



**Ontario
Ministry of
Natural
Resources**

<small>Subject</small> SNOWMOBILE BRIDGE DESIGN GUIDELINES		<small>Policy</small> PL 10.08.00
<small>Compiled by - Branch</small> Lands & Waters	<small>Section</small> Land Management	<small>Date Issued</small> August, 1992
<small>Formerly Referenced As</small> Access Roads Manual: Snowmobile Bridge Design Guidelines		<small>Number</small> RA 3-3

ACCESS ROADS MANUAL	Number RA 3-3
	Section OPERATION
	Subject SNOWMOBILE BRIDGE DESIGN GUIDELINES

Design Guidelines:

The Ministry of Natural Resources has a policy and guidelines for bridges on Crown land. The policy requires that all bridges must be designed to carry the loads expected to be applied to them. At present there is only one live load condition set out in the guidelines, the Ontario Highway Bridge Truck Load (OHBD). This represents the heaviest licensed trucks operating in Ontario. This load is suitable for access roads open to public travel because during their lifetime they will likely experience heavy loads like dump trucks, pulp trucks or floats carrying heavy equipment.

Snowmobile trails are built on Crown land for the use of snowmobilers. The loading condition is different and much lighter than the OHBD Truck. Discussions were held with the Ontario Federation of Snowmobile Clubs to develop economical and safe loading standards for bridges on snowmobile trails.

It is recognized that loading conditions will vary from trail to trail, depending on site accessibility and use made of the bridge by the snowmobilers and by the public. The design of a bridge for less than full highway loads will require vehicle restrictions (eg. signs, deck width limits) to prevent overloading and possible collapse.

Winter Loads

During the winter, snow loads must be considered. In accordance with the Ontario Building Code, bridges not in use must be capable of supporting 80% of the Ground Snow Load as defined in the Code. Bridges in use, should be capable of supporting 50% of the Ground Snow Load plus vehicular live loads. Vehicular loads could be either one heavy grooming machine with drag, or a line of snowmobiles.

A variety of grooming machines are available on the market; a summary is presented in Table No. 1. At present, it appears that heaviest vehicle in use is the Tucker 2000C machine with a 10,000 lb operating weight, including drag. Other heavier units are on the market but not in use. A reasonable minimum design criteria would be two loads of 5,000 lb each, spaced 10 feet apart along the bridge. The bridge would have a 5 ton load limit and the owner club must be careful not to acquire equipment weighing more than this limit.

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Snowmobiles normally weigh between 400 and 580 lbs. The heaviest unit weighs 770 lbs. In addition to these weights, the driver and passenger must be added. It is considered reasonable to apply snowmobile loads to the bridge as a continuous uniformly distributed land load of 125 pounds per lineal foot.

Summer Loads

It is important to develop a Use Management Strategy for the section of trail on which a bridge is located. The strategy will define the types and sizes of vehicles likely to cross the bridge during its lifetime. In the absence of an approved Use Management Strategy for the trail, all bridges over 10 feet in width on gravel roads should be designed for the OHBD truck load.

If the snowmobile trail is planned for future use as a public road to access resources or cottages, design for the full OHBD truck is required. Some assistance from the Ministry may be available in recognition of this future broader use.

If a bridge is removed at the end of the winter season, design for summer loading is not necessary. A mechanism must be in place to ensure this is done (eg. condition of LUP).

Some snowmobile trails are cut through the bush with no gravel surface, designed for winter travel only. It is very difficult to prevent the summer use of these trails by a 4 wheel drive off-road type vehicles. All bridges on ungravelled trails would be designed to support a minimum summer load of a two axle pickup with a Gross Vehicle Weight of 7,500 pounds.

Some snowmobile trails are located on old abandoned roads where recreational vehicles may travel the bridges during the snow-free time of year. Bridge design should provide for safe passage by heavy recreational vehicles, like motorhomes and campers. On these trails an appropriate design load is considered to be 20,000 lbs. All bridges on gravelled roads would be capable of carrying this minimum load. A guide for wheel load distribution and spacing is provided in the AASHTO Bridge Design Code.

A bridge, not designed for OHBD truck load which is located in an urban area, must be checked to ensure it can carry live load for pedestrian bridges, as defined in engineering codes.

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Minimum Design Criteria For Snowmobile Bridges

- . Bridges not capable of supporting the OHBD truck load are to be posted with a load limit sign.
- . Bridges made of untreated wood are to be either replaced within 10 years or have their condition monitored and evaluated by a qualified engineer.
- . Recycled materials proposed for use in bridges are to be inspected and approved by a qualified engineer before use.
- . Substructures, stringers and decking must be designed for dead load, live load and impact moments and shears. Suggested minimum live load requirements are set out below.
 - All bridges must support 80% of Ground Snow Load without vehicle load.
 - All bridges 5 feet or more above creek bottom must be provided with a hand railing. The railing is to be about 42" high and capable of withstanding 50 lbs. per lineal foot horizontal and vertical loads applied simultaneously.
 - Bridges must be designed to carry 50% of Ground Snow Load and a lane load of 125 pounds per lineal foot. If the bridge width exceeds 6 feet, the designer must consider the possibility of two lanes of traffic over all or part of the bridge.
 - Bridges must be designed to carry the largest grooming machine expected to be used during the lifetime of the bridge. For bridges more than 6 feet wide, the minimum groomer loading is two 5,000 lb. loads spaced 10 feet apart. snowmobile clubs must be aware of bridge capacities when selecting grooming machines.
- . Bridges must be designed to support the type of loads that may be applied to the bridge in summer, as determined by MNR. Minimum criteria are:
 - Roads with gravel surface and where there are no use restrictions - full OHBD truck loads.

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- Roads with gravel surface where approved Use Management Strategy includes load restrictions and a mechanism to maintain warning signs - 20,000 lb. vehicle.
- Trails with no gravel surface which are only accessible by off-road 4 wheel drive vehicles - 7,500 lb. vehicle.
- Bridges less than 10 feet wide in urban areas, design for pedestrian loads as per Ontario Building Code or Ontario Highway Bridge Design Code.

The strength of members used for bridge construction is to be determined in accordance with current engineering practice using stresses recommended in applicable codes. Where decay, corrosion, holes or notches have reduced section sized, the minimum section will be used for analysis.

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Table No. 1 - Details About Snowmobiles and Trail Groomers

<u>Groomers</u>	<u>Operating Weight</u>	<u>Length</u>	<u>Width</u>
Bombardier BR-100+	3,910 lbs	124"	88"
Bombardier BR-60+	6,600 lbs	144"	92"
Bombardier SV-252	6,600 lbs	159"	92"
Kassbohrer PB100DR	5,000 lbs	126"	98"
Kassbohrer PB130D	6,870 lbs	140"	97"
Kassbohrer PB150D	6,320 lbs	140"	97"
Tucker 2000C-28-4-2	7,600 lbs	183"	96"
ASV Model 2800	3,600 lbs *	150"	69"
Sur-Trac Groomer All Season Vehicule 2120	6,000 lbs *		82"
Sur-Trac Groomer All Season Vehicule 4610	11,800 lbs *		103"
Sur-Trac Groomer All Season Vehicule 6610	12,600 lbs *		108"
Drag weights (towed behind groomer)	1,500 to 3,000 lbs		
<u>Snowmobiles</u>			
Average Heavy Snowmobile (with 2 passengers @ 350#)	900 lbs	120"	24"
Heaviest Snowmobile (with 2 passengers @ 350#)	1,120 lbs	121"	43"

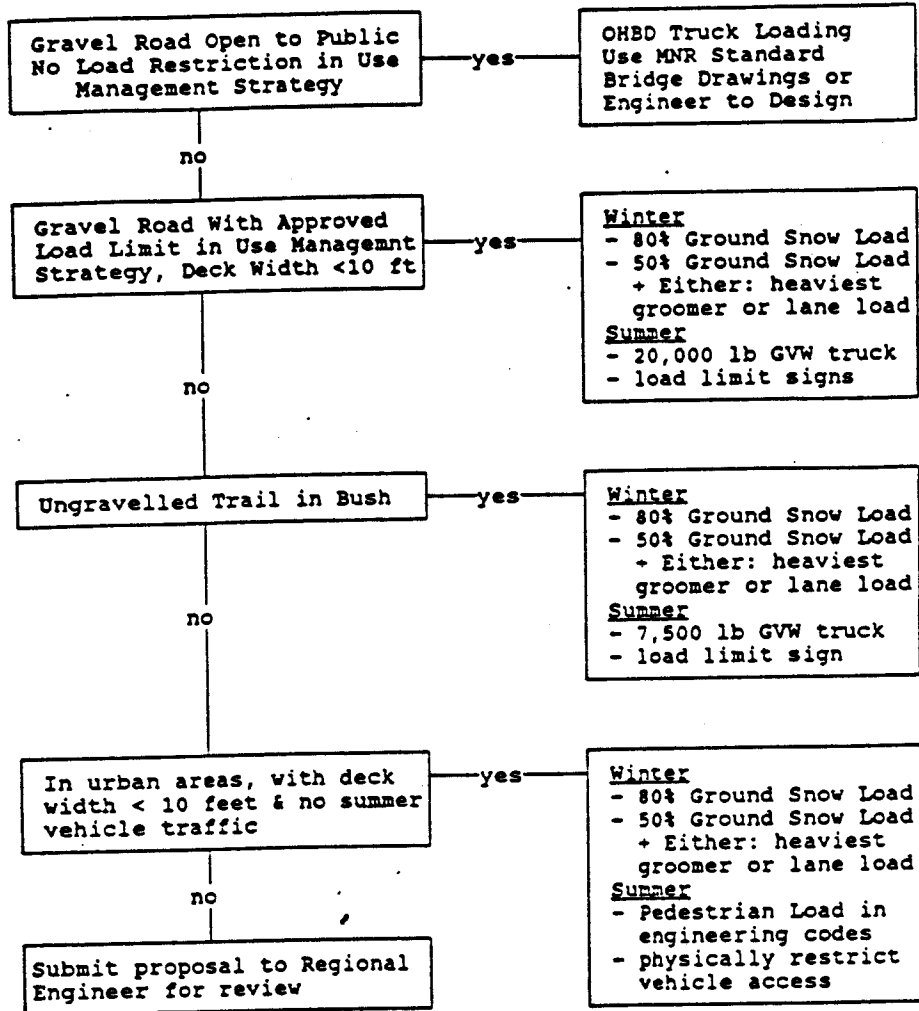
* 600 lbs added to basic vehicle weight for driver and fuel.

(Information provided by Ontario Federation of Snowmobile Clubs).

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Snowmobile Bridges - Decision Tree



Note: For bridges removed at the end of each winter season, summer design load does not apply.

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Minimum Pole and Log Sizes For Snowmobile Bridges

Type 1 Bridges:

For Bridges having a deck no more than 6 feet wide and trail use limited to snowmobiles - NO GROOMER. On trails WITHOUT GRAVEL SURFACE. Posted sign says "Snowmobiles Only", or approved equivalent.

Assumes good poles or logs with no decay. They must be either pressure treated or checked for decay after 10 years in service. Eastern white cedar is not to be used for stringers.

Design live load conditions applicable are:

- Snow load at 50% of Ground Snow Load plus one lane of snowmobiles at 125 lbs/lineal foot.
- Snow load at 80% of Ground Snow Load and bridge not in use.
- Summer load of 7500 lb GVW 4 wheel drive off-road pickup.

Bridge Span	Mid-Span Log Dia Log Spacing=1.2 x Log Dia	Mid-Span Log Dia Log Spacing=2 x Log Dia
8 ft	6 inches	6 inches
10 ft	6 inches	7 inches
12 ft	6 inches	8 inches
14 ft	7 inches	8 inches
16 ft	7 inches	9 inches
18 ft	8 inches	10 inches
20 ft	8 inches	10 inches
22 ft	9 inches	10 inches
24 ft	9 inches	11 inches
26 ft	10 inches	12 inches
28 ft	11 inches	13 inches
30 ft	11 inches	13 inches

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Minimum Pole and Log Sizes For Snowmobile Bridges

Type 2 Bridges:

For Bridges having a deck no more than 10 feet wide and trail groomers weigh less than 5 tons. On trails WITHOUT GRAVEL SURFACE. Posted sign says "Snowmobile Bridge, Maximum 5 Tons", or approved equivalent.

Assumes good poles or logs with no decay. They must be either pressure treated or checked for decay after 10 years in service. Eastern white cedar is not to be used for stringers.

Design live load conditions applicable are:

- Snow load at 50% of Ground Snow Load plus two lane of snowmobiles at 250 lbs/lineal foot.
- Snow load at 50% of Ground Snow Load plus groomer load of two 5,000 lb loads spaced ten feet apart.
- Snow load at 80% of Ground Snow Load and bridge not in use.
- Summer load of 7500 lb GVW 4 wheel drive off-road pickup.

Bridge Span	Mid-Span Log Dia Log Spacing=1.2 x Log Dia	Mid-Span Log Dia Log Spacing=2 x Log Dia
8 ft	6 inches	6 inches
10 ft	6 inches	7 inches
12 ft	6 inches	8 inches
14 ft	7 inches	9 inches
16 ft	8 inches	10 inches
18 ft	9 inches	11 inches
20 ft	9 inches	12 inches
22 ft	10 inches	13 inches
24 ft	11 inches	14 inches
26 ft	12 inches	15 inches
28 ft	13 inches	16 inches
30 ft	14 inches	17 inches

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Minimum Pole and Log Sizes For Snowmobile Bridges

Type 3 Bridges:

For Bridges having a deck no more than 10 feet wide and trail groomers weigh less than 5 tons. On gravel surfaced road having use restricted to light vehicles. Posted sign says "Snowmobile Bridge, Maximum 5 Tons", or approved equivalent.

Assumes good poles or logs with no decay. They must be either pressure treated or checked for decay after 10 years in service. Eastern white cedar is not to be used for stringers.

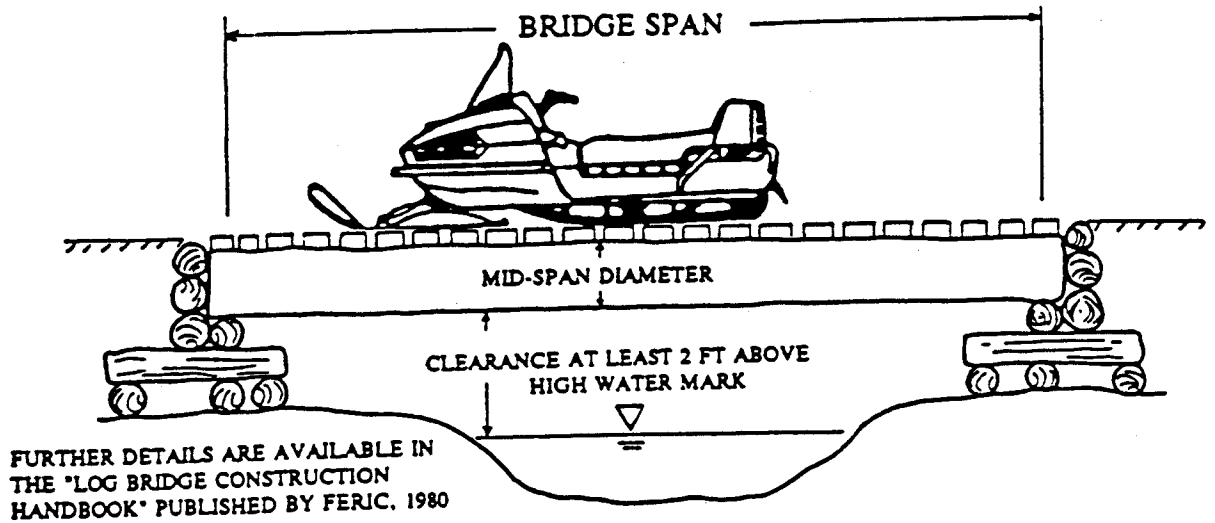
Design live load conditions applicable are:

- Snow load at 50% of Ground Snow Load plus two lanes of snowmobiles at 250 lbs/lineal foot.
- Snow load at 50% of Ground Snow Load plus groomer load of two 5,000 lb loads spaced ten feet apart.
- Snow load at 80% of Ground Snow Load and bridge not in use.
- Summer load of 20,000 lb GWV heavy recreational vehicle.

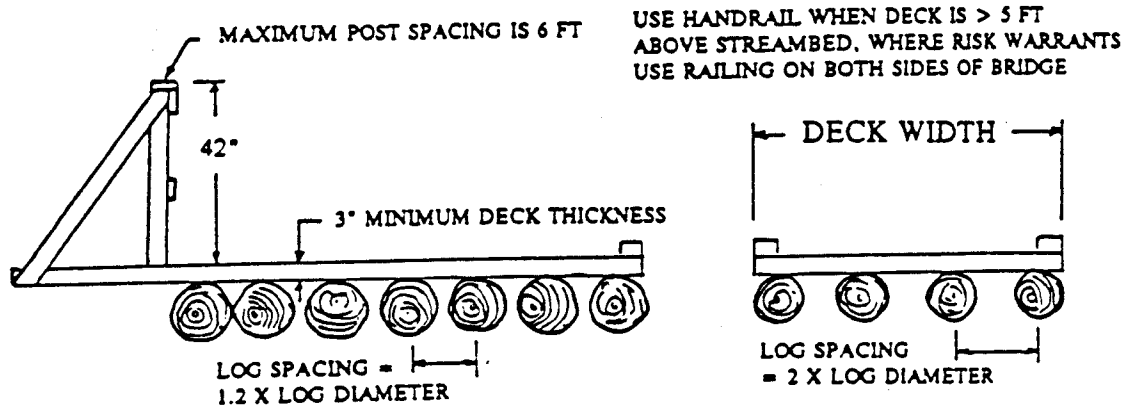
Bridge Span	Mid-Span Log Dia	Mid-Span Log Dia
	Log Spacing=1.2 x Log Dia	Log Spacing=2 x Log Dia
8 ft	7 inches	9 inches
10 ft	8 inches	11 inches
12 ft	9 inches	12 inches
14 ft	10 inches	13 inches
16 ft	11 inches	14 inches
18 ft	12 inches	14 inches
20 ft	12 inches	15 inches
22 ft	13 inches	16 inches
24 ft	14 inches	17 inches
26 ft	15 inches	18 inches
28 ft	15 inches	19 inches
30 ft	16 inches	20 inches

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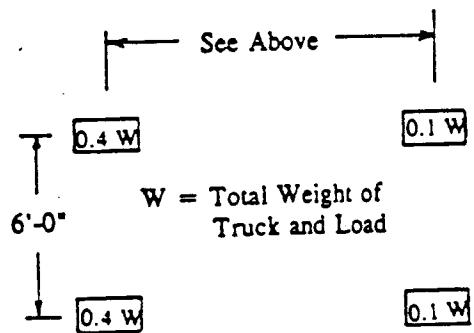
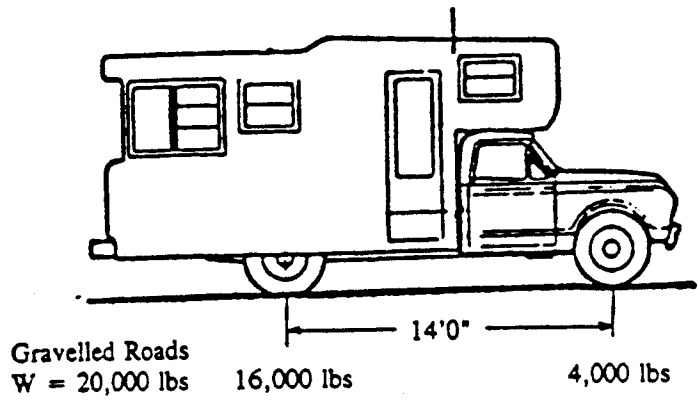
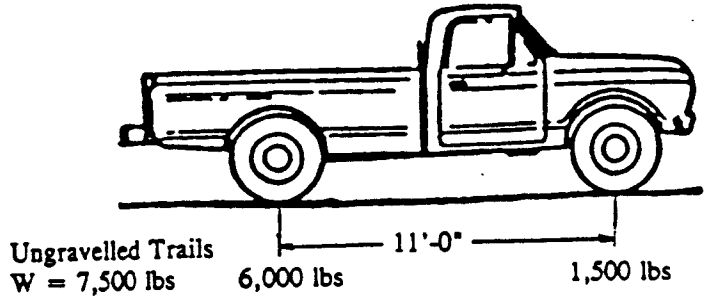
TYPICAL BRIDGE PROFILE



TYPICAL BRIDGE CROSS-SECTIONS

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Typical Summer Loads on Snowmobile Bridges



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Liability:

The amended Public Lands Policy LM 7.01.06 outlines direction for determining when it is appropriate to issue a Land Use Permit for trails, and contains a section dealing specifically with bridges.

Work permits shall be issued for the construction or repair of snowmobile bridges. The maintenance and security of the bridge are to be the responsibility of the permittee and shall be agreed upon in a memorandum of understanding.

There may be certain situations where the permittee and MNR agree that the bridge should be privatized in order to allow the permittee to exercise year-round control of the bridge. In such situations, authority will be issued by means of a Land Use Permit. It is the responsibility of the permittee to place signs indicating that the trail bridge is private.

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