

Table 3-4 General guidelines for cut and fill slope angles for use in forest road design

	Cut Slope :		Fill Slopes	
	Examples of Material Types^a	Suggested Cut Slope Angles^b for Cut Bank Height < 6 m^c	Examples of Material Types^a	Suggested Fill Slope Angles^b
Coarse-grained Soils ^d	Road cuts in loose to compact SANDS or SANDS and GRAVELS (not cement and non-cohesive)	1½ H : 1 V	Road fills composed predominantly of SANDS, or SANDS and GRAVELS, or drained mixtures of coarse-grained and fine-grained soils	1½ H : 1 V
Fine-grained Soils	Road cuts in loose SILTS, or soft cohesive soils such as SILTY CLAYS or CLAYS (not consolidated and not cemented) Road cuts in hard cohesive soils such as SILTY CLAYS or CLAYS (consolidated)	1½ H: 1 V for lower cuts to 2 H: 1 V for higher cuts 1 H : 1 V or flatter	Road fills composed predominantly of SILTS or CLAYS ^e	2 H: 1 V
Dense Glacial Till / Cemented Sands and Gravels	Road cuts in dense to very dense GLACIAL TILL (i.e., basal till), or cemented SANDS or SANDS and GRAVELS	¾ H : 1 V or flatter	See above for coarse-grained soils	See above for coarse-grained soils
Rock ^f	Road cuts in strong, good quality ROCK mass with no significant weaknesses	¼ H : 1 V to vertical	Road fill composed predominantly of individually placed and locked together (not dumped) good quality angular blasted or ripped ROCK	1 H : 1 V
	Road cuts in other ROCK types should be flatter to include any weaknesses from the effects of structural discontinuities in the rock mass, and other factors such as the strength of the rock material, and the spacing, aperture, roughness, filling, weathering, and orientation of discontinuities	¼ H : 1 V to 1¼ H : 1 V	Road fill composed predominantly of dumped angular ROCK or placed rounded ROCK	1¼ H : 1 V to 1½ H : 1 V

Notes Table 3-4:

- ^a Not all material types in the soil groups are represented in the table.
- ^b For the design of roads located in domestic watersheds, on sensitive terrain, or in other areas where transport of sediment or landslides may adversely affect resources, it may be necessary to use flatter cut and fill slope angles to reduce the hazard of erosion or failure of cut and fill slopes. During construction of roads, it may be necessary to build flatter slopes where the road prism exhibits signs of distress, such as, for example:
 - (1) cracks or scarps within original ground above the top of cut slopes, in the road surface, or within the fill slope on the downslope side of the road; and
 - (2) significant zones of ground water seepage such that localized failure of cut or fill slopes are expected. Alternatively, installation of retaining wall structures may be needed to reduce excavation, contain bank material, or prevent slope failure. The significance of observed seepage zones might dictate application of other special measures to reduce the likelihood of slope failure during construction and over the operating life of the road.
- ^c Consider the need to obtain advice from a Specialist for cut heights greater than 6 m, or where the ground slopes away from the edge of the excavation at a slope steeper than a ratio of 3 horizontal to 1 vertical. The advantages of steeper cuts may include: less area occupied by road; less excavated material; less sidecast; and shorter slope lengths exposed to erosion processes. The disadvantages of steeper cuts may include: increased difficulty to establish vegetation; increased chance of slope raveling, tension crack development and slope failure; and increased road maintenance costs. The disadvantages of steeper cut slopes can be reduced if high banks are avoided.
- ^d Erosion control may be particularly problematic for slopes composed of sand, silty sands, or silts. Consider the need for erosion protection measures for cut slopes, fill slopes, and ditches, such as revegetation, soil bioengineering and biotechnical slope stabilization techniques, riprap, or other special slope treatments.
- ^e If significant compaction of the road fills can be achieved, then fill slopes (of limited height) may be placed steeper than 2 H : 1 V.
- ^f If potential problems are anticipated for rock slopes either during design, construction, maintenance, or deactivation, consult with a geotechnical engineer or other rock slope specialist. It may be necessary to address the need for special rock slope stabilization measures (e.g., rockfall catch ditch, wire mesh slope protection, shotcrete, rock bolts).