

Guidelines for Drainage Behind and Below Retaining Walls (February 2015)

Construction of retaining walls is one of the major works in road construction in hilly terrain. In earlier phases, RAP built hundreds of kilometres of road with extensive use of retaining walls. There were a number of instances of retaining wall failure and collapse during RAP1 and 2. Even though there was no specific study and research conducted on such cases, the failure could be attributed to insufficient foundation preparation, improper backfilling, inappropriate design (wall configuration and composition) and non-compliance with specifications during construction (i.e. lack of proper bonding of stone, tying and bracing of gabion). One important but often ignored aspect in the construction of wall is the provision of drain behind and below the wall. Backfilling with free draining granular materials is ideal as such type of materials may not be available from nearby road excavation and it is impractical to provide free draining material by transporting from longer distance under the labour-based road construction approach like ours. The foundation base and heel get most saturated due to the water percolating through the back fill as well as from the structure itself thereby building up high pore water pressure and softening of the foundation. The excessive pore water pressure developed there would increase the lateral earth pressure significantly, resulting in high probability of structural failure. So, if we make some arrangements to drain off water from the heel and foundation base, this would greatly help to relieve the pore water pressure thereby contributing to stability of the retaining wall.

In order to increase the stability of retaining wall and prevent structural failure, RAP3 has introduced a sub-soil drainage system to facilitate the proper flow of water behind and below the wall. The system consists of a longitudinal drain running adjacent to the heel (bottom back) of the wall and transverse drains to drain off the water coming to the longitudinal drain. Both drains shall be of 300 mm width, the longitudinal one being of tapered section to facilitate the flow of water and transverse drain of 300 mm depth with 3% outward slope as shown in the attached typical design sketches. The drains shall be filled with broken stone chips (aggregate) or gravel (20 – 70 mm size) whichever is practicable as per site conditions. The aggregates or gravel shall be wrapped in geotextile to prevent clogging due to fine-grained soils.

This drain system is proposed to be built for all retaining walls of 5 m retained height and above. However, when the site lies in water logged (seepage) area and the back fill mass is likely to get saturated most of the year, provisions have to be made for such drains irrespective of the retained height. For such cases, proper dry stone-lined side drains are required to be constructed to intercept water seeping from hillside of the road.

All DTAs of new construction districts are required to make provision of the sub-soil drains for the retaining wall as specified above in Stage 2 design of roads and quantities/costs need to be accordingly estimated based on the typical design.

As for the method of laying of geotextile on the back of wall, at least 450 mm length of the geotextile sheet needs to be placed under the wall at the base to prevent unravelling during back fill and there should be at least 450 mm overlap between the consecutive sheets when making a vertical joint . Normally it is not necessary to place geotextile over the full foundation floor and great care must be taken to make sure the wall is founded on a solid surface otherwise the excavation should be deepened. The geotextile sheet should be laid on the stepped back of the gabion wall in such a way that there would be no gap left between the sheet and the gabion stepping. In addition, the entire top width of the wall should be covered with the geotextile if there is some earth filling over the top of the wall.

The same amount of overlap in geotextile sheet is required when making the aggregate drain behind and below the wall.

