



<b>CODE OF PRACTICE - VOLUME THREE - TRAM SYSTEM [CP3] TRANSADELAIDE INFRASTRUCTURE SERVICES</b>		
<b>PART 9: EARTHWORKS</b>		<b>DOC. NO. CP-TS-979</b>
<b>Issue: 1</b>	<b>Date: 22/10/07</b>	<b>Page: 1 of 7</b>

**TRACK AND CIVIL INFRASTRUCTURE**

**CODE OF PRACTICE**

**VOLUME THREE - TRAM SYSTEM [CP3]**

**EARTHWORKS**

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TRANSADELAIDE INFRASTRUCTURE SERVICES****PART 9: EARTHWORKS****DOC. NO. CP-TS-979****Issue: 1****Date: 22/10/07****Page: 2 of 7****TABLE OF CONTENTS**

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**1.0 PURPOSE AND SCOPE****1.1 PURPOSE**

The purpose of this part is to set standards to ensure that:

- a) earthworks meet the meet the safety risk profile determined by TransAdelaide;
- b) by inspection, earthworks are maintained safely;
- c) in the event of earthworks becoming unstable or failing, precautions and actions are taken to ensure safety of tram operations.

**1.2 PRINCIPLES**

This part complies with the principles set out in the "Code of Practice for the Defined Interstate Rail Network", volume 4, part 2, section 8.

**1.3 SCOPE**

This part specifies general procedures for:

- a) the design/rating, monitoring and maintenance of new earthworks and geotechnical structures;
- b) the identification of existing geotechnical special locations; and
- c) the determination of defined events which may lead to unsafe conditions at those locations.

**1.4 REFERENCES****1.4.1 Industry codes of practice**

Australian Bridge Design Code - Published by Austroads Incorporated

Code of Practice for the Defined Interstate Rail Network, volume 4 (Track, Civil and Electrical Infrastructure), part 2 (Infrastructure Principles), section 8: Earthworks.

**1.4.2 TransAdelaide documents****a) CP3**

CP-TS-973: Part 3, Infrastructure management and principles

**b) Infrastructure Services Management System Procedure Manual**

QP-IS-501: Document and Data Control

CPRD/PRC/046 Records Management

**1.4.3 TransAdelaide drawings**

304-A4-81-116: Design standard: typical cross sections - cut: rail reserve

304-A4-81-117: Design standard: typical cross sections - fill: rail reserve

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Design and rating of earthworks and geotechnical structures shall where necessary include geotechnical investigation and specialist geotechnical advice of the site and or materials. Geotechnical structures and their stability should be determined in accordance with the following documents:

- a) Rolling stock loading shall be determined in accordance with the Australian Bridge Design Code.
- b) Geotechnical stability shall be determined in accordance with the appropriate Standards Australia Codes as applicable.

**2.2 DESIGN PROFILES**

- a) Cuttings shall conform with the profile shown on drg no. 304-A4-81-116.
- b) Embankments shall conform with the profile shown on drg no. 304-A4-81-117.

**2.3 DEFINED EVENTS AND SPECIAL LOCATIONS**

- a) The defined events for sections of track potentially at high risk of geotechnical failure i.e. geotechnical special locations, shall be determined. Defined events in accordance with CP-TS-973 (Infrastructure management and principles) may include earth movement, rainstorms, thunderstorms, earthquake, blasting, or inundation.
- b) The defined events at geotechnical special locations may be determined and reviewed through detailed investigation in accordance with CP-TS-973 (Infrastructure management and principles) and analysis in accordance with the above manuals and codes. The analysis shall take into account the environmental conditions at the location and documentation relating to unscheduled inspections resulting from previous defined event occurrences.
- c) A register of geotechnical special locations and the defined events requiring actions should be established and maintained.



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### 3.0 MONITORING AND MAINTENANCE

#### 3.1 SPECIAL LOCATIONS

Track sections prone to (e.g. with a history of) earthworks instability or vulnerability should be identified and managed as special locations until rectification or earthworks stabilization can be carried out. Detailed inspections may be necessary for this purpose.

#### 3.2 INSPECTION, ASSESSMENT AND MAINTENANCE ACTIONS

Inspection, assessment and maintenance actions of earthworks shall include the specific conditions shown in table 3.1:

**Table 3.1: Earthworks inspection, assessment and maintenance actions**

<b>Type of inspection</b>	<b>Specific actions or conditions to look for</b>
<b>Scheduled inspections</b>	
Walking inspections	<ul style="list-style-type: none"> <li>a) Identify visually, and report, obvious conditions which may affect, or indicate problems with, earthworks stability as listed in sub-section 3.3.</li> <li>b) Sections of track with suspected defects related to the stability of earthworks should be subject to a general inspection.</li> <li>c) Particular attention should be paid to conditions at special locations</li> <li>d) Intervals between walking inspections shall not exceed 31 days.</li> </ul>
General inspections	<ul style="list-style-type: none"> <li>a) Should be of sufficient detail to identify defects and conditions as for walking inspections including changes in condition that may affect their vulnerability to instability;</li> <li>b) To be scheduled at an interval appropriate to each location, dependent on its nature and condition, and other seasonal factors but shall not exceed 12 months. Earthworks protection (including that at geotechnical special locations) shall be inspected prior to the risk season appropriate to the area.</li> </ul>
<b>Unscheduled inspections</b>	
Earthworks instability inspections at special locations	<ul style="list-style-type: none"> <li>a) At earthworks nominated as special locations, the onset of a defined event exceeding a specific magnitude, including indications from remote ground movement sensors (where installed), should be subject to unscheduled general earthworks inspection until rectification or stabilizing work can be carried out. Track sections and associated earthworks with a history of instability should be nominated as special locations.</li> <li>b) These inspections should collect information on the physical condition of the earthworks to allow assessment of the stability and the actions to be taken. Detailed inspections may be necessary for this purpose. Operating restrictions may also be appropriate at some special locations prior and during the inspection.</li> <li>c) Records should be maintained showing the history of defined events and the results of unscheduled general earthworks instability inspections at special locations.</li> </ul>



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**Table 3.1 (continued): Earthworks inspection, assessment and maintenance actions**

Type of inspection	Specific actions or conditions to look for
General inspections	<p>a) These inspections should be carried out to confirm the presence of suspected defects identified from walking inspections or in response to a reported movement, instability or failure of earthworks (e.g. by tram crews) to allow necessary action to be determined. The condition of the earthworks at the location should be determined in terms of its impact on stability. Sections of track within identified earthworks instability should be nominated as special locations until rectification or earthworks stabilization can be carried out. Detailed inspections may be necessary for this purpose.</p> <p>b) Traffic may need to be restricted until the suspected defect or failure is inspected and the necessary actions assessed.</p>
<b>Assessment, method of assessment, response and maintenance actions</b>	<p>a) The integrity of earthworks shall be assessed to verify their capacity to safely perform their required function or determine the necessary actions.</p> <p>b) At special locations where significant changes in condition have been identified, reassessment of the defined event should be carried out.</p> <p>c) During defined or other events requiring inspection, assessments of the condition should be made to determine the actions necessary to maintain safety.</p>

**3.3 INDICATORS OF TRACK INSTABILITY**

Earthworks defects and conditions (i.e. indicators of a defect) that may affect, or indicate problems with, the stability of earthworks include the following:

- a) indications of recent movement including slippage, slumping, settlement or heaving;
- b) fissures and cracks in formation or earth batters;
- c) rock, earth or other debris falling on or near the track;
- d) loss of track geometry;
- e) track subsidence due to ground movements;
- f) earthwork scour and/or erosion including narrow formation leading to loss of ballast and undercutting of the toe of embankments and cuttings by water or wind;
- g) water seepage from embankments and cuttings;
- h) damage to embankments or cuttings including that caused by construction or vehicle access;
- i) conditions that may cause future slip, scour, slump, settlement including burning off or clearing of steep embankments and cuttings;
- j) any other occurrence likely to impact on the stability of earthworks.

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**4.0 DOCUMENTATION****4.1 REGISTER OF GEOTECHNICAL SPECIAL LOCATIONS**

A register of geotechnical special locations and the defined events shall be established and maintained in accordance with QP-IS-501 (Document and Data Control). *REGISTER TO BE PREPARED*

**4.2 SCHEDULE OF GEOTECHNICAL STRUCTURES**

A schedule of cuttings and embankments shall be established and maintained in accordance with QP-IS-501 (Document and Data Control). *SCHEDULE TO BE PREPARED*

**4.3 INSPECTION REPORTS**

All inspection reports shall be maintained in accordance with CPRD/PRC/046 Records Management.