Appendix

Method Statement

Permanent Road Construction and Temporary Access over Wetlands

1. Introduction

When planning the alignment of a road, it is generally desirable to avoid crossing any wetlands. The environmental sensitivity of wetland areas is acknowledged by road planners and designers. However, it should also be noted that wetlands create design challenges in terms of a road's strength and stability, often requiring specific foundation treatments which can add significantly to the cost.

Nevertheless, the crossing of wetlands, whether natural or created, is occasionally unavoidable. The methodologies below describe the manner in which such crossings are constructed such that negative impacts on the environment are mitigated as far as is practical.

Understanding wetlands and their hydrologic function is a specialist field of study. When construction activities cross wetlands, very careful investigations and planning are carried out in order to establish and limit the overall effect of the final product on the wetland. Best management practices (BMP) are applied to construct access without serious long term impact on the natural functioning of the particular wetlands.

There are two typical scenarios in providing access for crossing wetlands, namely :

a. Permanent road construction, which will be built on a porous fill with properly designed cross drainage to minimize the impact. This requires careful planning, collaboration with environmental specialists, and execution by experienced contractors.

b. Temporary access required for construction purposes, such as for bridge and culvert foundations (spread footings) and for substructures (piling operations). This involves making use of decks or mats designed and supplied by Specialist Suppliers to construct a temporary roadway for the construction vehicles.

2. Construction Method for permanent roads crossing wetlands

Fill embankments across wetlands are generally constructed on top of rockfill layers which provide stability and dissipate pore water pressures. It is good practice to construct the fills at least 6 months before the pavement layers are added on top. This allows for any settlement to take place without causing any deformation in the new road surface. It also allows for the natural flow in the wetland to be monitored to ensure that the drainage layers are functioning effectively.

The typical construction sequence is summarised overleaf.

2.1 Establish depths of wetland bottom at various chainages along the road.
2.2 Establish approximate bearing capacities of soil at bottom of wetland.
2.3 Excavate to the required width and depth, with shoring or cofferdams to prevent slumping of the saturated material.
2.4 If required, excavate further to acceptable bearing capacities.
2.5 Place a pioneer layer of permeable material over the bed of the excavation, or place a layer of suitable geo grid.
2.6 Lay down a double layer of suitable geotextile to cover the base and sides of the excavation, plus sufficient geotextile to fold over the rockfill.
2.7 Place rock fill, size between 50mm and 200mm to width of road bed in layers not exceeding 500 mm. The top of layer not to extend above any required culvert invert levels.
2.8 Fold geotextile back over rock fill and tuck in on other side.
2.9 Construct road fill embankment with dry, selected materials.
2.10 Allow the fill embankment time to settle and install culverts as necessary (refer to 3 below).
2.11 Construct pavement and sub-base layers to specified compactions.
2.12 Construct base course layers to specified compaction.
2.13 Apply road surface and auxiliary works (guardrails, signage, etc)
2.14 *End of roadway construction.*

3. Alternative Method in Extremely Unstable Conditions

In extreme conditions, it may not be practical, or safe, to excavate in the wetland. The alternative method of 'end tipping' the rock fill to create a solid foundation for the road fill embankment would then be used. The rock is tipped at the edge of the wetland and gradually pushed in until firm enough footing is achieved. Subsequent loads can then be laced further into the wetland. Thus the rock fill is gradually placed across the affected area.

A geo-grid or geotextile, as appropriate, is placed on top of the levelled rock fill, before carrying out steps 2.9 to 2.14 above.

4. Construction Method for Culverts on Permanent Wetland Crossings

4.1 Trench for culverts through the road fill embankment at the specified positions down to grade but not less than 300mm above the geotextile folder over the rock fill.
4.2 It is preferable to install the culverts before the road pavement layers are constructed.
4.3 If it is required that the culvert invert be lowered further, carefully excavate by hand to ensure that the geotextile is not damaged.
4.4 Construct culvert bedding to correct fall and specification.
4.5 Lay culvert to correct crossing angle and fall.
4.6 Backfill according to the specifications indicated on the construction drawings with material approved by the engineer to the height of the fill.
4.7 Perform required compaction tests on all backfill material.

4.8 Construct the culvert inlet and outlet structures, which will typically be headwalls, wingwalls and apron slabs.
4.9 Trim the fills and construct any protection works such as gabions, stone pitching, and berms.
4.10 Repeat process for all culverts.
4.11 *End of culvert installations.*

5. Construction Method for Temporary Access over wetlands using decks or mats

Temporary access systems may be utilise to facilitate access for excavation or for piling. These would generally be used where a bridge structure is being constructed as opposed to a fill embankment.

5.1 Mark out temporary access LH edge line. (direction of increasing chainage)
5.2 Use DURA-BASE Composite Mat System or other Deck/Mat system approved by the Engineer.
5.3 Lay mats to 3 overlapped widths along complete route.
5.4 Where wider work areas are required, lay extra mats as needed.
5.5 Lock all mats in position with the twist lock or other specified fasteners.
5.6 If a proprietary Deck system is approved, construction and fasteners must be in accordance with the Suppllier's specifications.
5.7 *End of mat/deck access surface construction.*

6. Conclusion

Road-planning and road-building practitioners understand wetlands and their hydrological functions. However, inputs from environmental experts must be incorporated in the design process for inclusion in the environmental authorisation applications.

The construction of roads across wetlands is preferably avoided, but is sometimes necessary. Construction methods are intended to mitigate any negative impacts.

Where bearing capacity permits, it is possible to construct a permeable road base from large aggregate to allow for water movement under the road. Geotextile can be used to contain the rock fill and to ensure that it does not get clogged by fine material.

Culverts can be used for streams with well-defined channels or for balancing water to either side of the road in the absence of defined channels. Installing a battery of culverts, or placing culverts at a set spacing may be a cost effective alternative to, or addition to, a permeable layer. Bridges may also be provided over defined channels within wetlands.

References:

1. SANRAL : Drainage Manual – 6th Edition 2013
2. SANRAL : Geometric Design Guidelines
3. COLTO : Standard Specifications for Road and Bridge Works, specifically Section 6100.
4. SANRAL : Code of Procedures for the Planning and Design of Highway and Road Structures in South Africa – 1st Edition 2002, updated 2008.
5. SANRAL : Construction Monitoring Manual for Bridges and Structures – 1st Edition 2011 – Chapter 4.8.