RESOURCE ROAD MAINTENANCE GUIDELINE

A BC FOREST INDUSTRY INITIATIVE

Developed by: Provincial Resource Road Maintenance Group

Industry Initiative: Log Truck Technical Advisory Committee

Supported By: Trucking and Harvesting Advisory Group

BACKGROUND

The Resource Road Maintenance Guideline has been developed by a group of subject matter experts and stakeholders in response to an initiative from the Log Truck Technical Advisory Committee.

The purpose of the initiative is to provide industry with a guideline for implementing a road maintenance program that ensures that resource roads are maintained for safe operations. The need for a specific focus on log hauling has been identified as the configurations, weight and maneuverability of log trucks increases the risk of incident when roads are not maintained adequately to provide safe operations.

A road maintenance program should include criteria that provide for:

- Consistent road maintenance for safe log hauling activities
- Increased efficiency and production through consistent/improved cycle times
- Reduced vehicle maintenance costs
- Healthier workplace and environment (physical and mental)
- Increased lifespan of roadways
- Responsible parties taking ownership for compliance

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RESOURCE ROAD MAINTENANCE GUIDELINE

The resource road maintenance guideline has been established to provide the forest industry with minimum requirements of a road maintenance program. The guidelines have been developed to the end that log haulers can have a reasonable expectation that resource roads, when used for the intended purpose of log hauling, will be maintained in such a manner that a log truck can be operated in a safe and consistent manner.

The key components of the guideline are:

- Road use assessment
- Risk hazard assessment process
- Inspection and inspection criteria
- Monitoring
- Administrative controls

Road Use Assessment

As a minimum, a road must be assessed by a qualified person. Qualified means knowledgeable by reason of education, training, experience or a combination thereof ; of vehicle dimensions (including height, width, length and axle spacing), vehicle axle configuration, weight allowed per axle, and total gross vehicle weight and the hazards as they pertain to road fit.

Assessments of safe operational use should include:

- Bridge capacity(s).
- Road and bridge horizontal alignment as it pertains to design speed(s) and vehicle road width requirements.
- Road and bridge vertical alignment as it pertains to vehicle clearance requirements.
- As-built geometric and geotechnical road hazards
- Overhead clearance requirements.
- Number and length of pull-outs.
- Steep grades as they pertain to vehicle gradeability and descent under low friction conditions.
- Locations of concern for sight distance, road hazards, etc.
- Records of safety complaints, issues, and management responses.
- 'Hot spots' = collision and close call frequency, severity, location, and causes.
- Road surface distress impacts.
- Location, visibility, and condition of signage (including must call signs).

Risk Hazard Assessment Process

A road maintenance program must include a process to assess the road condition, determine if hazards are present or impending, and utilize a risk assessment process to prioritize maintenance activities.

As a minimum, the following factors should be considered:

- Road condition
- Road complexity
- Road design
- Volume of log truck traffic
- Volume of Industrial traffic
- Volume of public traffic
- Community Interface

Appendix 1 includes an example of a road maintenance priority matrix that meets the intent of the guideline document. The matrix identifies risk factors, provides metrics to quantify the risk and provides a risk ranking for each factor. Each road or segment of road is assessed using the matrix. Road complexity, road design hazards, season of use, and community interface will remain constant for the identified road or segment; whereas road surface condition and traffic volumes may vary. The total risk calculation determines priority for road maintenance.

Inspections:

Road conditions, including roughness, influence driver fatigue as well as vehicle handling that can result in incidents and truck damage. Inspections must be completed to ensure that road conditions are maintained to prevent unsafe conditions.

As a minimum, the following documented inspections must be completed by a qualified person:

- A Pre-haul Inspection must be completed prior to the commencement of new hauling activities on a road that;
  - has not previously been used for hauling or,
  - has not been inspected for hauling within the current season or
  - has not been inspected following a significant environmental / weather event
- Seasonal Inspection: Prior to the commencement of hauling activities following break-up

Note that there is no requirement to complete both a seasonal inspection and a pre-haul inspection if either inspection has occurred within the required period.

Inspection Criteria:

The following table includes conditions that should be assessed as a minimum requirement when completing inspections. The identified metric should be used as a guideline when determining if maintenance is required. Regional constraints may impact maintenance recommendations.

Condition	Metric	Maintenance Recommendations
Washboard / potholes	Loss of handling Driver fatigue	Grading (cut to depth, reshape with 4% crown, pack)
Rutting > 75 mm (3”) deep	Loss of handling Poor drainage Surface erosion	Grading
Loose gravel accumulations	Loss of traction Stone spraying	Grading (tight blade gravel to road edge, incorporate in next reshaping)
Surface traction	Loss of traction (traction coefficient $\leq$ 0.3)	Sand, salt, gravel, surface material Grading with ice blade
Snow Accumulations	Depth > 50 mm (2”) Limited traction (traction coefficient 0.3)	Snow Plowing Winging
Roughness (bridge approach)	Rough ride	Grading Paving
Impeded sight line	Sight distance reduced	Brushing Re-align roadway
Inadequate signage	Missing or damaged signage Signage not visible	Add or maintain signage Brushing
Poor visibility (dusty)	Visibility obscured when following or passing vehicles	Dust palliative treatment Watering
Road narrowing (snow)	>1m total width loss of running surface	Winging (snow)
Road failure (washouts)	Drainage structure failure Road surface drainage	Temporary closure, repair road prism
Hazard tree	Infringes upon the road prism	Removal
Debris	Obstacle located on the travelling surface, shoulder or pullout on a roadway.	Removal
Landslide / Avalanche	Obstacle located on the travelling surface, shoulder or pullout on a roadway.	Temporary closure, assess and stabilize as necessary, clear away debris

Monitoring:

As a minimum road conditions must be assessed at a frequency that reduces the risk of road conditions contributing as a root or basic cause to incidents.

The following table indicates suggested road monitoring frequencies for active haul roads. Regional and site specific factors may influence monitoring frequency.

Summer Monitoring Frequency May 1 to September 30	Winter Monitoring Frequency October 1 to April 30
Once per 2 weeks or after a weather event	Twice per week or after a weather event

Appendix 2 includes a road condition assessment tool sample that can be used by industry personnel, drivers or road maintenance staff to record and report hazards including when the condition of a road does not facilitate safe and efficient travel.

A copy of the assessment can also be submitted to the BC Forest Safety Council Transportation Department.

Administrative Controls

Where environment, weather or other conditions result in unsafe conditions, a Road Maintenance Program must include identification of administrative controls that will be implemented to reduce the risk of an incident.

Risk may be temporarily mitigated using administrative controls that address the hazard however maintenance activities to eliminate the unsafe condition should be scheduled at the earliest opportunity.

Road shut downs (engineering controls) may be used as an engineering control dependent on the nature of the barrier.

Controls may include:

- Shut down
- Posting of temporary reduced speed limits
- Identification of mandatory chain-up locations
- Alternate routes

Additional Resources

Report: "Understanding the relationship between heavy vehicle weights and dimensions, and resource road safety"

http://fpinnovations.ca/Extranet/Assets/ResearchReportsFO/TN2011Bennett.pdf

Bridge approach curve report

http://fpinnovations.ca/Extranet/Assets/ResearchReportsFO/16355.pdf

9-axles on resource roads report

http://fpinnovations.ca/Extranet/Assets/ResearchReportsFO/TR2015N30.pdf

Appendix 1

ROAD MAINTENANCE PRIORITY MATRIX

Purpose: The road maintenance priority matrix example below provides a methodology to assist in ranking the priority for maintenance activities. The methodology to prioritize maintenance may be influenced by regional or site specific factors. The matrix identifies risk factors, provides metrics to quantify the risk and provides a risk ranking for each factor. Each road or segment of road is assessed using the matrix. Road complexity, road design hazards and community interface will remain constant for the identified road or segment, whereas volume of log truck traffic, industrial traffic and public traffic may vary. The total risk calculation determines priority for road maintenance.

Using the Risk Factor Table:

Step 1: Identify road name or segment of road being ranked
Step 2: Identify the start and end kilometer for the segment
Step 3: For each factor, use the metrics in the Matrix to identify the risk ranking
Step 4: Input the risk ranking number into the appropriate column in the risk factor table
Step 5: Calculate the total risk by adding the risk rankings for each factor
Step 6: Using the total risk calculated in the risk factor table, identify the priority for maintenance in the priority ranking table
Step 7: Identify the maintenance action required
Step 8: Assign equipment for each road or segment of road

Factor	Metrics	Risk Ranking
Road Condition	Imminent Danger (landslide, avalanche, washout, structural failure)	High 6 (Road Closure)
	Loss of traction, loss of handling, poor visibility	Mod =4
	Impeded sight line, inadequate signage	Low=2
Road Complexity	Specialized design (retaining structures, specialized drainage)	High =6
	Complex design (steep/unstable terrain, steep grades)	Mod =4
	Basic design (no stability concerns, low risk)	Low=2
Road design hazards	Blind corners, bridges, adverse grades > 3 per 5 km	High =3
	Blind corners, bridges, adverse grades > 1 per 5 km	Mod =2
	Blind corners, bridges, adverse grades < 1 per 5 km	Low=1
Volume of Log Truck Traffic	Anticipated vehicles (one way/hr) >13	High =3
	Anticipated vehicles (one way/hr) 6-12	Mod =2
	Anticipated vehicles (one way/hr) 0-5	Low=1
Volume of other Industrial Traffic	Anticipated vehicles (one way/hr) >13	High =3
	Anticipated vehicles (one way/hr) 6-12	Mod =2
	Anticipated vehicles (one way/hr) 0-5	Low=1
Volume of Public Traffic	Anticipated vehicles (one way/hr) >13	High =3
	Anticipated vehicles (one way/hr) 6-12	Mod =2
	Anticipated vehicles (one way/hr) 0-5	Low=1
Community Interface	School, community	High =3
	Bus stop, residence, identified recreational area (lodge, snowmobile, ski area)	Mod =2
	None	Low=1

ROAD MAINTENANCE PRIORITY MATRIX

RISK FACTOR TABLE										
Road Name	Start Km	End Km	Road Condition	Road Complexity	Road Design Hazards	Volume of Log Truck Traffic	Volume of other Industrial Traffic	Volume of Public Traffic	Community Interface	Total Risk

PRIORITY RANKING TABLE						
Road Name	Start Km	End Km	Total Risk	Priority Ranking	Action	Equipment

Appendix 2

ROAD HAZARD ASSESSMENT TOOL

Road Name:						Rated by:			Date:				
Rate the road condition	**Road Condition:** **Good (G)**: No maintenance or repair required **Fair (F)**: Safe travel at posted speed limit is difficult **Poor(P)**: Safe travel is not possible at posted speed limits												
	Surface Hazards					Environmental Hazards			Other				
Location: Start km – End km	Water in ditch	Loose gravel	Washboard	Rutting	Potholes	Ice	Snow	Dust	Signage	Bridge approach	Debris	Pull Outs	Line-of-sight (brushing)
Notes (additional comments):													

Appendix 3

TRACTION ASSESSMENT TOOL

When selecting traction, always select the worst-case traction level for the road section under review. A well-drained gravel surface can be expected to maintain its moderate traction even when wet. However, the presence of silt or clay in the gravel will lower the traction level when wet. If traction aids, such as sand or chains, are used then traction levels may be increased by one category (e.g., from very low to low).

Stopping Distance Test (Output =Traction co-efficient (TC))

- Locate level grade with surface material and compaction to be measured
- Conduct stopping distance test observing appropriate safety protocols.
- Ensure brakes are applied with almost enough pressure to achieve wheel- lockup
- Measure speed (in km/h) when brakes were applied (V)
- Measure distance (in meters) from where brakes were actually applied (D)

For example, a stopping distance test is conducted from a speed of 50 km/h and the measured stopping distance was 22 m. Therefore, applying the formula, the traction coefficient is 0.446. Note that it is important to measure stopping distance from as close as possible to where the brakes were applied (accounting for reaction and actuation delay), as well as the speed at that point.

Traction Coefficient is calculated as follows:

$$TC = \frac{\left[\left(\frac{V}{3.6}\right)^2\right]}{[19.62D]}$$

The following sample traction coefficients can be expected for the described road surface conditions:

Traction Level	Description	Traction Co-efficient
Very Low	Ice/snow	0.20
Low	Loose gravel/wet hardpan	0.30
Moderate	Compact gravel/shot-rock	0.45
High	Dry, smooth, compact gravel	0.60