APPENDIX 1

Key Stakeholders in the Wet Tropics Region

Department of Main Roads
Environment and Technology Division
GPO Box 1412
BRISBANE QLD 4001
or
Department of Main Roads
2nd Floor
Dickens Street
SPRING HILL QLD 4000
Telephone:  (07) 3834 2645
Facsimile:  (07) 3834 5966

Department of Main Roads
96 Abbot Street
CAIRNS QLD 4870
Telephone:  (070) 505 444
Facsimile:  (070) 510 168

Department of Main Roads
PO Box 1089
TOWNSVILLE QLD 4810
Telephone:  (077) 207 200
Facsimile:  (077) 207 211

Queensland Transport
96 Abbot Street
CAIRNS QLD 4870
Telephone:  (070) 505 414
Facsimile:  (070) 510 188

Queensland Transport
146 Wills Street
TOWNSVILLE QLD 4810
Telephone:  (077) 810 611
Facsimile:  (077) 713 350

Department of Environment
10-12 Macleod Street
CAIRNS QLD 4870
Telephone:  (070) 523 092
Facsimile:  (070) 314 390

Department of Environment
PO Box 5391
TOWNSVILLE MAIL CENTRE 4810
Telephone:  (077) 225 211
Facsimile:  (077) 225 358

Department of Primary Industries
Queensland Government Offices
2nd Floor
36 Shields Street
CAIRNS QLD 4870
Telephone:  (070) 532 288
Facsimile:  (070) 523 360

Department of Natural Resources
PO Box 937
CAIRNS QLD 4870
Telephone:  (070) 523 434
Facsimile:  (070) 510 851

Department of Natural Resources
167 Walsh Street
MAREEBA QLD 4880
Telephone:  (070) 922 555
Facsimile:  (070) 923 939

Cairns City Council
151 Abbot Street
CAIRNS QLD 4870
Telephone:  (070) 502 402
Facsimile:  (070) 510 287

Townsville City Council
103 Walker Street
TOWNSVILLE QLD 4810
Telephone:  (077) 271 235
Facsimile:  (077) 256 649
Appendix 1

Roads in the Wet Tropics

Atherton Shire Council
45 Mabel Street
ATHERTON QLD 4883
Telephone: (070) 911 311
Facsimile: (070) 914 300

Mareeba Shire Council
P O Box 154
MAREEBA QLD 4880
Telephone: (070) 303 900
Facsimile: (070) 923 323

Cardwell Shire Council
Civic Centre
38-48 Bryant Street
TULLY QLD 4850
Telephone: (070) 681 033
Facsimile: (070) 681 772

Thuringowa City Council
86 Thuringowa Drive
TOWNSVILLE QLD 4810
Telephone: (077) 738 411
Facsimile: (077) 738 499

Douglas Shire Council
64-66 Front Street
MOSSMAN QLD 4873
Telephone: (070) 982 599
Facsimile: (070) 982 902

Wet Tropics Management Authority
PO Box 2050
CAIRNS QLD 4870
Telephone: (070) 520 555
Facsimile: (070) 311 364

Eacham Shire Council
31 James Street
MALANDA QLD 4885
Telephone: (070) 965 311
Facsimile: (070) 965 086

CRC-Tropical Rainforest
Ecology and Management
PO Box 6811
CAIRNS QLD 4870
Telephone: (070) 421 246
Facsimile: (070) 421 247

Herberton Shire Council
6 Grace Street
HERBERTON QLD 4872
Telephone: (070) 962 244
Facsimile: (070) 962 689

Alliance for Sustainable Tourism
PO Box 2291
CAIRNS QLD 4870
Telephone: (070) 550 709
Facsimile: (070) 550 742

Hinchinbrook Shire Council
PO Box 366
INGHAM QLD 4850
Telephone: (077) 762 211
Facsimile: (077) 764 824

Community Committee
for Cassowary Conservation
PO Box 180
MISSION BEACH QLD 4854
Telephone: (070) 587 248
Facsimile: (070) 687 298

Dalrymple Shire Council
14 Mossman Street
CHARTERS TOWERS QLD
Telephone: (077) 875 600
Facsimile: (077) 873 903

North Queensland Conservation Council
PO Box 364
TOWNSVILLE QLD 4810
Telephone: (077) 716 226
Facsimile: (077) 716 216

Johnstone Shire Council
70 Rankin Street
INNISFAIL QLD 4860
Telephone: (070) 702 222
Facsimile: (070) 614 258

Cairns and Far North
Environment Centre
PO Box 323
NORTH CAIRNS QLD 4870
Telephone: (070) 321 746
Facsimile: (070) 533 779
## APPENDIX 2

**Road Engineering Manuals and Guidelines**

- **AustRoads Guide to Traffic Engineering Practice**
  - Part 1 Traffic Flow
  - Part 2 Roadway Capacity
  - Part 3 Traffic Studies
  - Part 4 Road Crashes
  - Part 5 Intersections at Grade
  - Part 6 Roundabouts
  - Part 8 Traffic Control Devices
  - Part 9 Arterial Road Traffic Management
  - Part 10 Local Area Traffic Management
  - Part 11 Parking
  - Part 12 Roadway Lighting
  - Part 13 Pedestrians
  - Part 14 Bicycles

- **Queensland Transport**
  - Cost Benefit Analysis Manual 1993
  - Road Design References 1991

- **AustRoads - Rural Road design**

- **Queensland Transport**

- **NAASRA**

- **ARRB**
  - Subsurface drainage of Road Structures, SR35 (1987)
NAASRA  Guide to the Control of Moisture in Roads (1983)
NAASRA  Bridge Waterways Hydrology and Design (1989)
The Institution of Engineers Australian Queensland  Soil Erosion and Sediment Control (1996)
NAASRA  Safety Barriers (1987)
Queensland Transport  Pavement Design Manuals 1990
Queensland Transport  Manual of Uniform Traffic Control Devices
AS1742.2 (1986)  Traffic Control Devices for General Use
AS1742.7 (1987)  Railway Crossings
NAASRA  Guide Provision and Signposting of Service and Tourist Facilities
NAASRA  Joint Code of Practice Telecom Australia Plant in Road Reserve (1980)
Main Roads  Road Maintenance Performance Contracts Volume 1 to 4
APPENDIX 3

Relevant Legislation and Government Policies

FEDERAL

- World Heritage Properties Conservation Act 1983;
- Endangered Species Protection Act 1992;
- Australian Heritage Commission Act 1975;
- Environmental Protection (Impact of Proposals) Act 1974;
- Wet Tropics of Queensland World Heritage Area Conservation Act 1994;
- National Greenhouse Response Strategy;
- National Strategy for Ecologically Sustainable Development;
- National Strategy for Biological Diversity; and
- Intergovernmental Agreement on the Environment.

STATE

- Wet Tropics Plan Act (1997);
- Wet Tropics World Heritage Protection and Management Act 1993;
- Environmental Protection Act 1994, and subordinate legislation for Air, Water, Noise and Waste;
- Contaminated Land Act 1991;
- State Development and Public Works Organisation Act 1971;
- Nature Conservation Act 1992;
- Cultural Record (Landscapes Queensland and Queensland Estate) Act 1987;
- National Parks and Wildlife Act 1975;
- Forestry Act 1959;
- Agricultural and Chemicals (Queensland) Act 1988;
- Agricultural Chemicals Distribution Control Act 1966;
- Marine Parks Act 1992;
- Fisheries Act 1994;
• Water Resources Act 1989;
• Local Government (Planning and Environment) Act 1990;
• Queensland Heritage Act 1992;
• Transport Planning and Coordination Act 1994;
• Transport Infrastructure Act 1991;
• Transport Infrastructure (Roads) Act 1991;
• Transport Operations (Passenger Transport) Act 1994;
• Transport Operations (Marine Pollution) Act 1995;
• Carriage of Dangerous Goods by Road Act 1984;
• Transport Portfolio Environmental Framework;
• Transport Coordination Plan;
• Queensland Greenhouse Response Strategy;
• ANZECC Ozone Strategy;
• Queensland Transport Policy Directions Statement; and
• Queensland Transport Environmental Policy.
### APPENDIX 4

**Undesirable Plants Of The Wet Tropics**

**NOTE:** These plants are recognised as existing or potential weeds which can invade native vegetation.

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>FAMILY</th>
<th>COMMON NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allamanda cathartica</td>
<td>ACANTHACEAE</td>
<td>allamanda</td>
</tr>
<tr>
<td>Annona glabra</td>
<td>APOCYNACEAE</td>
<td>pond apple</td>
</tr>
<tr>
<td>Bambusa spp</td>
<td>POACEAE</td>
<td>bamboo</td>
</tr>
<tr>
<td>Brachiaria mutica</td>
<td>POACEAE</td>
<td>para grass (ponded pasture)</td>
</tr>
<tr>
<td>Calopogonium mucunoides</td>
<td>CABOBACEAE</td>
<td>cabomba (aquadatic weed)</td>
</tr>
<tr>
<td>Centrosema pubescens</td>
<td>FABACEAE</td>
<td>calopo (pasture legume)</td>
</tr>
<tr>
<td>Chukrasia velutina</td>
<td>FABACEAE</td>
<td>centro (pasture legume)</td>
</tr>
<tr>
<td>Cinnamomum camphora</td>
<td>MELIACEAE</td>
<td>East Indian mahogany</td>
</tr>
<tr>
<td>Clitoria laurifolia</td>
<td>LAURACEAE</td>
<td>camphor laurel</td>
</tr>
<tr>
<td>Coffea arabica</td>
<td>FABACEAE</td>
<td>clitoria</td>
</tr>
<tr>
<td>Duranta repens</td>
<td>RUBIACEAE</td>
<td>coffee</td>
</tr>
<tr>
<td>Eichhornia crassipes</td>
<td>VERBENACEAE</td>
<td>golden dewdrops or sky flower</td>
</tr>
<tr>
<td>Glycine spp</td>
<td>PONTEDERIACEAE</td>
<td>water hyacinth</td>
</tr>
<tr>
<td>Harungana madagascariensis</td>
<td>FABACEAE</td>
<td>glycine</td>
</tr>
<tr>
<td>Hemigraphis colorata</td>
<td>Meliaceae</td>
<td>harungana</td>
</tr>
<tr>
<td>Eipomoea spp</td>
<td>ACONVOLVULACEAE</td>
<td>morning glory</td>
</tr>
<tr>
<td>Lantana camara</td>
<td>VERBENACEAE</td>
<td>lantana</td>
</tr>
<tr>
<td>Ligustrum spp</td>
<td>OLEACEAE</td>
<td>privat</td>
</tr>
<tr>
<td>Melinis minutiflora</td>
<td>POACEAE</td>
<td>molasses grass</td>
</tr>
<tr>
<td>Miconia calvescens</td>
<td>MELASTROMATACEAE</td>
<td>miconia</td>
</tr>
<tr>
<td>Momordica charantia</td>
<td>CUCURBITACEAE</td>
<td>balsam pear</td>
</tr>
<tr>
<td>Montanoa hibiscifolia</td>
<td>ASTERACEAE</td>
<td>anzac flower</td>
</tr>
<tr>
<td>Panicum maximum</td>
<td>POACEAE</td>
<td>guinea grass</td>
</tr>
<tr>
<td>Passiflora spp (exotics)</td>
<td>PASSIFLORACEAE</td>
<td>passion fruits or flowers</td>
</tr>
<tr>
<td>Pennisetum purpureum</td>
<td>POACEAE</td>
<td>elephant grass</td>
</tr>
<tr>
<td>Perilepta dyeriana</td>
<td>ACANTHACEAE</td>
<td>caribbean pine</td>
</tr>
<tr>
<td>Pinus caribaea</td>
<td>PINACEAE</td>
<td>guava</td>
</tr>
<tr>
<td>Psidium guajava</td>
<td>MYRTACEAE</td>
<td>pueru (pasture legume)</td>
</tr>
<tr>
<td>Pueraria phaseoloides</td>
<td>FABACEAE</td>
<td>salvinia or water fern</td>
</tr>
<tr>
<td>Salvinia molesta</td>
<td>AZOLLACEAE</td>
<td>raintree</td>
</tr>
<tr>
<td>Saman samonea</td>
<td>MIMOSACEAE</td>
<td>sanchezia</td>
</tr>
<tr>
<td>Sanchezia parvibracteata</td>
<td>ACANTHACEAE</td>
<td>mother-in-law’s tongue</td>
</tr>
<tr>
<td>Sansevieria spp</td>
<td>AGAVACEAE</td>
<td>peacock fern</td>
</tr>
<tr>
<td>Selaginella wildenovii</td>
<td>SELAGINELLACEAE</td>
<td>African tulip tree</td>
</tr>
<tr>
<td>Spathodea campanulata</td>
<td>BIGNONIACEAE</td>
<td>prayer plant</td>
</tr>
<tr>
<td>Stephanopysm longifolium</td>
<td>ACANTHACEAE</td>
<td>black-eyed susan</td>
</tr>
<tr>
<td>Thaumastochloa daniellii</td>
<td>MARANTACEAE</td>
<td>blue thunbergia</td>
</tr>
<tr>
<td>Thunbergia alata</td>
<td>ACANTHACEAE</td>
<td>laurel clock vine</td>
</tr>
<tr>
<td>Thunbergia grandflora</td>
<td>ACANTHACEAE</td>
<td>Japanese sunflower</td>
</tr>
<tr>
<td>Thunbergia laurifolia</td>
<td>ACANTHACEAE</td>
<td>wandering jew</td>
</tr>
<tr>
<td>Tillonia diversifolia</td>
<td>ASTERACEAE</td>
<td>turbina</td>
</tr>
<tr>
<td>Tradescantia spp</td>
<td>COMMERLINACEAE</td>
<td>Singapore daisy</td>
</tr>
<tr>
<td>Turbina corymbosa</td>
<td>COMMERLINACEAE</td>
<td>wandering jew</td>
</tr>
</tbody>
</table>
NOTE: These concept plans have been prepared as examples of the various measures identified throughout the manual. The concept plans have not been designed for specific applications, and their applicability to an individual circumstance must be determined as part of the planning and design processes for the particular project.
<table>
<thead>
<tr>
<th>CROSS SECTIONS</th>
<th>TYPE</th>
<th>ROAD FUNCTION</th>
<th>TERRAIN</th>
<th>DESIGN SPEED</th>
<th>HORIZ. RADIUS</th>
<th>CLEAR ZONE FROM TRAFFIC LANE</th>
<th>DESIRABLE MAXIMUM GRADE</th>
<th>DESIGN VEHICLE</th>
<th>HEIGHT CLEARANCE</th>
<th>ROAD TYPE</th>
<th>MINIMUM WIDTH OF CLEARING</th>
<th>CARRIAGEWAY WIDTH</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAJOR HIGHWAY &amp; IMPORTANT REGIONAL ROAD</td>
<td><strong>TYPE C</strong></td>
<td>FLAT</td>
<td>HILLY</td>
<td>MOUNTAINOUS</td>
<td>100 - 120</td>
<td>90 - 100</td>
<td>75 - 90</td>
<td>&gt; 900</td>
<td>9.0m</td>
<td>9.0m</td>
<td>6.0m</td>
<td>6.0m</td>
<td>3% - 6%</td>
<td>4% - 6%</td>
</tr>
<tr>
<td>TOURIST ROADS</td>
<td><strong>TYPE C</strong></td>
<td>FLAT</td>
<td>HILLY</td>
<td>MOUNTAINOUS</td>
<td>80 - 100</td>
<td>75 - 90</td>
<td>75 - 90</td>
<td>25 - 70</td>
<td>9.0m</td>
<td>6.0m</td>
<td>3.0m</td>
<td>3% - 6%</td>
<td>4% - 6%</td>
<td>9% - 10%</td>
</tr>
<tr>
<td>LOCAL ACCESS</td>
<td><strong>TYPE A</strong></td>
<td>FLAT</td>
<td>HILLY</td>
<td>MOUNTAINOUS</td>
<td>80</td>
<td>60 - 60</td>
<td>60 - 70</td>
<td>25 - 70</td>
<td>9m</td>
<td>6.0m</td>
<td>3.0m</td>
<td>3.0m</td>
<td>3% - 6%</td>
<td>6% - 10%</td>
</tr>
</tbody>
</table>

* CONSIDER SEALING AT GRADES OVER 10%.

** REFER TABLE 7 FOR FULL DETAILS.**

### CROSS SECTIONS

DEPARTMENT OF MAIN ROADS
ROADS IN THE WET TROPICS
NOT TO SCALE
DEPARTMENT OF MAIN ROADS
ROADS IN THE WET TROPICS
NOT TO SCALE

TYPICAL CROSS SECTIONS

A1. UNSEAWA ROAD
NOTE: SINGLE CROSSFALL OF 4% ON CURVES

A2. TWO LANE UNSEALED ROAD

A3. TWO LANE UNSEALED ROAD

A4. SINGLE LANE UNSEALED ROAD

A5. SINGLE LANE UNSEALED ROAD

* CROSS SECTION A3 TO A5 ARE FOR LOW SPEED LOW VOLUME ROADS.

B. SINGLE LANE SEALED

C. SEALED ROAD

D. HIGHWAY - 4 LANES UNDIVIDED

E. DIVIDED NARROW MEDIAN

F. INDEPENDENT SPLIT CARRIAGEWAY

# IN FIELD DESIRABLE CLEARANCE TO TREES GREATER THAN 75mm ROAD DIAMETER:
60 km/h 3.0m
80 km/h 4.0m
100 km/h 6.0m
GUARDRAIL 1.0m NO IND RAIL

TYPICAL CROSS SECTIONS
DEPARTMENT OF MAIN ROADS
ROADS IN THE WET TROPICS
NOT TO SCALE
A. IMPROVISED FROM LOCAL MATERIALS

- 100mm VERTICAL FACE
- 2 REO-BARS, STEEL PICKETS, OR 50x50 STAKES, 0.5 - 0.7m IN GROUND
- ROCK OUTLET TO HALF HEIGHT OF GABIONS.
- ROCK GABIONS.

B. SMALL EARTHWORKS

- FLOW
- EXCAVATION
- OVERFLOW WATER LEVEL
- UNDISTURBED VEGETATION
- SMALL DIAMETER DRAINAGE PIPE
- OVERFLOW UNDISTURBED VEGETATION AREA - MINIMUM GRADIENT WIDE AS POSSIBLE

C. BRUSHWOOD BANK

- FLOW
- FILTER FABRIC
- TRAPPED SEDIMENT

D. SILT FENCE

- WIRE OR STEEL MESH
- STAR PICKET
- GEOTEXTILE FILTER FABRIC BURIED IN GROUND

E. PORTABLE TANKS

- COARSE GRID
- PORTABLE STEEL TANK FITTED WITH BAFFLES (REMOVABLE FOR CLEANING)
- PERFORATED Baffle TO REDUCE WATER VELOCITY
- ROCK RIP-RAP
- FINE Silt
- COARSE Silt

NOTE: FOR USE IN DewaterING SMALL EXCAVATIONS.
A. SEDIMENTATION BASIN FEATURES

SECTION A-A

SECTION B-B

SECTION C-C

LOW FLOW OUTLET DETAIL

B. COURSE SEDIMENT AND TURBIDITY CONTROL

C. SEDIMENT TRAP USING ROAD EMBANKMENT AND CULVERT
TABLE DRAIN TREATMENTS AND GRAPHS

DEPARTMENT OF MAIN ROADS
ROADS IN THE WET TROPICS
NOT TO SCALE
A. CROSS BANK OR WHOA BOY

<table>
<thead>
<tr>
<th>ROAD FORMATION</th>
<th>BASE OF RISE</th>
<th>TOP OF RISE</th>
<th>BASE OF FALL</th>
<th>TOP OF FALL</th>
</tr>
</thead>
</table>

PLAN

ELEVATION

MAXIMUM SPACING OF CROSS DRAINS (WET TROPICS) (m)

<table>
<thead>
<tr>
<th>GRADE OF TRACK</th>
<th>MAXIMUM SPACING OF CROSS DRAINS (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW HAZARD</td>
</tr>
<tr>
<td>&lt;9% (5°)</td>
<td>40</td>
</tr>
<tr>
<td>9-27% (5-15°)</td>
<td>40</td>
</tr>
<tr>
<td>27-47% (15-25°)</td>
<td>20</td>
</tr>
<tr>
<td>≥47% (25°)</td>
<td>10</td>
</tr>
</tbody>
</table>

(1) FROM QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES - FOREST SERVICE, 1988
(2) SOIL ERODIBILITY MAY BE RECOGNISED BY THE SOIL DESCRIPTIONS PROVIDED IN TABLE C4.2 (QDPF - FOREST SERVICE, 1998 IN THE E AUST QUELD (ESC) GUIDELINES)
(3) COVER CROP ESTABLISHMENT IN BASE AND BANKS OF ALL DRAINS IS RECOMMENDED ON SLOPES EXCEEDING 47% (25°). GRADIENTS OF THIS MAGNITUDE ARE ONLY RECOMMENDED FOR SHORT DISTANCES ON THE SOIL TYPES WITH LOW ERODIBILITY ADAPTED FROM E AUST QUEENSLAND DIVISION ENGINEERING GUIDELINES FOR QUEENSLAND CONSTRUCTION SITES 1996.

NB: FOR CROSS DRAINAGE ON UNSEALED ROADS (TEMPORARY OR PERMANENT) ON GRADE, AS GRADES BECOME STEEPER THE MORE FREQUENT THE SPACING OF THE WHOA BOY. ALSO NOTE THAT WHOA BOYS CAN BE A STAFF HAZARD AND A RISK ASSESSMENT SHOULD BE MADE BEFORE DESIGN OR CONSTRUCTION.

B. GRADE DIPS

WHOA BOY WITH ROCK PROTECTION

C. DOWNDRAIN STRUCTURE
A. MINIMAL DISTURBANCE OF STREAM

- Shoulder dyke
- Drainage chute
- Batter protection
- Scour protected drain into stream
- Minimal disturbance to stream bed and banks

B. BATTER PROTECTION UNDER BRIDGE

- Batter protection
- Why a bridge?
- Large flows
- High velocities
- Minimal disturbance
- Berms for stabilisation and fauna crossing

C. IMPACT OF LONGER BRIDGE vs SHORTER BRIDGE

- Economical requirement?
- Increase flow velocities
- Increase scour potential
- Ongoing maintenance problems
- Not best environmental solutions in the long term
- Minimal disturbance

NOT TO SCALE

D. TYPICAL PLAN OF BRIDGE STRUCTURE

- Flow
- Turn drains downstream
- Scour protection at end of drains
- Grade bridge to drainage chutes
- Drainage chutes and shoulder dykes
- Table drains
- Turn drains downstream
A. TYPICAL RUMBLE STRIP SPACING
100km/h (REFER TABLE)

NOTE: DO NOT PLACE RUMBLE STRIPS ON CURVES LESS THAN 1500m. MOTORCYCLES WILL HAVE SAFETY PROBLEMS, ESPECIALLY WHEN WET.

B. TABLE OF RUMBLE STRIP SPACINGS

<table>
<thead>
<tr>
<th>DESIGN SPEED (Km/h)</th>
<th>TIME SPACING OF RUMBLE STRIPS (sec)</th>
<th>DISTANCE BETWEEN RUMBLE STRIPS (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.5s</td>
<td>2.5s</td>
</tr>
<tr>
<td>100</td>
<td>98</td>
<td>69</td>
</tr>
<tr>
<td>40</td>
<td>78</td>
<td>56</td>
</tr>
<tr>
<td>60</td>
<td>58</td>
<td>42</td>
</tr>
<tr>
<td>40</td>
<td>39</td>
<td>29</td>
</tr>
</tbody>
</table>
A. ELEVATED AREAS

NB: OPTION 1: CONSTRUCT A SHED TO DIVERT STORMWATER FROM OVERFLOWING THE SYSTEM INSTEAD OF A FOX VALVE.
OPTION 2: NO SHED BUT USE A FOX VALVE AND A TANK TO CONTROL THE STORMWATER FROM OVERFLOWING THE SYSTEM.

B. CONSTRUCTION EXITS

C. WASH DOWN BAY

NOTE:
IF PLANT PATHOGENS ARE PRESENT IN THE WASHDOWN WATER THEN TREATMENT WILL BE REQUIRED BEFORE DISCHARGE.

D. DEPARTMENT OF MAIN ROADS

ROADS IN THE WET TROPICS

NOT TO SCALE

CONSTRUCTION
ENTRANCES AND EXITS
WASH DOWN BAY

DEPARTMENT OF MAIN ROADS
ROADS IN THE WET TROPICS
NOT TO SCALE
## A. SUMMARY TABLE

<table>
<thead>
<tr>
<th>Failure Type</th>
<th>Treatment</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plane, Wedge, Toppling and Ravelling Failures</td>
<td>Rock bolting</td>
<td>Quickly installed, minimal excavation</td>
<td>Expensive, not suitable for fracture pattern of mixed strata, very expensive</td>
</tr>
<tr>
<td>Structural Support by Walling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catch area to collect stones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Berm at top of cutting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diversion dyke</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope benches</td>
<td>Some velocity of surface water, collects water</td>
<td>Map cause additional failures if water seeps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prevents cut slope from sliding</td>
<td>For improper design or construction, collects water for slope drains or</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>may shift water to adjacent</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Wedge, Slip Circle and Sliding Failures Where Surface Water Significantly Contributes to the Problem</td>
<td>Seeding/mulching</td>
<td>The dig-out is used to seed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sodding</td>
<td>Provides immediate protection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Batter facing</td>
<td>Provides immediate protection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temporary cover</td>
<td>Protects area available in wide</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serrated slope</td>
<td>Long-term design is effective in collecting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Horizontal drains bored into aquifer</td>
<td>Can substantially improve the factor of safety</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flatten batters</td>
<td>Ideally constructed with conventional fail</td>
<td></td>
</tr>
</tbody>
</table>

## B. FALLS AND TRANSLATIONAL SLIDES IN MIXED STRATA

<table>
<thead>
<tr>
<th>Failure Mechanisms In Soil</th>
<th>SLOPE FAILURE TYPES AND VARIOUS METHODS OF TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DEPARTMENT OF MAIN ROADS</td>
</tr>
<tr>
<td></td>
<td>ROADS IN THE WET TROPICS</td>
</tr>
<tr>
<td></td>
<td>NOT TO SCALE</td>
</tr>
</tbody>
</table>

NB: ADAPTED FROM ROAD DESIGN GUIDE (RTA)