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# **VicRoads Supplement to the Austroads Guide to Road Design**

## **Part 7 – Geotechnical Investigation and Design**

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**NOTE:**

**This VicRoads Supplement must be read in conjunction with the Austroads Guide to Road Design.**

**Reference to any VicRoads or other documentation refers to the latest version as publicly available on the VicRoads website or other external source.**

# VicRoads Supplement to the Austroads Guide to Road Design Updates Record

## Part 7 – Geotechnical Investigation and Design

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| Rev. 1.0<br>July 2010             | First Edition                              | Development of Supplement                      | ED – Network & Asset Planning                        |
| Rev. 1.1<br>Sept 2010             | Various                                    | Minor changes to text, references and layouts. | Principal Advisor – Design, Traffic & Standards      |
| Rev. 2.0<br>Dec 2012              | Appendix B2<br>Minor editing<br>References | Removal of reference to superseded documents   | Principal Advisor – Road Design, Traffic & Standards |
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This VicRoads Supplement has been developed by VicRoads Technical Services and authorised by the Executive Director – Policy & Programs.

The VicRoads Supplement to the Austroads Guide to Road Design provides additional information, clarification or jurisdiction specific design information and procedures which may be used on works financed wholly or in part by funds from VicRoads beyond that outlined in the Austroads Guide to Road Design guides.

Although this publication is believed to be correct at the time of printing, VicRoads does not accept responsibility for any consequences arising from the information contained in it. People using the information should apply, and rely upon, their own skill and judgement to the particular issue which they are considering. The procedures set out will be amended from time to time as found necessary.

## References

AGPT – Austroads Guide to Pavement Technology

AGRD – Austroads Guide to Road Design

GTEP – Guide to Traffic Engineering Practice (superseded)

SD – VicRoads Standard Drawing for Roadworks

VRD/RDG – VicRoads Road Design Guidelines (superseded)

- Austroads (2008). Guide to Pavement Technology – Part 4H: Test Methods.
- Austroads (2009). Guide to Pavement Technology – Part 4I: Earthworks Materials.
- Austroads (2009). Austroads Guide to Pavement Technology – Part 10: Subsurface Drainage.
- Austroads (2009). Austroads Guide to Road Design Part 5: Drainage Design.
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- VicRoads (2003). Road Design Guideline – Part 7: Drainage.
- VicRoads (2005). Bridge Technical Note 1996/001A Design Parameters for Driven Piles, updated.
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- VicRoads (2006). Technical Note 36 – Rock Slope Stability.
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- VicRoads (2006). Technical Note 78 – Guide to Planning Geotechnical Site Investigations.
- VicRoads (2006). Technical Note 79 – Guide to Slope Instability Monitoring.
- VicRoads (2006). Technical Note 80 – Road Drainage and Embankment Stability.
- VicRoads (2007). Technical Note 90 – Use of Clay Rich Biosolids as Fill Material for Road Embankment Construction.
- VicRoads (2007). Technical Note 92 – Groundwater in Cut Excavations.
- VicRoads (2007). Technical Note 93 – Groundwater Sampling and Analysis.
- VicRoads (2008). Technical Note 94 – Investigation of Acid Sulphate Soils.
- VicRoads (2008). Technical Note 95 – Investigation of Contaminated Sites.
- VicRoads (2008). Technical Note 96 – Risk Management of Roadside Geotechnical Hazards.
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- VicRoads (2008). Test Method RC 402.01 – Estimated California Bearing Ratio from Dynamic Cone Penetrometer Test Results.
- VicRoads (latest). VicRoads Supplement to AGRD – Part 5: Drainage Design
- VicRoads (latest). Standard Specification for Roadworks and Bridgeworks Section 683 Soil Nail Walls.
- VicRoads (latest). Standard Specification for Roadworks and Bridgeworks Section 682 Reinforced Soil Structures.
- VicRoads (undated). Major Projects Division Risk Management Assessment Guide.
- Vict. Govt. (1987). Planning and Environment Act 1987.

Note: Refer to the latest version available.



## 1.0 Introduction

VicRoads has no supplementary comments for this section.

## 2.0 Overview of Geotechnical Investigations

Refer to *VicRoads Technical Note (VTN) 78 – Guide to Planning Geotechnical Site Investigations* for an overview of VicRoads specific requirements and standard practices for geotechnical investigations.

### 2.1.1 Desktop Assessment

As part of the desktop study it is essential that previous land ownership and land use is established for all land within an alignment. This should date back as far as records are available and include the use of photos and land titles as a minimum.

The following sources of data should be reviewed during a desktop assessment:

- existing geotechnical investigation results held or archived by VicRoads Geotechnical Services, VicRoads Regions, VicRoads Projects and VicRoads Corporate Plan Filing (particularly the results of geotechnical investigations for both structures and roads built by the Melbourne Metropolitan Board of Works prior to 1980).
- existing geotechnical investigation results held by Melbourne Water.
- existing geotechnical investigation results held by other government departments, agencies (usually difficult to obtain) and from the private sector.
- pile driving records, earthworks testing results and other details held or archived by VicRoads Geotechnical Services, VicRoads Regions or VicRoads Projects.
- geological maps – all previously published geological maps can be obtained from the Department of Sustainability and Environment (DSE) website as well as GIS data.
- topographical maps – most topographical data previously published is available as GIS data from the DSE website.
- mining records – this information is shown on old geological maps and records of capped shafts is available as GIS data from the DSE website.
- VicRoads register of roadside geotechnical hazards – Geotechnical Monitoring database.
- VicRoads register of contaminated sites – Spatial Information Portal.
- surface water and groundwater data – all data is available from the Victorian Water Data Warehouse website.
- aerial photographs – historical aerial photographs are available from United Photo and Graphic Services (managers of the State's aerial photo archives) and for VicRoads staff, recent aerial photos are available from VicRoads' Spatial Information Portal.
- seismicity data – the epicentre and magnitude of all previously recorded earthquakes in Victoria are available as GIS data from the DSE website.
- historical records – access to historical records is best obtained by engaging the local historical society to undertake a search of all local records.
- municipal records of roadworks undertaken by the municipality and of landfill sites.
- knowledge of the site held by local VicRoads Regional staff and VicRoads Road Services road workers.

### 2.1.3 Field Reconnaissance

The following should be investigated and recorded during field reconnaissance to allow preparation of the preliminary geotechnical report:

- overall land form and drainage pattern
- rock outcrop types, weathering and discontinuities
- exposed soil and rock types in stream beds and banks
- exposed soil types and rock types, weathering and discontinuities in existing cuttings, quarries and mine workings
- surface and subsurface erosion or potential for erosion
- slope instability
- expansive soils
- soft ground, silt, peat and existing fill
- swamps
- groundwater bores
- groundwater seeps and springs

- water levels in streams, including tidal movements
- dams
- potential acid sulphate soils and saline soils
- previous and current industrial sites, which may have contaminated soil and groundwater
- significant changes in vegetation which may indicate changes in geology or soil contamination
- proximity and condition of existing structures and nearby buildings
- existing batter slope angles and performance
- existing services type and location.

The following should be investigated and recorded during field reconnaissance to allow planning of the detailed geotechnical investigation:

- vehicle access points, clearances (horizontal and vertical) and load limits
- requirements for access tracks on soft ground
- water supply source and access arrangements
- traffic management requirements
- status of land acquisition of private property.

#### **2.1.4 Preliminary Geotechnical Report**

Preliminary geotechnical reports should include a geotechnical risk register compiled in accordance with *VicRoads Major Projects Division Risk Management Assessment Guide*.

## **2.2 Approvals for Site Investigations**

A Cultural Heritage Management Plan (CHMP) is required before any geotechnical investigation can be undertaken at all greenfield sites and some previously developed sites.

Trimming and removal of vegetation should be avoided during geotechnical investigations. If vegetation trimming or removal is required, it should only be undertaken after a planning permit for the project has been issued by the relevant municipality and should also be undertaken in compliance with all relevant conditions of the planning permit.

If a site includes private property that is covered by a Public Acquisition Overlay on the local planning scheme but has not been

compulsorily acquired at the time of the geotechnical investigation, a *Notice of Intent to Enter* under the *Planning and Environment Act 1987* should be issued to the affected landowners prior to the geotechnical investigation commencing. This notice states the rights and responsibilities of both VicRoads and the landowners during the geotechnical investigation.

## **2.3 Detailed Geotechnical Investigation**

The investigation of contaminated soil and groundwater is not discussed in the AGRD Part 7. The presence, quantity and quality of contaminated soil and groundwater should be determined so that appropriate treatments complying with legislative requirements can be designed.

## **2.4 Design of Special Systems**

VicRoads has no supplementary comments for this section.

## **2.5 Production of Geotechnical Reports**

VicRoads has no supplementary comments for this section.

# **3.0 Methods of Geotechnical Investigation**

## **3.1 Seismic Surveys**

VicRoads has no supplementary comments for this section.

## **3.2 Auger and Bore Holes**

VicRoads has no supplementary comments for this section.

## **3.3 Penetrometer Testing**

Refer to the latest version of the following VicRoads Technical Notes (VTN) and Test Methods for further information on interpretation of penetrometer testing results:

- *VTN 24 – Interpretation of Piezo-Cone Penetration Tests*
- *VicRoads Test Method RC 401.02 Estimated California Bearing Ratio from Static Cone Penetrometer Test Results*
- *VicRoads Test Method RC 402.01 Estimated California Bearing Ratio from Dynamic Cone Penetrometer Test Results.*

### 3.4 Installation of Standpipes (Piezometers)

Refer to *VTN 93 – Groundwater Sampling and Analysis* for further information on installation of standpipes.

### 3.5 Trenching

VicRoads has no supplementary comments for this section.

### 3.6 Sampling of Materials

#### 3.6.2 Test Properties

Refer to *Austroads Guide to Pavement Technology (AGPT) Part 4I: Earthworks Materials* for a full description of most laboratory tests described in this section.

Refer to the *VicRoads Supplement to the AGPT Part 4H: Test Methods* for a list of VicRoads Test Methods for laboratory tests described in this section.

Refer to *VTN 93 – Groundwater Sampling and Analysis* for further information on groundwater testing.

The sampling and testing of contaminated soil and groundwater is not discussed in this Guide. Refer to *VTN 95 – Investigation of Contaminated Sites* for guidelines on the investigation methods, sampling and testing of contaminated soil and groundwater.

## 4.0 Design Elements

### 4.1 General

VicRoads has no supplementary comments for this section.

### 4.2 Horizontal Alignment

VicRoads has no supplementary comments for this section.

### 4.3 Vertical Alignment

VicRoads has no supplementary comments for this section.

### 4.4 Cuttings

#### 4.4.4 Interception of Groundwater

Refer to *VTN 92 – Groundwater in Cut Excavations* for further information on managing groundwater intercepted in cuts.

### 4.5 Embankments

VicRoads has no supplementary comments for this section.

### 4.6 Pavements

VicRoads has no supplementary comments for this section.

### 4.7 Subsurface Drainage Systems

Refer to *VTN 99 – Use of Geocomposite Drainage Systems* for guidance on the types and suitable purposes for geocomposite drainage systems for interception of groundwater and drainage of structures.

#### 4.7.2 Pavement Drains

The location and configuration of sub-surface drainage systems is covered *VicRoads RDG Part 7: Drainage, Standard Drawings for Roadworks* and the *VicRoads Supplement to AGRD Part 5: Drainage Design and Austroads Guide to Pavement Technology (AGPT) Part 10: Subsurface Drainage*.

### 4.8 Foundations for Structures

#### 4.8.1 General

Refer to *VicRoads Bridge Technical Note 1996/001A Design Parameters for Driven Piles* for further information on the requirements of geotechnical investigations for driven pile foundations.

Refer to *VTN 44 – Pile Capacity Using the Pile Driving Analyser* for guidance on confirming driven pile capacity estimated from geotechnical investigation results.

## 5.0 Sustainable Design Practices

### 5.1 General

VicRoads has no supplementary comments for this section.

### 5.2 Materials Stewardship

VicRoads has no supplementary comments for this section.

### 5.3 Minimisation of Erosion

Refer to *VicRoads Supplement to the AGRD Part 5* for further information regarding erosion control.

### 5.4 Water for Construction and Landscaping Purposes

VicRoads requires the use of non-potable water for all construction and maintenance activities, where feasible.

Further technical details regarding the applicability of various non-potable sources on VicRoads activities can be obtained from *VicRoads – Technical Services* and *VicRoads – Environmental Sustainability*.

Refer to VicRoads website and EPA regulations for further information and legislative requirements regarding the sustainable use of non-potable water.

## 5.5 Preservation of Topsoil

VicRoads has no supplementary comments for this section.

## 5.6 Use of Non-standard or Recycled Materials

VicRoads encourages the use of non-standard or recycled materials during the construction and maintenance of the road network.

Further technical details regarding the applicability of non-standard or recycled materials on VicRoads activities can be obtained from VicRoads – Technical Services and VicRoads – Environmental Sustainability.

Refer to VicRoads website and EPA regulations for further information and legislative requirements regarding the sustainable use of non-standard or recycled materials.

Refer to *VTN 90 – Use of Clay Rich Biosolids as Fill Material for Road Embankment Construction* for further information on use of clay rich biosolids from Melbourne Water's Eastern Treatment Plant.

## Appendices

### Appendix A

Refer to *AGPT Part 4I: Earthworks Materials* for a full description of most laboratory tests described in Appendix A.

Refer to the *VicRoads Supplement to AGPT Part 4H: Test Methods* and *VicRoads Manual of Testing* for a list of VicRoads Test Methods for laboratory tests described in Appendix A.

### Appendix B

#### B2 Slope Stability Treatments

The assessment of geotechnical risk associated with slopes is not discussed in this Guide. Refer to the latest version of the following VicRoads Technical Notes for further information on risk assessment and monitoring of slopes:

- *VTN 96 – Risk Management of Roadside Geotechnical Hazards.*
- *VTN 79 – Guide to Slope Instability Monitoring.*

Refer to the latest version of the following VicRoads Technical Notes for further information on slope stability treatments not discussed in AGRD Part 7:

- *VTN 36 – Rock Slope Stability*
- *VTN 80 – Road Drainage and Embankment Stability*
- *VTN 25 – Embankment/Landslip Repair Using Expanded Polystyrene*

Design requirements regarding retaining walls must be obtained from a suitably qualified structural engineer.

#### B.2.2 Soil Nailing and Rock Anchors

Refer to *VicRoads Standard Specification for Roadworks and Bridgeworks Section 683 Soil Nail Walls* and the accompanying Guide Notes for further information on the design, specification, construction and testing of soil nails.

#### B.2.3 Reinforced Soil Retaining Walls

Refer to *VicRoads Standard Specification for Roadworks and Bridgeworks Section 682 – Reinforced Soil Structures* and the accompanying guide notes for further information on the design, specification, construction and monitoring of reinforced soil structures.

#### B.3.5 Lightweight Fill

Refer to *VTN 40 – Construction of Embankments over Weak Ground Using Lightweight Fill (Expanded Polystyrene)* for further information on this technique.

#### B.6.2 Runoff from Contaminated Soils

Refer to the following VicRoads technical notes for further information on identifying and investigating acid sulphate soils:

- *VTN 22 – Acid Sulphate Soils*
- *VTN 94 – Investigation of Acid Sulphate Soils.*

## Tables and Figures

VicRoads has no supplementary comments for this section.

## References

VicRoads has no supplementary comments for this section.