

## 5.9 Stabilizing the Subgrade & Surfacing the Road

### 5.9.1 Ballasting

Ballasting is the use of rock to construct the road subgrade when other available material is incapable of supporting the design traffic load during the period of use.

Generally, ensure that suitable ballast material:

- drains well;
- forms a structurally competent fill;
- compacts well; and
- resists erosion.

### 5.9.2 Surfacing

Surface the subgrade with pit-run gravel or crushed rock aggregate for one or more of the following reasons:

- where subgrade material is highly erodible and needs to be protected from water or wind action;
- where subgrade material will not support traffic loading during periods of use; and
- to form a driveable and gradeable surface.

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#### **Surfacing material selection**

Surfacing materials include crushed rock and pit-run gravel aggregates. Surfacing materials consist of inert, tough, durable particles that will not deteriorate when worked (handled, spread, or compacted) and combined with suitable fines, or when exposed to water and freeze-thaw cycles. Ensure that aggregate particles are uniform in quality and free from an excess of flat or elongated pieces.

Ensure that the aggregate is well graded (contains a mix of all particle sizes) for compaction and for a durable wearing surface. When the only source material is poorly graded, consider:

- screening the material to remove the excessive particle sizes; or

- blending in the deficient material size.

Because crushed aggregate is expensive to produce, protect it with a base coarse stabilizer (e.g., calcium chloride or magnesium chloride, installed to the manufacturers' specifications) to prevent the loss of fines. Obtain and rigidly apply specifications for high fines crushed gravel when use of a calcium chloride or related stabilizer is being considered. Note that some stabilizers are not acceptable in community watersheds or near licensed water intakes.

### 5.9.3 Surfacing Compaction

Compaction of the subgrade and surface through the use of equipment designed for this purpose will increase the load-carrying capacity of the road bed and reduce the volume of surfacing material that will be required to maintain the road bed during its service life.

For optimum strength, place the surfacing material in uniform lifts compatible with the compaction equipment that is to be used. Uniformly compact each lift before being covered with the next lift. To achieve maximum compaction, ensure that the moisture content of the material is close to optimum. Material that is too dry or too wet will not achieve the best compaction. Therefore, during the spreading phase, add water to dry material, or allow saturated material to dry to achieve the optimum moisture content.

### 5.9.4 Protecting Erodible Fills Located Within Floodplains

All embankments, dikes, streambanks and channels, culvert inlets and outlets, abutment wings, and structure foundations may require protection by the addition of riprap, or other armouring material.

When constructing embankments within active floodplains, take action to prevent erosion of those embankments by forming the entire embankment of non-erodible material. Where this is not possible or practical, armour the fill.

Table 5-2: Indicates the stream velocities that can erode different size materials.

Table 5-2 Example erosion velocities

<b>Material</b>	<b>Diameter (mm)</b>	<b>Mean velocity (m/sec)</b>
Silt	0.00	0.15
Sand	1.0	0.55
Fine gravel	10.0	1.00

Medium gravel	25.0	1.40
Coarse gravel	75.0	2.40
Cobble	150.0	3.30

If the embankment is to be formed by one of the materials in Table 5-2 and will likely be subject to velocities at least equal to those corresponding to that material, then use armouring. Several forms of armouring material exist:

- angular and durable riprap (see below);
- sand bags (a very short-term solution only, as bags break down over time);
- concrete, including concrete blocks (quick, easy installation), sprayed concrete (shotcrete or gunnite), or poured-in-place concrete (uncured concrete products should be kept isolated from the stream until the concrete has cured);
- binwalls (for velocities less than 1 m/sec or used in conjunction with riprap and where suitable fill material – cobble, coarse gravel – is readily available); and
- other commercial erosion control systems.

For riprap, ensure that the rock selected is sized to resist peak flow velocities, and graded to act as a filter to resist movement of underlying soil through the riprap (all in accordance with the approved design). Place the riprap on firm, stable ground, taking care to provide mass stability and a regular surface with a minimum of voids. Place it horizontally to form an apron, and trench it below the scour depth. Consider keying it into the bed of a watercourse below the scour depth where acceptable to the environmental agencies.

### 5.9.5 Litter, Petroleum Products & Other Waste Materials

Ensure that all workers on the site are familiar with the requirements for the use, storage, and disposal of litter, equipment fuel, and servicing products. Those most commonly associated with road construction are:

- waste oil and grease and spoiled fuel;
- refuse: camp garbage, waste paper, old machine parts, and damaged culvert pipe;
- batteries and battery acid;
- sewage and litter: where camps are to be established, sewage disposal via permitted septic systems is required; and
- fuel storage (a permit from the appropriate agencies is required for the establishment of

fuel tank farms).

Ensure that all ministry contractors have petroleum product spill response kits on hand, and that personnel are familiar with spill containment procedures. Refer to the [BC Timber Sales Environmental Management System Manual \(PDF\)](#), which contains information on environmental policy, training, awareness and competence, emergency preparedness and response and records, among other items. Spill kit contents vary by type of work, potential size of spill, and impact potential, covering a range of incidents, from minor hydraulic leaks to major watercourse spills. At a minimum, ensure that each machine has a spill kit with extra absorbents in the support vehicle.

Dispose of waste and contaminated materials as appropriate and in accordance with the relevant federal and provincial statutes, including:

- burning;
- burying; or
- containing and removing from the site to an approved disposal location.