3.2 Definitions

Add the following definition:

Supervision – monitoring of the passage of a permit vehicle by a BC registered professional engineer familiar with bridge design or their designate to ensure bridge crossing restrictions of a permit are followed including weighing of a permit vehicle if required by the overload permit. The engineer shall have the authority to stop further movement of the permit vehicle if in non-compliance the bridge crossing requirements of a permit. The engineer shall submit a record detailing their observations to the Ministry upon completion of the move, including records of vehicle and axle weight, dimension measurements and any other requirements specified in the bridge crossing conditions of the permit.

3.5 Load factors and load combinations

3.5.1 General

When special load vehicle lanes are mixed with normal traffic loaded lanes, each lane will be assigned its corresponding different live load factor based on the traffic in the lane. For example, a special load vehicle lane will get a special load live load factor and the other lanes will get normal traffic live load factors.

Add the following to Table 3.1 Load factors and load combinations:

	Permanent Loads			**Transitory Loads**				**Exceptional Loads**			
Loads	***D***	***E***	***P***	***L****	***K***	***W***	***V***	***S***	***EQ***	***F***	***A***	***H***
Ultimate Limit States‡												
ULS Combination 5A	α_D	α_E	α_P	λ	*0*	*0*	*0*	*0*	*1.00*	*0*	*0*	*0*

λ shall be equal to 0.30 unless otherwise Consented to by the Ministry.

ULS Combinations 5 and 5A shall only be used for force-based design (FBD) when FBD is permitted in accordance with Table 4.11.

Effects of live load on bridge inertia mass shall not be included in dynamic analysis.

Commentary: *If a vertical design spectrum is considered explicitly in a site-specific study, the load factor for dead load,* α_D*, shall be taken as 1.0 in ULS Combination 5 and 5A.*

Add the following two columns to: Table 3.2 Live load factors ultimate limit states:

Load	Live load factor Special loads travelling on bridges without Supervision meeting crossing restrictions in Clause 3.8.3.2.3 Short spans	Other Spans
ULS Combination 1	1.70	1.50
ULS Combination 2	1.60	1.40
ULS Combination 3	1.40	1.25

Commentary: *These load factors are consistent with the PS load factor approach in Section 14.*

Calibration of load factors and resistance factors in Table 3.2 of S6:19 and the Ministry supplement to CHBDC are based on a minimum annual reliability index of 3.75 for traffic loading, including special load vehicles with no travel restriction or supervision, and 3.50 special load vehicles travelling alone on a bridge under supervision in accordance with Clause 3.8.3.

3.6 Dead loads

Add the following paragraphs:

Dead loads shall include an allowance for an additional 50 mm concrete overlay over the full area of the bridge deck to account for future deck rehabilitation and also to partially account for any unanticipated dead loads that may be added to the structure following construction.

For bridges with waterproof membrane and asphalt overlay on a concrete deck, the dead load for design shall include the design asphalt thickness of 100 mm of asphalt (see Section 2.7), and no allowance for future additional overlay thickness is required.

Add the following to **Table 3.4 Unit material weights**:

Material	Unit Weight, kN/m^3
Wood	
Untreated Douglas Fir	5.4
Creosote treated sawn timber and glulam, >114 mm	6.6
Creosote treated truss chords, < 114 mm	7.0

3.8 Live loads

3.8.3 Traffic Loads

3.8.3.1 Normal traffic

3.8.3.1.1 CL-W loading

Delete the third paragraph and replace with the following:

A loading of CL-800 shall be used for the design of bridges under the authority of the Ministry.

3.8.3.1.2 CL-W Truck

Commentary: *The Ministry has increased the weight of the design vehicle from BCL-625 to CL-800 as there has been a trend towards heavier term permit overload vehicles approaching 80T GVWs, which must travel with no bridge crossing restrictions or conditions. Single trip overload weights have also been increasing so this will help to have fewer bridge crossing restrictions/conditions and permit denials.*

3.8.3.2 Special loads

Add the following clauses:

3.8.3.2.3 Geographically Specific Special Loads

In addition to CL-800 loading, structures located in the specific geographic regions indicated below shall also be designed for the indicated special loads. A refined method of analysis shall be used to distribute live loads. Analysis and dynamic load allowance shall be based on the crossing restrictions indicated. Axle spacings and weights for Special Trucks EPLL1 and EPLL2 are shown in Figures 3.8.3.2.3 i, ii and iii. Special Lane load shall be considered for EPLL1 loading only.

The Plans shall show the design vehicle diagrams, design crossing restrictions, and the ULS live load factors used for the Special Loads.

3.8.3.2.3.1 Special Load EPLL1

EPLL1 shall have the following crossing restrictions:

EPLL1 loading shall be placed in one lane and allowed to travel mixed with normal traffic. Both truck and lane loading shall be considered.

EPLL1 shall apply in the following specific geographic regions:

<u>Sparwood Area</u>

Hwy 3 between the BC/AB border and the south entrance to Douglas Fir Road in Sparwood, Highway 43, Corbin Road and Fording River Road.

<u>Peace District</u>

- H97 from Prince George to Hasler
- H29N from Chetwynd to Hudsons Hope
- Chowadee Rd #187U
- Cypress Cr Rd #187
- Graham R Rd #123
- Upper Halfway Rd #117
- Fort Nelson Airport Connector
- Fort Nelson Airport Drive
- Rolla Rd #3 south from Rd #222
- Peace River Sweetwater Rd#6 from Rolla Road Rd#3 to Highway H97
- Braden Rd #22
- Jackfish Lake Rd #12
- Rd #137
- Rd #101
- Rd #146
- Rd #146 east
- Beaton Montney #271
- Montney Hwy #114
- Becker #285W
- Prespatou Rd #193
- Buick Cr Rd #154
- Mile 30 Rd #169
- Triad Rd # 169A
- Rosefield Rd #142
- Doig Rd #188
- Siphon Cr Rd #184

3.8.3.2.3.2 Special Load EPLL2

EPLL2 shall have the following crossing restrictions:

- Centerline of the Special Load to remain within 600 mm of the centerline of the available bridge roadway between barriers in the direction of travel of the EPLL2 vehicle.
- For undivided bridge roadways - No other vehicles on the bridge while the Special Load crosses
- For divided bridge roadways - No other vehicles on the bridge travelling in the same direction of the EPLL2 vehicle and with normal traffic allowed on the other side of the barrier(s),
- Crossing speed to be less than 10 km/h
- Travelling on bridge without supervision

EPLL2 shall apply in the following specific geographic regions:

<u>Peace District</u>

- Highway 2 from the BC/Alberta border to the junction with Dangerous Goods Route
- Highway 52

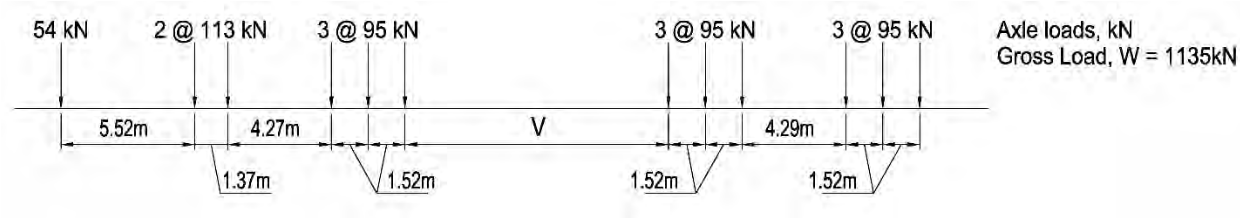
- Highway 29S from Chetwynd to Highway 52
- Highway 97 from Hasler north to Mile 83.5 on the Alaska Highway/Highway 97
- Highway 49
- Highway 29N from Charlie Lake to Canyon Dr #520R
- Highway 77
- Dangerous Goods Route
- Rd #259 (Fort St John Underpass Bypass)
- Rd 22 / Braden Rd
- Rolla Rd # 3 between Highway 2 and Rd #222
- Rd #148
- Rd#269
- Cecil Lake Rd #103
- Beatton River Airport Rd #151
- Beryl Prairie Rd #118
- Beryl Prairie Arterial Rd #715R
- Darrel Cr Rd #115
- Canyon Dr #520 from Highway 29 to Rd 715R

<u>Other Districts</u>

- Highway 23 between Shelter Bay and the Mica Dam
- Highway 1 between the north and south sections of Highway 23.
- Highway 22 between the BC/US border at Paterson and Highway 3B near Rossland
- Highway 3B between Highway 3 near Nancy Greene Provincial Park and Highway 22A at Waneta Junction
- Highway 3 between Highway 3B near Nancy Greene Provincial Park and the Ootischenia Interchange
- Highway 22 between Castlegar and Trail
- Highway 22A between Highway 3B at Waneta Junction and the BC/US border
- Highway 3A between the Ootischenia Interchange and Blewett Road
- Broadwater Road in Castlegar between the Keenleyside Dam and Highway 3A
- Highway 97 between Highway 39 (near the Parsnip River Bridge No. 1185) and the Old Caribou Highway (south of Prince George).

Figure 3.8.3.2.3 i

EPLL1

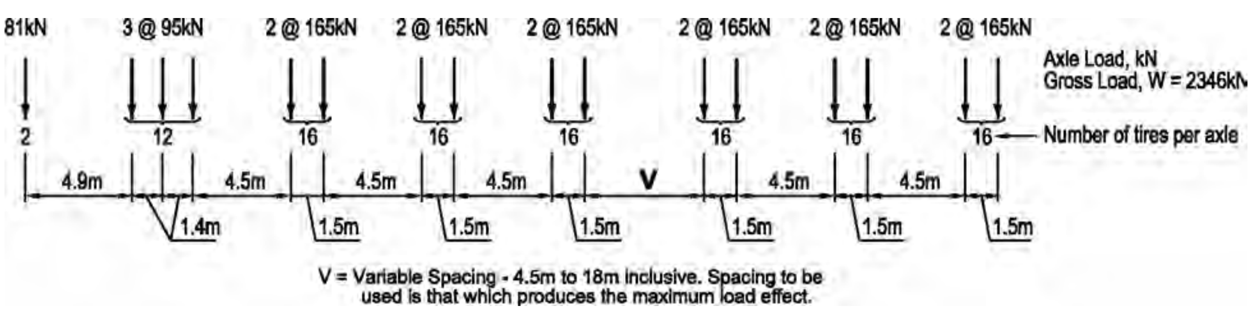


V = Variable Spacing = 10m to 16m. Spacing to be used is that which produces the maximum load effect

Transverse wheel spacings and the clearance envelope for EPLL1 truck load shall be similar to those indicated for the CL-W truck in Figure 3.2 of CHBDC.

Figure 3.8.3.2.3 ii

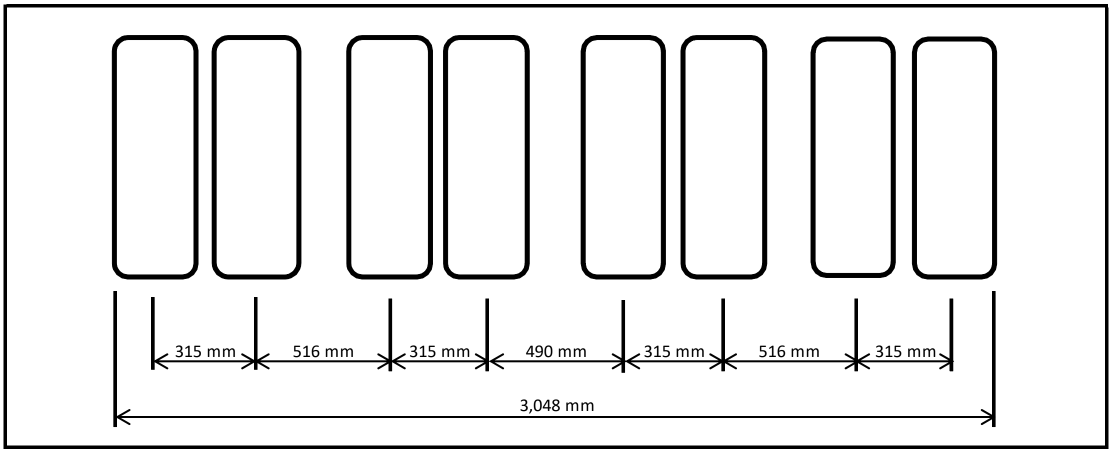
EPLL2



For the EPLL2 truck, transverse wheel spacings for 16 tire groups (8 tire axles) shall be as indicated in Figure 3.8.3.2.3 iii. Transverse wheel spacings for 2 and 12 tire axles shall be similar to those indicated for the CL-W truck in Figure 3.2 of CHBDC. The clearance envelope for the EPLL2 truck shall be assumed to extend 0.3 m on each side beyond the out-to-out width of tires shown in Figure 3.8.3.2.3 iii.

Figure 3.8.3.2.3 iii

Transverse Wheel Spacings for 16 Wheel Tandem Group of EPLL2



Commentary: *The extraordinary vehicle configurations described in this section are based on overload evaluation requests in different geographic regions and anticipated future demands. The oil and gas industry is prevalent throughout the Peace District. Compressors, pipe rack modules and drilling equipment frequently need to be hauled in and out of remote locations within the District to and from Alberta. Future supply and servicing of this industry from Prince George is contemplated and therefore full length of the John Hart Highway is included in this geographic region. Maintenance and upgrading of existing, and construction of new hydro power facilities on the Peace, Columbia and Kootenay Rivers requires the transport of turbine runners and transformers. Several coal mines are found in the area around Sparwood. Bridges in this area have been designed or load rated for EPLL1 loading to allow for the transport of mining equipment between different mining operations.*

3.8.4 Application

3.8.4.1 General

Revise (c) to the following:

For the FLS, the traffic load shall be one CL-800 Truck that causes maximum effects only, increased by the dynamic load allowance and placed at the centre of one travelled lane. The Lane Load shall not be considered.

For the SLS Combination 2, the traffic load shall be one CL-800 Truck or the Special Truck that causes maximum effects only, increased by the dynamic load allowance and placed at the centre of one travelled lane. The Lane Load shall not be considered.

Commentary: *Special load vehicles are rare compared to other live loads and therefore fatigue design for special load vehicles is not required.*

Add the following at the end of this clause:

(c) Design shall address both the Special Truck and Special Lane loading for special load EPLL1. Design for the EPLL2 special load need only address the Special Truck loading since there is no Special Lane loading for EPLL2. The design lane(s) that the EPLL1 and EPLL2 special load occupies and other lanes that are loaded shall be selected to maximize the load effect. The normal traffic in other loaded lanes shall address both truck and lane loading.

3.8.4.3 Local components

Add the following:

For local components, the axle loads of a CL-625 truck shall be used.

Commentary: *The design vehicle has been increased to CL-800 to capture the global demands of permit trucks; however no increases are anticipated for allowable axle loads. Increasing the design loading for local components would lead to unnecessary conservatism.*

3.8.4.4 Wheels on the sidewalk

Add the following:

For wheels on the sidewalk, a CL-625 truck shall be used.

3.8.4.5 Dynamic load allowance

3.8.4.5.3 Components other than buried structures

Delete the last paragraph and replace with the following:

The dynamic load allowance given in Items (a) to (d) may be reduced by applying the modification factors from Clause 14.9.3 for a Special Truck travelling at reduced speed.

3.16 Construction load and loads on temporary structures

3.16.1 General

Insert the following paragraphs:

It shall be the responsibility of the Contractor to ensure that loads developed as a result of the construction methods can be properly carried unless a specific construction methodology is required by the designer. Assumed construction staging and loads shall be indicated on the Plans by the designer if a specific methodology is required.

All temporary support during construction shall be removed unless otherwise Consented to by the Ministry.

A3.2 Wind loads on highway accessory supports and slender structural elements

A.3.2.1 General

Delete the first paragraph and replace with the following:

Highway accessory supports include overhead and cantilever sign structures, overhead and cantilever traffic signal structures and luminaire structures. Highway accessory supports shall be designed for horizontal drag loads due to natural wind buffeting at the serviceability and ultimate limit states. The fatigue limit state designs required by Clause 12.5.5.4.1, shall use the design loadings in accordance with AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals 11.7 Fatigue Design Loads. Each of the AASHTO fatigue loading types shall be applied separately.

Galloping load from the AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals 11.7 Fatigue Design Loads does not apply for cantilever traffic signal support structures with approved vibration mitigation devices, and trussed or double mast-arm sign support structures.

Fatigue Importance Factor I_F shall be in accordance with AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals 11.6 Fatigue Importance Factors.

Fatigue Limit State Pressure Range for luminaire structures with heights of 16 m or greater design, P_{FLS} shall be in 310 Pa.

Slender structural elements, other than highway accessory supports, shall be designed for horizontal drag loads due to natural wind buffeting at the SLS and ULS and for horizontal drag loads due to natural wind buffeting, vertical loads due to truck induced wind buffeting and across-wind loads due to vortex shedding excitation at the FLS.

Delete the ULS Combination A2 from the Table A3.2.1.

Commentary: *The Ministry adopted AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals for fatigue design loading approach for highway accessory structures. Vortex shedding effect calculation in accordance with the S6:19 is not practical for the design of this type of structures and can be replaced with the equivalent static equations presented in the AASHTO LRFD Specification. All units shall be converted to Metric units.*

A3.3 Vessel collision

A3.3.5.3 Probability of aberrancy

A3.3.5.3.1 General

Replace the first sentence with the following:

Unless Consented to by the Ministry, the probability of vessel aberrancy, PA (the probability that a vessel will stray off course and threaten a bridge) shall be determined by the following approximate method:

Replace the definition of *BR* with the following:

BR = aberrancy base rate (0.6×10^{-4} for ships and 1.2×10^{-4} for barges)

Commentary: *The Ministry does not keep a data base of vessel collision with its structures. The values for BR are taken from AASHTO LRFD 2014 and are based on analysis of historical data for high use waterways. If site specific historical data is available, a statistical analysis may be used.*