

6.9 Routine Types of Road Maintenance Works

6.9.1 Clearing Width Maintenance

Clearing width maintenance includes brushing and vegetation control, and dangerous tree falling.

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Brushing and vegetation control

Carry out brushing when one of the following conditions occurs:

- The sight distance and/or the usable road width are dangerously impeded or reduced, such that the design speed of the road cannot be safely maintained.
- The useable road width is dangerously reduced to the point that vehicles cannot safely pass each other at road widenings or turnouts or the road cannot be driven at the design speed.
- Drainage systems are functioning below acceptable levels and roadside vegetation is a major contributing factor.
- The presence of roadside vegetation is impeding drying out of the road surface.
- Snow cannot be readily removed.

For example, potential hazards exist where brush limits visibility at the inside of a curve or at bridge approaches, or where heavy snow loads on roadside trees may cause the trees to bend over the road surface, restricting use of the road and creating a user safety hazard.

Manual methods for removing trees, brush, and other vegetation may include the use of axes, machetes, sandvik axes, chainsaws, or gasoline- or air-powered circular saws. These methods are labour-intensive and require close supervision to ensure good production and worker safety.

Mechanical methods may include the use of crawler tractors, graders, hydro-axes, hydro-mowers or attachments for graders, front-end loaders, and excavators. The higher cost of operating mechanical equipment is usually offset by increased brushing productivity and user safety when compared to manual brushing and vegetation control methods. Better clean-up and dressing of gentle cut and fill slopes during construction improves the likelihood of being able to use mechanical methods of brushing after construction.

Use site chipping or mulching to minimize the fire hazard and increase the rate of decomposition. Leave mulch material in the ditchline, as it will usually flush out and through cross-ditch culverts.

Use of chemical defoliant and herbicides is tightly regulated under the province's *Integrated Pest Management Act*. The user will possess a valid pesticide applicator's licence and have a valid permit for the pesticide being used.

Be aware that brushing projects can create hazards, such as:

- Accumulated cut vegetation can plug culvert intakes and should be cleaned by hand concurrently with the brushing operation.
- Accumulated vegetation can plug ditchlines and should be either cleaned by hand or by a follow-up machine concurrent with brushing operations.
- Serious physical injury or equipment damage can occur when debris being cut by a machine shatters and flies in unpredictable directions. Appropriate roadway control (such as flaggers and warning signs) should be used during operations.

Dangerous tree falling

In addition to brushing and vegetation control, remove all snags and leaning or overhanging trees that are a safety concern for road users or workers. This is usually accomplished by hand falling. Such trees are known as “dangerous trees” and are defined by the Workers’ Compensation Board of BC (WorkSafeBC), in Occupational Health and Safety Regulation (Sec. 26.11).

6.9.2 Ditch & Culvert Maintenance

Probably the most critical aspect of any road maintenance project is maintenance of the drainage systems. Implement the following types of maintenance works to minimize the likelihood of clogged or damaged drainage systems which can potentially cause road washouts:

- Clean and grade ditches
- Clean and repair culvert inlets, outlets, catch basins, trash racks, flumes, and transition areas from the ditchline to catch basins
- Replace or repair ditchblocks, small culverts, flumes and rip rap, head walls, and spillways, particularly during and after major storms and after yarding and loading operations
- Shape and grade off-take ditches to drain away from the road prism

Ditch maintenance

Road side ditches have two major functions: first, they collect moisture from the road surface, the cut slope, and the road base, directing the water to suitable discharge locations; and second, they provide a snow storage area.

Implement the following steps:

- Clean and grade ditches to keep them clear of obstructions that might impede drainage flow. Vegetation or other debris that is hindering the flow of water should be removed. However, grass or low vegetation lining the ditches is desirable to minimize scour and sediment transport. Where necessary, installing ditch erosion prevention materials may be necessary to accomplish this. Lining the ditch perimeter with shot rock, boulders, vegetation, or fabric are some of the methods used. Near licensed waterworks, maintain ditches by removing rock falls and any slumping or raveling material, while retaining as much grass cover or other low vegetative cover as is practicable.
- Ensure that ditch water can enter culverts freely and directly. Ditches should be free of standing water to prevent saturation and weakening of the road subgrade, which can result in surface rutting.
- Keep the ditch elevation below the level of the subgrade to ensure the free drainage of the road base. The ditch gradient will be sufficient to maintain a continuous flow.
- When cleaning ditches, do not undermine ditch slopes, cutbanks, road shoulders, and culvert catch basins, and do not block the ends of culverts.
- Do not use material excavated during ditch cleaning for widening road shoulders. Typically, this material is unsuitable for use as fill in the road prism because it contains too many fines and is usually too wet to place and compact. Left on the road shoulder, this material could prevent free drainage of granular sub-base materials and cause roadside sloughing. Material that cannot be used as surfacing or sidecast should be hauled to a designated disposal site.
- Where a grader cannot be used, opt for articulated ditch-cleaning machines (such as Gradalls) because they usually provide a cleaner, smoother finish. Rubber-tired front-end loaders and excavators are often preferred for cleaning ditches of loose rock.
- Take extra care when working around culverts to prevent damage to intakes and outlets. Ditches should be kept unobstructed by tall vegetation, so that maintenance equipment operators can see the ditches and drainage structures. Culverts are often damaged because the grader operator cannot see the culvert ends through the vegetation growing in the ditches.

Culvert maintenance

Include in routine culvert maintenance operations:

- cleaning and repairing culverts and ancillary drainage works to provide for flow of water;
- repairing inlets, outlets, ditch blocks, catch basins, and flumes;
- replacing cross-drain culverts, flumes, and rip rap; and
- installing additional cross-drain culverts and ditch blocks where required [usually made evident where standing water or erosion (scour) is observed in the bottom of the ditches].

Carry out these maintenance works at a time and in such a way as to minimize the potential for sediment transport to streams.

Consider implementing the following additional maintenance works:

- dispose of floating debris that could be lifted by the headwater pool during a high flood;
- clear debris barriers and trash racks regularly;
- remove accumulated debris from the inlet settling basin;
- backfill scour holes;
- ensure that the stream channel leads directly to the culvert entrance;
- repair or replace rip rap alongside pipe to retain fills;
- repair aprons, headwalls, and flumes; and
- cut brush and clear away debris at inlets.

Using a simple hand shovel is probably still a very effective way of maintaining culverts during the spring runoff period. Carry out hydraulic flushing of drainage structures only when approved by the appropriate environmental agency. If an existing cross-drain culvert cannot be unplugged in place, consider removing and cleaning it, and then re-installing the culvert. Replace irreparable culverts.

During cold weather operations, hot water generators, steam generators, or compressed air are probably the fastest and most effective methods of thawing culverts.

6.9.3 Road Prism Maintenance

Carry out road maintenance to ensure user safety and stability of the road prism; minimize sediment transport from the road prism; and ensure that the road system will fulfill its designed function until deactivation.

Methods to maintain the road prism include:

- stabilizing the road cut and fill slopes, repairing of minor scours and washouts, and

- improving drainage systems before more serious problems occur;
- stabilizing landslides, rockfalls, and other sites of significant hazard;
- removing loose rocks, stumps, or other unstable materials (including dangerous trees) that present a hazard to road users; and
- seeding all exposed soil that will support vegetation, by hydro-seeding or dry seeding, and reseeding of bare spots as required.

Assess the reasons the above problems are occurring and determine long-term corrective measures.

6.9.4 Subgrade Maintenance

Subgrade maintenance is necessary to ensure that the road system will fulfill its designed function until deactivation. Measures to consider include:

- repairing chronic soft subgrade areas and problematic frost sections by excavating and replacing the unsuitable soils with granular material, including use of geosynthetics where appropriate;
- replacing or repairing the running surface if the road has chronic problems with ruts, potholes, and a broken surface that renders the road unable to support design loads;
- cleaning up slides, slumps, rock falls, and other sites where potential hazards are evident; and implementing measures to stabilize the site (if materials generated by the work cannot be otherwise used or sidecast on site, they should be removed and disposed of in designated disposal sites);
- correcting the potential failure of stream-crossing approach fills; and
- re-locating the road (may require a new design).

Maintenance items such as scours, slope failures, and rockfalls will be dealt with on a site-specific basis, usually requiring professional expertise.

To repair frost heaves, carry out the following steps:

- Excavate at least 1m deep and remove the unsuitable soil. If an excess flow of water is encountered, a drain of perforated culvert pipe may be required.
- Place a 300 mm lift of clean sand into the excavated area. It will act as a filter and prevent any contamination or pumping of underlying silt into the upper granular material. Alternatively, consider using a suitable geotextile fabric.
- Refill the excavation with clean, coarse gravel. Compact and grade it. Gravel used for refilling should be free of sand and silt to prevent water from rising through capillary action.
- If working in a roadway, ensure that the road side ditch is deep enough to ensure that

ditchwater does not seep into the granular backfill of the subgrade.

6.9.5 Road Surface Maintenance

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Grading

Standing water can soften or weaken a road's subgrade. Water running on the road surface can erode expensive surfacing material and deposit sediment in adjacent drainages. Grading involves using specialized, heavy equipment to smooth out the running surface of the road and eliminate rough spots and potholes. One of the main objectives of grading is to prevent water from standing or running down the road in wheel ruts or because of a lack of crowning. (A windrow is an accumulated pile of road fill or surfacing material left on the road shoulders during grading. Windrows are the result of poor grading practices. They are different from berms, which may be beneficial in directing water off the road surface.)

Grade roads to maintain structural integrity or to protect the subgrade from damage. Grading can also help reduce the costs of maintenance for those vehicles using the road and can improve both the comfort and safety of road users.

If the subgrade is to be protected, grade roads before the road surface:

- reaches severe stages of wash-boarding or pothole formation; or
- begins to trap water in windrows or ruts.

In most instances, slightly crown the road, not leaving any windrows left after the final pass. This facilitates storm water and meltwater drainage, minimizing erosion and transport of sediment from the road surface. However, a crowned road is not always desired. Consider insloping or outsloping for surface water management.

Restoring a severely damaged road surface can be a major undertaking and may require ripping the surface to below the pothole depth and recompacting the surface material. Grade roads when moisture conditions are suitable, and not when the road is either too wet or too dry. Minimize the grading of material over the banks or into ditches, as this material may be difficult to retrieve.

Grade and shape the existing traveled way and shoulders (including turnouts) to produce a surface that is smooth, uniform, consistent to grade, and crowned or cross-sloped as indicated by the character of the existing surface.

It is recommended that a grading pattern should be established to provide:

- a uniform driving surface;
- retention of the surfacing material on the roadbed;

- a thorough mixing of the materials within the completed surface width; and
- no mixing of contaminated ditch material with any processed surfacing material.

Final grade such that no disturbed material such as gravel, cobbles, and boulders protrude more than 50 mm above the road surface. If it does, remove the material and place it outside the running surface of the road so as not to obstruct drainage ways or structures. Scatter this material off the roadbed if there is free drainage.

Do not leave any windrows remaining after the final pass.

Material should roll freely across the blade of the grader. For best results, carry out grading under moist, but not saturated, road conditions. This provides optimum moisture content for compaction, while eliminating dust and loss of fines.

Under dry soil conditions, the road surface should be blade-roughened to remove small ruts and depressions without disturbing the lower road surface.

For roads with pit run surfacing material, to eliminate potholes, cobbles, and washboard, scarify the entire rough section to a depth below the deepest pothole or surface imperfection or largest cobble size over the full road width and then regrade, compact with a suitable roller, and, if feasible, apply a dust palliative. Also, use this procedure for regravelling a hard-packed surface.

Reshaping requires a cut deeper than normal grading to obtain the proper cross-section. Tilt the blade back sufficiently to remove any washboard or other irregular conditions and take special care to “crown” the centre of the road.

Because reshaping requires cutting down into the grade, ensure that there is sufficient moisture to:

1. ensure the fines and binder material are not lost or blown away when brought to the surface; and
2. provide for sufficient compaction of the re-shaped gravel. In most areas this dictates that reshaping should be scheduled for the spring and fall.

Leaving windrows is a bad grading practice. It keeps surface runoff on the road and leads to washouts. During dry conditions, when the hard road surface is difficult to grade, leave a windrow on the upper side of the road where there is no crown. Do not leave windrows on the lower side of the road, because these can deflect water and eventually cause the road to wash out.

Resurfacing

Resurface gravel roads when the existing surfacing material is no longer sufficient to support traffic loading or when there is not enough material available for grading purposes. Over time, surfacing material can break down and is lost from the road surface. Spot-gravel roads where short sections of the road surface are failing or have a potential for failure, or where potholes that cannot be satisfactorily graded out are evident.

Surface with materials of sufficient strength, durability, and gradation so that at completion of the surfacing application, the surface will not rut when subjected to the loading exerted by the rear axles of a fully loaded tandem truck on the completed surface. Suitable sources of gravel materials include:

- material from existing pits that have proven performance;
- gravels with 10%-15% fines; and
- materials that do not easily rut, washboard, or break down when wet.

Dust suppression

Dust from unpaved roads is not only a nuisance but can create a safety hazard by reducing a driver's visibility. It may be necessary to apply a dust suppressant product to eliminate the dust problem by sealing the surface of the road. However, these products are not a permanent solution and their effectiveness decreases with time. Carry out further applications of the products if dust suppression is to be maintained.

To properly select the appropriate product, it is important to understand the primary factors that generate dust, including:

- vehicle speed;
- number of wheels per vehicle;
- number of vehicles;
- vehicle weight;
- particle size distribution (gradation) of the surface material;
- restraint of the surface fines (compaction, cohesiveness/bonding, durability); and
- surface moisture (humidity, amount of precipitation, amount of evaporation).

In selecting the proper dust abatement program consider not only the above factors, but also the total long-term cost and environmental impacts of that program. Long-term costs include road improvement, road preparation, application of the dust suppressant in conjunction with the number of times the product needs to be applied, and expected change in maintenance practices.

Environmental considerations typically include impacts to the water quality, aquatic habitat, and plant community.

A wide variety of dust suppressants are available on the market. They fall into seven basic categories:

- water;
- water-absorbing products;
- petroleum-based products;
- organic non-petroleum-based products;
- electrochemical products;
- polymer products; and
- clay additive products.

Regardless of the type used, the criteria for an acceptable dust suppressant product are that they must:

- be environmentally compatible (i.e., without there being any adverse environmental effects);
- be easily applied with common road maintenance equipment;
- be workable and respond to surface or structural maintenance;
- provide reasonable retention and dust control;
- provide little loss of riding quality and be cost competitive; and
- be approved by the Ministry of Transportation and Infrastructure.

6.9.6 Winter Operations: Snowplowing & Sanding

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General

Serrated grader blades will cut ice and snow much better than ordinary blades, and the rough surface left by a serrated blade usually improves traction.

Restrict snow removal to the usable traveled way having roadbed support. Reshape over-width plowing as necessary to define the usable width.

Do not excavate into the gravel surface or remove surfacing materials along with the snow.

Breach snow berms frequently enough to allow road surface runoff from snowmelt to have a safe place to drain.

Before allowing snow removal from any road is allowed to take place, identify all road-related fixtures that might be at risk from snow removal operations (such as culvert markers, signs, bridge delineators, bridge guard logs, cattleguards, and fencing) and notify the snow removal

operators.

In an area of daylighted cuts, plow the road from the inside of the cut to the outside (in the direction away from the cut slope) to avoid plugging culverts and ditches with snow.

Plow roads to a firm surface before sanding.

Fine crushed gravel as a sanding medium is superior to pit-run sand. The sharp angular material provides better traction and breaks up an icy surface by rolling under vehicle tires.

Do not stop the spreading of sand in the middle of a curve, halfway up a hill, or at any other potential roadway hazard.

As a general rule, spread sand only along the centre of the road. Vehicle wheels will spread the sand full width. Use spinners or other power spreaders where available.

Snow removal at rail crossings

When conducting snowplowing operations at rail crossings, ensure that snow removal crews that are responsible for Forest Service road maintenance are aware of the following snow removal guidelines:

1. When snowplowing at rail crossings, the snowplow blade **must** be raised before going over the crossing surface to ensure that the blades do not damage the rails.
2. Windrows **must not** be left between the rails or within 8 metres of the track. Leaving windrows can result in unsafe conditions with reduced sightlines at the crossing and increased potential for trains or other rail vehicles impacting windrows and derailing or which could result in injuries to pedestrians and or damage to nearby motor vehicles caused by thrown snow and ice.
3. Snow **must not** be piled up in close proximity or restrict sightlines at the crossing.

As road crossings are licensed by the rail companies, improper snow removal practices at rail crossings, or an accident at any rail crossing caused by improper snow removal practices may result in a crossing license being revoked and the crossing permanently closed.

Ensure that emergency contact information for the railway company is available in the event of an incident involving snow removal or other reason at a rail crossing. Any incident involving damage to signage, crossing surface or rails at a crossing should be called in to the emergency number immediately.

6.9.7 Spring Break-Up: Temporary Vehicle Weight Restrictions

Where it is necessary to impose vehicle weight restrictions to protect Forest Service Roads from considerable damage during spring break-up, the restrictions may vary from 30% to 50% (or more) of the legal axle loading. Restrictions normally extend from about mid-March to mid-May, depending on the weather conditions and the susceptibility of the subgrade to frost.

Certain indicators provide a guide to the timing of restrictions. These indicators are tied to the stages of spring break-up:

- Incipient stage – the stage at which the surface starts to thaw and turn muddy; usually most of the ice and snow will be gone from the surface and along the road; and
- Advanced stage – the stage at which the subgrade starts to thaw; most likely the surface will appear quite dry.

Impose the restrictions towards the end of the incipient stage. The road's bearing strength is substantially reduced when thawing of the subgrade occurs during the advanced stage. This is the time the road is most susceptible to damage.

Since there are not any specific indicators or guides for when restrictions should be lifted, local knowledge is critical. Therefore, utilize the output of the local offices of the Ministry of Transportation and Infrastructure, who determine when to impose and lift restrictions, and provide criteria for any exemptions. Central tire inflation research has been conducted by FERIC, a division of FPInnovations, on [**{{{Tire Pressure Control Systems \(PDF\)}}}**](#) in conjunction with log haulers and the Ministry of Transportation and Infrastructure which has implemented various trials allowing log haul on roads that would normally be shut down due to 'breakup'. Consult with engineering branch staff prior to implementing a log haul program of this nature.

Publish notice of impending or imposed restrictions in local newspapers and/or announce restrictions on local radio stations before they are imposed.

When temporary vehicle weight restrictions on roads are posted for FSRs, use the ministry's warning load limit posters:

- [Poster - Warning Load Limit - Percentage Max Allow Weight \(FS 639\) \(PDF\)](#)
- [Poster - Warning Load Limit \(FS 639a\) \(PDF\)](#)