

NEED FOR SUBSURFACE DRAINAGE ON LOCAL ROADS

INTRODUCTION

The objective of this TECHnote is to assist road owners identify the need for subsurface drainage. It further discusses the various options of providing subsurface drainage types on local roads.

BACKGROUND

Historically roads were built to a budget with limited road seal width and formation width with gravel shoulders. Over the years, the numbers of heavy vehicles have increased creating pressure on local government to widen and strengthen the local roads. Widening of roads is done by extending the road carriageways towards the table drain plus widening the bitumen seals bringing the edge of road seals closer to the table drains groundwater table. This causes pavement saturation and weakening of the road pavement subgrade. Heavy traffic travelling closer to the road edge causes pumping of ground water into the road pavement resulting in road deformations. The weakened subgrade results in pavement failure requiring reconstruction and heavy patching, which is only a temporary fix. A permanent solution is providing subsoil drainage to lower the water table out of the pavement layers.

PURPOSE OF SUBSURFACE DRAINAGE

Subsurface drainage system is required to control the moisture content of the pavement and underlying material and maintain pavement strength and serviceability. Different types of subsoil drains are provided to intercept, collect and then discharge water from beneath the pavement. Subsurface drains are provided to avoid the following types of premature failure:

- Loss of subgrade strength and shape due to increase in moisture.
- Overload of the subgrade due to hydrostatic transmission of live load through a saturated pavement.

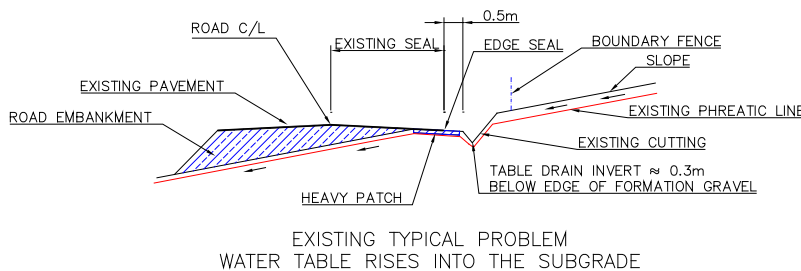
SUBSOIL DRAINAGE OPTIONS FOR LOCAL ROADS

Major factors in assessing the need and type of subsurface drainage required are permeability and capillary moisture characteristics of the material surrounding the pavement.

- Excavation of embankment cuttings, widening of the road formation and excavating deeper table drains and filling of embankments in fill. This requires removal of trees and vegetation which requires approval processes with policy guidelines and native title, fauna threatened species and other legislation compliance. The Councils' Road Verge Vegetation Management policy should provide guidance and direction to the maintenance staff for the maintenance of table drains creating road safety hazard. Widening may require boundary fence adjustment and land purchase costs. This solution may not be always acceptable.
- As an alternative construct subsoil drainage and formation subsoil drainage along the cutting table drain invert. The purpose of this is to lower the phreatic groundwater and prevent saturation of the road subgrade. If there is limited space, use subsoil piping.

Cross-section drawings showing options for typical subsurface drainage

The sketches below show a typical drainage problem of water table rising into the subgrade with three options for providing suitable subsurface drains for various conditions.



Definitions

Drainage Blankets: Layers of open graded aggregate material confined by geotextile filter both above and below the aggregate.

- Type A Drainage blankets: Blankets constructed under fill embankment. Filter gradings labelled A1 to A6 are documented in 1171 Subsurface drainage.
- Type B Drainage blanket: Blankets constructed in road cuttings. Filter gradings labelled B1 to B4 are documented in 1171 Subsurface drainage.

Subsurface Drainage types:

- Subsoil drains: Drains below the ground surface which collects subsurface water throughout its length of ground water or seepage from subgrade/subbase in cutting and filling areas.
- Formation drains: Drains designed to intercept water before it reaches the pavement structure and are generally deeper than the pavement drains.
- Pavement drains: Drains designed to remove water from the subgrade and pavement materials.

Phreatic Line: The top flowline of a saturated soil mass below which seepage takes place.

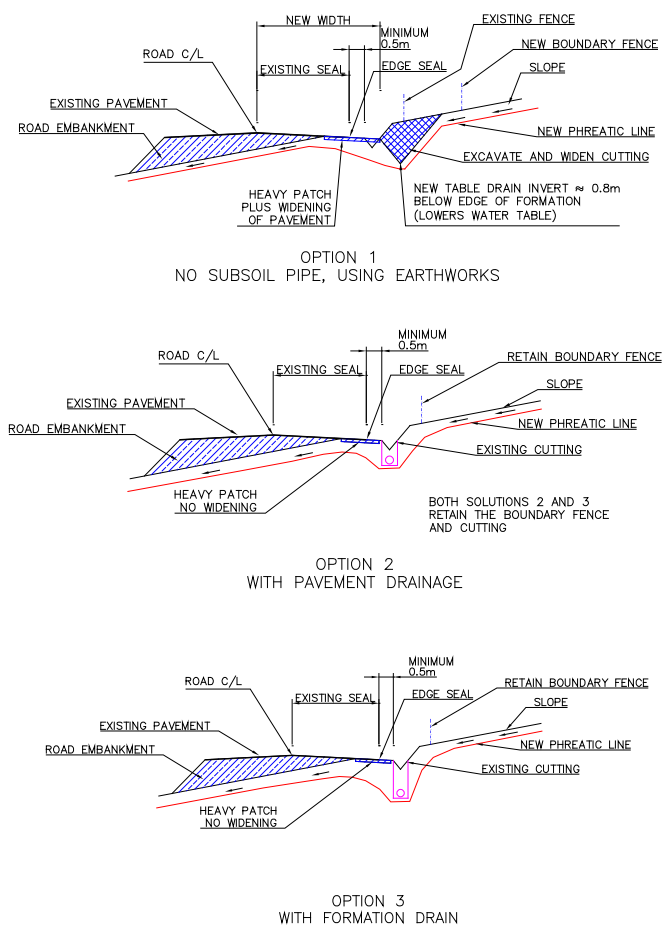
Relevant publications

- Austrroads
 AGRD Guide to road design
 AGRD05A Drainage – Road surface network, basins and subsurface
 AGPT Guide to pavement technology
 AGPT10 Subsurface drainage

Relevant worksections

- 0043 Subsurface drainage (Design)
 1171 Subsurface drainage
 1172 Subsoil and formation drains
 1173 Pavement drains
 1174 Drainage blankets

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Typical legal requirements of subsurface drainage in NSW

Vegetation management should be part of any road widening or heavy patching construction programme. Vegetation Management Legal requirements in NSW (Variations of this will be required in other states)

- Endangered Ecological Community (EEC) affects road reserve vegetation clearing. An assessment should be undertaken of all roads identifying the EEC value of particular sections of roads.
- From this a maintenance handbook should be prepared identifying low, medium or high EEC value. This is a guide only mainly for grader operators.
- Assessments are needed for low impact works and Reviews of Environmental Factors (REF) for works with potential or significant impact.

The following is a summary of legislation covering the statutory processes involved with the REF.

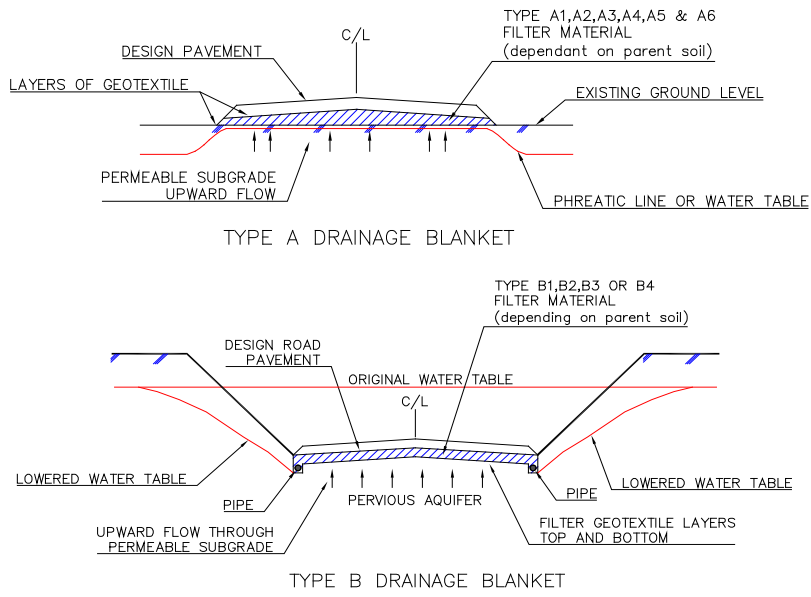
Commonwealth Legislation

- Environmental Protection and Biodiversity Conservation Act 1999.

NSW Legislation as an example for other states

- Environmental Planning and Assessment Act 1979.
- Environmental Planning and Assessment Regulation 2000.
- Threatened Species Conservation Act 1995.
- Protection of the Environment Operations Act 1997.
- Rivers and Foreshores Improvement Act 1948.
- Fisheries Management Act 1994.
- Heritage Act 1977.
- National Parks and Wildlife Act 1974.
- Local government – Local Environment Plans – Town planning.

Drainage blankets comprising a blanket of free draining material, Type A and Type B.



Conclusion

When planning and designing maintenance of local roads the designer should consider the reasons of road failure including observing the cutting geology and assessing possible ground water movements causing problems in the pavement. Select a suitable subsurface drainage option considering road boundary fencing and road widening requirements, vegetation, flora and fauna approval matters. Use of vegetation policy documents assist execution of maintenance.