP);
Pedestrian and Bicycle Master Plan;
Linear Parks Master Plan; and
Council-Adopted Urban Centre Plans;

4.2 Road Classifications

Road classifications are identified within ***Map 13.1 Functional Road Classification*** of the City's ***OCP***. Refer to **Section 4.3 – Cross sections** and **Schedule 1 – Works & Services Requirements** to determine the cross-section requirements based on the classification assigned to a road.
Not all Collector roads, Local roads, laneways, public pathways, and emergency accesses necessary to facilitate development are shown on **Map 13.1 Functional Road Classification.** New connections may be required as directed by the City Engineer or the Approving Officer.

The road classifications, shown in **Table 4.2.1: Road Classifications** below, consider both a road's function within the transportation system network and the mix of trips it services (land use context).

Table 4.2.1: Road Classifications

		Road Type					
		Neighbourhood Street Network			Major Road Network		
		Laneway	Local	Collector	Minor Arterial	Major Arterial	Highways
Land Use Context	Rural	Rural Laneway	Rural Local	Rural Collector	Rural Minor Arterial	Rural Major Arterial	MOTI Jurisdiction (see description below)
	Hillside	Hillside Laneway	Hillside Local	Hillside Collector	Hillside Minor Arterial	-	
	Suburban	Suburban Laneway	Suburban Local	Suburban Collector	Suburban Minor Arterial	Suburban Major Arterial	
	Industrial	Industrial Laneway	Industrial Local	Industrial Collector	-	-	
	Core Area	Core Area Laneway	Core Area Local	Core Area Collector	Core Area Minor Arterial	Core Area Major Arterial	
	Urban Centre	Urban Centre Laneway	Urban Centre Local	Urban Centre Collector	Urban Centre Minor Arterial	Urban Centre Major Arterial	

4.2.1 Road Types

Road types are described as follows:

Neighbourhood Street Network

- **Laneway:** A laneway, or alley, is a road that provides access to residences and businesses, often in higher density areas, and can be used to manage/control access to the Major Road Network. A laneway needs to consider operational functionality and accessibility. A laneway is narrow and accommodates small to mid-sized vehicles and parking is not facilitated. Typically, industrial laneways are not supported. Traffic volumes and speeds are low.

  Laneways are classified based on the land use context of the surrounding road network shown within OCP ***Map 13.1 - Functional Road Classification***.

- **Local Road:** Local roads operate with the primary function to provide direct land access and are not intended to carry through traffic. Typically, Local roads include on-street parking and traffic volumes are less than 1,000 vehicles per day in residential areas, and less than 3,000 vehicles per day in mixed-use areas.

- **Collector Road:** Collector roads provide direct land access but with more emphasis on accommodating mobility as compared to Local roads. Typically, Collector roads are used for short distances and movement between Arterial roads and Local roads. Vehicle speeds tend to be low and on-street parking and driveways are present but managed.

Major Road Network

- **Minor Arterial Road:** Minor Arterial Roads provide the primary function of traffic mobility with some land access allowed. Minor Arterial Roads provide links between town centres, and on-street parking is rare. The desired traffic volume range may overlap with Collector Roads; with the key differentiators being that Minor Arterial Roads have a greater emphasis on mobility (longer trips at higher speeds with less direct land access).
- **Major Arterial Road:** Major Arterial Roads provide a continuous route primarily for longer trips for through traffic, with limited land access. Typically, no on-street parking is allowed.
- **Highways:** Highways fall under the authority of the BC Ministry of Transportation and Infrastructure. Due to their critical role in Kelowna's vehicle network, Highways are included within the system despite being under provincial authority. Anywhere the City has a role in managing areas along, approaching, or within Highways (such as frontage requirements from the curb to the property line), Major Arterial Roads guidelines for the applicable land use context shall apply.

4.2.2 Land-Use Context

The land-use context helps understand the potential character and urban form of an area plus movement and activity patterns, including the type and expected number of users. In a transportation context, land use often indicates the amount of pedestrian, bicycle, and transit activity that can be expected on the corridor and informs the types of vehicles that should be accommodated. The land use types are described, from a transportation perspective, as follows:

- **Rural:** Rural land use is primarily agricultural or industrial. Properties are larger with lower access frequency but with larger vehicles. The primary mode is vehicle, and typically no parking or urbanization is provided.
- **Hillside:** Hillside land use is typically lower density single family residential. Typically, vehicle focused with basic active transportation facilities. Often constrained corridors due to geography that result in narrow, winding roads.
- **Suburban:** Suburban land use is typically lower density single family residential. Typically, vehicle focused with basic active transportation facilities.
- **Industrial:** Industrial land use supports a range of modes and primarily vehicles with accommodation for heavy vehicles. Active transportation facilities should be considered in areas with uses with high customer/employment numbers and as part of the larger network. Roads may allow on-street parking.
- **Core Area:** Core Area land use is higher density with residential, commercial, and mixed uses. More pedestrian, cycling and transit activity is expected. Therefore, vehicle and active transportation are accommodated with higher emphasis on pedestrians and bicycles compared to the Suburban land use.
- **Urban Centres:** Urban Centres land use has the highest density of development with elevated levels of street level activity. Streets often provide a secondary function as public spaces. Many trips are internal and completed on foot or bicycle. While access to the area is important, the speed of vehicles through the area is a lower priority, with a greater emphasis on pedestrians.

4.2.3 Network Overlay Maps

Network Overlay Maps have been developed to identify transportation elements that apply across multiple classifications (type and land use), and therefore require a consistent application. The following OCP Network Overlay Maps to the Functional Road Classification are:

- **OCP Map 13.2 – Transit Overlay:** The Transit Overlay identifies key corridors for existing and future transit infrastructure. Most transit trips begin and end with walking, so it is important that these streets have good sidewalks, pedestrian network connectivity and convenient places to cross streets and catch the bus. Special attention is necessary to accommodate the larger transit vehicles along these routes and additional space may be required for specialized infrastructure, such as shelters or benches. Implemented as per **Section 4.13 Transit Facilities**, **4.5 Intersections** and Standard Drawings **SS-59 - Urban Transit Stop Layout** and **SS-60 - Urban Transit Stop Shelter Pad Details**.
- **OCP Map 13.3 – Biking Overlay:** The bicycle overlay identifies the existing and future primary (All Ages and Abilities) network and secondary (supporting) network. It shows streets where additional space is typically needed to separate people biking from vehicle traffic. *Primary Bike Routes* are intended to accommodate people of all ages and abilities with physical separation from traffic. These have site-specific designs, generally guided by Development Cost Charge Bylaw (DCC) project design, for which prior consultation with the City Engineer is required. Where a Primary Biking Route is identified on OCP Map 13.3 Bike Overlay Map, up to 2.0 m of additional ROW may be required. *Secondary Bike Routes* are usually bike lanes that connect people to the primary routes and their destinations. These should be implemented as per standard cross section drawings. All bike facility designs require consideration of current design practice as outlined **in Section 4.12 Cycling Infrastructure**, with priority given to user safety.
- **OCP Map 13.4 – Truck Route Overlay:** The Truck Route Overlay identifies the truck routes and industrial areas where trucks are expected. Special attention is necessary to accommodate larger vehicles along these routes, particularly at intersections. See **Section 4.5 - Intersections** as well as **Section 4.17 - Pavements Structures**.
- **OCP Map 13.5 – DCC Project Overlay:** The DCC project overlay shows places where transportation projects are planned to support sector growth. These projects have specific transportation objectives to meet the needs of our growing community. They may not be implemented as per standard cross sections; designs that interact with this overlay map require prior consultation with the City Engineer and often require DCC Design Reports.

4.2.4 Linear Park Trail Classifications:

The trails of Kelowna vary with their context, level of use, and specific location. To capture the hierarchy, the trails have been classified into six types. The Linear Parks Trails shall follow the locations identified in **Map 10.1 – Linear Corridors** of the City's **OCP**. The determination of which trail class to use in which location is determined by the standards and use requirements below.

- <u>Class 1 – Major Urban Promenade:</u> A hard surface promenade designed to withstand a high level of use in an urban setting. These major City-wide routes are within, between or adjacent to popular destination points such as City-wide parks. They receive a variety of uses including walking, jogging, cycling, wheelchairs, roller blades, general passage by all ages, and maintenance vehicles. They are typically in town centres and prominent, such as the waterfront.

- **Class 2 – Major Urban Multi-Use:** A hard surface pathway designed for shared users and multiple directions. These are major routes through the City that are designed for bi-directional travel and multiple user types including walking, jogging, cycling, wheelchairs where possible, general passage by all ages, and maintenance vehicles. These are sometimes linkages between other trail types and are on occasion along rural roads.
- **Class 3 – Major Rural Multi-Use:** An aggregate or asphalt millings surface trail designed for major City-wide routes. These will accommodate multiple user types such as walking, jogging, cycling, wheelchairs where possible, equestrian, general passage by all ages and maintenance vehicles. Typical locations are parks, creek corridors beyond the Riparian Management Area and irrigation flumes.
- **Class 4: Standard Multi-Use:** An aggregate or asphalt millings surface trail along significant routes through parks, neighbourhoods, secondary routes, creek corridors beyond the Riparian Management Area, irrigation flumes and natural parks for moderate use and bidirectional travel. These will accommodate walking, jogging, cycling, wheelchairs where possible, and equestrians in some locations. They shall have a width and gradient to accommodate a maintenance vehicle and specialized fire suppression equipment.
- **Class 5: Narrow Multi-use:** An aggregate or asphalt millings surface trail along routes where a Narrow Multi-Use Trail is required to accommodate topography, through parks, neighbourhoods, secondary routes, creek corridors beyond the Riparian Management Area for low or moderate level of use. These will accommodate walking, jogging, and mountain biking.
- **Class 6: Nature Trails:** A natural ground trail, with aggregate cover as required, for locations in natural parks and creek corridors with locations of steeper terrain, intended primarily for single track travel, for low to moderate levels of use. Steps may be needed in very steep sections. Lower use locations. These will accommodate walking, mountain biking, and hiking

4.3 Cross Section Elements

4.3.1 General

Refer to **Schedule 1 – Works & Services Requirements** and **Section 4.2 – Road Classifications** to identify the applicable road classification and standard cross section for a road. Cross section requirements are identified within **Schedule 1 – Works & Services Requirements**.

Details include:

- Pavement width is measured from lip of gutter to lip of gutter, or edge of pavement to edge of pavement.
- Lane widths are measured from:
  - Centre of pavement marking to centre of pavement marking;
  - Centre of pavement marking to face of curb; or
  - Centre of pavement marking to edge of pavement (where there is no curb).
- Rights-of-way and pavement widths are identified in **Table 4.3.1: Road Cross section Summary** and may necessitate increases, as is warranted by engineering analysis and attributable to the proposed subdivision or development, or to achieve larger transportation objectives, to accommodate:

- Special purpose lanes (turning lanes, passing lanes, climbing lanes, parking/loading lanes, or bus lanes, etc.)
- Transit facilities (queue jumper lanes, bus bays/pullout, transit stops, transit shelter, transit infrastructure, etc.) in accordance with OCP **Map 13.2 – Transit Overlay**;
- Active transportation facilities (bicycle lanes, protected bicycle lanes, multi-use pathways, space for queuing, and turning at intersection etc.) in accordance with OCP **Map 13.3 – Biking Overlay**; and
- For operational or constructability considerations related to roadways being adequately supported, protected, or drained.

Note that the objectives of the Standard Road Cross Sections, as detailed in **Table 4.3.1: Road Cross section Summary** and the Standard Drawings, are the clear and intended goals on all roads within the City. **Table 4.3.1: Road Cross section Summary** is intended to provide guidance for most design scenarios. Designs for more complex or unique developments require consultation with the City Engineer, as outlined in **Section 4.1.1 – Transportation Design Standards.**

Table 4.3.1: Road Cross Section Summary[1]

Road Classification[1]	Land Use	Maximum Units Served[11]	Cross Section Drawing #	Lanes (excl. special purpose)[2] #	Lanes Width (m)[2]	Median[3] /Aux. Lane Y/N	Median Width (m)[2]	Shoulders Y/N	Shoulders Width (m) Gravel	Shoulders Width (m) Paved	Parking[4] Y/N #	Parking Width (m)	Pavement Width (m)	Drainage Ditch[5] Y/N	Drainage Curb & Gutter Barrier	Drainage Curb & Gutter Rollover	Sidewalks Y/N	Sidewalks #	Sidewalks Width (m)	Blvds[4] Y/N #	Blvds Width (m)	Border[5] Y/N #	Border Width (m)	Bicycle Facilities (see OCP Map 13.3) MUP Y/N	MUP Width (m)	Bike Lane[4] Y/N	Bike Lane Width (m)	Bike Buffer Y/N	Bike Buffer Width (m)	ROW Width (m)
Emergency Access	All	--	--	1	6.0	✗	--	✗	--	--	✗	--	6.0	✗	✗	✗	✗	--	--	✗	--	✗	--	✗	--	✗	--	✗	--	6.0
	Hillside	--	--	1	4.5	✗	--	✗	--	--	✗	--	4.5	✗	✗	✗	✗	--	--	✗	--	✗	--	✗	--	✗	--	✗	--	4.5
Laneway[6]	Hillside[9]	10	XS-R01	1	5.7	✗	--	✗	--	--	✗	--	5.1	✗	✗	✓	✗	--	--	✗	--	✗	--	✗	--	✗	--	✗	--	6.0
	Suburban	--	XS-R02	1	6.0	✗	--	✗	--	--	✗	--	6.0	✗[7]	✗	✗	✗	--	--	✗	--	✗	--	✗	--	✗	--	✗	--	6.0
	Core Area	--	XS-R02	1	7.6	✗	--	✗	--	--	✗	--	7.6	✗[7]	✗	✗	✗	--	--	✗	--	✗	--	✗	--	✗	--	✗	--	7.6
	Urban Centre	--	XS-R02	1	7.6	✗	--	✗	--	--	✗	--	7.6	✗[7]	✗	✗	✗	--	--	✗	--	✗	--	✗	--	✗	--	✗	--	7.6
Local	Rural	--	XS-R20	2	3.5	✗	--	2	1.5	--	✗	--	7.0	✓	✗	✗	✗	--	--	✗	--	2[8]	3.0[8]	✗	--	✗	--	✗	--	16.0
	Hillside	200	XS-R21	1	4.8	✗	--	✗	--	--	2	2.4	9.0	✗	✓	✓	✓	2	1.5	2	1.35	2	0.9	✗	--	✗	--	✗	--	17.4
		200	XS-R22	2	3.0	✗	--	✗	--	--	2[9]	2.4[9]	10.2/5.4	✗	✗	✓	✓	1	1.5	2	2.25[9]	2	0.9	✗	--	✗	--	✗	--	14.1
		200	XS-R23	2	3.0	✗	--	✗	--	--	1	2.4[9]	7.8/5.4	✗	✓	✓	✓	1	1.5	2	1.35/2.25[9]	1	0.9	✗	--	✗	--	✗	--	12.3
		200	XS-R24	2	3.0	✗	--	✗	--	--	✗	--	5.4	✗	✓	✗	✓	1	1.5	2	1.35	✗	--	✗	--	✗	--	✗	--	10.5
	Suburban	--	XS-R25	1	5.1	✗	--	✗	--	--	2	2.4	9.3	✗	✓	✗	✓	1	1.8	1	1.8	2	1.10	✗	--	✗	--	✗	--	16.0
	Industrial	--	XS-R26	2	3.4	✗	--	✗	--	--	2	2.7	11.6	✗	✓	✗	✓	2	1.8	✗	--	2	1.95	✗	--	✗	--	✗	--	20.0
	Core Area	--	XS-R27	1	5.2	✗	--	✗	--	--	2	2.2	9.0	✗	✓	✗	✓	2	1.8	2	1.95	2	0.3	✗	--	✗	--	✗	--	18.0
	Urban Centre	--	XS-R28	2	3.0	✗	--	✗	--	--	2	2.2	9.8	✗	✓	✗	✓	2	2.1	2	2.25	2	0.3	✗	--	✗	--	✗	--	20.0
Collector	Rural	--	XS-R40	2	3.2	✗	--	2	0.6	1.8	✗	--	10.0	✓	✗	✗	✗	--	--	✗	--	2[9]	4.4[9]	✗	--	✗	--	✗	--	20.0
	Hillside	600	XS-R41	2	4.0	✗	--	✗	--	--	2	2.4	12.2	✗	✓	✗	✓	2	3.2/4.0	2	3.2/4.0	✗	--	✗	--	✗	--	✗	--	20.0
		600	XS-R42	2	4.0	✗	--	✗	--	--	2	2.4	12.2	✗	✓	✓	✓	2	1.5	2	1.35	2	1.0/0.2	✗	--	✗	--	✗	--	20.0
		600	XS-R43	2	4.3	✗	--	✗	--	--	2[9]	2.4[9]	12.8	✗	✗	✓	✓	2	1.5	2	2.25[9]	2	0.9	✗	--	✗	--	✗	--	18.2
		600	XS-R44	2	4.3	✗	--	✗	--	--	1[9]	2.4[9]	10.4	✗	✓	✓	✓	1	1.5	2	1.35/2.25[9]	1	0.9	✗	--	✗	--	✗	--	14.9
		600	XS-R45	2	4.3	✗	--	✗	--	--	✗	--	8.0	✗	✓	✗	✓	1	1.5	2	1.5/1.35	1	0.9	✗	--	✗	--	✗	--	14.0
		500	XS-R46	2	3.5	✗	--	✗	--	--	1[9]	2.4[9]	8.8	✗	✓	✗	✓	1	1.5	2	1.5/2.4[9]	1	0.9	✗	--	✗	--	✗	--	13.3
		500	XS-R47	2	3.5	✗	--	✗	--	--	✗	--	6.4	✗	✓	✗	✓	1	1.5	2	1.35	1	0.9	✗	--	✗	--	✗	--	12.4
	Suburban	--	XS-R48	2	3.2	✗	--	✗	--	--	2	2.4	10.6	✗	✓	✗	✓	2	1.5	2	1.8	2	0.95	✗	--	✗	--	✗	--	20.0
		--	XS-R49	2	3.2	✗	--	✗	--	--	1	2.4	11.8	✗	✓	✗	✓	2	1.8/1.5	1	1.85	2	0.3/1.85	✗	--	2	1.8	✗	--	20.0
	Industrial	--	XS-R50	2	3.5	✗	--	✗	--	--	2	2.7	11.8	✗	✓	✗	✓	2	1.5	2	1.85	2	0.3	✗	--	✗	--	✗	--	20.0
	Core Area	--	XS-R51	2	3.2	✗	--	✗	--	--	2	2.4	10.6	✗	✓	✗	✓	2	1.8	2	2.15	2	0.3	✗	--	✗	--	✗	--	20.0
		--	XS-R52	2	3.2	✗	--	✗	--	--	1	2.4	12.7	✗	✓	✗	✓	2	1.8	2	2.10	2	0.3	✗	--	2	1.8	1	0.9	22.0
	Urban Centre	--	XS-R53	2	3.2	✗	--	✗	--	--	2	2.4	10.6	✗	✓	✗	✓	2	2.4	2	1.55	2	0.3	✗	--	✗	--	✗	--	20.0
		--	XS-R54	2	3.2	✗	--	✗	--	--	1	2.4	12.7	✗	✓	✗	✓	2	2.4	2	1.5	2	0.3	✗	--	2	1.8	1	0.9	22.0

Road Classification[1]	Land Use	Maximum Units Served[11]	Cross Section Drawing #	Lanes (excl. special purpose)[2] #	Lanes Width (m)[2]	Median[3] /Aux. Lane Y/N	Median[3] /Aux. Lane Width (m)[2]	Shoulders Y/N	Shoulders Width (m) Gravel	Shoulders Width (m) Paved	Parking[4] Y/N #	Parking[4] Width (m)	Pavement Width (m)	Drainage Ditch[5] Y/N	Drainage Curb & Gutter Barrier	Drainage Curb & Gutter Rollover	Sidewalks Y/N	Sidewalks #	Sidewalks Width (m)	Blvds[4] Y/N #	Blvds[4] Width (m)	Border[5] Y/N #	Border[5] Width (m)	Bicycle Facilities (see OCP Map 13.3) MUP Y/N	MUP Width (m)	Bike Lane[4] Y/N	Bike Lane[4] Width (m)	Bike Buffer Y/N	Bike Buffer Width (m)	ROW Width (m)
Minor Arterial	Rural	--	XS-R60	2	3.4	✗	--	2	0.6	1.8	✗	--	10.4	✓	✗	✗	✗	--	--	✗	--	2[8]	4.7[8]	✗	--	✗	--	✗	--	21.0
		--	XS-R61	2	3.4	✗	--	2	0.6	1.5	✗	--	9.8	✓	✗	✗	✗	--	--	✗	--	2[8]	4.6[8]	1	3.8	✗	--	✗	--	24.0
	Hillside[5]	>600	XS-R62	2	4.3	✓	4.4	✗	--	--	✗	--	11.0	✗	✓	✗	✓	2	1.5	2	1.65	2	0.2	✗	--	2	1.5	✗	--	23.0
		>600	XS-R63	2	3.5	✗	--	✗	--	--	✗	--	9.4	✗	✓	✗	✓	2	1.5	2	1.65	2	0.2	✗	--	2	1.5	✗	--	17.0
		>600	XS-R64	2	3.5	✗	--	✗	--	--	✗	--	9.4	✗	✓	✗	✓	1	1.5	2	1.65/1.5	1	0.2	✗	--	2	1.5	✗	--	15.0
	Suburban	--	XS-R65	2	3.4	✗	--	✗	--	--	✗	--	11.0	✗	✓	✗	✓	2	1.8	2	1.80	2	1.45	✗	--	2	1.8	2	0.6	22.0
		--	XS-R65	2	3.4	✓	3.0	✗	--	--	✗	--	14.0	✗	✓	✗	✓	2	1.8	2	1.50	2	0.25	✗	--	2	1.8	2	0.6	22.0
	Core Area	--	XS-R66	2	3.3	✗	--	✗	--	--	1	2.4	13.8	✗	✓	✗	✓	2	2.1	2	2.25	2	0.3	✗	--	2	1.8	2	0.9	24.0
		--	XS-R66	2	3.3	✓	3.0	✗	--	--	✗	--	13.8	✗	✓	✗	✓	2	2.1	2	2.25	2	0.3	✗	--	2	1.8	2	0.6	24.0
	Urban Centre	--	XS-R67	2	3.3	✗	--	✗	--	--	1	2.4	13.8	✗	✓	✗	✓	2	3.0	2	1.85	2	0.3	✗	--	2	1.8	2	0.9	25.0
		--	XS-R67	2	3.3	✓	3.0	✗	--	--	✗	--	13.8	✗	✓	✗	✓	2	3.0	2	1.85	2	0.3	✗	--	2	1.8	2	0.6	25.0
Major Arterial	Rural	--	XS-R80	2	3.4	✓	4.4	2	0.6	2.1	✗	--	15.4	✓	✗	✗	✗	--	--	✗	--	2[8]	4.7[8]	✗	--	✗	--	✗	--	26.0
		--	XS-R81	2	3.4	✓	4.4	2	0.6	1.8	✗	--	14.8	✓	✗	✗	✗	--	--	✗	--	2[8]	4.5[8]	1	4.0	✗	--	✗	--	29.0
		--	XS-R82	4	3.4	✓	4.4	2	0.6	2.1	✗	--	22.2	✓	✗	✗	✗	--	--	✗	--	2[8]	4.8[8]	✗	--	✗	--	✗	--	33.0
		--	XS-R83	4	3.4	✓	4.4	2	0.6	1.8	✗	--	21.6	✓	✗	✗	✗	--	--	✗	--	2[8]	4.6[8]	1	4.0	✗	--	✗	--	36.0
	Suburban	--	XS-R84	2	3.4	✓	4.4	✗	--	--	✗	--	15.4	✗	✓	✗	✓	2	1.8	2	1.75	2	0.3	✗	--	2	1.8	2	0.6	24.0
		--	XS-R85	4	3.4	✓	4.4	✗	--	--	✗	--	22.2	✗	✓	✗	✓	2	1.8	2	1.50	2	0.15	✗	--	2	1.8	2	0.6	30.0
	Core Area	--	XS-R86	2	3.3	✓	4.2	✗	--	--	✗	--	15.0	✗	✓	✗	✓	2	2.1	2	2.15	2	0.3	✗	--	2	1.8	2	0.6	25.0
		--	XS-R87	4	3.3	✓	4.2	✗	--	--	✗	--	21.6	✗	✓	✗	✓	2	2.1	2	2.10	2	0.3	✗	--	2	1.8	2	0.6	31.5
	Urban Centre	--	XS-R88	2	3.3	✓	3.0	✗	--	--	✗	--	13.8	✗	✓	✗	✓	2	3.0	2	2.10	2	0.3	✗	--	2	1.8	2	0.6	25.5
			XS-R89	4	3.3	✓	3.0	✗	--	--	✗	--	20.4	✗	✓	✗	✓	2	3.0	2	2.05	2	0.3	✗	--	2	1.8	2	0.6	32.0
	Provincial[10] Highway	Design to be approved by MOTI																												

Notes:

1. Refer to ***Map 13.1 - Functional Road Classification*** within the ***OCP***.
2. Additional width may be required to accommodate active transportation corridors, transit facilities or by special purpose lanes at intersections. Refer to ***Map 13.2 – Transit Overlay***, ***Map 13.3 – Biking Overlay***, ***Map 13.4 – Truck Overlay***, *and* ***Map 13.5 – DCC Project Overlay*** of the City's ***OCP***. Special purpose lanes are required as per site conditions, projected traffic volumes and ***TAC Geometric Design Guide for Canadian Roads***. Where a primary Biking Route is identified on OCP **Map 13.3 - Bike Overlay** up to 2.0 m of additional ROW may be required.
3. Raised medians and boulevards shall be planted as per Landscape and Irrigation, **Schedule 4, Section 7** of this Bylaw.
4. Parking and bicycle lane width measured from centre of pavement marking to face of curb.
5. Where existing dedicated ROW exceeds the standard cross section ROW identified, additional space shall be allocated at the discretion of the City Engineer to best achieve transportation objectives.
6. If an Industrial Laneway is required, it shall be designed to accommodate the anticipated design vehicle.
7. Surface stormwater management is by inverted crown.
8. Border includes width for ditch. Border for MUP included in MUP width.
9. Alternating between parking bays and boulevard.
10. Provincial Highway frontage improvements (back of curb to property line), unless otherwise directed, to be based on Major Arterial road classification, land use context, and an additional 1.0 m of boulevard width
11. Subject to **Section 4.9**

4.4 Alignments

4.4.1 General

Alignment values shall be in accordance with the ***TAC Geometric Design Guide for Canadian Roads***, unless otherwise noted herein. This Bylaw addresses typical conditions found in the City of Kelowna are not necessarily suitable for high-speed design considerations (i.e., 70km/h or greater). Any high-speed design shall be in accordance with ***TAC Geometric Design Guide for Canadian Roads*** and undertaken in consultation with the City Engineer.

In addition to this section, please refer to **Section 4.19 – Hillside Standards**.

4.4.2 Grade

Normal grade limits shall be as shown in **Table 4.4.1: Geometric Guidelines**.

The use of the maximum grades shall be restricted to cases where:

- The desired maximum grade cannot be obtained due to topographical constraints along accepted alignments; or
- The geometric design of intersections can be improved by increasing the grade on the minor road to avoid compromising the design of the major road.

Driveway grades shall be designed according to Standard Drawing **SS-R58 – Driveway Grade**

4.4.3 Vertical Curves

Vertical curve limits, as shown on **Table 4.4.1: Geometric Guidelines** and **Table 4.4.4 : K-Values** are defined by the K-Value. The K-Value is the ratio of the curve length in meters to the algebraic difference in percent grades.

Use of K-Values below the limits shown in **Table 4.4.1: Geometric Guidelines** and **Table 4.4.4 : K-Values** shall be restricted to cases justified by topographical constraints and are subject to approval by the City Engineer, who shall consider the adequacy of the resulting sight distances for any proposed reduction in K-values.

At road intersections, the minor road and/or cul-de-sac shall be constructed with an approach grade of not greater than 3% for a distance of not less than 15 m from the adjacent edge of asphalt of the major road.

4.4.4 Cross-Slopes

Standard roads shall have a centreline crown. The location of offset crowns shall be located on the lane line or the centre of the lane. Under adverse topographic conditions, and with approval of the City Engineer, offset crown or non-standard cross-slope may be used. An inverted crown (centreline swale) may be used for lanes.

The standard cross-slope is 2.0%. Superelevation introduction, transition, and usage shall follow guidelines within the TAC Geometric Design Guide for Canadian Roads, and as shown in **Table 4.4.1: Geometric Guidelines.**

At intersections, the cross-slope of the minor street shall be varied to suit the profile of the major street.

The maximum rate for changing cross-slope at intersections shall be as follows:

- Arterial: 3% in 30 m
- Collector: 4% in 30 m
- Local: 6% in 15m

Additional provisions for adequate drainage across roadways may be warranted in areas of cross-slope transition.

4.4.5 Horizontal Alignment

Minimum radii and corresponding crown and super-elevations are shown in **Table 4.4.1: Geometric Guidelines** and **Table 4.4.3 : Minimum Radii.** The centreline alignment of the road shall be located on the centreline of the right-of-way.

Horizontal alignments, including road centreline and curb return chainage stationing, shall be fully referenced and fully described, showing internal angles, radii, tangent and arc lengths, taper ratios, and other descriptions as may be necessary for orienting, design review, and constructability.

4.4.6 Taper Lengths

Narrowing or widening of lane widths or dropping/adding a lane(s) are road characteristics that require appropriate and consistent pavement markings, signing and taper lengths based on speed. Centreline lane width transitions shall be as per TAC Manual of Uniform Traffic Control Devices and shown in **Table 4.4.6 : Taper Values.** Auxiliary lane development tapers shall be as per principles in TAC Geometric Design Guide and as shown in **Table 4.4.6: Taper Values.**

Table 4.4.1: Geometric Guidelines

Classification	Design Speed (km/h)	Super Elevation % (max.)	Radius m (min.)	% Grade			K-Value (min.)			Sight Distance (min.)	
				Min	Desired Max	Max	Crest	Sag		Stopping (m)	Decision (m)
								No Illum.	Illum.		
Public Pathway/Multi-Use Pathway	--	--	TAC 5.5.3.1	1.0	5	8	--	--	--	TAC 5.5.2	--
Driveway, Single-family	--	--	--	1.0	8	10 15[3]	--	--	--	--	--
Driveway, Commercial/ Multi-family	20	--	20	1.0	+6 -4	+10 -4	2	2	2	20	--
Hillside Emergency Access	20	--	12	1.0	10	15	2	2	2	20	--
Laneway	20	2 I.C.[2]	20	0.5[8]/ 1.0	8	12 15[3]	3	2	2	20	80
Local	**Table 4.4.2**	2 N.C.[2]	**Table 4.4.3**	0.5	6	12 10[1] 15[3]	**Table 4.4.4**			**Table 4.4.5**	
Collector		6 4[1]		0.5	6	10 8[1] 12[3]					
Minor Arterial		6 4[1]		0.5	6	8 6[1] 10[3]					
Major Arterial		6 4[1]		0.5	6	8 6[1]					
Provincial Highway	Road design to be approved by MOTI. Frontage improvements (back of curb to property line) to be based upon Major Arterial Road classification, land use context, and an additional 1.0 m of boulevard width.										

Notes:

1. Through roads at an intersection shall have the identified lower grades and increased radii extended on each side of the intersection for a distance equivalent to the Stopping Sight Distance.
2. Inverted Crown (I.C.) and Normal Crown (N.C.) to be 0.02 m/m (2%).
3. Within Hillside context maximum grade permitted where necessary due to topographic constraints and as approved by the City Engineer.
4. Tangent sections of Local roads, Collector roads and Minor and Major Arterial Roads shall have a N.C., located along the centreline of the road.
5. Reverse Crown may be considered in special circumstances.
6. Maximum super elevation reduced to 4% where there are intersecting roads or private accesses.
7. Changes in gradient more than 1% on Arterial roads and Collector roads, and over 2% on all other road classifications, shall be connected by vertical curves. Vertical curves shall be designed in accordance with the ***TAC Geometric Design Guide***.
8. If longitudinal grade of a lane is less than 1.0% a Concrete Drainage Swale Across Asphalt shall be used, see standard drawing **SS-R23 - Concrete Drainage Swale Across Asphalt**.

9. The designer is responsible for establishing the appropriate combination of decisions to determine the required decision sight distance.
10. The combination of maximum grades with minimum horizontal and/or vertical curves shall be avoided.
11. Where there is a combination of horizontal/vertical curves with vertical grades, they shall satisfy the following equations, while meeting individual maximums and minimums:

$$\frac{Min.\,Radius}{Design\ Radius} + \frac{Min.\,K}{Design\ K} \leq 1.6$$

$$\frac{Design\ Grade}{Max\ Grade} + \frac{Min.\,Radius}{Design\ Radius} \leq 1.6$$

Table 4.4.2: Design Speeds

Design Speed (km/h)[1,2,3]					
Classification	**Land Use**				
	Rural	**Suburban**	**Hillside**	**Industrial**	**Core Area & Urban Centre**
Local	50	40	30	40	30
Collector	50	50	50 40[4]	50	40
Minor Arterial	70	50	60 50[4]	--	50
Major Arterial	80	60	60 50[4]	--	50

Notes:

1. Design speed is the speed set for the design of the geometric features of the road that affect vehicle operation. Posted speed is the speed limit set by the City for reason of safety, economy, traffic control, and regulatory policy to encourage drivers to travel at an appropriate speed for surrounding conditions.
2. The City generally posts speed limits to the design speed, except where the design speed is ≥70km/h, where the posted speed is typically be 10 km/h lower.
3. Where the existing posted speed is or exceeds 70km/h, maintain the posted speed unless otherwise directed by the City Engineer.
4. Minimum permitted design speed, where necessary due to topographic constraints, and approved by the City Engineer.

Table 4.4.3: Minimum Radii

	Minimum Radius (m)			
Design Speed	Normal Crown 2%	Reverse Crown 2%	Superelevation 4%	Superelevation 6%
20	12	--	--	--
30	25			
40	55	50		
50	105	90	80	
60	180	145	130	120
70	300	230	205	185
80	420	315	280	255

Notes:
1. For radii less than 55 m, no parking shall be permitted on the inside of the curve.
2. Intersection sight distance shall be provided for the approach and departure of an intersection, in accordance with the TAC Geometric Design Guide for Canadian Roads.
3. In retrofit designs, when the curve radius does not meet the minimum identified in **Table 4.4.3: Minimum Radii**, the designer shall consider lane width widening to accommodate the design vehicle

Table 4.4.4: K-Values

Design Speed	K-Value (min)		
	Crest	Sag	
		Illuminated	
		No	Yes
30	2	6	2
40	4	9	4
50	7	13	6
60	11	18	9
70	17	23	12
80	26	30	16

Table 4.4.5: Sight Distance

Design Speed	Minimum Sight Distance[1]	
	Stopping	Decision[2]
30	35	0-120
40	50	20-160
50	65	75-200
60	85	95-235
70	105	125-275
80	130	155-315

Note:
1. In addition to stopping and decision sight distance, intersection sight distance shall be provided as per TAC Geometric Design Guide, Section 9.9.2.3, where warranted or required by the City Engineer.
2. Distances are subject to adjustment based on approach grade. Refer to TAC Geometric Design Guide, Section 2.5.

Table 4.4.6: Taper Values

	Minimum Taper	
Design Speed	Through Lane Alignment	Auxiliary Lane Development
20	NA	NA
30	15:1	5:1
40	20:1	7.5:1
50	25:1	10:1
60	40:1	15:1
70	45:1	20:1
80	50:1	25:1

Notes:

1. Through lane alignment tapers are made both by utilizing horizontal curves at the beginning and end of transition that is 2x the radius indicated in **Table 4.4.3: Minimum Radii**.
2. Auxiliary lane development taper is made by utilizing horizontal curves at the beginning that is 2/3 and end of transition that is 1/3 the radius indicated in **Table 4.4.3: Minimum Radii**
3. Through lane alignment tapers shall not be used within horizontal curves.

4.5 Intersections

4.5.1 General

Intersections shall be designed according to ***TAC Geometric Design Guide for Canadian Roads - Intersections Chapter***. Intersections require specialized design, are often complex, and no one treatment can be universally applied, nor do road cross sections simply apply.

Intersections shall be designed with roads intersecting as close to 90° as possible. The acceptable range of intersection angle is between 70° and 110°.

4.5.2 Curb Returns

The minimum curb return radii for intersections at 90° angles shall be as follows in **Table 4.5.1: Minimum Curb Return Radii**. The designer shall consider the appropriate design vehicle expected to utilize the intersection and follow the curve radius principles listed in ***TAC Geometric Design Guide*** and ***BC Active Transportation Design Guide***. Curb returns located on roads within industrial, agricultural, and commercial areas may require a larger radius to facilitate truck traffic and bus traffic. For truck and transit routes, shown on **OCP** ***Map 13.4 – Truck Route Overlay*** and **OCP** ***Map 13.2 – Transit Overlay*** and in Industrial areas, as per ***OCP Map 13.1 – Functional Road Classification***, turning path analysis is required at intersections.

Right turn channelization should not be used in Core Areas and Urban Centres. However, where larger design vehicles are expected (e.g., Industrial Land Use, Major and Minor Arterial Roads, Truck Routes), right turn channels shall be designed as Urban Smart Channels. An Urban Smart Channel is a hybrid right turn channel where vehicles enter the cross street at a sharper angle (typically ≥70°) and utilize a truck apron which accommodates larger design vehicles while managing the speeds of general traffic. This reduces the turning radius, causing drivers to slow down to complete the turn. This layout positions crossing pedestrians more directly in the line of sight of oncoming vehicles, thereby increasing visibility. See standard drawing **SS-R50 - Smart Channel Right Turn.**

Table4.5.1: Minimum Curb Return Radii

Classification	Intersection with		
	Local	Collector	Arterial
Lane	With 3:1 flare to property corners		
Local	7.5 m	7.5 m	7.5 m
Collector	7.5 m	7.5 -10 m	*
Arterial (Minor or Major)	7.5 m	*	*

*The designer shall consider pedestrians, design vehicle, projected volumes, turning movements, approach and receiving lane widths, intersection angles, design vehicle turn path speed, and whether turning lanes are provided. When it is necessary to accommodate turning movements by large trucks, the use of offsets, tapers, and compound curves is recommended in place of a larger simple radius to minimize pedestrian crossing distances.

Curb return layouts are Illustrated in standard drawings **SS-R51 - Intersection Curb Extension – Higher Class Road No Parking** and **SS-R52 - Intersection Curb Extension – Higher Class Road With Parking.**

Gutter elevations on curb returns and cul-de-sacs shall be shown on the drawings at the beginning, one-quarter points, and end of curb returns, and at minimum 7.5 m intervals around cul-de-sacs. Profile drawings may be required where vertical curves or complex geometry are present in designs.

4.5.3 Corner Cuts

A corner cut is a triangular area of dedicated land at the corner of a property located at the intersection of two roads. This triangular area is required to achieve sight distances and to provide space for vehicle turning movements and accessibility.

Corner cuts shall be sufficient to provide a minimum distance from curb face to property line through the curve of 4.0 m or 5.0 m within Urban Centres. For the Major Road Network, property dedication shall be based on traffic control, axillary lanes and turn path analysis. Minimum corner cuts shall be as shown in **Table 4.5.2: Minimum Corner Cut Areas**.

Table 4.5.2: Minimum Corner Cut Areas

Intersection Type	Corner Cut
Lane to Lane	5 mx 5 m
Suburban Hillside Lane to all other roads	Not required
All other lanes to any road	3 m x 3 m
Local	3 m x 3 m
Collector	5 m x 5 m
Arterial (Minor or Major)	5 m x 5 m

4.5.4 Left Turn Lanes

Warrants for, and details of, left turn lanes shall be designed in accordance with the ***TAC Geometric Design Guide***. Left turn lanes shall be required at signalized intersections.

Left turn lanes shall be "opposing" in design style.

4.5.5 Sight Distance

In addition to sight distance requirements elsewhere in this and other Bylaws, intersection sight distance shall be provided for the approach and departure of an intersection, in accordance with the ***TAC Geometric Design Guide for Canadian Roads***.

Supplementary devices, such as mirrors, shall not be an acceptable solution to inadequate sight lines for new construction.

4.5.6 Curb Extensions

Curb extensions, also known as bulges or bulbs, should be considered for vehicle speed reduction, reduced pedestrian crossing distance, and improved pedestrian visibility. Design of the curb extensions shall be in accordance with the ***TAC – Canadian Guide to Traffic Calming*** and **Section 4.20 – Traffic Calming**.

For the design of Local roads and Collector roads with on-street parking, curb extensions shall be included both at intersections and at pedestrian crossings.

See Standard Drawing **SS-R51 - Intersection Curb Extension – Higher Class Road No Parking** and **SS-R52 - Intersection Curb Extension – Higher Class Road With Parking** for general design layout. Note that turn path analysis and site-specific design is required.

4.6 Roundabouts

A modern roundabout is a circular intersection in which vehicles travel counterclockwise around a central island. Vehicles entering the roundabout shall yield to traffic circulating within the roundabout. As traffic speeds are slower than within a traditional intersection, roundabouts tend to be a safer intersection treatment.

Recognizing the safety, environmental, operational, and life-cycle cost benefits, modern roundabouts shall be considered as the first option for greenfield situations where all-way stop control or traffic signals are, or will be, warranted by traffic analysis at Arterial/Arterial and Arterial/Collector roads intersections.

Roundabouts shall be considered for higher level intersection control for existing intersections with high turn volumes, intersections with a documented accident history, intersections that require complex decisions and movements, and intersections where not all legs are constructed at once.

Roundabouts generally are not be considered for intersections with low turning movements, little accident history or potential, steep topography, or a significantly higher life-cycle costs than for a signalized intersection.

Roundabouts shall be designed in accordance with ***TAC – Canadian Roundabout Design Guide.***

4.7 Railway Crossings

Locations and details of railway grade crossings are subject to requirements included in the ***TAC Geometric Design Guide*** and references noted therein. Railway crossing signs shall be in accordance with ***TAC Manual of Uniform Traffic Control Devices for Canada*** and any other applicable Federal or Provincial standards for Railway Crossings.

4.8 Traffic Control Devices

All traffic control devices, signs, pavement markings and warrants, shall be in accordance with the ***TAC Manual of Uniform Traffic Control Devices for Canada*****,** ***TAC Geometric Design Guide for Canadian Roads,*** and ***British Columbia Active Transportation Design Guide.***

All pavement markings (longitudinal, transverse, and symbols) shall be durable and in accordance with the **Approved Product List**. Pavement marking types, locations, dimensions, and materials shall be provided for review and acceptance by the City Engineer.

The developer is responsible to supply and install all sign sleeves and bases. The City, at their discretion, may produce the signs or provide the developer with a list of suppliers to have the signs made.

Traffic Control Device materials shall be as per the City's **Approved Products List**.

Signage and pavement markings for roundabouts shall be designed in accordance with **4.6 - Roundabouts**.

Traffic Signals shall be designed in accordance with **Section 6 – Traffic Signals**, of this Schedule.

4.9 Cul-de-Sacs

4.9.1 General

The following requirements are for all roads unless superseded by **Section 4.9.2 – Hillside Cul-de-Sacs**.

A cul-de-sac is required at the terminus of roads longer than 90 m and shall be designed as per standard drawing **SS-R53 - Cul-De-Sac Turnaround** to permit safe and adequate space for the turning of vehicles. The maximum road length for a cul-de-sac (excluding Hillside areas) is 200 m, measured from the edge of the intersecting through road to the centre of the cul-de-sac bulb.

A pedestrian walkway shall be provided in each cul-de-sac to provide active transportation access through the neighbourhood. The walkway shall conform to the standard drawing, **SS-T02 - Major Multi-Use (Urban) standards** of this bylaw.

When a cul-de-sac is at the bottom of a hill, the longitudinal gradient of the first 50 m of road uphill from the cul-de-sac bulb shall not exceed 5%. The maximum longitudinal gradient for the rest of the hill shall not exceed 8%. When a cul-de-sac is at the top of a hill, the longitudinal gradient for the road downhill from the cul-de-sac shall not exceed 12%.

The draining grade around the outside curb of a cul-de-sac shall not be less than 0.5% and not greater than 5%. Longitudinal gradients of cul-de-sac bulbs shall not exceed 5%.

4.9.2 Hillside Cul-de-Sacs

In hillside areas, as identified in ***Map 13.1 Functional Road Classification***, long streets may be required to access developable pockets within areas of steep terrain. Due to the complex topography, it may not be possible for connectivity to be achieved at both ends of a street. However, in response to public safety:

1. A cul-de-sac or a second point of access is required at the terminus of roads longer than 90 m.
2. A Hillside Emergency Access is required on roads between 90 m and 360 m in length, serving more than 100 units[1].
3. A Secondary Access Public Lane is required within the last 360 m on roads longer than 360 m and serving/designed to serve up to 100 units*.
4. A Local roads is required within the last 360 m on roads longer than 360 m and serving more than 100 units[1].
5. Beyond 600 units, a third access route is required. Turn-arounds are required every 360 m.

[1]Unit count total shall include all units that depend on a single point of access to the Major Road Network (see **Section 4.2.1**), including branching cul-de-sacs. The number of units shall include the maximum potential unit count of single family, multi-family, secondary suite/carriage houses as permitted by zoning. For non-residential land uses, building occupancy will be considered.

In general, temporary secondary points of access will not be considered. However, a Hillside Emergency Access may be considered, consistent with the limitations of this access type, where it is:

1. Ultimately replaced by a permanent connection on another alignment or to higher standard (e.g., public lane, Local roads, etc.);
2. Constructed over the applicants' lands within a highway road reserve;
3. Constructed to the Hillside Emergency Access standard (but unpaved); and
4. Maintained by the applicant to the satisfaction of the Kelowna Fire Department.

Temporary secondary points of access will not be considered to defer the construction of ultimate works on the same alignment. Maintaining street connectivity for safety reasons wherever possible is a priority.

For Hillside Cul-de-Sacs, see standard drawing **SS-R53 - Cul-De-Sac Turnaround**. The City's preference for turn-around is a Cul-de-sac. A hammerhead turnaround, as per standard drawing **SS-R54 - Hammerhead Turnaround**, may be permitted by the City Engineer in hillside areas where there are topographic constraints, upon demonstrated hardship.

4.10 Traffic Barriers

A traffic barrier is a concrete barrier that primary functions to prevent penetration and safely redirect an errant vehicle away from a roadside or median hazard. The use of barriers within urban areas should be avoided and an appropriate clear zone should be provided.

If alternative design strategies are not viable and where warrants are met and approved by the City Engineer, in accordance with the Roadside Safety section of the ***TAC Geometric Design Guide*** and ***BC Supplement to TAC Geometric Design Guide, Section 610 – Safety Barriers***, traffic barriers may be installed as per ***Section 640 – Highway Safety Drawings***.

4.11 Sidewalks and Pedestrian Crossings

Appropriate allocation of pedestrian facilities through sidewalks and pedestrian crossings is an important multi-modal consideration as part of transportation infrastructure.

4.11.1 Sidewalks

Sidewalk requirements vary by road class and shall be as outlined above in **Table 4.3.1: Road Cross section Summary**. Sidewalks, crosswalks, and pedestrian facilities shall be designed in accordance with the following guidelines:

BC MOTI – British Columbia Active Transportation Design Guide;
CSA – Accessible Design for the Built Environment;
TAC – Geometric Design Guide for Canadian Roads;
TAC – Manual of Uniform Traffic Control Devices (MUTCD); and
TAC – Pedestrian Crossing Control Manual.

For sidewalks crossing accesses, the sidewalk grade shall be maintained across driveway crossings using methods outlined in the ***BC Active Transportation Design Guide*** and as per **SS-C7a - Driveway Crossing for Barrier Curbs – Separate Sidewalk and Letdown** and **SS-C7b - Driveway Crossing for Barrier Curbs – Combined Sidewalk and Letdown.**

4.11.2 Pedestrian Crossings

Safe and accessible pedestrian crossings are crucial to ensuring that people of all ages and abilities can navigate the transportation network. Pedestrian crossings present one of the greatest challenges for vulnerable road users, as they are exposed to conflicts with motorists and other road users. Geometric design elements, signage, pavement markings, and traffic control devices can be used to assist pedestrians and reduce these conflicts.

The provision and design of pedestrian crossings shall consider existing and future site conditions, pedestrian and traffic volumes, network connectivity, and pedestrian accessibility. The warrant for a proposed crosswalk shall be evaluated using the ***TAC Pedestrian Crossing Control Guide***. New developments shall include future site conditions in the crossing warrant analysis.

The pedestrian crossing width can range from a minimum of 2.5 m to as wide as 4.0 m (***TAC Design Guidelines, Section 2.3.14.1***). The pavement marking and signage configuration for crossings shall be designed in accordance with the ***TAC Manual of Uniform Traffic Control Devices for Canada***.

4.11.3 Accessibility

Accommodating people of all abilities is a primary objective of the City when designing transportation facilities. Universal design principles ensure that the built environment is accessible to people of all ages and abilities, regardless of any type of physical or cognitive impairment.

Tactile Walking Surface Indicators (TWSI) shall be required on new or upgraded curb letdowns within urban and village centres, adjacent public institutions, or crossing Active Transportation Corridors. TWSI shall be installed on curb letdowns of any new or upgraded crosswalk with a higher-level treatment, including: rectangular rapid flashing beacons (RRFB), protected centre median pedestrian refuge, pedestrian signal, overhead flashers, or any crossing enhanced beyond a signed and marked crosswalk. See standard drawings **SS-C8 - Sidewalk Ramp Details** and **SS-C9 Sidewalk Ramp Layouts**. Refer also to the ***CSA Accessible Design for the Built Environment*** for design guidelines.

4.12 Cycling Infrastructure

Cycling infrastructure shall be designed in accordance with the following guidelines:

BC MOTI – British Columbia Active Transportation Design Guide;
TAC – Geometric Design Guide for Canadian Roads;
TAC – Manual of Uniform Traffic Control Devices (MUTCD); and
TAC – Bikeway Traffic Control Guidelines for Canada.

There are different types of cycling infrastructure that can be applied in various contexts. These facilities include on-street facilities (neighborhood bikeways, protected bicycle lanes, painted and buffered bicycle lanes, advisory bicycle lanes, bicycle accessible shoulders, shared-use lanes and Shared Street) or off-street facilities (multi-use pathways or bicycle pathways).

The **OCP Map 13.3 – Biking Overlay** identifies the City's planned cycling network and facility type. Designers should consider motor vehicle speeds and volumes as the most important considerations in selecting the appropriate bicycle facility design. Higher motor vehicle speeds and volumes necessitate a greater degree of separation between motor vehicles and bicycles.

Cycling infrastructure requirements shall be as outlined in **Table 4.3.1: Road Cross Section Summary, Schedule 1 – Works and Services Requirements** of this bylaw, and **OCP Map 13.3 – Biking Overlay**.

4.13 Transit Facilities

Transit is an important component of the transportation system, facilitates growth in urban areas, helps to protect residents' quality of life and sustains economic growth. All transportation designs shall make provisions for existing bus routes and stops, as well as accommodate future services and associated transit facilities.

Transit facilities shall be designed in accordance with the following guidelines:

- British Columbia Active Transportation Design Guide;
- BC Transit – Infrastructure Design Guidelines;
- BC Transit – Infrastructure Design Summary;
- BC Transit – Transit Service Guidelines, Central Okanagan Region; and
- TransLink – Universally Accessible Bus Stop Design Guidelines.

Infrastructure for transit is dependent upon current and planned transit services, service level type (Rapid, Frequent, Local), current and planned fleet vehicles, land use, road classification, and road performance. Requirements for transit infrastructure including station or stop locations, furnishings and other amenities, bus bays, queue jumper lanes, and signal equipment, shall be coordinated with the City Engineer and BC Transit based on ***OCP Map 13.2 – Transit Overlay.*** Transit stop intervals shall be as per BC Transit's Infrastructure Design Summary, as per **Table 4.13.1: Transit Stop Spacing** below:

Table 4.13.1: Transit Stop Spacing

Transit Service	Typical Spacing (m)	Spacing Range (m)
Urban Centre	200	200-300
Core Area	230	200-365
Suburban/Industrial/Hillside	300	200-760
Rural	380	200-800

Note: For Rapid Bus stop spacing, consult with City Engineer.

Where transit vehicles are to be accommodated within the road design, appropriate lane widths, turning radii, gradients and sight distances shall be incorporated. Geometric designs shall consider the implications on transit users, specifically addressing accessibility constraints, safety, and capacity at bus stop locations. Transit infrastructure shall be located such that it does not interfere with pedestrian movements on the sidewalk.

For detailed transit stop requirements, see Table 3.2 – Bus Stop Amenities within the BC Transit Infrastructure Design Guidelines. For the Frequent Transit Network and Rapid Transit Routes, stop requirements shall be as shown in **Table 4.13.2: Transit Stop Requirements** and shown in standard drawings **SS-R59 – Urban Transit Stop Layout** and **SS-R60 – Urban Transit Stop Details.**

Table 4.13.2: Transit Stop Requirements

<table>
<tr><th rowspan="2">Road Class</th><th rowspan="2">Service Layer</th><th colspan="4">Amenity</th><th colspan="3">Passenger/Shelter pads[8]</th></tr>
<tr><th>Shelter[1]</th><th>Bench</th><th>Trash can</th><th>Electrical</th><th>Within Boulevard</th><th>Back of Walk</th><th>Structural Requirements</th></tr>
<tr><td rowspan="3">Arterial</td><td>Rapid</td><td colspan="7">Consult City / BC Transit</td></tr>
<tr><td>Frequent</td><td>Avg. weekday boardings >20</td><td>Required if shelter not warranted</td><td rowspan="6">Within Urban Centres & 250m of commercial food service[2]</td><td rowspan="6">Where shelters are warranted[3]</td><td rowspan="2">9m x 3.5m[4]</td><td rowspan="4">7m x 2.25m[5]</td><td rowspan="6">Consult City[6]</td></tr>
<tr><td>Local</td><td>Avg. weekday boardings >15</td><td>Avg. weekday boardings >5</td></tr>
<tr><td rowspan="2">Collector</td><td>Frequent</td><td>Avg. weekday boardings >20</td><td>Required if shelter not warranted</td><td rowspan="2">9m x 3.25m[4]</td></tr>
<tr><td>Local</td><td>Avg. weekday boardings >15</td><td>Avg. weekday boardings >5</td></tr>
<tr><td rowspan="2">Local</td><td>Frequent</td><td>Avg. weekday boardings >20</td><td>Required if shelter not warranted</td><td rowspan="2">9m x 2.4m[7]</td><td>7m x 2.25m[7]</td></tr>
<tr><td>Local</td><td>Avg. weekday boardings >15</td><td>Avg. weekday boardings >5</td><td>7m x 1.8m[7]</td></tr>
</table>

Average weekday boardings are based upon historical transit data for existing stops or forecasted activity for new transit stops. Consult with the City Engineer for values.

1. Shelters shall be required at all transit stops located on Transit Supportive Corridors, within Urban Centres, or nearby secondary schools, community centres, or low income housing, regardless of current average boardings.
2. Trash receptacles shall be required at all transit stops within Urban Centres and within 250 m of commercial food services. Food services includes restaurants, convenience stores, service stations, cafes and schools. Consult City for types of receptacles.

3. Electrical service shall be required where shelters are required and at all transit stops located on Transit Supportive Corridors or within Urban Centres. Requirements: duct from slab to junction box with grounding and connection to nearest City streetlight. Where shelter installations will be deferred, duct to be stubbed at Junction Box. Refer to detail on standard drawing **SS-R60 - Urban Transit Stop Details.**
4. Where combined width of boulevard, sidewalk, buffer is greater than 6.0 m, consult the City Engineer for possible reconfiguration of elements within right-of-way.
5. A minimum 9.0 m by 2.25 m shelter pad behind the sidewalk, and a 9.0 m long passenger platform in the boulevard shall be required at all transit stops located on Transit Supportive Corridors or in Urban Centres. Refer to standard drawing **SS-R59 – Urban Transit Stop Layout.**
6. Where transit shelters are warranted, model specific foundations shall be required. Consult the City Engineer. Refer to standard drawings **SS-R59 – Urban Transit Stop Layout** and **SS-R60 - Urban Transit Stop Details** for required standard bus stop elements.
7. Consult City for possible reconfiguration of above-curb elements to accommodate transit stops. Area reflects required shelter pad back of sidewalk - minimum 9.0 m long passenger platform in boulevard is also required.
8. Where articulated buses are expected to operate in the future, landing pad and shelter pad length shall be 15 m.

4.14 Driveways

Driveways are intended to provide functional access to property while minimizing conflict and speed. Opportunities to consolidate driveways with shared accesses easements should be considered where possible.

4.14.1 Residential Driveways

Residential driveway access to an Arterial road is not permitted unless alternate access onto a lower classification road is not possible. The dedication of new Local Roads or Lanes shall be considered for Subdivision applications to preclude residential driveways accessing directly onto Arterial Roads.

4.14.2 Number of Driveways

For ground-oriented residential developments, only one driveway is permitted per lot. A second driveway may be permitted for a corner lot, if that driveway is not on an Arterial Road or Collector Road.

When two or more new lots are created through Subdivision, lots with frontages less than 14m shall share a common driveway on the shared property line on Local Roads, Collector Roads, or where adjacent to an **Active Transportation Corridor**.

Where access onto a lower classification road is not possible and two or more new residential lots are created through subdivision on an Arterial road, driveway accesses shall be consolidated into one common access with shared access agreements.

For commercial, industrial, institutional, agricultural, comprehensive, and multi-family developments, only one access is permitted. A second access may be permitted upon demonstrated need, if supported by engineering analysis acceptable to the City Engineer.

When multiple sites consolidate into a single development site, the resulting parcel's accesses shall be consolidated to bring it into conformance with this Bylaw. Where several parcels operate as a single site, consolidation of accesses should be considered.

4.14.3 Driveway Location and Widths

Where a lot abuts roads of different classifications, the driveway shall access the road of the lower classification. Where possible, driveways shall be placed outside **Functional Intersection Area**, as identified in TAC Geometric Design Guide for Canadian Roads.

Accesses across an existing or planned **Primary Bike Route**, as defined on **Map 13.3 –Biking Overlay** of the ***OCP***, shall not be permitted unless alternate access is not possible.

Ground-Oriented Housing:

- Driveways located on corner lots shall be at least 7.0 m from the property line corner nearest the intersection.
- Minimum and maximum widths of residential driveways shall be as shown in **Table 4.14.1: Driveway Widths**.

Commercial, Industrial, Institutional, Comprehensive, and Apartment Housing:

- Driveways to corner lots shall be located no closer than 15 m from the property line of the adjoining road.
- Consideration shall be given to the turning design vehicle in establishing the driveway width.
- The minimum width of a driveway to a property having one or more accesses is 4.0 m for one way access and 6.5 m for two-way access with a maximum of 11 m, as shown in **Table 4.14.1: Driveway Widths**.

Table 14.14.1: Driveway Widths

Access Type	Driveway Throat Width (m)	
	Lower Limit	Upper Limit[3]
Residential Zones	4.0	6.0
Commercial/Industrial with a single access	4.0[1]/6.5[2]	11.0
Commercial/Industrial with multiple access	4.0[1]/6.5[2]	9.0

Notes:

1. One-way access width
2. Two-way access width

3. Upon demonstrated need (turn path analysis or capacity analysis), a variance to these standards may be considered by the City Engineer.
4. Where lot frontage width is less than 13.5 m a shared driveway with the adjacent lot with a total width of 7.5 m is required.

4.14.4 Driveway Grades

General limits on driveway grades shall be as indicated in standard drawing **SS-R58 - Driveway Grades** and **Table 4.4.1: Geometric Guidelines**.

4.14.5 Driveway Letdown and Curb Return

Driveway letdowns shall be designed to conform to standard drawings **SS-C7a - Driveway Crossing for Barrier Curbs – Separate Sidewalk and Letdown** and **SS-C7b - Driveway Crossing for Barrier Curbs – Combined Sidewalk and Letdown**.

At the discretion of the City Engineer, access to large parking areas for commercial, industrial, and apartment housing may be designed as intersections per **Section 4.5**, including curb returns, provision for adequate sightlines, turning path analysis, and laning.

Auxiliary lanes may be required for access off major roads for safety reasons and to minimize disruption to traffic flows. Designs of such access shall be in accordance with the ***TAC Geometric Design Guide***.

4.14.6 Access Management

In addition to the above access guidelines, access management techniques including driveway consolidation, medians, and turn restrictions should be applied in accordance with the Access Section of the ***TAC – Geometric Design Guide*** and the requirements of the City Engineer.

4.14.7 Queuing Storage

Minimum queuing for on-site storage at parking lot driveways, measured from driveway exit at the property line to the closest parking stall or aisle, shall be as identified in **Table 4.14.2: Driveway Storage Requirements with Parking** or as informed by Transportation Assessment recommendations:

Table 4.14.2: Driveway Storage Requirements with Parking

Number of Parking Stalls	Length of Storage (m)
7 to 100	6
101-150	12
151-200	18
≥200	24

Storage requirements for Drive Throughs shall be determined generally by **Zoning Bylaw No. 12375 Section 9.4**, however, a Transportation Assessments may be required by the City Engineer, to ensure impacts the road network are mitigated.

4.14.8 Sight Distance

Driveway accesses on Arterial Road and Collector Roads shall achieve **Intersection Sight Distance – Case B**, as defined in the ***TAC – Geometric Design Guide***, and may be required to be achieved on Local Roads if warranted.

4.15 Clearances

4.15.1 Aerial Utilities

Clearances requirements for electrical and communication utilities are contained within the Canadian Electrical Code and can be impacted WorkSafe BC requirements. Additionally, an Electrical or Communication Utility may have additional clearance requirements. The following clearances are recommended separations for municipal infrastructure and may not be adequate to meet the requirements of a Utility, the Canadian Electrical Code, or WorkSafe BC requirements. Designers should confirm clearance requirements with a Utility prior to commencing design work.

Type	Vertical Clearance
Communications and guy wires	5.0 m
Electrical conductors to 90,000 V[1]	5.5 m

[1] For higher voltages, check with FortisBC

4.15.2 Signs and Poles

For roads with design speeds of 60 km/h or below, the horizontal clearance for signs and poles from the edge of the travel lane to the edge of a utility pole or sign shall be:

- Roads without curbs: ≥2.0 m.
- Roads with curbs and boulevard: 0.9 m preferable, 0.3 m minimum.
- Roads with curbs and monolithic sidewalk: located behind sidewalk.

For roads with design speeds above 60 km/h, refer to TAC Geometric Design Guide for Canadian Roads Chapter 7- Roadside Design.

The use of minimum clearance may be justified when using safety appurtenances such as poles with break-way or frangible bases, or sign poles of light weight fabrication.

Horizontal clearance to lighting and signal poles and signal controller cabinets shall be in accordance with **Section 5 – Roadway Lighting** and **Section 6 – Traffic Signals**.

4.15.3 Trees

Refer to **Section 7 – Landscape and Irrigation** for minimum setbacks for trees.

4.15.4 Drainage Structures and Traffic Barriers

Clearances to drainage structures and traffic barriers shall be in accordance with the Roadside Safety section of ***TAC Geometric Design Guidelines*** and the ***BC Supplement to TAC Geometric Design Guidelines***.

4.16 Utility Locations

The locations of utilities within the road right-of-way may vary within the road cross section. However, they are to be generally located as shown on Road Cross Section Drawings **XS-R01** to **XS-R89** and as per **Schedule 4: Section 0 - General Design Considerations, Part 0.4 - Utility Rights-of-Way and 0.5 - Utility Separation**.

Additional Guidelines include:

- Manholes, valve boxes and underground structures shall be clear of wheel paths;
- All utilities shall be clear of curb and gutter;
- Third-party utilities (gas, underground telecommunications, and underground power) shall be placed based on the third-party *Joint Trenching* detail as identified in Fortis BC Specification for Installation of Underground Conduit Systems, as close to the property line as possible with a minimum utility offset of 200 mm from the property line.
- Third-party utilities shall not be located under planted boulevards. If no outer boulevard exists, third-party utilities shall be located under the sidewalk, with vaults and junction boxes installed outside of the sidewalk where possible.
- In rural areas, where identified in Schedule 1 of this Bylaw, overhead power and telecommunications shall be located at the back of walk, or back of ditch, and as close to the edge of right-of-way as practical.

4.17 Pavement Structures

4.17.1 General

Pavement design shall include consideration of the subgrade soil type, frost susceptibility, moisture conditions, subgrade drainage provisions, Equivalent Single Axle Loads (ESAL) and anticipated traffic type and volumes.

4.17.2 Subgrade Preparation

Subgrade preparation shall be considered integral for construction of new roads.

Frost Susceptible Soils (ML - Silt):

The susceptibility of soils to frost heave is commonly classified using the US Corp of Army Engineers four categories, as shown in Table 15.2 of the 4th Edition of the Canadian Foundation Engineering Manual, 2006. All geotechnical reports shall address the frost susceptibility of the subgrade soil.

Swelling Soils (CH - Clay):

Pockets of soils known to change volume with variation of moisture content are known to exist in several locations within the limits of the City of Kelowna. These soils are typically identified as high plastic clays (CH), using the Unified Soil Classification System and Atterberg Limits index test American Society for Testing and Materials (ASTM) D4318. Where these soils are encountered as subgrade, special subgrade preparation considerations shall be required, as outlined below.

Scarification should render the subgrade to cohesive pieces of a maximum size of 20 mm to allow adequate moisture conditioning of the soil. The soil should be moisture conditioned to achieve a homogeneous moisture content between 0 and 3% over optimum. Following moisture conditioning, the subgrade soil should be compacted to a minimum of 95% of Modified Proctor density, as determined by ASTM D1557.

The subgrade should be covered with granular sub-base as soon as practical to minimize the variation of the moisture content in the subgrade. The contractor should be aware that additional moisture condition and compaction may be required, at the contractor's expense, should the moisture content be allowed to vary significantly from optimum prior to placing the sub-base.

4.17.3 Pavement Design

Designers of pavement structures shall consider four primary factors in undertaking a specific design. These factors are:

- Subgrade support quality (geotechnical report);
- Design life (20 years);
- Traffic loading (expressed in ESALs); and
- Climate.

New pavement structures shall be designed in accordance with the methodologies presented in American Association of State Highway and Transportation Officials (AASHTO) *AASHTO Guide for Design of Pavement Structures, 1993*. The pavement structure shall be designed for a twenty (20) year design life.

The AASHTO design method is based on a Structural Number (SN) for the entire pavement structure (i.e., hot mix asphalt, granular base, and granular sub-base). The method incorporates the subgrade strength expressed as the Subgrade Resilient Modulus (Mr), and design loading (ESALs). Each component of the pavement structure is assigned a layer coefficient.

Subgrade strength is frequently characterized utilizing the California Bearing Ratio (CBR) test procedure (ASTM D1883). This test should be performed on soaked subgrade soil specimens compacted to 95% of Modified Proctor density as determined by ASTM D1557. The Resilient Modulus may be approximated from the soaked CBR test values using the following relationships:

- Mr (MPa) = 10.3 CBR, or
- Mr (psi) = 1,500 CBR

The soaked CBR properties of subgrade soil should be determined at a frequency of at least one test per every 150 lineal metres, or a portion there of, and for each major soil type encountered. Where more than one test is required, the tests should be evenly spaced.

The required SN for the pavement structure is the sum of the product of the layer coefficient, the component thickness, and a drainage coefficient for each component:

$$SN = a_{ac}D_{ac} + a_bD_bM_b + a_{sb}D_{sb}M_{sb}$$

Where:

SN	=	Structural Number for pavement structure	D_{ac}	=	Thickness of hot mix asphalt, mm
a_{ac}	=	Layer coefficient for hot mix asphalt (0.4)	D_b	=	Thickness of granular base, mm
a_b	=	Layer coefficient for granular base (0.14)	D_{sb}	=	Thickness of granular sub-base, mm
a_{sb}	=	Layer coefficient for granular sub-base (0.10)	M_b and M_{sb}	=	Layer drainage coefficient (1.0 for Kelowna)

Road classifications, design traffic values and minimum depths of hot mix asphalt and granular base components of the total pavement structure shall as shown in **Table 4.17.1: Minimum Asphalt & Granular Base Depth**.

Table 4.17.1: Minimum Asphalt & Granular Base Depth

Classification	Min. Design Traffic (ESALs)	Minimum Depth of Hot Mix Asphalt (mm)	Minimum Depth of Granular Base (mm)
Walkways/Multi-Use Pathway	--	50	75
Local, Lanes, Accesses & Emergency Access	2.8×10^4	50	75
Collector	2.8×10^5	100	75
Arterial (Minor & Major)	1.0×10^6	100	75

Notes:

1. See Part 1, Chapter 1 of AASHTO for definition of ESAL
2. Special design reviews may be requested by the City Engineer

Standard pavement structures, including required SN values, shall be as provided on **Table 4.17.2: Standard City of Kelowna Pavement Structures** for three strengths of subgrade. The standard pavement structures incorporate the minimum depths of hot mix asphalt and granular base shown in **Table 4.17.1: Minimum Asphalt & Granular Base Depth**, above.

Table 4.17.2: Standard City of Kelowna Pavement Structures

Classification	Structural Component	Thickness (mm) for Soaked CBR[1] of:		
		3.0[4] < CBR ≤ 5.0	5.0 < CBR ≤ 10	CBR > 10[5]
Walkway/Multi-Use Pathway	Asphalt – surface	50	50	50
	Granular Base	75	75	75
	Granular Sub-base[3]	150	150	150
	Required SN Value	n/a	n/a	n/a
Local, Lanes, Accesses & Emergency Access	Asphalt – surface	50	50	50
	Granular Base	75	75	110[2]
	Granular Sub-base[3]	275	765	0
	Required SN Value	58	47	35
Collector	Asphalt – surface	50	50	50
	Asphalt - base	50	50	50
	Granular Base	75	75	100[2]
	Granular Sub-base	335	185[3]	0
	Required SN Value	84	69	53
Arterial (Minor & Major)	Asphalt – surface	50	50	50
	Asphalt - base	50	50	50
	Granular Base	75	75	75
	Granular Sub-base	535	355	155[3]
	Required SN Value	104	86	66

Notes:

1. Soaked CBR value shall be at 95% of Modified Proctor maximum dry density and optimum moisture content, as determined by ASTM D1557.

2. Placement of equivalent sub-base layer is not practical and shall be replaced with additional granular base.
3. Maximum aggregate size of sub-base material shall be no more than 50% of total depth of sub-base.
4. Where the top 1.0 m of subgrade has a soaked CBR value of less than 3, then the subgrade strength should be supplemented with an additional thickness of granular sub-base material in order to achieve a soaked CBR value of 3 or greater. The thickness of the supplemental sub-base and the corresponding composite CBR value for the top 1.0 m of composite subgrade can be determined by the following formula:

$$CBR\ Composite = ((t_{ssb} \times CBR_{ssb}{}^{0.33} + (100\text{-}t_{ssb}) \times CBR_{sg}{}^{0.33})/100)^3$$

   Where:

   CBR Composite is 3 or greater
   t_{ssb} = thickness of supplemental sub-base (cm)
   CBR_{ssb} = CBR value of supplemental sub-base
   CBR_{sg} = CBR value of subgrade soil
5. For design purposes, the maximum subgrade soaked CBR value shall not exceed 10.

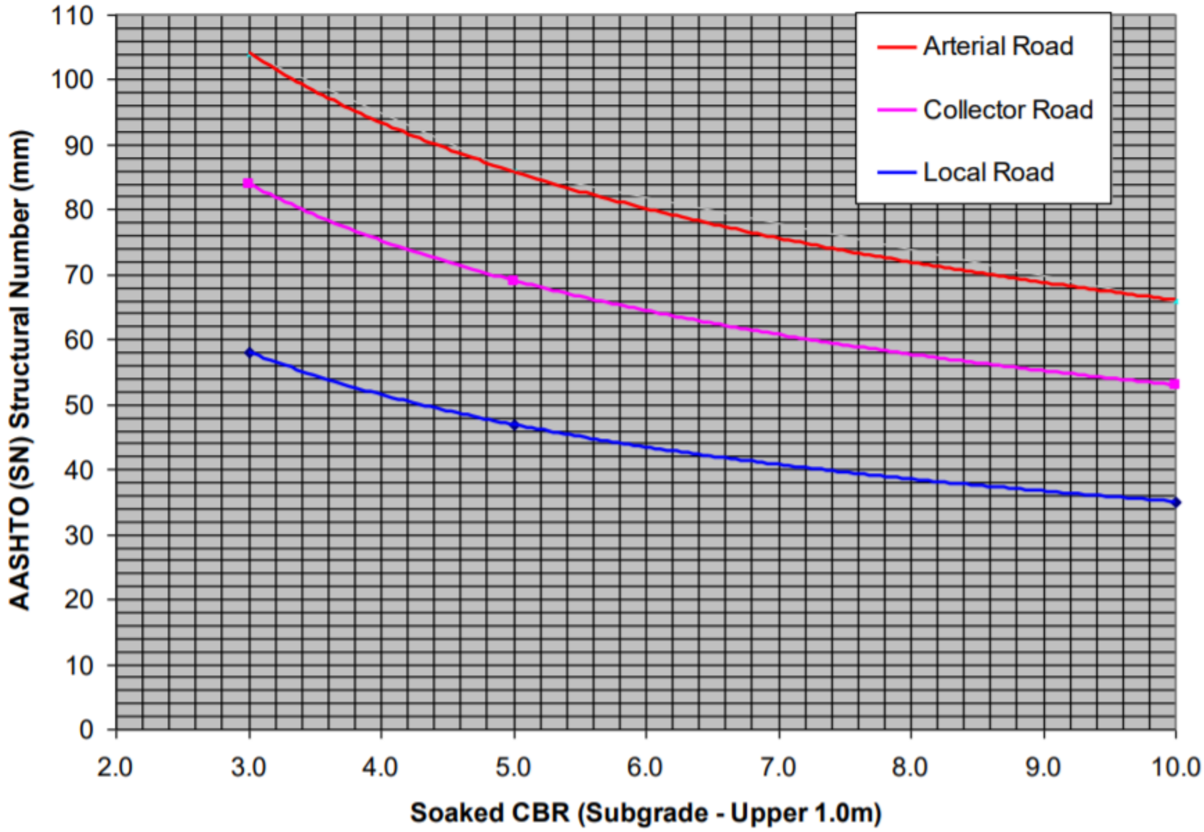
Design pavement structure to be placed on a prepared subgrade or compacted fill embankment. Refer to the MMCD and Schedule 5 – Construction Standards of this Bylaw.

Granular base and granular sub-base to have a minimum soaked CBR value of 80 and 20, respectively (refer to City Supplemental Specifications to MMCD).

Required physical properties for granular base and granular sub-base are given in **Schedule 5 – Construction Standards**.

Table 4.17.2: Standard City of Kelowna Pavement Structures provides standard pavement structures for roads constructed on only three strengths of subgrade. Alternate pavement structures may be designed based on the SN determined using **Figure 4.17.1: AASHTO Structural Number (SN) Values for Kelowna Street Classifications as a Function of Soaked Subgrade CBR Value.**

Figure 17.17.1: AASHTO Structural Number (SN) Values for Kelowna Street Classifications as a Function of Soaked Subgrade CBR Value



4.18 Bridges

4.18.1 General

Bridges, including culvert structures that span larger than 3.0 m, shall be designed in accordance with the latest version of the **Canadian Highway Bridge Design Code CAN/CSA S6**, and the BC **MOTI Supplement to Canadian Highway Bridge Design Code**. Consult with the City Engineer to establish design criteria for each structure prior to commencing design.

Bridges shall be designed with a minimum 75-year life span and to BCL-625 Live Loading specifications.

4.18.2 Road Clearance

Minimum vertical clearance to bridge structures shall be 5.0 m over paved road surfaces. The minimum vertical clearance to any lightweight structures spanning the road (pedestrian overpasses, sign bridges, etc.) shall be 5.5 m.

4.18.3 Flood Clearance

For creek crossings, the minimum clearance between the soffit and the Q200 design flood elevation (including a 15% increase in Q200 for climate change) shall not be less than 1.5 m.

4.19 Hillside Standards

4.19.1 General

Hillside standards are incorporated throughout this Bylaw section, including **Sections 4.2 – Road Classifications**, **4.3 – Cross-Section Elements, 4.4 – Alignments, 4.9 Culs-De-Sac**. Additional design guidance is provided in **Table 4.19.1: Hillside Alignment Design Criteria**.

The hillside standards have been designed for environmental sensitivity with reduced physical impacts in mind. The street standards proposed herein have been drawn from the following principles:

- The public interest requires safe, liveable, and attractive streets that contribute to the urban fabric;
- Streets should be designed to suit their function. Many streets, especially local ones, have purposes other than vehicular traffic; and
- A hierarchical street network should have a rich variety of types, including bicycle, pedestrian, and transit routes.

In Hillsides, rollover curb is only permitted in front of ground oriented residential development.

Table 4.19.1: Hillside Alignment Design Criteria

Horizontal Curve Radii (m)	60 km/h	50 km/h	40 km/h	30 km/h
Roadway Crossfall				
Normal Crown (-2%)	260	165	90	25
2% superelevation	205	120	65	25
4% superelevation	150	80	45	22
6% superelevation	120	--	--	--
Through Intersections	200	120	70	40
Superelevation (%)	**60 km/h**	**50 km/h**	**40 km/h**	**30 km/h**
Max. superelevation	6	4	4	4
Max. superelevation at intersections	4	4	4	4
Superelevation Transition Lengths (m)	**60 km/h**	**50 km/h**	**40 km/h**	**30 km/h**
Transition length (2/4-lane roadways)				
Normal Crown to +2%	24/36	22/34	20	20
Normal Crown to +4%	38/54	33/50	30	30
Normal Crown to +6%	48/72	--	--	--
Min. Tangent Length between reversing curves				
2% superelevation	15/22	13/20	12	12
4% superelevation	28/42	26/40	24	22
6% superelevation	42/64	--	--	--

1. Values for transition lengths include tangent runout applied at the same rate as superelevation runoff.
2. 60% of superelevation runoff occurs on the tangent approach and 40% on the curve, resulting in a minimum length of tangent between reversing curves of 120% of the superelevation runoff length.

Gradients (%)	**60 km/h**	**50 km/h**	**40 km/h**	**30 km/h**
Minimum Grade	0.5	0.5	0.5	0.5
Maximum Grade				
On horizontal tangents	8[1]	10[2]	12	12
On minimum radius horizontal curves[3]	8	9	10	10
Grades through intersections				
With design speed on major road				
Approach distance for major road[4]	15m/5m[5]	5m	0	--
With design speed on minor road	5%[6]	5%	6%	6%
Approach distance for minor road[7]	20m	15m	5m	5m

1. Under special circumstances, grades up to 10% may be permitted.
2. Under special circumstances, grades up to 12% may be permitted.
3. Applies where radius is less than 1.5 times minimum allowable radius.
4. Minimum distance back from the gutter line of the minor road that the specified grade may not be exceeded.
5. Distances for design road approach to intersection with collector road / local road.
6. 4% desirable.
7. Minimum distance back from the gutter line of the major road that the specified grade may not be exceeded.

Vertical Curve K Values	**60 km/h**	**50 km/h**	**40 km/h**	**30 km/h**
Minimum Crest	15	8	4	2
Minimum Sag	10	7	4	2
Crest/Sag on approach to stop condition	4	3	2	2

K values listed assume that new roadways will be illuminated.

Stopping Sight Distance (m)	**60 km/h**	**50 km/h**	**40 km/h**	**30 km/h**
Downgrades:				
12%	109	78	52	34
9%	101	73	50	32
6%	94	69	48	31
3%	89	66	46	30
0%	85	63	45	30
Upgrades:				
3%	81	61	44	29
6%	78	59	42	29
9%	76	57	41	28
12%	73	56	40	28

Decision Sight Distance (m)	**60 km/h**	**50 km/h**	**40 km/h**	**30 km/h**
Minimum decision sight distance	175-235	--	--	--

1. Note that decision sight distance applies only to multi-lane roads at intersections.
2. The range of values recognizes the variation in complexity that occurs at various sites. For less complex situations, values towards the lower end of the range are appropriate and for more complexity, values at the upper end are used.

4.20 Traffic Calming

Traffic calming provides a standardized approach to challenges associated with maintaining the appropriate traffic volumes and speeds for specific road classifications. Increased volumes and speeds may result from road users navigating around areas of congestion or moving more rapidly through a particular road to get to a destination.

As traffic calming requirements are location specific, the designer shall work with the City to identify the type and location of appropriate traffic calming devices. The design of traffic calming measures shall be consistent with the ***TAC Canadian Guide to Neighbourhood Traffic Calming***. The use of traffic calming measures shall be considered within the context of the neighbourhood, to ensure short-cutting traffic is not moved from one neighbourhood street onto another.

The designer shall use appropriate design elements to limit vehicle operating speed to the required design speeds.

In general, restrictions include:

- No vertical deflections permitted on Arterial Roads, where transit routes are present or where a road is the only/primary access to a neighbourhood.
- No vertical deflections permitted on roads with grades >6%.
- No vertical deflections permitted on new roads, unless approved by the City.
- In rural areas, consideration for agricultural activities may limit the use of vertical deflection.

Pedestrian bulges or curb extensions shall be designed on Local Roads and Collector Roads with on-street parking to improve pedestrian visibility and shorten crossing distances, as per **4.5.6 – Curb Extensions**.

If new development traffic negatively impacts the speed and volume of existing Local Roads and Collector Roads, traffic calming shall be included at developers cost.

Priority shall be given to traffic calming measures on roads near elderly and child-oriented spaces and facilities.

4.21 Street Parking

Where conditions allow, the provision of parallel street parking enables access to the surrounding area while maintaining the safe and appropriate traffic throughput of the road design. The designer shall consult the City to confirm the requirements for on-street parking.

Parking lanes shall be designed as per **Table 4.21.1: Parking Lane Width**, in addition to the ***TAC Geometric Design Guide***.

Table 21.1: Parking Lane Width

Classification	Parking Lane Width[1] (m)
Lane	Not allowed
Local Road	2.2-2.4
Hillside Roads	2.4
Collector	2.4
Industrial Roads	2.7
Minor Arterial	2.4
Major Arterial	2.4[2]

Notes:
1. Parking lane widths are measured from the face of curb.
2. Street Parking is not recommended but may be considered in Urban Centres.

The location of parking areas shall not encroach within the Parking Distance Restrictions, as identified within Schedule K of City **Traffic Bylaw 8120**.

4.22 Road Safety

Road safety shall be considered in all designs to ensure that all users, particularly vulnerable users such as pedestrians and bicyclists, are accounted for and accommodated safely. Road safety shall consider existing and future safety issues within each design. The design phase is the easiest and most cost-effective time to address road safety.

At the discretion of the City Engineer, a Road Safety Audit may be required for designs of new segments of Arterial Roads, signalized intersections, roundabouts, Major Road Network bridges, and when making changes to an existing Arterial Road that include any of the following:

- New road features such as lanes, intersections, traffic control devices, or changes in alignment;
- The presence of vulnerable road users such as the elderly, children, cyclists, schools or Active Transportation Corridors;
- The proposed design cannot meet Bylaw or TAC Design guidance; or
- The intersection or road segment has higher than average collision frequency.

The Road Safety Audit process shall be conducted in accordance with the ***TAC Canadian Road Safety Audit Guide***. To support a clear and efficient process, a Terms of Reference or Work Plan shall be developed identifying scope, schedule for completion, team requirements, audit tasks, formal audit report contents and format, and response report expectations aligning with the ***TAC Canadian Road Safety Audit Guide*** process.

4.23 Transportation Assessments

4.23.1 General

A Transportation Assessment (TA) analyzes the likely impacts a proposed development will have on the transportation system and identifies potential mitigation measures to accommodate the additional trips and provide adequate network connectivity for all road users in a satisfactory manner. The City Engineer may require the completion of a TA in combination with other information to inform the transportation-related Works & Services requirements of a development application.

4.23.2 Requirement

Typically, an applicant is required to complete a TA when a proposed application is anticipated to generate 100 or more trips in the peak hour (unadjusted). A TA may be required for all Area Structure Plans (ASP), updates to ASPs, amendments to the OCP, or at the discretion of the City Engineer. Where a TA was previously completed, an update is required when a previously completed TA contains assumptions that are no longer valid; this may be due to, but not limited to, any of the following:

- When traffic data used is over three years old;
- When the previous TA contains a site access plan that has changed significantly; or
- When a modified development proposal results in a trip generation estimate for the current site plan that is 10% higher or lower than the previously analysed development proposal.

4.23.3 Study Process

The first step is for the applicant's traffic consultant is to establish the Terms of Reference (TOR) for the TA with the City prior to proceeding with analysis. The scope of the study shall be determined based on the scale, characteristics, and location of the proposed development. The key assumptions and methodology shall be outlined in the TOR, based on, but not limited to, **4.23.4 Study Components**.

Any development within 800 metres of an intersection with Highway 97 or Highway 33 shall be subject to requirements of the Ministry of Transportation and Infrastructure. In this case, any additional terms for completion of the analysis will be coordinated by the City Engineer.

4.23.4 Study Components

The TA shall be specific to the proposed development and in general include the following items:

- Development Plan: a current site concept plan identifying development location, proposed land use, size of buildings/uses, phasing of development, timing of phases, proposed multi-modal access plan, internal roads, truck loading and parking layout for vehicles and bicycles;
- Peak Hours: Typically, weekday a.m., mid day and p.m. peak hour periods shall be analyzed. Commercial developments may require Saturday midday peak hour. Schools shall require analysis at all pick up and drop off times;
- Horizon Years: For single-year buildout, the opening year and 10 years hence shall be analyzed. Interim horizon years shall be analyzed for multi-phased developments;
- Study Area: The study intersections and network locations shall be identified based on the location, access plan and scale of the development;
- Analysis Software: Software applications for analysis and modelling shall be confirmed within the TOR. All analysis files shall be submitted electronically with the report for City review;
- Background Traffic Volumes: Traffic count data less than three years old shall be used and included with the report. Available count data may be obtained from the City, as per Miscellaneous Fees and Charges Bylaw 9381.The TA shall identify the appropriate annual traffic growth rate and future background traffic from approved and anticipated developments in the vicinity;
- Site Trip Generation: The TA shall identify the appropriate vehicle trip rates based upon the current Institute of Transportation Engineers' Trip Generation Manual or local trip

generation survey. Where appropriate, the TA shall include pedestrian, cyclist, transit ridership estimation methodology;

- Trip Adjustment: Mode splits from the City's model, based on the Regional Household Travel Survey, may be applicable throughout the City of Kelowna. Developments along high-quality transit routes (≥15 min frequency FTN's, multiple routes), adjacent Primary Bicycle Routes, and within OCP Urban Centres may be eligible for up to a 10% trip adjustment. Additional reductions to vehicle trip generation shall be tied to specific improvements associated with the development;
- Network Connectivity: The TA shall identify:
  - Pedestrian network gaps on-site, and within a 400 m radius of the outer perimeter of the site,
  - Bicycle network gaps on-site, and within an 800 m radius of the outer perimeter of the site, and
  - Vehicular gaps within the study area to meet the OCP **Map 13.1 – Functional Road Classification** and well connected Neighbourhood Street Network, lanes need for access and access management for Major Road Network and other relevant OCP and City policies (such as Urban Centres Roadmap);
- Transit: The TA shall identify the scale of impact to the transit facilities and network in the study area;
- Safety Analysis: The TA shall include accident history for all intersections and conflict points in the study area. Evaluation of the safety data and recommended modifications shall be included;
- Intersection Performance Criteria: The operational performance of the transportation network is assessed with and without the development. The vehicle capacity analysis results shall be reviewed based on the following benchmarks (as per Highway Capacity Manual):

  Signalized Intersections and Roundabouts:
  - Overall intersection Level of Service (LOS) – LOS D,
  - Overall intersection Volume to Capacity (v/c) ratios – 0.85,
  - Individual movement LOS – LOS E,
  - Individual movement v/c ratios – 0.90, and
  - 95th Percentile queue lengths do not exceed the available storage length.

  Unsignalized Intersections:
  - Individual movement LOS is LOS D, individual movement v/c 0.90, and
  - 95th Percentile queue lengths do not exceed the available storage length; and
- Warrant Analyses: the TA shall include as appropriate:
  - Intersection control determination - Consistent **Section 4.6 - Roundabouts**, roundabouts are the preferred treatment. Where a roundabout is determined by the City to not be viable, the TAC traffic signal warrant analysis shall be used,
  - TAC pedestrian crossing warrant analysis – to identify the appropriate level of treatment ranging from zebra marking with flashers, curb bulb-outs, centre refuge median or pedestrian-activated signals,
  - Left turn phase warrant analysis – If a signal is warranted, use the MOTI spreadsheet tool.

4.23.5 Report Submission

The Transportation Assessment report and all supporting data and analysis files shall be submitted electronically, signed and sealed by a Professional Engineer (P.Eng.) registered within the Province of British Columbia. Options to mitigate the assessed impacts and provide adequate network connectivity for pedestrians, cyclists, and transit users shall be comprehensively evaluated, clearly tabulated, and include proposed responsibilities and trigger thresholds.

4.24 Linear Park Trails

The design of Linear Park Trails shall be based on the context of the trail the classification of the trail based on OCP **Map 10.1 -Linear Corridors** and be guided by the **Linear Parks Master Plan.** Design shall consider siting, experiential components, vegetation, bridges and boardwalks, safety, accessibility, trail access including trail heads, signage and parking, and integrating viewpoints and rest areas. Trail Design shall follow guidelines in **Table 4.24.1- Trail Design Guidelines** as referenced in **Figure 4.24.1- Trail Design Guidelines Label Reference** and standard drawings **SS-T01** to **SS-T06.**

Figure 4.24.1- Trail Design Guidelines Label Reference

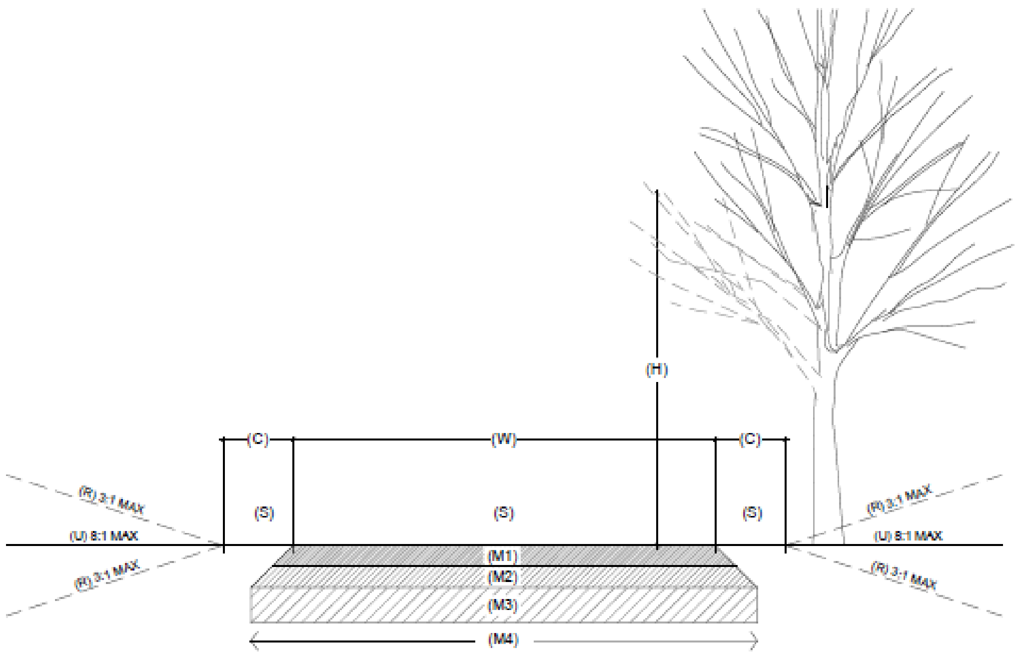


Table 4.24.1- Trail Design Guidelines

CLASS		DIMENSIONS			LONGITUDINAL SLOPE		CROSS SLOPE	MATERIALS				
Trail Class	Trail Type	(W) Width (m)	(C) Clear Zone (m)	(H) Min. Vertical Clearance	(S) Typical Slope	(S) Slope for Short Sections (max. 10m)	Cross Slope	Surface Type	(M1) Type Depth	(M2) Granular Base	(M3) Sub-Base	(M4) Compacted Sub-Grade
1	Major Urban Promenade SS-T01	4.5 or greater	0.5	3.0 m	5% max. (1:20)	8% max. (1:12)	2% min.	Asphalt	50 mm	100 mm	200 mm	95% MPD
								Concrete Or Brick	100 mm or 75 mm	100 mm	N/A	95% MPD
2	Major Multi-Use Urban SS-T02	4.5 - 3.0	0.5	3.0 m	8% max. (1:12)	12% max. (1:8)	2% min.	Asphalt	50 mm	100 mm	200 mm	95% MPD
								Concrete Or Brick	60 mm	100 mm	N/A	95% MPD
3	Major Multi-Use Rural SS-T03	4.5 - 3.0	0.5	2.5 m	8% max. (1:12)	12% max. (1:8)	2% min.	Asphalt	50 mm	75 mm	150 mm	95% MPD
								Concrete Or Brick	60 mm	100 mm	N/A	95% MPD
4	Standard Multi-Use Rural SS-T04	3.0 - 2.0	0.5	3.0 – 2.5 m	8% max. (1:12)	15% max. (1:7)	2% min.	Asphalt millings	60 mm	75 mm	150 mm	95% MPD
								Aggregate	50 mm	100 mm	N/A	95% MPD
5	Narrow Multi-Use Rural SS-T05	1.5 - 1.2	0.5	2.5 m	8% max. (1:12)	15% max. (1:7)	2% min.	Asphalt millings	60 mm	75 mm	150 mm	95% MPD
								Aggregate	50 mm	100 mm	N/A	95% MPD
6	Nature Trails SS-T06	1.2 - 0.6	0.5	2.5 m	20% (1:5) max. hiking & walking	Over 20% use steps	2% min.	Natural ground	N/A	N/A	N/A	95% MPD
					15% (1:7) max. mountain biking	15%		Aggregate if needed	50 mm	100 mm	N/A	95% MPD