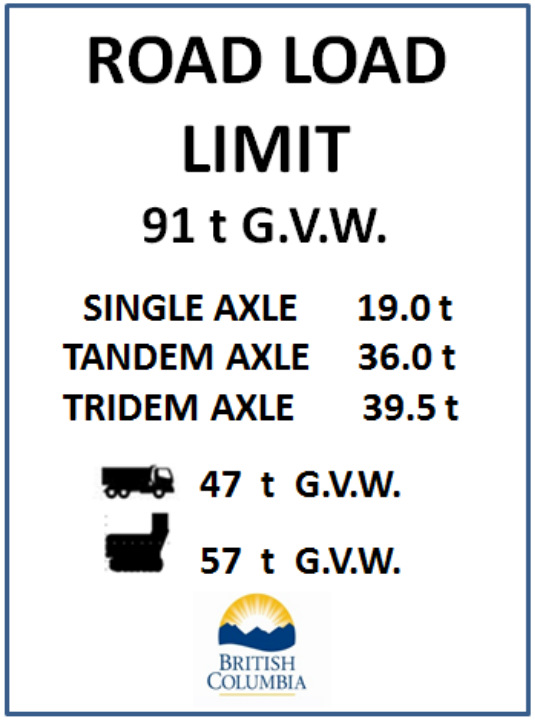
Ministry of Forests, Lands and Natural Resource Operations

FPInnovations

New FSR bridge signage and the 'Road Load Rating' concept

Presentation to
Resource Road User/Safety Committees
April 2016



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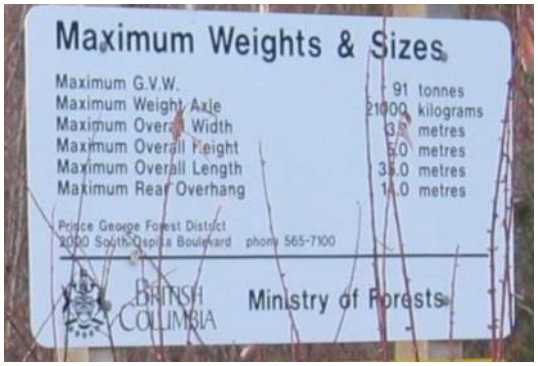
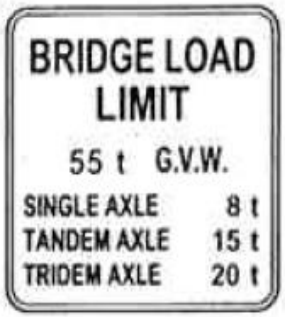
FSR capacity signs

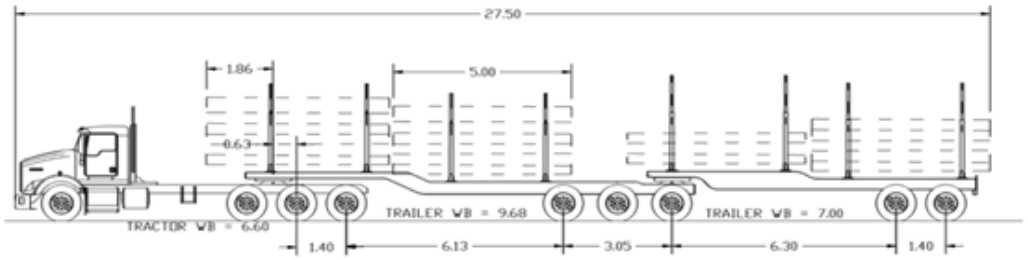




- Resource road bridge capacity signage historically and currently inadequate
- Focus is on GVW – not understanding that this is based on a design vehicle configuration

New truck configurations

- Truck configurations are evolving to maximize payloads per trip
- Vehicles do not resemble original design vehicles (BCFS L-series)



Axle group	Steering	Drives	Lead trailer	Rear trailer	Total
Axle load (kg)	6,900	24,000	24,000	17,000	71,900
Axle width (m)	2.50	2.50	2.60	2.60	
Bunk width (m)		2.90	2.90	2.90	

Figure 2. Proposed high-capacity log-hauling configuration for B.C.: tridem drive 9-axle B-train.

Very heavy loads used by non-forestry users of FSRs

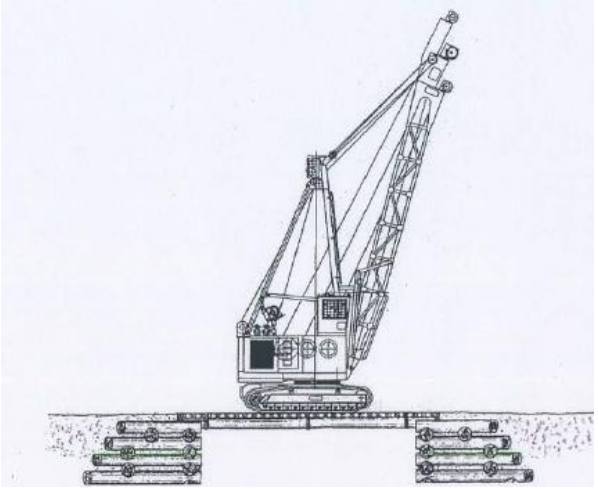
- Resource roads are increasingly being used by mining, oil & gas, and clean energy projects

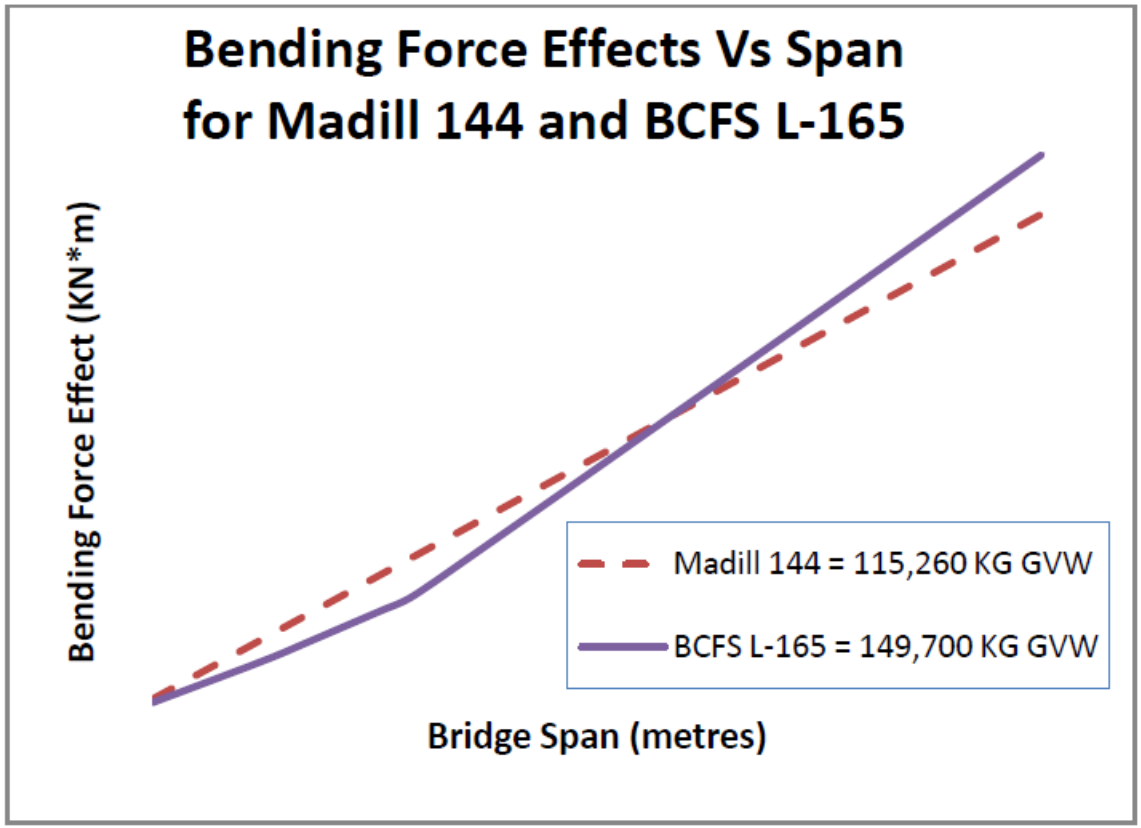
82-t GVW. Tandem axle jeep left at side of highway

Concentrated loading

- Implications of concentrated loads (i.e., short loads and tracked vehicles) not well understood

Concentrated Loads – Force Effects





Bridge capacity load limits for resource road bridges are not well understood

- Original (existing) load limit signs are inadequate
- Real concern for overloading of bridges and other infrastructure
- A new methodology for posting of bridges is required
- BCFS L-series bridge design vehicles do not resemble “real” log trucks or other vehicles on FSRs
- Need to allow road users to relate bridge ratings to their own vehicles
- Need a way to address variable vehicle configurations

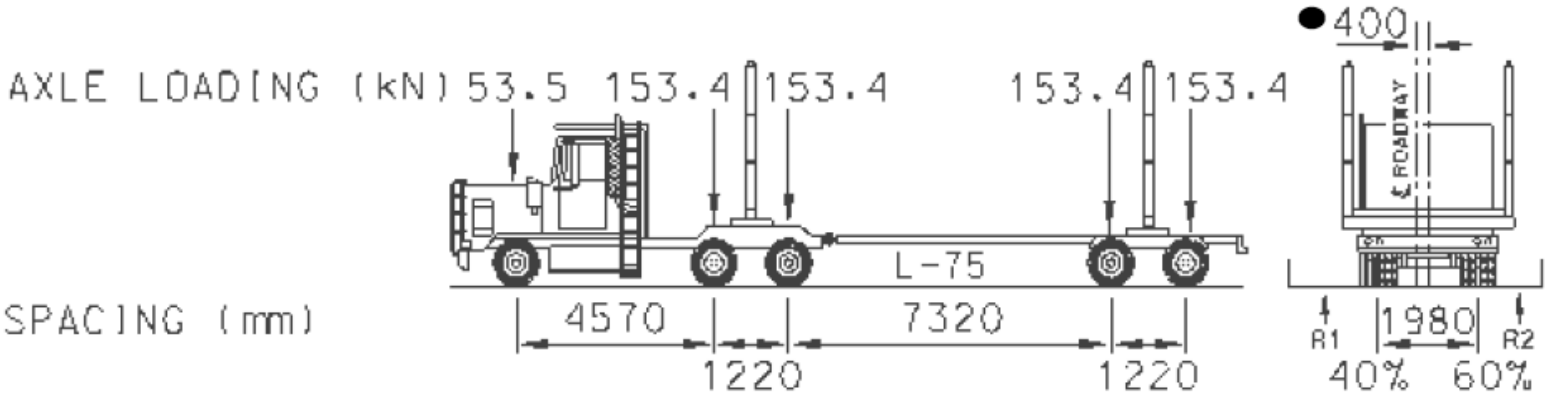
Determining the Safe Load Limit

- Analysis based on broad scale screening rather than designs of individual bridges.
- Force effects of actual trucks were compared against maximum design vehicle force effects to ensure that designs were sufficient.
- Safe load limits for GVW and axle loads, and concentrated loads were determined for each bridge design vehicle.

Load limits for B.C. forestry bridges

BCFS Design Vehicle Configuration		GVW Load Limit (tonnes) [a]	Single Axle Load Limit (tonnes) [b]	Tandem Axle Load Limit (tonnes) [b]	Tridem Axle Load Limit (tonnes) [b]	Short Truck Load Limit (tonnes) [a]	Tracked Equipment Load Limit (tonnes) [a]	
							2 Girder Forestry Bridge	Slab or Gravel Over Log Stringer Bridge
On-Highway	L-45	41	8.5	16	17.5	26	38	32
	L-60	55	11.5	22	23.5	28	42	35
	CL-625	64	9	17	24	31	33	39
	BCL-625	64	9	17	24	33	51	43
Off-Highway	L-75	68	14.5	27	29.5	36	54	45
	LOH	82	20	38	41.5	46	68	57
	L-100	91	19	36	39.5	47	68	57
	L-120	109	23	43	47.5	57	82	69
	HOH	129	31.5	60	65.5	71	103	86
	L-150	136	28.5	53	59	70	102	85
	L-165	150	31.5	59	65	90	131	110

BCFS L-75 design vehicle



L-75 (OFF HIGHWAY) GVW 68,040 kg

BCFS L-75 design vehicle

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BCL-625 and CL-625 GVW and axle group load limits

- As specified in the Commercial Transport Act and consistent with MOTI specifications.
- Used on routes connected to highways.
- Although capacity may be understated for log hauling vehicles, it is well suited to highway traffic with more variable loading (NP type – Normal Traffic).

BCL-625 and CL-625 GVW and axle group load limits

BCFS Design Vehicle Configuration		GVW Load Limit (tonnes) [a]	Single Axle Load Limit (tonnes) [b]	Tandem Axle Load Limit (tonnes) [b]	Tridem Axle Load Limit (tonnes) [b]	Short Truck Load Limit (tonnes) [a]	Tracked Equipment Load Limit (tonnes) [a]	
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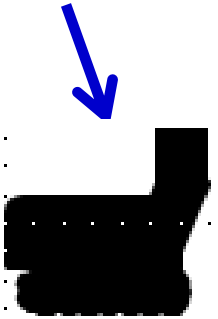
Short trucks and tracked vehicles



- GVW load limit found with relative comparisons of shear and flexure to design bridge capacity.

Load limits for B.C. forestry bridges

BCFS Design Vehicle Configuration		GVW Load Limit (tonnes) [a]	Single Axle Load Limit (tonnes) [b]	Tandem Axle Load Limit (tonnes) [b]	Tridem Axle Load Limit (tonnes) [b]	Short Truck Load Limit (tonnes) [a]	Tracked Equipment Load Limit (tonnes) [a]	
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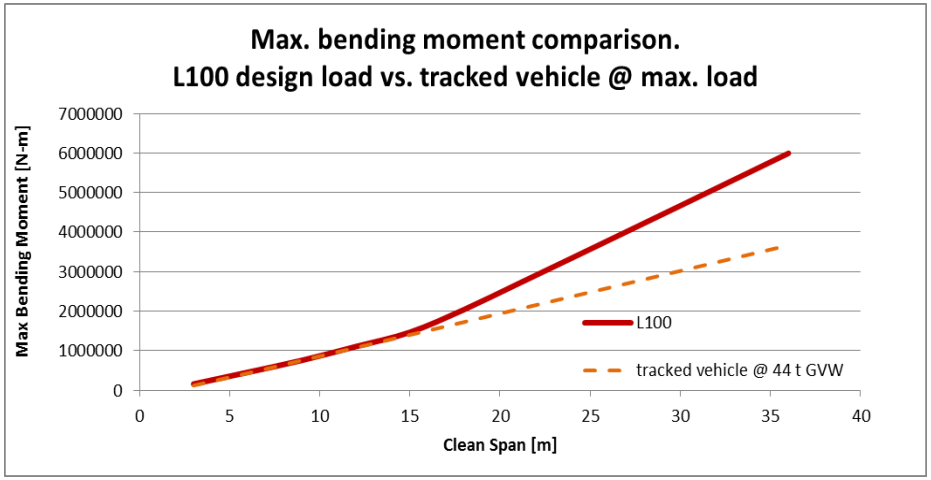
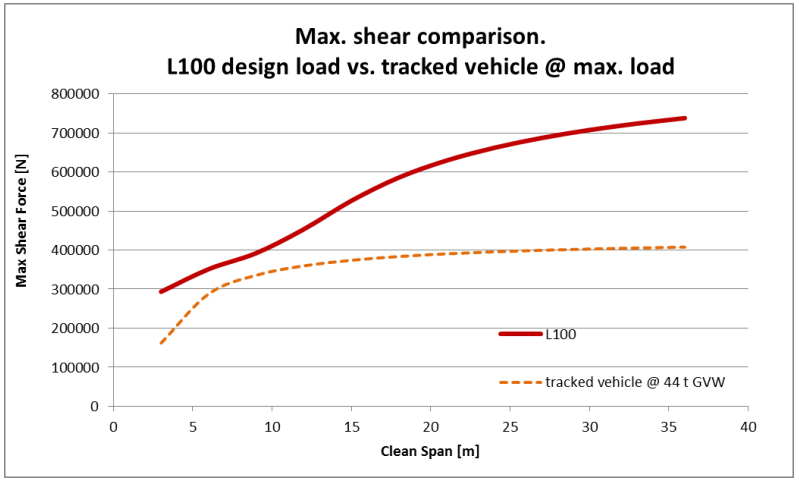
For tracked equipment, differences in 2 girder and slab/stringer bridges as a consequence of live load factors and dynamic load allowance

Tracked vehicle load limit
Relative comparison of force effects:
unfactored* BENDING & SHEAR





For short truck and tracked equipment load limit: load limit determined by increasing vehicle mass until either shear or bending moment equals design vehicle force effect

* Application of load factors increases values to those in Load Limits table

Proposed Load Limit Format

BRIDGE LOAD LIMIT

64 t G.V.W.

SINGLE AXLE	9 t
TANDEM AXLE	17 t
TRIDEM AXLE	24 t


33 t G.V.W.


43 t G.V.W.

BRITISH COLUMBIA

ROAD LOAD LIMIT

91 t G.V.W.

SINGLE AXLE	19.0 t
TANDEM AXLE	36.0 t
TRIDEM AXLE	39.5 t


47 t G.V.W.

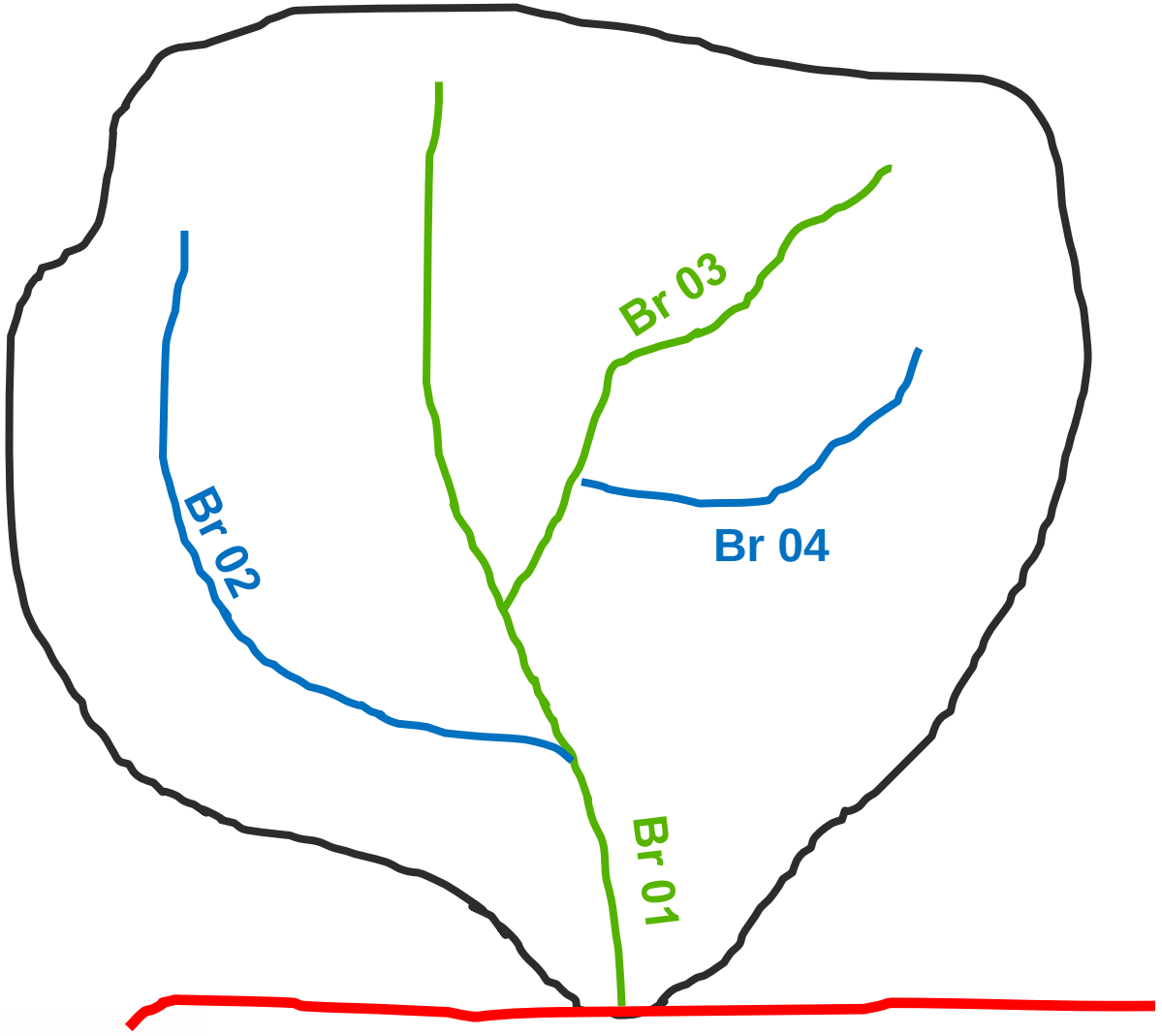

57 t G.V.W.

BRITISH COLUMBIA

Road Load Rating Concept

- Not practicable or useful to post every bridge on a route with limits
- Road systems typically designed to specified design vehicle loading (e.g. BCFS L-100)
- One bridge rating per network. Posted bridge capacity signs are that of lowest capacity bridges on the network
- Concept is same as for Provincial highways where load limits are described in regulations only and bridges are good for legal truck configurations.
- Only down-rated structures posted

Road Load Rating concept



ROAD LOAD LIMITS

BRANCH 02 & 04 LOAD LIMIT

64 t G.V.W.

SINGLE AXLE	9 t
TANDEM AXLE	17 t
TRIDEM AXLE	24 t

 33 t G.V.W.

 43 t G.V.W.

BRITISH COLUMBIA

BRANCH 01 & 03 LOAD LIMIT

91 t G.V.W.

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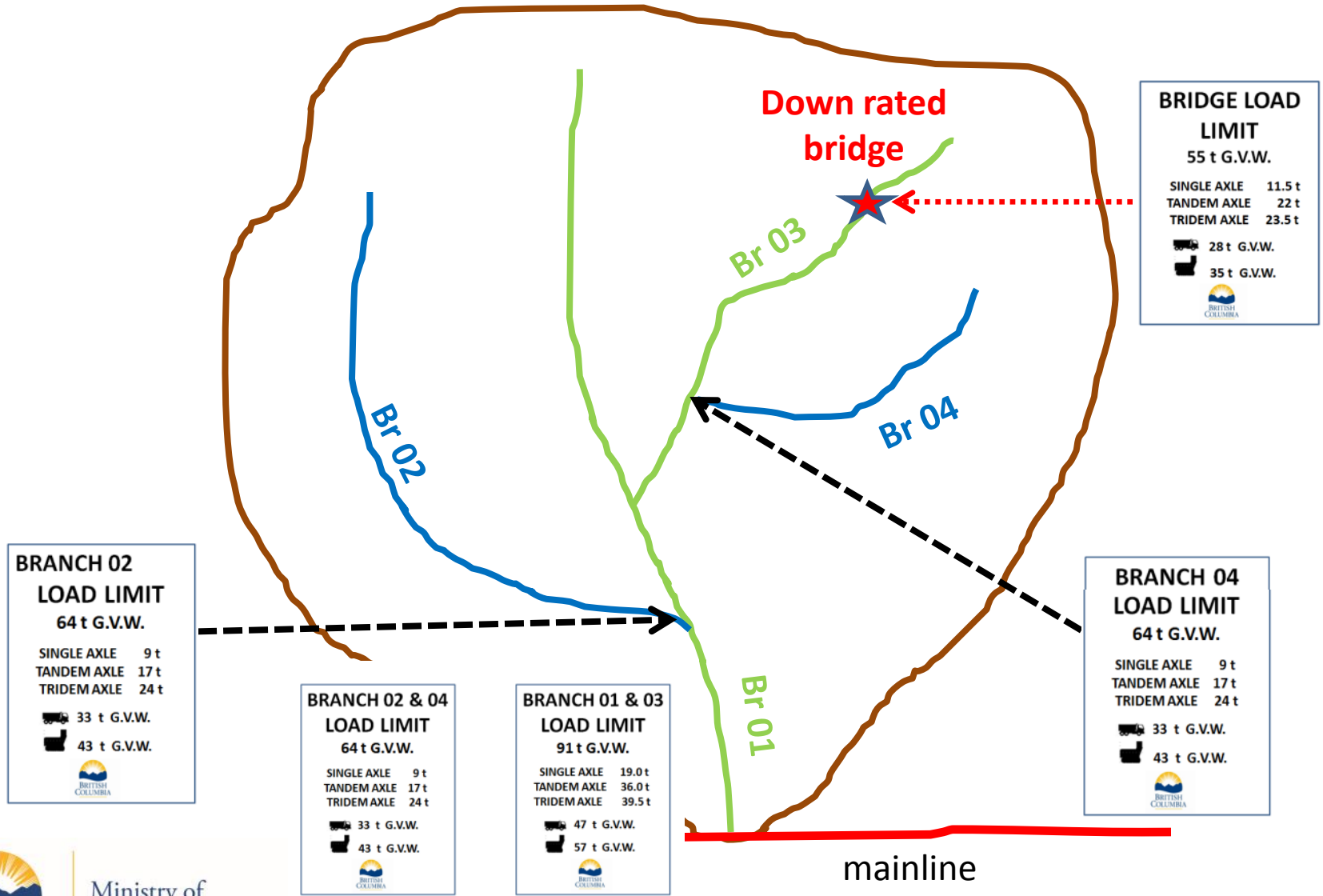
Road Load Rating concept



Road Load Rating Concept – some of FPI survey feedback

- Concept makes sense and is timely response to rapid industrial growth in north.
- Not sure that new signs will alleviate overloading problem – may only cost extra $.
- Locate new sign somewhere safe to stop, near PoC, and where trucks can turn around.
- Some networks are inter-connected and will require signs at all entrances.
- Signs must clearly delineate applicable portion of network.

Road Use Permits

- Road use permits authorize use of Forest Service Roads for industrial use
- Currently – only maximum GVW and single axle for off-highway configurations specified

- Proposed:
  - include load limit tables with maximum single, tandem, tridem, short truck and equipment load limitations consistent with proposed signage

Road Use Permits

SCHEDULE "A" (continued)

VEHICLE SIZE LIMITS

1. The load limits of vehicles to be used on the road(s) shall conform to:

	BCFS Design Vehicle Configuration	GVW Load Limit (tonnes) [a]	Single Axle Load Limit (tonnes) [a,b]	Tandem Axle Load Limit (tonnes) [b]	Tridem Axle Load Limit (tonnes) [a,b]	Short Truck Load Limit (tonnes) [a]	Tracked Equipment Load Limit (tonnes) [a]	
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Notes: GVW loads have been rounded to the nearest tonne, and axle group loads to the nearest 0.5 tonne.

Road Use Permits

2.→ The dimensions of vehicles to be used on the road(s) shall conform to¶

Vehicle Size¤	BCFS Design Vehicle Configuration¤	Vehicle Dimension Limits (metres)¤				¤
		Length¤	Width¤	Height¤	Overhang beyond rear trailer bunk¤	¤
A¤	¤	¤	¤	¤	¤	¤
B¤	¤	¤	¤	¤	¤	¤
C¤	¤	¤	¤	¤	¤	¤

¶

Road Use Permits

ROAD USE PERMIT

SCHEDULE "A"

Date: °°°°° File: °°°°°

FSR Name/Project Number	FSR Branch No.	Section to be Used km to km		Vehicle Size A, B, or C to be used on this road section	FLNR USE ONLY Road Use Permit holder required by District Manager to maintain the FSR Name/telephone number
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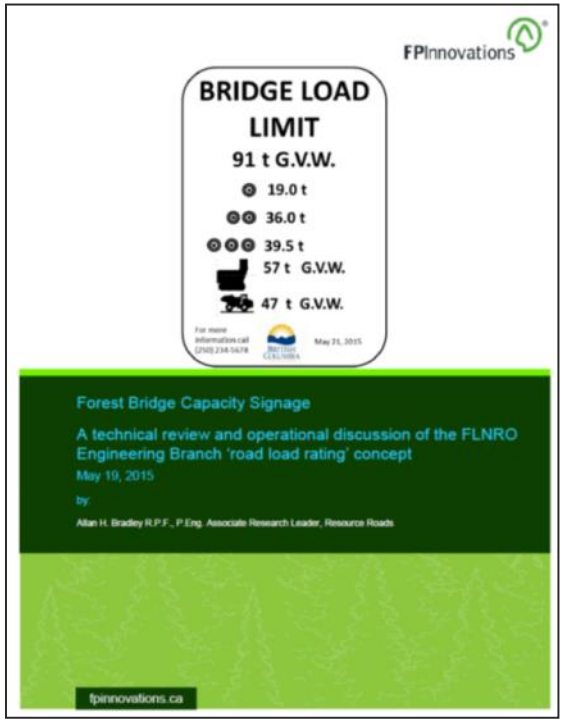
Summary of Key Points

- Current format for load limit signage inadequate
- Load limits approach based on limits arising due to original design vehicles
- Proposed approach accommodates differing vehicle & industry types and will accommodate future vehicles
- Load limit signage suited for posting of road load limits as well as individual bridges
- Authorizations (RUPs) will be consistent with approach

Further Information

See "**Road Load Rating Project**" on the FLNRO Engineering Branch Website: *https://www.for.gov.bc.ca/hth/engineering/Bridges_And_Major_Culverts.htm*

FPInnovations report and technical presentation detailing this information as well as other background reports



Feedback

Questions and Discussion

Thank you

For more information please contact:
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Brian Chow at (250) 953-4370 Brian.Chow@gov.bc.ca