

Geotechnical Design Specifications for Subdivisions

The developer of a subdivision is responsible for all aspects of the geotechnical design for that subdivision. Any geotechnical design completed for a subdivision must be completed by a Qualified Professional, registered with the Association of Professional Engineers and Geoscientists of BC (APEGBC). The Qualified Professional completing the geotechnical design, except in special circumstances as determined by the Provincial Approving Office, must follow applicable sections of the following documents:

- Ministry of Transportation Technical Circulars including the following:
(<http://www2.gov.bc.ca/gov/content/transportation/transportation-infrastructure/engineering-standards-guidelines/technical-circulars>).
 - T04-17 “Geotechnical Design Criteria”
 - T16-00 “Cold Weather Paving”
 - T01-15 “Pavement Structure Design Guidelines”
 - T04-13 “ARD Testing at Quarry and Rock Cut Sites”
 - T01-10 “Rock Stacked Retaining Walls”
 - T06-09 “EOR and Field Review Guidelines”
 - T06-15 “Climate Change and Extreme Weather Event Preparedness and Resilience in Engineering Infrastructure Design”
 - T07-09 “Record Drawings”
 - 04-12 “Subdivision Roads – Design Flexibility and Use of a Geometric Design Criteria Sheet”
- Ministry of Transportation Technical Bulletin GM2001 Rock Slope Design
(http://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/technical-bulletins/geotechnical-materials-and-pavement/tb_gm02001_rock_slope_design.pdf)
- BC Ministry of Transportation Supplement to CHBDC CSA S6-14. This also includes the BC Ministry of Transportation Seismic Retrofit Criteria (June 2005).
(<http://www2.gov.bc.ca/gov/content/transportation/transportation-infrastructure/engineering-standards-guidelines/structural/standards-procedures>)
- CSA S6-14 (Canadian Highway Bridge Design Code, CHBDC)
- Design Build Standard Specifications (Current Version)
(<http://www2.gov.bc.ca/gov/content/transportation/transportation-infrastructure/engineering-standards-guidelines/standard-specifications-for-highway-construction/design-build-standard-specifications>)
- APEGBC “Guidelines for Legislated Landslide Assessments for Proposed Residential Development in British Columbia” (May 2010)
(<https://www.apeg.bc.ca/getmedia/5d8f3362-7ba7-4cf4-a5b6-e8252b2ed76c/APEGBC-Guidelines-for-Legislated-Landslide-Assessments.pdf.aspx>)
- Flood Mapping in BC (APEGBC 2017)
(<https://www.apeg.bc.ca/getmedia/8748e1cf-3a80-458d-8f73-94d6460f310f/APEGBC-Guidelines-for-Flood-Mapping-in-BC.pdf.aspx>)

- Legislated Riparian Assessments in BC (APEGBC 2017)
(<https://www.apeg.bc.ca/getmedia/d2019fb5-eb9b-48fd-8f5e-c5cdaede57af/APEGBC-CAB-ABCFFP-Guidelines-for-Legislated-Riparian-Area-Assessments.pdf.aspx>)
- BC Ministry of Transportation “Manual of Control of Erosion and Shallow Slope Movement” (August 1997)
(http://www.th.gov.bc.ca/publications/eng_publications/environment/references/Man_Control_Erosion.pdf)
- BC Supplement to TAC Geometric Design Guide (2007)
(<http://www2.gov.bc.ca/gov/content/transportation/transportation-infrastructure/engineering-standards-guidelines/highway-design-survey/tac-bc>)
- Utility Policy Manual (BC MoTI 1995)
<http://www.th.gov.bc.ca/permits/utility%20permit%20manual.pdf>

The Qualified Professional completing the geotechnical design, as the designer shall perform Engineer of Record requirements for the design and the construction as outlined in the Ministry’s Technical Circular T06-09 “EOR & Field Review Guidelines”

(<http://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/technical-circulars/2009/t06-09.pdf>).

Prior to the construction of a subdivision, the developer may be required to submit a Quality Management Plan (QMP). The QMP must follow the requirements outlined in Section 101 of the Ministry’s Design Build Standard Specifications.

Aspects of a geotechnical design that may be included as part of the subdivision design include, but is not limited to:

- Seismic Design:

Seismic design is required on all structures and slopes that will be on/or adjacent to highways. This includes walls retaining an embankment supporting a highway or walls that are supporting a cut above the highway where failure of the wall or cut will enter Ministry right-of-way. The BC Ministry of Transportation Supplement to CSA S6-14 and CSA S6-14 defines the seismic performance levels for structures; Section 4.4.6.4 in the BC Supplement to CSA S6-14 is specific to retaining walls, slopes and embankments. Low Volume Roads, as defined in Section 1.3.3 of the BC Supplement to CSA S6-14, shall be designated under the importance category of “other”. All structures and slopes shall be designed such that existing adjacent and dependent structures meet their seismic performance requirements. Additionally, inertia forces of the facing component on a structure shall be accounted for during seismic loading.

For preliminary screening, the seismic coefficient used in the pseudo-static limit equilibrium slope stability analysis should be equal to the 2% in 50 year Peak Ground Acceleration (PGA) (i.e. $k=1.0(\text{PGA})$). If the Factor of Safety (FS) is > 1 , when $k=1.0(\text{PGA})$ is used no further stability analyses are required. However, if the Factor of Safety is < 1 , then the further stability analyses are required as outlined in the APEGBC “Guidelines for Legislated Landslide Assessments for Proposed Residential Development in British Columbia.” (May 2010)

For site specific numerical analyses of site response and soil structure interaction, a site specific seismic hazard value can be obtained from the Geological Survey of Canada

<http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/zoning-zonage/haz-en.php>

Liquefaction potential of the subsoil shall be evaluated for structures, walls and embankments and the design will incorporate ground improvements and other methods of addressing potential liquefaction in accordance with the BC Supplement to S6-14 and CSA-S6-14.

- Natural Hazard Risk:

It is most important that natural hazards be identified on land that is about to be subdivided. Natural hazards may include, but are not limited to flooding, land slip, or avalanche. For assessing landslide hazards the most recent version of the APEGBC Guidelines for Legislated Landslide Assessment for Residential Developments in BC must be followed. This includes fully executing the Landslide Assessment Assurance Statement in Appendix D. Also, the criteria outlined in the Subdivision Preliminary Layout Review – Natural Hazard Risk document should be followed. For assessing flood hazards, the most recent version of the APEGBC Professional Practice Guidelines - Legislated Flood Assessments in a Changing Climate in BC shall be followed.

- Culverts:

Culverts shall adhere to the design requirements of the BC Supplement to TAC Geometric Design Guide, Canadian Highway Bridge Design Code, the BC Supplement to CSA S6-14 and/or CSA S6-14. Consideration shall be given to hydraulic design, and the structural design. As a minimum sub-division roads shall be constructed with minimum 600mm culverts with 2.8mm minimum wall thickness, and shall comply with the Ministry's Recognized Product List.

An evaluation shall be performed, by a Qualified Professional, downstream of any new culvert location to determine any potential consequences. The mitigation measures shall be provided as recommendations to the developer.