

BRIDGE LOADING AND RATING

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1

LOADS

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2

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.)



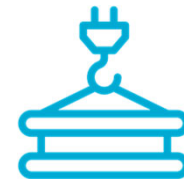
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3

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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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4

4

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.

7

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Real Truck Configurations

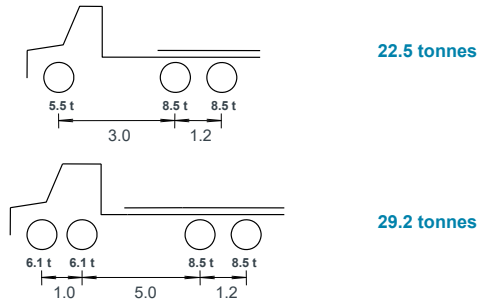
- There are many truck configurations that can legally travel on Alberta roads.
- The truck configurations are grouped into three categories:
 - Single unit trucks
 - Tractor semi-trailers
 - Truck trains
- Within each of the categories there are many different weights and axle configurations.

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Typical Legal Single Unit Trucks

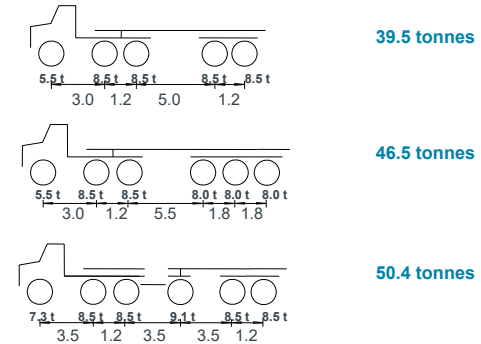


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Typical Legal Tractor Semi-Trailer Units

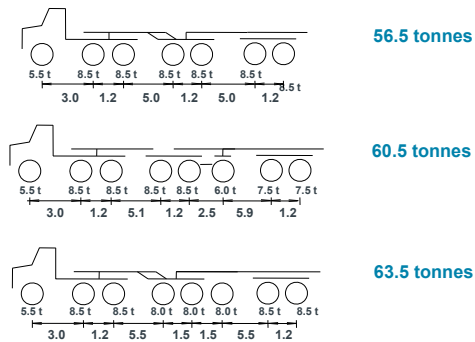


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10

Typical Legal Truck Trains



11



11

Rating Truck Models

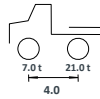
- Each one of the trucks produces unique forces and stresses in the bridge.
- It is not practical to load rate the bridge for each one of the real truck configurations.
- A model truck is used to represent each one of the truck configuration categories.
- CS1 Rating Truck Model - Single unit trucks
-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

12



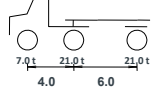
12

Rating Truck Models



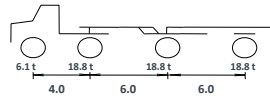
[CS1 Rating Truck Model](#)

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)

13

13

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

14

14

Rating Equation

Rating Equation

$$\text{LLCF} = \frac{R - D}{L (1 + I_D)}$$

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_D = Impact (dynamic) factor for live load

15

15

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.



16

16

Legal Loads

Highway Type	CS1 Truck Single Unit	CS2 Truck Semi-Trailer	CS3 Truck Truck-Trains
Primary	28	49	63.5
Secondary	28	49	63.5
Local	28	49	63.5 (2021/previously 54)

Note: Loads are expressed in tonnes

17



18

18

Bridge Load Evaluation Manual

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

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

19



19

Questions?



20