

BRIDGE LOADING AND RATING

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LOADS

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Types of Loads

- Bridges are subjected to many different types of loads.
- There are three important types of bridge loads:
 - Dead load
 - Live load
 - Other loads (wind, snow etc.)



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Dead Load

- Dead load consists of the self-weight of the bridge.
- The load is usually stationary and permanent.
- Typical dead loads are:
 - Beams and girders
 - Concrete deck
 - Asphalt wearing surface
 - Curbs
 - Railing



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Live Load

- Live loads are usually temporary and are applied in a short duration of time.
- The loads are usually moving.
- Typical types of live loads are:
 - Truck load
 - Dynamic load allowance (impact)
 - Pedestrian load
 - Longitudinal live load



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Other Loads

- The bridge is subjected to other loads beside dead and live load.
- Other typical bridge loads are:
 - Wind load
 - Earth pressure
 - Ice pressure
 - Temperature effects
 - Collision loads



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Rating Bridges

- Many older bridges were designed to carry smaller and lighter trucks.
- Are these older bridges capable of carrying today's heavier and longer legal truck configurations?
- Bridges are rated to determine the load carrying capacity of the bridge.
- Generally, only the superstructure is load rated.
- The ratings normally assume that the bridge is in good structural condition.

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Real Truck Configurations

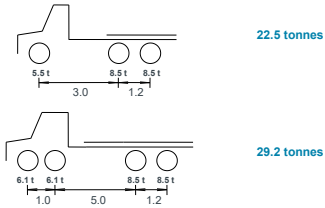
- There are many truck configurations that can legally travel on Alberta roads.
- The truck configurations are grouped into three categories:
 - Single unit trucks
 - Tractor semi-trailers
 - Truck trains
- Within each of the categories there are many different weights and axle configurations.

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Typical Legal Single Unit Trucks

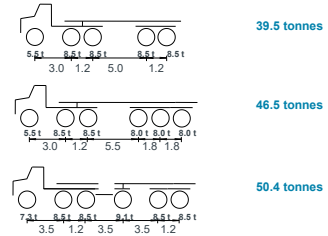


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Typical Legal Tractor Semi-Trailer Units

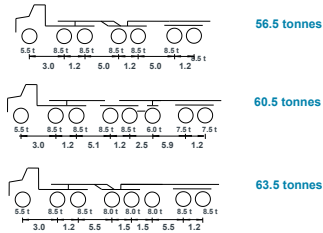


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Typical Legal Truck Trains



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Rating Truck Models

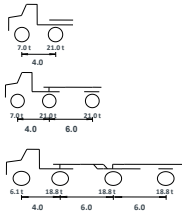
- Each one of the trucks produces unique forces and stresses in the bridge.
- It is not practical to load rate the bridge for each one of the real truck configurations.
- A model truck is used to represent each one of the truck configuration categories.
- CS1 Rating Truck Model - Single unit trucks
- CS2 Rating Truck Model - Tractor semi-trailer
- CS3 Rating Truck Model - Truck trains

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Rating Truck Models



CS1 Rating Truck Model
28 tonnes

CS2 Rating Truck Model
49 tonnes


CS3 Rating Truck Model
63.5 tonnes for Primary & Secondary Highways
63.5 tonnes for Local Roads (Bulletin 8, 2021)

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Load Rating a Bridge

- Step 1
 - calculate load carrying capacity of critical member
- Step 2
 - calculate Dead Load this member is required to carry
- Step 3
 - member capacity less Dead Load, etc. is Live Load that the member can carry

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Rating Equation

Rating Equation $LLCF = \frac{R - D}{L (1 + I_b)}$

Where:


- LLCF = Live Load Capacity Factor (fraction of rating truck the bridge can safely carry for the load effect considered)
- R = Resistance, load effect the bridge can safely carry
- D = Dead load effect of the bridge
- L = Live load effect due to the rating truck model
- I_b = Impact (dynamic) factor for live load


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Rating Equation (cont'd)

- Live Load Capacity Factor (LLCF) is calculated for each rating truck model.
- A LLCF of 1.0 or greater indicates that the bridge is capable of safely carrying the current legal load for the particular truck category.



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Legal Loads on Alberta Roadways

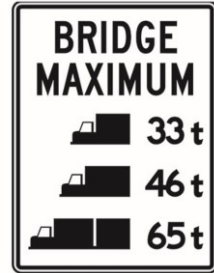
Truck Type	Provincial Highways	Local Roads
Single (CS1)	28	28
Semi (CS2)	49	49
Truck Train (CS3)	63.5	63.5 (2021/previously 54)

Note: Loads are expressed in tonnes

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Bridge Load Evaluation Manual”

For further information refer to Alberta Transportation “Bridge Load Evaluation Manual” at:

<https://open.alberta.ca/publications/7027044>

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