5.6 Subgrade Construction

5.6.1 Construction Near Licensed Waterworks

Licensed waterworks have been identified as part of the road layout and road survey and design processes. Based on the information gathered through those processes, and for any other licensed waterworks discovered during construction of the road, unless there is an exception in accordance with FPPR, ensure that the road is constructed so as not to damage a licensed waterworks and to achieve at least 100m distance from any such waterworks or springs in community watersheds.

Additionally, ensure that at least 48 hours notice of impending construction work is provided to water licensees or water purveyors in community watersheds.

5.6.2 Construction in Riparian Management Areas

Ensure that a road is constructed in accordance with the layout and the design, such that there are no subgrade construction works within a riparian management area, unless otherwise exempted from this requirement under FPPR, section 50.

5.6.3 Fan Destabilization

Fans can be the runout zones for debris flows and can be influenced by over-bank flows during debris floods and floods. These events are not rare and can impact roads on fans. Conversely, roads can exacerbate the effects of these events.

FRPA recognizes fan destabilization on the Coast; province-wide, FRPA recognizes impacts to fish habitat and forest soils—impacts that can result from fan destabilization. There may be a range of causes of fan destabilization as a result of road construction, and a variety of potential mitigative practices (see Land Management Handbook 57 Forest Management on Fans Hydrogeomorphic Hazards and General Prescriptions (PDF, 3.2MB). Ensure that the following practices are carried out when constructing roads on fan landforms that are identified along the proposed route:

- explore each fan for evidence of debris flows, debris floods, and floods,
- build to account for the identified hazards with attention to the specific location of the crossing on the fan, the need, if any, for climbing roads, drainage structure size and

configuration, and excavations into the stream channel or banks.

5.6.4 Wildlife Measures & Features

Ensure that a road is constructed in accordance with any general wildlife measures that may be in place (as identified in the road layout process), and the construction activities do not damage resource or wildlife habitat features.

5.6.5 Construction Surveys

Where the location and volumes of road building materials are critical, carry out construction surveys to re-establish the road centerline, to determine the limits of the cut and fill slopes, and to provide grade control during construction.

Preferably, carry out construction surveys after clearing and grubbing operations, but before primary excavation begins.

5.6.6 Modifying the Road Layout & Design

If the road design does not reflect the field conditions actually encountered after the clearing operations, then modify the design to address those unforeseen conditions. Should a professional prescription not reflect actual field conditions, or if the layout and design revisions affect a prescription to maintain slope stability, then ensure that any design changes are reviewed and approved by a qualified registered professional before construction begins.

5.6.7 Sidecast Construction

Where terrain stability is not an issue, cut and fill (sidecast) is a common forest road building technique. During sidecast construction, excavated material from the uphill slope is placed on the downhill slope (using crawler tractors or excavators) to form a fill to support the outside portion of the running surface of the road (Figure 5-2). If this fill material is not properly compacted, settlement will likely occur, leading to slumping at the shoulders and the creation of settlement or tension cracks in the road surface. Refer to the suggested cut and fill slope angles in Chapter 3, Table 3-4 General guidelines for cut and fill slope angles for use in forest road design (PDF).

Do not use topsoil and debris, and saturated and other unsuitable soils, as road fill. Rather, remove them, because they have a very low strength and can readily fail under vehicle loading. In areas having a low likelihood of landslides, however, consider placing stumps, roots, and embedded logs outside of the subgrade width (Figure 5-3).

Key in or notch the fill material into the slope, after all organic material and unsuitable soils have first been removed from the road prism. Ensure that the notch is sufficiently wide to allow equipment to work. Build up the fill in shallow lifts and compact it using the road-building

machinery—or, ideally, roller compactors. Properly compacted fills have a higher load-carrying capacity and tend to shed water rather than absorb it. This results in a more stable, erosion-resistant subgrade that requires less maintenance while minimizing the potential for adverse environmental impacts.

5.6.8 Full Bench & Partial Bench Construction

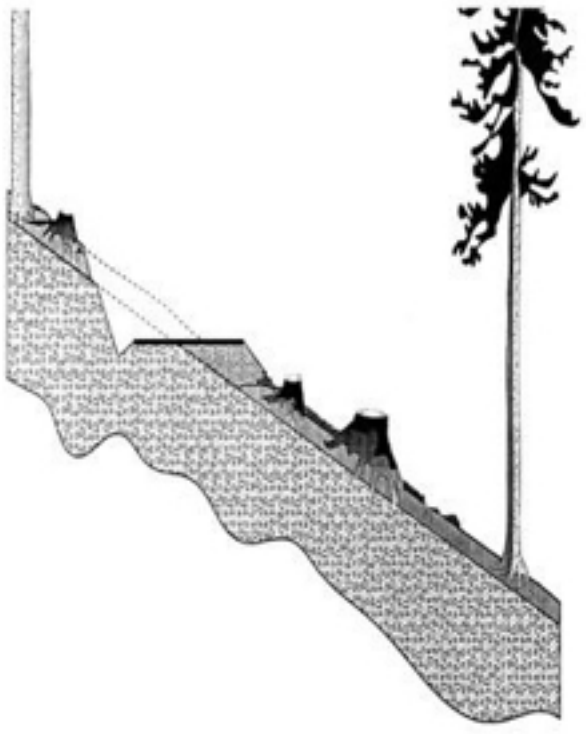
To maintain slope stability in areas having steep slopes or unstable (or potentially unstable) terrain, consider applying full bench and partial bench construction techniques. Base the decision to use these techniques for this purpose on the results of a Terrain Stability Assessment prepared by a qualified registered professional. Refer to Guidelines for Terrain Stability Assessments in the Forest Sector (PDF, 1.87MB) (published by the Association of Professional Engineers and Geoscientists of British Columbia).

Full bench construction involves cutting a bench into the side hill equal to the width of the road (including the ditch). Transport all the excavated material (endhaul) to an approved disposal site for excavation spoil, unless otherwise prescribed by a qualified registered professional.

Partial bench construction is similar to the full bench construction technique except that the bench is less than the full width of the road, with the remaining road width built on sidecast fill. To maintain slope stability, transport (endhaul) the surplus excavated soil and rock material to an approved disposal site for excavation spoil, but do not place it along steep slopes below the road unless prescribed by a qualified registered professional.

Figure 5-9 Full Bench

Figure 5-10 Partial Bench



5.6.9 Endhauling Surplus Excavation Materials

“Endhauling” during road building is the loading, hauling, and placing of surplus excavated soil and rock material (excavation spoil) from a construction site either to a different location along the road for use in road fills (if required and if the materials are suitable) or to an approved disposal site for excavation spoil.

5.6.10 Location of Disposal Sites for Excavation Spoil

Identify potential disposal sites for excavation spoil during the field reconnaissance or survey and design and incorporate them into the final road design. Ensure that such sites take advantage of swales, depressions, benches, and shallow slopes—and, ideally, are situated in depleted borrow pits or quarries. Do not locate disposal sites:

- in a riparian management area;
- in an area having a moderate or high likelihood of landslides; or
- at the crest of a slope or top of an escarpment.

Ensure that all disposal sites for excavation spoil maintain natural drainage patterns.

Carefully place and pile debris material transported to a disposal site to maintain slope stability at all times and take measures to control erosion and sediment transport. Consider the following measures:

- placing the coarse material on the bottom and the finer-grained material on the top, and then compacting the pile to eliminate large voids;
- using topsoil to cover the pile to aid revegetation and limit surface erosion;
- not exceeding the natural angle of repose of the soil or rock materials;

- “benching” the sides of the spoil pile when heights exceed 5m;
- crowning, sloping, and grooming the spoil pile to ensure that the surface does not pond water; and
- installing sediment control devices below the disposal site for excavation spoil to capture and prevent sediment transport beyond the site until the spoil pile is revegetated.

5.6.11 Rock Excavation

Where the rock hardness, weathering, and jointing are suitable, consider the use of a backhoe-mounted hydraulic hammer or ripper for rock breaking. Where these techniques are not appropriate, fracture rock by drilling and blasting. Ensure that qualified blasters assess rock and site conditions, formulate appropriate blast designs, learn from previous results, and immediately revise field practices to reflect changing conditions. Use controlled blasting techniques where the cut bank height exceeds 5m. Where site conditions are complex or beyond the experience of the blaster, seek guidance from a specialist professional engineer.

Ensure that the rock cut has a ditch of width sufficient to capture material that may fall from the rock cut, and that drilling and blasting techniques minimize:

- flyrock (airborne rock displaced beyond the road prism by blasting) to avoid damage or disturbance to forest resources and existing improvements;
- the potential for landslides or slope instability; and
- the amount of overbreak (any material that is excavated, displaced, or loosened outside and beyond the designed road prism, regardless of whether it was because of the inherent character of any formation encountered or because of something else).