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Railway Drainage Systems Manual

Part 2E: Installation

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1 Purpose

The purpose of this Part of the Manual is to provide guidance on methods of installing the components of Drainage Systems.

2 Scope

This Part of the Manual applies to new Drainage Systems, and the Remediation and Maintenance of existing Drainage Systems.

3 Installation of drainage components

3.1 Channel Drains

3.1.1 Lined Channel Drains

Lined Channel Drains require minimum excavation for their installation.

The trench excavated to receive the Channel Drain units should be about 150mm wider than the outside width of the units, the side spaces being filled with porous material, such as clean aggregate or gravel (20mm nominal size), or a filter medium where the ground conditions so require.

The size of the material selected for the porous fill should be such that the material will not enter the channels via any weep holes provided in the side walls of the units.

Channel Drain units can be precast concrete, or other approved material, and should be laid to the designed line and level, and preferably bedded on weak concrete or dry mix. The units should be laid open jointed to provide a means for water to enter the drain.

The top of the channel should be slightly (25mm to 50mm) above ground level, and be uncovered except when located in walkways.

A length of pipe drain might be required at the low end of a Channel Drain to connect the Drain to the Outfall. When the pipe extends beyond the area being drained, it should be laid as a Carrier Drain with a diameter commensurate with the designed flow rates. A Trash Screen might be fitted over the inlet end of the pipe to control the ingress of debris.

3.1.2 Channel Drains adjacent to walkways

Channel Drains, when installed at the locations shown below, should be fitted with loose covers or cover slabs:

- narrow cesses;
- stations;

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- sidings;
- other areas where personnel could walk;
- where ballast, dead leaves, etc., could fall into the Channel.

Covers or cover slabs should not be allowed to become buried.

3.2 Pipes

3.2.1 Excavation and installation

Trench excavation is the best option for most piped Drainage Systems. There are few locations on the rail network where access cannot be gained for the excavation plant (that is, wheeled excavators adapted to run on track and mini excavators). However the use of trenchless methods, described in Appendix A, might be necessary in some locations, but even these methods require excavation for accessing the pipe or for constructing launch and reception pits.



Figure 1E.1: Trench excavation for laying pipes

Drain laying and back-filling of the trench should follow as closely behind the excavation as practicable.

The excavated trench for the drain should be at least 150mm wider than the outside diameter of the pipe; this dimension should be larger for deep drains to accommodate the trench support system and to afford working room.

Pipes should be laid to the design line and level and bedded on a 75mm to 150mm thick layer of a graded filter medium.

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The collars of glazed earthenware pipes used as Carrier Drains should be sealed.

Perforated or slotted pipes for Collector Drains should be installed with the slots or perforations downwards and not be obstructed. Spigot and socket earthenware and cast iron pipes for Collector Drains should be laid open jointed.

3.2.2 Backfilling trenches

After laying the pipe, the trench should be back-filled with a porous material (see **3.2.3**). In areas where personnel could walk over the back-filled trench, the backfill should be finished off with a blinding of chippings or other approved type of cess walkway surfacing.

To prevent the backfill clogging the collars or perforations of the pipe, thereby shortening the effective life of the drain, the pipe should be covered initially to a depth of 150mm with a graded filter (see **3.2.4**) before completing the back filling. This backfill should extend around the sides of the pipe to a width of 75mm to 100mm.

Trenches containing ferrous metal pipes should not be back-filled with acidic material such as ashes, and a non-acidic backfill should be provided to ferrous metal pipes laid in acidic soils. Ferrous metal pipes laid in sulphate bearing soils should be protected against corrosion, such as by a bitumen wrapping.

All backfill should be placed in layers and adequately compacted to minimise internal settlement.

3.2.3 Porous fillings

The grading for porous fillings, such as clean graded ballast or gravel, should have:

- a minimum particle size not less than 12mm;
- a maximum particle size of between 50mm and 75mm;
- an even grading between these limits.

3.2.4 Filters

The required characteristics of a filter depend upon the type of soil in which the drain is being installed.

Clayey soils are made up of very fine particles and when pipes are laid in such soils they have to be surrounded with a filter to prevent them from entering the drain. The filter has to be porous to allow the passage of

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water but sufficiently fine grained to reduce the amount of fines entering the Drainage System. Chippings and ballast are not suitable for use as filters.

For clays, silts and fine-grained sandy soils, the filter should have D_{15} greater than 4 times D_{15} and less than 4 times D_{85} of the surrounding soil, where D_{15} and D_{85} are the particle sizes determined from a grain-size distribution curve for 15% and 85% respectively (as determined in accordance with BS 1377-2).

Filters used for bedding and surrounding pipes and Catchpits should comply with Table 2E.1.

Nominal diameter (mm)	BS EN 12620 Coarse Aggregate	
	Graded aggregate ranges (mm)	Single sized aggregate sizes (mm)
Not exceeding 140	–	10
Exceeding 140 but not exceeding 400	20 to 5 or 14 to 5	10, 14 or 20
Exceeding 400	14 to 5, 20 to 5 or 40 to 5	10, 14, 20 or 40

Table 2E.1: Granular filters

The advice of the Drainage Engineer should be sought when there is any doubt about the suitability of a material proposed for use as a filter.

3.2.5 Geotextiles

Where a pipe is being installed with a permeable geotextile (when renewing a track substructure for example) the geotextile should be carried down the side of the trench to the bottom and extended under the pipe.

A review of the performance of Track Drainage identified a concern relating to the use of a geotextile (or 'geosock') to surround a pipe. This has been a particular issue when a drain is installed independently of a track renewal. In such situations the efficiency of the drain is affected as the flow of water into the drain is restricted; this is compounded as the geotextile becomes clogged with fines.

A track drain in the six foot or cess shall not be surrounded by a geotextile (or geosock).

A geotextile used with a track drain shall tie into the Track Support System.