

MAP CODE  
ROAD

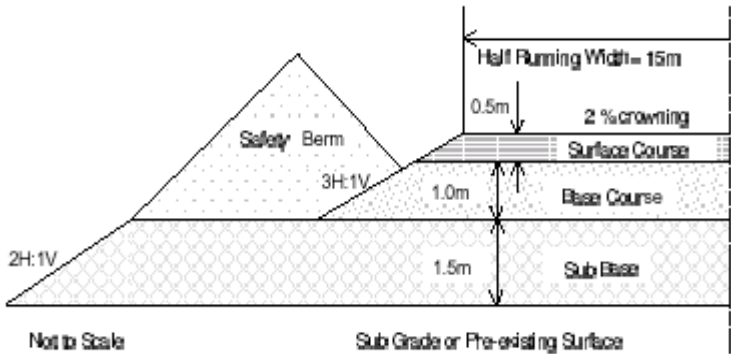
# HAUL ROADS

**USE** Dust  
Noise  
Sediment  
Stormwater

**What** ➤ System of roads within an aggregate mining operation.

**Purpose** ➤ To facilitate safe and efficient operation of mobile equipment while minimizing environmental impacts.

➤ When well-designed and constructed, haul roads can make the aggregate operation safer, more productive, and cause less wear and tear on equipment.



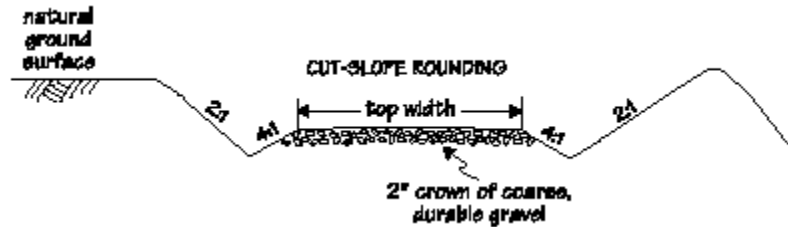
Typical haul road cross-section.

Source: University of Alberta

**Where** **YES:** All aggregate operations.

**Materials** ➤ Mine waste, gravel, overburden, crushed stone, asphalt or concrete.  
**Equipment** ➤ Bulldozer, excavator, scraper, dump truck.  
**& Costs** \$ Varies.

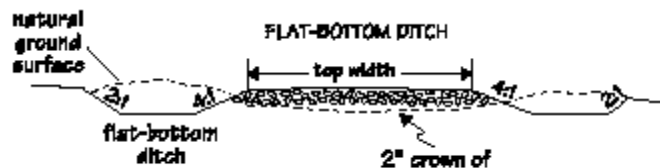
- Plans & Spec's**
- Keep frequently used haul roads and other heavy traffic areas dry by elevating the surface to facilitate runoff.
  - Dryer roads cause less wear and tear on tires and equipment and create less sediment-laden water that will require treatment.
  - Make sure roads are well capped with durable rock of appropriate size.
  - Road widths are usually designed to be 3 times the width of the largest haul truck (for 2 way traffic) with extra width employed on the curves. (Refer to [HSRC 6.8](#))
  - Road shoulder barriers/berms should be  $\frac{3}{4}$  of the height of the largest tire on any vehicle hauling on the road.



#### Profile of elevated haul road on side hill.

Source: Washington State Department of Natural Resources, Oregon  
Department of Geology and Mineral Industries

- Banking of curves (super-elevations) and their transitions are designed to minimize the centrifugal forces on the haul truck while negotiating the curve. Super-elevations should be in the range of 4% to 6%, depending on the curve radius and equipment speed.
- In the design of both horizontal and vertical curves, line-of-sight and stopping distance are key criteria. Design curves so that the line-of-sight of the driver is equal to or longer than the stopping distance of the loaded haul truck.



#### Profile of elevated haul road on flat ground.

Source: Washington State Department of Natural Resources, Oregon  
Department of Geology and Mineral Industries

- Grades usually vary from -20% to +20%. Grades over 10%, however, are used only for short distances in temporary situations. The preferred maximum grade is usually 8%.
- Sharp horizontal curves should not be designed at the top or bottom of hills.
- Intersections should be located at flat, straight alignments of the haul road.
- Road surface cross-slopes should be approximately 1:25 (4%) for good drainage.
- Curve radii should always exceed the minimum turning radius of the equipment.
- Provide runaway lanes for grades in excess of 5%.

### ECONOMICS

When considering the quality of the road to construct, the most important items are:

- Life of road
- Use of road (amount of production over the road)
- Location of road (is it permanent or does it have to be removed?)

## Classification of Haul Roads by lifespan

<b>Temporary Roads</b>	<ul style="list-style-type: none"> <li>• short life</li> <li>• minimum thickness</li> <li>• low specification material</li> <li>• inexpensive to build</li> <li>• used mainly for shovel or dump access</li> </ul>
<b>Semi-Permanent Roads</b>	<ul style="list-style-type: none"> <li>• medium life</li> <li>• engineered to desired thickness</li> <li>• high specification material</li> <li>• relatively expensive to build</li> <li>• used for main haul roads in pits and out-of-pit hauls in non-final pit walls</li> </ul>
<b>Permanent Haul Roads</b>	<ul style="list-style-type: none"> <li>• long life</li> <li>• engineered to ultimate thickness</li> <li>• high specification material (may even be paved)</li> <li>• expensive to build</li> <li>• used for final out-of-pit haul roads.</li> </ul>

## DESIGN

- A haul road consists of four distinct layers:
  - Sub-grade  
Sub-grade made of hard, sound rock or dense, compact gravel, may not require fill as haul trucks can travel on the sub-grade surface. If the sub-grade lacks the required bearing capacity, then it needs to be altered through suitable measures such as compaction.
  - Sub-base  
Run of mine and coarse rock usually make up this layer. The sub-base provides structural strength to the road and can also prevent intrusion of the sub-grade soil into the base course and vice-versa, minimizing the effect of frost and accumulation of water in the road structure.
  - Base course  
Usually high quality material with suitable size fractions is used for the construction of this layer. As the base course is the main source of the structural strength of the road, specifications of strength, plasticity and gradation are generally more stringent than for the other layers.
  - Surface  
Generally constructed with appropriately sized gravel closely controlled grading to avoid dust problems while maintaining the binding characteristics of the material. Apart from providing a smooth riding surface, it distributes the load over a larger area, thus reducing stress.

- Maintenance**
- Establish a regular grading program that will minimize erosion, sediment build-up, noise and dust.
  - Ensure that potholes, washboarding and frost heaving are repaired immediately to minimize noise, dust and equipment wear.
  - Spray water, calcium chloride or other approved dust suppressant on the road surface.
  - Roads may also require scarifying, sanding and resurfacing.

## Sources

Ministry of Employment and Investment. (1997): **Health, Safety and Reclamation Code for Mines in British Columbia** Section 6.8.

British Columbia Ministry of Energy and Mines. (1997): **Health, Safety and Reclamation Code for Mines in British Columbia** Section 6-8; Mines Branch, URL <<http://www.em.gov.bc.ca/Mining/Healsafe/hsrecode1.htm>>, October 2001.

Tannant, D. and Regensburg, B. (2000): **Guidelines for Mine Haul Road Design**; *University of Alberta, School of Mining and Petroleum Engineering*.

Norman, D.K., Wampler, P.J., Throop, A.H., Schnitzer, E.F. and Roloff, J.M. (1997): **Best Management Practices for Reclaiming Surface Mines in Washington and Oregon**; *Washington State Department of Natural Resources* Open File Report 96-2 and *Oregon Department of Geology and Mineral Industries* Open File Report O-96-2, page 2-18 to 2-19, URL <<http://www.wa.gov/dnr/htdocs/ger/pdf/bmp.pdf>> [PDF, 7.6Mb], June 2001.