


# standard specification for roadworks

## v4.2



- miscellaneous provisions ■ provision for traffic ■
- clearing grubbing and rehabilitation ■ earthworks ■
- conformance testing ■ pavements and shoulders ■
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this document specifies the general standards of materials and workmanship required by the department for construction of civil road network assets

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## ABOUT THIS SPECIFICATION

This document was prepared by the Department of Infrastructure, Planning and Logistics (DIPL) and specifies the general standards of materials and workmanship required by the Department for roadworks. It brings together standard terminology and methods for roadworks work across all regions of the Northern Territory.

This document is designed to be used as a reference document for roadworks projects. It is to be read in conjunction with the Project Specific Requirements section of the Request for Tender document and the Drawings, if any.

The text has been edited to specify only the types of roadworks performed by the Department and is applicable to all regions of the Northern Territory. The text has been developed through consultation with Departmental officers with extensive experience in civil works in the Northern Territory.

This Standard Specification will remain unchanged until an updated version is published. This specification is also available electronically in PDF from the Department's Specification Services website: <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/technical-specifications/roads> .

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## **INFORMATION**

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V 4.2 - 21 July 2020

# STANDARD SPECIFICATION FOR ROADWORKS V 4.2

## REFERENCE TEXT

### REFERENCE

Read this Standard Specification in conjunction with the Project Specific Requirements and Drawings, if any. Only those parts of the Standard Specification which refer to the works being carried out apply in addition to those items listed in the Schedule of Rates which is attached to the Response Schedules for the particular Contract. This document may be used as a blanket reference specification referring generally to the standards of materials and workmanship required by the Department for roadworks.

### PROJECT SPECIFIC REQUIREMENTS

The selection of specific items or materials for the works being carried out are those items listed in the Schedule of Rates in the Response Schedules for the particular Contract and any items specified in the Project Specific Requirements section of the Request for Tender document. Any additional work or any changes to the reference specification will be specified in the Project Specific Requirements section.

### PRECEDENCE

Any provision in the Request for Tender, or in the Request for Quotation, or on the project drawings, shall override any conflicting provision in this Standard Specification.

### HOLD AND WITNESS POINTS

These apply whether Project Control or Quality Assurance is included in the project or not. Refer to the definitions of Hold Points and Witness Points in the Miscellaneous Provisions section of this Standard Specification. Tables of Hold and Witness Points are available via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/technical-specifications/roads> .

### SITE COPY

Retain a copy of this document on site for the duration of the works.

### COPYRIGHT

This Standard Specification is based on the Department's Roadworks Master Specification. This document is copyright protected and the property of the Government of the Northern Territory and must not be retained, copied, or used without authority.

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# STANDARD SPECIFICATION FOR ROADWORKS V 4.2

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# 1 MISCELLANEOUS PROVISIONS

## 1.1 STANDARDS, ACTS, AND PUBLICATIONS

Conform to the following Standards, Acts and Publications unless specified otherwise:

- AS/NZS 1336 Eye and face protection - Guidelines
- AS/NZS 1337(set) Personal eye protection and Eye and face protection
- AS/NZS 1338(set) Filters for eye protectors
- AS 1348 Road and traffic engineering - Glossary of terms
- AS 1379 Specification and supply of concrete
- AS 1742(set) Manual of uniform traffic control devices
- AS/NZS 1800 Occupational protective helmets - Selection, care and use
- AS/NZS 1801 Occupational protective helmets
- AS/NZS 1906(set) Retroreflective materials and devices for road traffic control purposes
- AS/NZS 1906.4 Retroreflective materials and devices for road traffic control purposes - High-visibility materials for safety garments
- AS/NZS 2161(set) Occupational protective gloves
- AS 2187.1 Explosives - Storage, transport and use - Storage
- AS 2187.2 Explosives - Storage, transport and use - Use of explosives
- AS/NZS 2210(set) Safety, protective and occupational footwear
- AS/NZS 2299 Occupational diving operations
- AS/NZS 2299.1 Standard operational practice
- AS/NZS 2299.2 Scientific diving
- AS 2815 Training and certification of occupational divers
- AS 2815.1 Occupational SCUBA diver – Standard
- AS/NZS 2815.2 Surface supplied diving to 30 m
- AS 2815.3 Air diving to 50 m
- AS 2815.4 Bell diving
- AS/NZS 2815.5 Dive supervisor
- AS/NZS 4399 Sun protective clothing - Evaluation and classification
- AS/NZS 4501.1 Occupational protective clothing - Guidelines on the selection, use, care and maintenance of protective clothing
- AS/NZS 4501.2 Occupational protective clothing - General requirements
- AS/NZS 4602.1 High visibility safety garments - Garments for high risk applications
- AS 4742 Machine-mounted forward and reverse audible warning alarm
- ISO 9533 Earth-moving machinery - Machine-mounted audible travel alarms and forward horns - Test methods and performance criteria
- NTMTM NT Materials Testing Manual (Includes NTCPs and NTTMs) accessible via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>
- NTCP NT Code of Practice (Included in the NTMTM)
- NTTM NT Test Method (Included in the NTMTM)

*Aboriginal Land Rights (NT) Act 1976 (Cth)*

*Mineral Titles Act 2010 and Mining Management Act 2001*

*Work Health and Safety (National Uniform Legislation) Act 2011* and Regulations 2011

*Dangerous Goods Act 1998* and Regulations 1985

Railways of Australia (ROA) Code - Installation of Other Parties Services and Pipelines Within Railway Boundaries

The *Water Act 1992*

The *Energy Pipelines Act 1991* (NT Gas)

ACMA Australian Communications Media Authority - any Standards, Acts, controls specifically required. Refer to ACMA directly.

Standard Specification for Environmental Management, DIPL publication

### **1.1.1 Standards in Conflict**

Where conflict arises between a referenced standard and particular clauses of this specification the specification prevails.

### **1.1.2 Overseas Standards**

Where no Australian Standard exists standards published by the British Standards Institute (BSI) or the American Society for Testing Materials are referenced.

### **1.1.3 Currency of Standards**

Use Standards, and their amendments, current 3 months before the date for the close of tenders except where different editions and/or amendments are required by statutory authorities, including, but not limited to, NATA and the National Construction Code including the Building Code of Australia.

## **1.2 DEFINITIONS**

The terms used in this specification are in accordance with the definitions laid down in AS 1348 unless specified otherwise in the **Definitions** clauses.

A reference to something in the singular includes a reference to it in the plural, and a reference to something in the plural includes a reference to it in the singular, unless the context clearly indicates otherwise.

**APPROVED:**

Means approved by the Superintendent except where applicable statutory requirements state otherwise or if a different approver is specified.

**AS BUILT:**

Has the same meaning as AS CONSTRUCTED.

**AS CONSTRUCTED:**

A documented record, including drawings, of the details of a construction following its completion. Includes and is the same as "As Built", "As Installed", and "Works as Executed".

**AS INSTALLED:**

Has the same meaning as AS CONSTRUCTED.

**AUTHORISED:**

Means authorised by the Superintendent except where applicable statutory requirements state otherwise or if a different authoriser is specified.

**BUSINESS DAY:**

Means the same as DAY.

**CALENDAR DAY**

Means any day of the week, including weekends, and including Public Holidays.

**DAY:**

Means working day, Monday to Friday, excluding Northern Territory wide Public Holidays, and excluding weekends.

**DIPL (THE DEPARTMENT):**

The Department of Infrastructure, Planning and Logistics.

**DRY DENSITY RATIO:**

The percentage ratio of the field dry density of a material to the modified maximum dry density of that material. This property is also termed Relative Compaction.

**EXTRACTION AREA:**

An excavation outside the formation limits for obtaining fill, gravel, rock and rubble. Also known as Borrow Pit.

**HOLD POINT:**

Obtain the Superintendent's written approval for that particular part of the works.

**PROVIDE:**

Provide and similar expressions mean supply, install, connect, test, commission, and leave ready for use. It includes development of the design beyond that documented.

**PUBLIC HOLIDAY**

A day proclaimed as a Northern Territory wide Public Holiday.

**RFQ:**

Request for Quotation. Technical specifications and conditions applicable to an RFQ are equally applicable to an RFT (Request for Tender).

**RFT:**

Request for Tender. Technical specifications and conditions applicable to an RFT are equally applicable to an RFQ (Request for Quotation).

**RURAL AREAS**

Means areas not defined as URBAN AREAS.

**SDS**

Safety Data Sheet – provides information about hazardous materials such as identity, ingredients, health and physical hazards, safe handling and storage, emergency procedures, and disposal considerations.

**SHALL:**

Indicates a mandatory requirement unless the context clearly indicates otherwise.

**URBAN AREAS**

Are; - Areas in the Darwin region which are North of Cox Peninsula Road (Stuart Highway), West of Trippe Road (Arnhem Highway) and up to the end of the seal on Gunn Point Road, and - Other areas which are within, and extending to, town boundaries.

**WITNESS POINT:**

Give the Superintendent sufficient prior notice, in writing, of an action so that that part of the works may be inspected.

**WORKING DAY:**

Means the same as DAY.

**WORKING HOURS:**

Means the hours, on a working day, from 8am to 4.30pm.

**WORKS AS EXECUTED:**

Has the same meaning as AS CONSTRUCTED.

### **1.3 THE CONDITIONS OF TENDER AND CONDITIONS OF CONTRACT**

The Conditions of Tender and the Conditions of Contract contain additional requirements which apply to works carried out under any contract awarded by NT Government, including any works carried out using this specification.

### **1.4 ENVIRONMENTAL MANAGEMENT**

The Standard Specification for Environmental Management applies for all construction and demolition work for building and civil works carried out by or on behalf of the Northern Territory Government. The Standard Specification for Environmental Management takes precedence over this specification. A copy of that document is available via:

<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/technical-specifications>.

#### **1.4.1 Preservation of Sites and Artefacts Cultural and Heritage Significance**

Refer to the Standard Specification for Environmental Management.

#### **1.4.2 Contractor's Environmental Management Plan**

Refer to the Standard Specification for Environmental Management. Submission of the Contractor's Environmental Management Plan is a Hold Point.

### **1.5 DISPOSAL OF WASTE**

Dispose of waste of all types in a legal manner at a legal waste disposal site.

Obtain any permits required by the operator, and by the owner, of the waste disposal site.

Pay all fees associated with the permits and the disposal of the waste.

### **1.6 ESTABLISHMENT**

Allow in the tender for establishment on site, including, but not necessarily limited to, the following:

MOBILISATION:

Transportation and establishment on site, of all the requirements to complete the work.

DEMOBILISATION:

Removal and transportation from site of all temporary and construction facilities and equipment.

Restoration of the site, on Practical Completion of the works, compatible with environs.

ONGOING COSTS:

All indirect costs associated with the contract. Provide, on request, details substantiating the amount shown in the Schedule of Rates.

### **1.7 VOLATILE SUBSTANCES MANAGEMENT – HOLD POINT**

Contractors must become familiar with any Volatile Substance Abuse Management Plan(s) which is/are applicable in the areas where the Contractor needs access so that the works can be carried out. This includes, but is not limited to, the site(s) of the works, the site(s) of any accommodation used by the Contractor, and any access routes used by the Contractor.

The Contractor must comply with the requirements of any applicable Volatile Substance Abuse Management Plan(s). Failure to comply with an applicable Volatile Substance Abuse Management Plan is an offence. Prosecutions may be instigated. Offenders may be required to leave the area(s).

Aspects of Volatile Substance Abuse Management Plans of particular significance to the Contractor include, but are not limited to:

- The type of fuels used in fuelled vehicles, plant and equipment, and the secure storage of these,

- Products which use propellants, such as aerosol cans, and the secure storage of these,
- Paints, and the secure storage of these,
- Tools and equipment, which could be used to gain access to storage facilities where volatile substances may be stored, and the secure storage of these tools and items of equipment.

Copies of Volatile Substance Abuse Management Plans are available from the community which has a plan in place, community councils, land councils, or via

<https://health.nt.gov.au/professionals/alc-hol-and-other-drugs-health-professionals/volatile-substances>.

Check with the community/communities to ensure you receive up to date information.

**Hold Point** – Provide details of the volatile substances proposed to be brought in to the area(s) subject to Volatile Substance Abuse Management Plan(s) and provide details of the proposed methods for complying with the requirements of any applicable Volatile Substance Abuse Management Plan(s).

This clause is applicable only in areas where Volatile Substance Abuse Management Plan(s) are in place.

## **1.8 PERMITS TO ACCESS LAND FOR WORKS ON ROADS – HOLD POINT**

The Department will advise the Contractor about the entities and/or organisations with jurisdiction over the land by way of the Environmental Risk Assessment document applicable to the contract.

The Contractor must obtain permission, from the entities and/or organisations with jurisdiction over the site(s) of the works, to have access to the land where the works are to be carried out.

The Contractor must pay all fees and charges related to obtaining this permission. This includes obtaining appropriate approvals and permission to enter Aboriginal Land.

**Hold Point** – The Contractor must provide documentary evidence of having been granted the required permission(s) to;

- enter the land which is the site(s) of the works, and
- enter any other lands for ancillary activities related to the works, and
- carry out the works and works related ancillary activities.

Do not enter the land until this evidence has been received by the Superintendent.

The Contractor must comply with all conditions imposed by the entities and/or organisations which have jurisdiction over the land.

All works and works related activities in these areas must be carried out within the limits of the existing roadway, existing shoulders, and existing cleared drainage areas immediately adjacent to the roadway.

Unless prior permission is given by the entities and/or organizations with jurisdiction over the area:

- Do not clear any additional land.
- Do not stockpile any materials beyond the pre-existing cleared areas.
- Do not leave any surplus materials windrowed or stockpiled at the worksite on completion of the works.
- Do not windrow surplus materials at the tree line.

Do not spread surplus materials on the batters without approval from the Superintendent.

**Hold Point** – Provide documented advice on sites to which surplus materials will be taken. Provide documentary evidence of permits, from the entities and/or organisations with jurisdiction over those sites, for the dumping of surplus materials at those sites.

## **1.9 CAMP SITE/COMPOUND/WORKSHOP – HOLD POINT**

**Hold Point** - Provide a copy of written permission from the owner or lessee of the land permitting establishment and operation of a camp site, compound and/or workshop, before commencing works.

Pay all costs associated with the use of the site(s).

Refer to the Department of Health - Environment Health Fact Sheet No.700 for Camp Site Requirements for Mining and Construction Projects.

Maintain all facilities in good condition.

Maintain buildings in relation to fire protection in accordance with the Northern Territory *Building Act 1993* and Northern Territory *Fire and Emergency Act 1996* and associated Regulations.

### **1.9.1 Food Preparation Facilities – Hold Point**

**Hold Point** - Provide a copy of proof of registration with Department of Health of any camp food preparation area in accordance with the *Food Act 2004*.

### **1.9.2 Waste**

Comply with the requirements of the *Waste Management and Pollution Control Act 1998*.

Remove from the site and dispose of all waste materials, including green waste, food scraps and other putrescible wastes, construction waste, chemicals and effluent in an appropriate manner, in approved legal waste disposal sites or facilities.

Failure to comply with these requirements may result in remedial action being taken at your cost and may result in legal action being taken.

### **1.9.3 Effluent – Hold Point**

**Hold Point** - Provide a copy of written approval from Department of Health (DoH) for any proposed on-site effluent disposal system, before commencing works.

Ensure that all effluent from amenities is discharged into an approved facility or, if permitted by the controlling authority, the local sewerage system. Effluent disposal direct to ground or water is NOT permitted.

Septic tanks and portable self-contained toilets of suitable capacity may be used subject to suitable arrangements for the disposal of effluent.

**Hold Point** - Where the use of septic tanks or portable toilets is not reasonable or practical, pit toilets may be used, but this requires the prior written approval of the Superintendent.

Any pit toilets constructed must be at least 100 m from any bore, at least 200 m from any watercourse and sites must be appropriately rehabilitated on completion.

All septic tank installations or alternative septic systems servicing buildings both within and outside of declared building control areas, apart from installations subject to the *Building Act 1993*, must be approved by the Chief Health Officer (CHO) or the CHO's delegate for the area in which the works are to be carried out. Further information may be obtained from the relevant Environmental Health Officer in whose area the works are to be located. Regional contacts are contained within the Code of Practice for On-Site Waste Water Management accessible via <https://nt.gov.au/property/building-and-development/wastewater-management/codes-and-guidelines>.

### **1.9.4 Rehabilitation – Hold Point**

**Hold Point** - Obtain approval from the Superintendent for the completed rehabilitation of the camp site/compound/workshop before final demobilisation.

On completion of the works remove all facilities, unless otherwise agreed in writing with the owner or lessee of the land and restore the site to a clean and tidy condition.

Rehabilitate the site to its condition prior to conducting site works for establishing the camp ground, compound and/or workshop unless another course of action is approved by the Superintendent.

Where the camp site/compound /workshop is located within an extraction area, rehabilitation is to be undertaken in accordance with the conditions applying to rehabilitation of extraction areas. Rehabilitation measures must be implemented to a standard approved by the Superintendent prior to final demobilisation. Refer to the Standard Specification for Environmental Management.

Assume all responsibility for any current and consequential damage caused to the site as a result of occupation and pay for all remedial action required.

Refer the **Environmental Management** clause in this work section and to ACTS, REGULATIONS, CODES, AND AUTHORITIES.

## **1.10 TIME LIMIT FOR ATTENDANCE**

Unless specified otherwise, the works must be attended within the following time limits:

Generally the work must be attended within 3 working days of notification.

For urgent call outs within and outside of normal working hours the Contractor must be mobilised within 2 hours of notification.

For priority works, which involve health, safety and security, the Contractor must be mobilised within 6 working hours of notification.

## **1.11 EXTRACTION AREAS AND WATER SOURCES**

### **1.11.1 Extraction Areas Locations**

Borrow pits will be allowed provided that all the clearances and approvals listed in the **Approvals For Extraction Areas** clause in the Standard Specification For Environmental Management are obtained. Extraction areas are not permitted within 125 metres of the road centreline.

### **1.11.2 Administration**

Take responsibility for locating, selecting, operating and rehabilitating all borrow pits and water sources.

Determine any constraints on the use of potential borrow areas and water sources, including sites of significance, environmental and salinity, etc. if not provided by the Principal or Superintendent.

### **1.11.3 Crushing or Screening – Witness Point**

The crushing or screening plant to be used on the project subject to this contract must be certified as fit for use by a competent person. The certification of fitness for use must have been issued not more than one year prior to the date of the scheduled completion of the works plus one calendar month. A competent person is defined in the NT Work Safe Bulletin 09.01.16 Competent Persons for Inspection and Maintenance of Plant.

Comply with the guidance provided in the Safe Work Australia Code of Practice Managing Risks of Plant in the Workplace.

**Witness Point** – Provide documentary evidence of the certification that the plant is fit for use issued by a competent person. Provide documentary evidence of that person's skills and qualifications which indicate their competence as defined in the NT Work Safe Bulletin cited above. This evidence is to be provided within 2 weeks of the award of the contract.

### **1.11.4 Process Control Testing of Extracted Materials**

The Contractor is responsible for ensuring extracted material conforms to the specifications. The Contractor must pay all costs associated with replacement of nonconforming material and for correction of all nonconforming works.

### **1.11.5 Operation of Extraction Areas – Hold Point Access**

Construct only one access road to each pit.

Confine all transport operations to the access road.

Provide and maintain adequate road drainage.

### **Extraction**

Strip 100 mm minimum depth top layer throughout the area of operation.

Stockpile stripped material clear of drainage courses to a maximum height of 2 m.

Ensure that side slopes of sand or gravel are not steeper than one vertical to two horizontal at any time when the excavation is unattended.

Remove or bury by-products of the excavation operations unless otherwise required.

### **Limit of Excavation**

Not within 6 m of any fence line or utility service.

Not within any gas pipeline reserve.

Not within sight of road traffic.

Not within 125 m of any road or railway centre line.

Not within 25 m of a water course.

Maximum area: Should not exceed 1 ha. Align the long side with the contour.

**Hold Point** – Obtain Superintendent approval to exceed 1ha pit size.

Maximum width: 50 m.

Maximum depth: 2 m.

Leave natural vegetation strips 25 m width between pits.

Stockpile cleared vegetation and subsequently spread over the surface of the extraction area.

Existing pits within 125 m of a public road may be used provided:

No significant revegetation exists.

Extension proceeds away from the road.

Site is rehabilitated after use.

### **1.11.6 Rehabilitation of Extraction Areas**

Progressively rehabilitate extraction areas.

Backfill all test pits.

Respread unused material and rip 0.5 m deep at 3 m spacing along the contours.

Remove all rubbish and debris.

Replace stockpiled topsoil and cleared vegetation uniformly over the extraction area.

Batter walls at three horizontal to one vertical where excavation is less than 1 m depth, and six horizontal to one vertical where depth exceeds 1 m.

Rehabilitate any access road constructed for the project.

Refer to the Standard Specification for Environmental Management.

### **1.11.7 Stream Sites**

Contact Department of Environment and Natural Resources (DENR) prior to conducting any work in a stream site.

#### **Excavation Limits**

Not within 200 m upstream or downstream of any road structure, pipeline or gauging station.

Not in a manner liable to cause erosion or further disturbance to the watercourse.

Not within 15 m of the trunk of a tree and not under the branches of any tree.

#### **Conditions**

Leave sizeable islands to ensure groupings of trees that will withstand stream bed erosion.

Maximum batter slope: Two horizontal to one vertical.

### **1.11.8 Inspection**

Allow authorised personnel from DENR to enter the site at any time.

### **1.11.9 Records**

Provide the following details on completion:

List of areas used.

Chainages of area along the public road.

Direction and length of haul road.

Approximate volume of material removed from each site.

Provide suitable forms for such records to the Superintendent.

## **1.12 EXPLOSIVES – HOLD POINT**

Provide evidence of the following requirements of NT WorkSafe:

- Licence to carry and store explosives.
- Vehicle licensed to carry explosives.
- Shot Firer's Certificate.

Inspect and record the condition of all structures and services subject to possible effect by use of explosives before and after blasting operations.

**Hold Point** - Obtain approval from Superintendent before commencing blasting operations.

## **1.13 PLANT AND EQUIPMENT**

### **1.13.1 Geo-spatial data**

If Geo-spatial data is provided by the Principal it is for information only. The data must not be relied on as being accurate. The data must not be uploaded to plant or equipment.

### **1.13.2 Specification Reference**

Refer to the Northern Territory Government Standard Specification for Environmental Management and to the RFT.

### **1.13.3 General**

Do not clean spray bars or other contaminated equipment on the work site.

Clean plant and equipment in a location and in a manner which prevents pollution of the surrounding environment.

Clean plant and equipment before it is brought on to the site and immediately before it leaves the site to make it pest and weed free.

Plant and equipment is to be inspected and maintained as necessary during the course of the works. Emissions and fluid leaks are to be minimized by ensuring plant and equipment are well maintained, in good repair and in good working order.

### **1.13.4 Mobile Plant Machinery - Broadband Alarm**

#### **Standards**

AS 4742: Machine-mounted forward and reverse audible warning alarm (withdrawn)

ISO 9533.

#### **Definitions**

**Broadband alarm:** Pulsed acoustic signal that comprises a range of frequencies and sometimes referred to as quacker, woosher, non-tonal reversing beepers or white sound.

### **1.13.5 Broadband/White-Sound Alarm Requirement:**

Broadband Alarms (White Sound) must be fitted to all construction vehicles and mobile plant before commencement of works.

Ensure that installation and operations of the alarm/warning systems are sufficient before commencement of works, including, but not limited to:

- All alarms clearly audible above the noise level of the machinery or vehicles.
- Alarms are automatically activated when reverse gear is selected in the vehicle to which it is fitted, or when the machine to which the alarm is fitted is switched on and is in use.
- Directional nature of the broadband alarm is appropriate for works.

### **1.13.6 Warning Beacons on Vehicles and Mobile Plant, Machinery, and Equipment**

Provide beacons, or other vehicle, or plant, or equipment, or machinery, mounted visual illuminated warning devices on the highest point of the cabin roof or superstructure of all vehicles, mobile plant, mobile machinery, and mobile equipment in accordance with the **Vehicle-Mounted Signs And Devices** Clause in the **Description And Use of Signs And Devices** Section of AS 1742.3 where these are being used within the road reserve.

Fit beacons with globes rated at a minimum of 55 watts, or the LED equivalent.

Do not use strobe lights.

Ensure that the light is operational whenever the plant or equipment is working on or within 9 m of the roadway.

Ensure that the light is visible from all approaches and not obscured by exhaust stacks, back hoe arms etc, and that the beacons or warning devices are not covered in dust.

Non-compliance with this clause may result in the Contractor being directed to cease work, which will be at no cost to the Principal, and which will not be grounds for an extension of time claim.

## **1.14 SAFETY**

Comply with the *Work Health and Safety (National Uniform Legislation) Act 2011* and Regulations and any applicable Codes of Practice, and any applicable Australian Standards.

All workers on site are to have undertaken and completed **Prepare to work safely in the construction industry** (CPCCWHS1001), or superseding or preceding equivalent qualification recognised by training.gov.au.

Site specific and Task specific induction training is still required for all work sites and is to be provided by the employer.

### **1.14.1 Safety Officer – Witness Point**

**Witness Point** - Appoint a Safety Officer and notify the Superintendent of the Safety Officer's name, and contact details, including an after-hours contact phone number.

Ensure the Safety Officer is capable and available at all times as required.

The Superintendent retains the right to revoke the appointment of the Safety Officer at any time, and direct that another person be appointed.

### **1.14.2 Work Health and Safety Management Plan - Hold Point**

**Hold Point** - If the Act requires it, provide a Work Health and Safety Management Plan within 14 calendar days of award of the contract. Do not commence works until the Superintendent has advised that the Work Health and Safety Management Plan may be used.

Comply with the *Work Health and Safety (National Uniform Legislation) Act 2011* and Regulations and any applicable Codes of Practice.

A person with control of a construction project, irrespective of monetary value of the contract, where five or more persons are working, or are likely to be working simultaneously on a construction site must ensure that:

- a site-specific Work Health and Safety Management Plan is prepared before the work commences; and
- The plan is monitored, maintained and kept up to date during the course of the work.

The person with control of the construction project must ensure that the Work Health and Safety Management Plan includes, but is not limited to:

- a statement of responsibilities, listing the names, positions and responsibilities of all persons who will have specific responsibilities on the site for Work Health and Safety;
- the detail of arrangements for ensuring compliance with the Work Health and Safety induction training requirements of this national standard;
- the detail of arrangements for the co-ordination of health and safety issues of persons engaged to undertake construction work;
- the detail of arrangements for managing Work Health and Safety incidents when they occur, including the identities of and contact details of all persons who will be available to prevent, prepare for, respond to and manage recovery from such incidents;
- any site safety rules, with the detail of arrangements for ensuring that all persons at the site, whether employees, contractors, suppliers or visitors, are informed of the rules;
- the hazard identification, risk assessment and risk control information for all work activities assessed as having safety risks; and
- The safe work method statements for all high-risk construction work.

### **1.14.3 Safety Practice**

Provide safety equipment, protective clothing and devices and first aid facilities.

Ensure that employees are instructed concerning hazards and how to avoid injury.

Observe good safety practices throughout the Contract.

### **1.14.4 Safety Equipment, Clothing, and Devices**

Safety equipment, clothing, and devices used are to comply with the requirements of the Australian Standards listed in this work section.

### **1.14.5 Work Involving Chemicals**

Comply with *Work Health and Safety (NUL) Act 2011* and Regulations 2011.

SDS documentation for chemicals used during the works must be held on site at all times during the works.

Spill clean-up equipment and materials, appropriate for the type and quantities of chemicals used on site, must be kept on site at all times during the works. They must be kept in a readily accessible location. The equipment and materials must be maintained and replenished as needed.

Staff trained in the use of the spill clean-up equipment and materials must be on site at all times during the works.

Report all chemical spills to the Superintendent.

Where appropriate, also report spills to the NT Pollution Hotline, phone 1800 064 567.

Chemicals include, but are not limited to, paints, fuels, oils, herbicides, pesticides, tars, lubricants, cleaning products (domestic and industrial types), inks, dyes, toners, fertilizers etc.

## **1.15 FENCING AND SHORING OF OPEN EXCAVATIONS**

Design, construct and maintain the excavation and shoring in a safe and satisfactory condition.

Support trenches in saturated or unstable ground with close timbered shoring or similar.

## **1.16 WORK ON RAILWAY SITES – HOLD POINT**

Comply with *Work Health and Safety (N.U.L) Act 2011* and Regulations 2011.

Carry out work within railway sites to the approval of the owner and accredited operator of the railway.

The Contractor must comply with all requirements, conditions and directions of the owners and accredited operators of the Railway pursuant to the Northern Territory *Rail Safety (National Uniform Legislation) Act 2012*. When carrying out work under the Contract within 100 metres of

the Railway obtain any approvals or licences required for such work.

Comply with the terms of any current existing interface agreement for work within the railway sites.

Provide documentation detailing all interfaces between the works under the Contract and the Railway or Railway land. The Contractor must fully comply with the terms of the plan.

The contractor indemnifies in the Principal in respect of any claim made by or liability to any person arising out of:

- The performance of work on, over or near the Railway, and
- The procurement or utilisation of a Railway track possession or track isolation (including any postponement, improper use or delay in relinquishing them).

Give 14 days written notice to the owner and operator of intent to commence work and provide a work plan showing safe working conditions for the site.

**Hold Point** - Do not commence work until the work plan has been approved by the owner and operator of the rail system.

If work is required to be carried out within 3 metres of the actual rail line, this work must be co-ordinated through the Superintendent.

### **1.17 WORK NEAR TRAFFIC COUNTING STATIONS – HOLD POINT**

**Hold Point** - Prior to commencing any excavation, boring of holes, blasting, rock breaking, soil compaction or similar activity in the vicinity of traffic counter station detector loops, obtain the location of the cables from the Department of Infrastructure, Planning and Logistics, Transport Planning Division, Data Contracts Officer and pay all fees.

Follow all directions and instructions issued by the Transport Planning Division in relation to work in the vicinity of such cables.

### **1.18 PROJECT NOTICE BOARDS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Supply, erect and maintain Project Notice Boards, at locations nominated by the Superintendent and in accordance with ROAD FURNITURE AND TRAFFIC CONTROL DEVICES, within 2 weeks of establishment on site.

Design the Project Notice Boards in accordance with the drawings.

Include the project specific wording on the boards.

For NT roads remove the boards within 2 weeks after the Certificate of Practical Completion has been issued.

For projects for Federal government roads remove the boards 52 weeks after the Certificate of Practical Completion has been issued.

### **1.19 LEVEL CHECKING**

Check levels of subgrade and final surface at 25 m intervals.

Check levels at centre line and to edges of pavement.

Check levels of intersections and parking areas at appropriate intervals.

Check levels using an independent and competent surveyor who is eligible for membership of the Institution of Surveyors Australia or the Institution of Engineering and Mining Surveyors Australia.

#### **Survey Pegs**

Install temporary survey pegs along the extent of the works.

The survey pegs are to be installed in close proximity to the edges of the formation but still provide clearance for plant and equipment to be used without damaging or moving the survey pegs.

The survey pegs must be installed in pairs, one on each side of the pavement, positioned and marked to have the same chainage.

The survey pegs are to be spaced at 100m intervals longitudinally along the works

Individual survey pegs are to be tied with high visibility flagging tape.

The survey pegs are to be marked with the design relative level of the finished pavement and the chainage at which each survey peg is located. This information must be clearly legible throughout the duration of works.

The finished pavement design levels are at points in the centre of the pavement for pavements with equal numbers of traffic lanes in each direction of travel.

The finished pavement design levels are at points in the centre of 2 adjacent lanes which have opposite directions of travel for pavements with unequal numbers of traffic lanes in each direction of travel.

Any survey pegs which are damaged must be repaired or replaced and reinstated in their correct positions as soon as practicable.

Any survey pegs moved but not damaged must be reinstated in their correct positions as soon as practicable.

## **1.20 LEVEL AUDITING**

The Superintendent may choose to audit any level survey submitted to show conformance with the specified tolerances.

Provide an experienced survey assistant when requested by the Superintendent to assist in audit checking.

## **1.21 CONTROL STATION CHECK SURVEY – WITNESS POINT**

Refer to the RFT Preliminary Clause SURVEYS AND SETTING OUT.

**Witness Point** - Where results exceed the quoted tolerance notify the Superintendent and obtain directions.

## **1.22 CYCLE AND PEDESTRIAN SHARED PATHS**

For concrete shared use paths provide 100mm minimum thick concrete to AS 1379 N25 with reinforcing mesh SL62 placed centrally. Mesh material to AS/NZS 4671, installation to AS 2870.

All relevant design principles contained in AUSTRROADS must be integrated in the design of cycle ways, pathways and associated infrastructure (Austroads Guide to Road Design Part 6A: Pedestrian and Cyclist Paths). Refer to Design drawings (if any) and conform to local Council requirements. Refer to PROJECT SPECIFIC REQUIREMENTS in the Request for Tender.

## **1.23 AS CONSTRUCTED INFORMATION – HOLD POINT – WITNESS POINT**

**Hold Point** – Provision of As Constructed information is a condition precedent to Practical Completion.

**Witness Point** - Provide As Constructed drawings for all of the works.

- Show in red, on the Contract Drawings, as constructed information relating to works constructed beyond the various construction tolerances. The information includes, but is not limited to:
  - o Setout co-ordinates, where applicable.
  - o Design levels.
  - o Detail dimensions.
- Pavement, seal, line marking and protection extents.
- Refer to the specific deliverables in the NTG Technical Drawings Part 1 - Requirements for Technical Records Management document, which is accessible via

<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/technical-records> .

- Drawings without changes shall be also be included and labelled as "As Constructed " in the amendment description column.

As Constructed includes and means the same as; works as executed, and as installed, and as built.

Hard copies of documents are no longer required. Electronic copies in Microsoft Word, Microsoft Excel, pdf, .dwg or .dgn, or as specified, are required.

Where the scope of work has been varied beyond the content of the Contract Drawings, provide As Constructed drawings to reflect the work, to the same format and style as defined in:

- The NTG Technical Drawings Part 1 - Requirements for Technical Records Management document, which is accessible via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/technical-records> .

- The NTG Technical Drawings Part 2 – Civil CADD Manual document, which is accessible via [https://dipl.nt.gov.au/\\_data/assets/pdf\\_file/0017/430019/ntg-technical-drawings-part-2-civil-cadd-manual.pdf](https://dipl.nt.gov.au/_data/assets/pdf_file/0017/430019/ntg-technical-drawings-part-2-civil-cadd-manual.pdf) .

Document all changes to and variations of the design as the work proceeds.

Provide amended versions of the information and drawings which reflect the as built conditions.

Provide PDF copies of drawings in A3 size format and provide the drawings in CAD format in AutoCad or Microstation. Provide copies of text information in A4 portrait format in Microsoft Word, and/or PDF format. Provide tables and schedules in Microsoft Excel and/or PDF.

Standard: To AS 1100(set) Technical drawing.

Where the drawings are to be reduced, the annotation character heights shall be selected so that the annotation character heights as reproduced are not less than 1.8 mm. Resolution to be a minimum of 600 dpi.

Provide the amended information and drawings to the Superintendent progressively as the work proceeds, with or before the next progress payment claim, or with or before the claim for the variation which led to the need to amend the information and drawings to accurately reflect the as built condition.

**Witness Point** - Before the work commences provide a proposed procedure for recording and submitting the amended drawings.

Use an independent surveyor who is eligible for membership of the Institution of Surveyors Australia or the Institution of Engineering and Mining Surveyors Australia to record the changes and variations, and certify each of the drawings and/or documents labelled and provided as "As Constructed" information.

## **1.24 DIVING WORK**

### **1.24.1 General**

Comply with the *Work Health and Safety (NUL) Act 2011* and Regulations 2011.

Comply with ADAS Operation Manual or DRDC (formerly DCIEM) Diving Manual or NOAA Diving Manual.

### **1.24.2 Standards**

AS/NZS 2299 Occupational diving operations

AS/NZS 2299.1 Standard operational practice

AS/NZS 2299.2 Scientific diving

AS 2815 Training and certification of occupational divers

AS 2815.1 Occupational SCUBA diver – Standard

AS/NZS 2815.2 Surface supplied diving to 30 m

AS 2815.3 Air diving to 50 m

AS 2815.4 Bell diving

AS/NZS 2815.5 Dive supervisor

### **1.24.3 Definitions**

ADAS Australian Diver Accreditation Scheme

DRDC Defense Research and Development Canada

NOAA National Oceanic and Atmospheric Administration (USA)

WHS (NUL) *Work Health and Safety (National Uniform Legislation) Act 2011*, Regulations, and applicable NT and Federal Codes of Practice

### **1.24.4 Diver Qualifications**

Provide evidence of competency for all personnel undertaking diving work (general occupational diving or high risk diving as applicable). Minimum competencies required are the competencies required by ADAS deemed by ADAS to be appropriate for the works to be undertaken. Refer to the AS 2815 (set).

### **1.24.5 Dive Safety Log**

Maintain and provide Dive Safety Log (in accordance with Regulation 180, of the WHS (NUL) Regulations). To be provided for review on request and at completion of works. Refer to AS 2299 (set).

### **1.24.6 Dive Plan**

Submit a Dive Plan (in accordance with Regulation 178, of the WHS (NUL) Regulations). To be submitted after contract award and at least 14 days prior to commencement of diving works. Refer to AS 2299 (set).

The Dive Plan is to include:

- the method of carrying out the diving work to which it relates;
- the tasks and duties of each person involved in the dive;
- the diving equipment, breathing gases and procedures to be used in the dive;
- as applicable, dive times, bottom times and decompression profiles;
- hazards relating to the dive and measures to be implemented in the control of risks associated with those hazards;
- emergency procedures.

### **1.24.7 Crocodile Hazard Management**

Provide a Crocodile Hazard Management Plan where diving work is to occur in waters known to have, or suspected of having, crocodiles. The plan can include, but not be limited to;

- Having spotters at water level and on a bridge,
- Minimizing movement of vessels once diving work commences to reduce risk of attracting crocodiles and
- Establishing a communication plan and having a communications system or methodology in place so that all parties conducting the activity can communicate with each other.

### **1.24.8 Dive Cage**

Diving work in waters known to have, or suspected of having, crocodiles is to be carried out by divers who are protected by a dive cage. This dive cage should be engineered for the task and can be mounted to either a service barge or other watercraft or lowered from a bridge, depending on the task environment.

### **1.24.9 Crocodile Net**

If a crocodile net is the only viable option provide details of the construction of the net and its support systems and provide details of the risk management plan which will be in place during use of the net.

### **1.24.10 Response if a crocodile is spotted**

Ensure or personnel move to a safe place.

Contact the Crocodile Management Unit of the Parks and Wildlife Service

- Darwin All hours 0419 822 859 or 0401 118 776 or Office hours 8999 4691
- Katherine All hours 0407 958 405 or Office hours 8973 8849

If safe and practical to do so, monitor the movement of the crocodile(s) so that the personnel from the Crocodile Management Unit can be told of the crocodiles last known location.

### **1.25 WORK NEAR AREAS WHERE CROCODILES MAY BE PRESENT**

For all work in or near areas where crocodiles may be present comply with the crocodile related sub-clauses in the **Diving Work** clause.

### **1.26 TIME ALLOWED FOR ASSESSMENT OF SUBMITTED DOCUMENTS**

This clause is related to documents which are to be submitted by the Contractor to the Superintendent for assessment and/or acceptance and/or approval and/or appraisal.

The documents subject to this clause include, but are not limited to:

- Traffic Management Plan
- Inspection and Test Plans
- Project Control Plan
- Quality Assurance Plan
- Work Health and Safety Plan which includes, but is not limited to:
  - Risk assessment and mitigation measures proposed
  - Project targets and how they will be achieved
  - Induction training sessions for all site personnel, including sub-contractors, suppliers, and the Principal's representatives
  - Cultural Heritage inductions by Cultural Monitors
- Indigenous Development Plan
- Contractor's Environmental Management Plan which includes, but is not limited to:
  - Erosion and Sediment Control Plan
  - Acid Sulphate Soils Management Plan
  - Weed Management Plan
  - Asbestos Management Plan
  - Cultural Heritage Management Plan

The Superintendent will provide a response in respect to the submitted documents to the Contractor within a reasonable time. The length of time considered reasonable will depend on the complexity of the documents, the amount of information in the documents and the workload of the Department's personnel who will assess the documents. The length of time considered reasonable can be negotiated between the Contractor and the Superintendent. Any such negotiated time must be fair to both parties.

If the documents are rejected, not accepted, not approved or returned for modification, the Superintendent will have an additional reasonable time period to assess the amended documents.

The time taken by the Superintendent to assess submitted documents or to assess re-submitted documents and to respond to the Contractor will not be accepted as a reason for the Contractor to claim an extension of time nor to claim a variation for costs related to the preparation of, or modification to, documents to be submitted or re-submitted.

These time frames do not apply in emergency situations where faster responses are appropriate.

Resubmitted documents must be sent with the changes made clearly marked. Changes should only be made to the plans to the extent required by the Superintendent. Any changes not

explicitly requested by the Superintendent but made in the resubmitted plans must be clearly visible in the document and the reasons for making the changes must be explained in a separate document or the covering email. Changes not made obvious and not explained or made obvious but not explained will not be accepted under the contract whether this is advised to the Contractor or not. Changes which were not requested but are made obvious and which are explained will be assessed during the re-assessment process.

Plans required in respect to works in specialised facilities such as health care facilities and secure facilities will be subject to responses in time frames to be negotiated.

### **1.27 CONTRACTOR'S SUBMISSIONS – HOLD POINT**

Find out the extents of the road reserve for the full length of the works. Widths of road reserve vary.

Obtain all required permits, and approvals, for works, and associated activities, proposed to be carried out in areas not in the road reserve. This is in addition to all other required permits and approvals.

**Hold Point** - Provide copies of permits, and approvals, for works, and associated activities, proposed to be carried out in areas not in the road reserve before commencing any proposed works, and activities.

### **1.28 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 2 PROVISION FOR TRAFFIC

### 2.1 GENERAL

Minimise obstruction and inconvenience to the public.

Ensure public safety is accommodated at all work sites at all times.

A traffic escort vehicle is required for all resealing works.

Assume responsibility for the safe conduct of traffic through, past or around the works, 24 hours a day, from possession of the site to completion of all works, defects liability period (if any) and handover.

Comply with the Acts, Regulations, Codes and Guidelines applicable to the works. Comply with the requirements of Authorities which have jurisdiction over the works or the sites of the works.

Comply with the *Work Health and Safety (NUL) Act 2011* and Regulations 2011.

#### 2.1.1 Ownership markings on temporary traffic control signs and devices

Ownership markings on the backs of signs and in unobtrusive locations on devices are permitted. Advertising markings are not permitted.

The limitations for ownership markings are:

- The entirety of the markings are to fit within a square of 200mm x 200mm,
- The markings are to be in one colour only,
- The markings are to be located on the backs of signs,
- The markings are to be located in unobtrusive locations on devices and should not be visible to motorists, and
- Only one marking per sign or device is permitted.

These limitations on ownership markings apply to, but are not limited to, the following temporary traffic control devices:

- Signs,
- Bollards,
- Cones,
- Portable traffic signals,
- Temporary traffic signals,
- Vehicle mounted signs,
- Vehicle mounted flashing arrow signs,
- Variable message signs, and
- Any other temporary signs and devices not listed above.

Signs and devices with non-compliant ownership markings, or with advertising markings, must be removed from site and be replaced with compliant signage at no cost to the Principal.

#### 2.1.2 Clean Up of Tracked Materials

Remove tracked materials such as dirt, mud, and other detritus, from the Workzone immediately.

Failure to comply with this requirement will render the Contractor liable to pay the costs incurred by the Department to procure any alternate means of having the tracked materials removed.

### 2.2 STANDARDS AND PUBLICATIONS

Conform to the following Standards and Publications unless specified otherwise:

- |           |  |
|-----------|--|
| AS 1742.2 | Manual of uniform traffic control devices - Traffic control devices for general use    |
| AS 1742.3 | Manual of uniform traffic control devices - Traffic control devices for works on roads |
| AS 1742.9 | Manual of uniform traffic control devices - Bicycle facilities                         |

AS 1742.10 Manual of uniform traffic control devices - Pedestrian control and protection  
AS/NZS 1906.1 Retroreflective materials  
AS/NZS 3845.1 Road safety barrier systems  
AS 4191 Portable traffic signals  
AS 4852.2 Variable message signs - Portable signs  
AS/NZS ISO 31000 Risk management  
NTTM NT Test Methods.  
NTMTM NT Materials Testing Manual, accessible via  
<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>

AUSTROADS Guide to Road Design  
AUSTROADS Guide to Bridge Technology  
AUSTROADS Guide to Road Safety Part 6: Road Safety Audit (AGRS06-09)

NT WorkSafe All Relevant Bulletins, Guides, Guidelines, and Codes of Practice  
Safe Work Australia All Relevant Bulletins, Guide, Guidelines, and Codes of Practice

## 2.3 LEGISLATION

Northern Territory of Australia *Control of Roads Act 1953*, and its Regulations  
Northern Territory of Australia *Traffic Act 1987*, and its Regulations  
Northern Territory of Australia *Work Health and Safety (NUL) Act 2011*, and its Regulations 2011

## 2.4 DEFINITIONS

**After Hours Rectification(s):** Work required to repair, amend, reset, replace, and the like, any item which is damaged or malfunctioning, and which is part of the works, and which is work which is required to be done outside of working hours, and is done to protect the safety of the traveling public.

**Appraised:** Appraised by the Superintendent, or a Department staff member with authority to appraise the item being appraised.

**Approved:** Approved by the Superintendent, or a Department staff member with authority to approve the item being approved.

**Authorised:** Authorised by the Superintendent, or a Department staff member with authority to authorize the item being authorised.

**Business day:** Means the same as **Day**.

**Calendar day:** Means any day of the week including weekends and Public Holidays.

**Day(s):** Means working days, Monday to Friday, excluding Northern Territory wide Public Holidays, and excluding weekends.

**DIPL / the Department:** The Department of Infrastructure, Planning and Logistics.

**Generic TGS** A TGS which has been appraised by the department, and has been deemed as suitable for use, and may be suitable for use at sites in addition to the site for which it was created, and relates specifically to the works to be undertaken.

**ITC:** Instruction to Contractor. Issued by the Superintendent, or by a Department PTW approval officer.

**Long term:** Applies when traffic guidance is required to operate for more than one shift irrespective of whether it is day or night.

**PTSA:** Portable Traffic Signals Authorisation.

**PTW:** Permit to Work in a Road Reserve. A Permit to Work in a Road Reserve does not confer any rights to the entity to which the permit is issued beyond the right to carry out activities for which the permit was issued. Those activities must have been approved before the activities commence.

**Shall:** Is indicative of a mandatory requirement, unless the context clearly indicates otherwise.

**Short term:** Applies when work is started and completed in one shift and the road is returned to normal conditions by the end of that shift.

**Superintendent:** As defined in the Contract for NTG procured works. For works not procured by, or on behalf of, the NTG, the term Superintendent means an employee of the Department, including the nominated Departmental Contact Officer, who has authority to make decisions in respect to works in road reserves.

**SWMS:** Safe Work Method Statement.

**TGS:** Traffic Guidance Scheme. Includes, but is not limited to, plans, drawings, sketches, diagrams, instructions, and after hours arrangements. Formerly referred to as Traffic Control Diagram.

**TMP:** Traffic Management Plan.

**Traffic Controller:** person responsible for the control of traffic on public roads utilising a stop-slow bat.

**TSLA:** Temporary Speed Limit Authorisation.

**VMS:** Variable Message Sign(s)

**Working day:** means the same as **Day**.

**Working hours:** Means the hours, on a working day, from 8am to 4.30pm.

## **2.5 WORKZONE TRAFFIC MANAGEMENT**

### **2.5.1 Traffic Management Personnel**

All personnel engaged in the works must have a current valid NT Construction Induction White Card.

Only persons qualified in nationally accredited units of competency in Workzone Traffic Management can be utilised for traffic management at worksites. The four levels of accreditation are:

- Workzone Traffic Management Plan Designer (WZ1)
- Workzone Traffic Controller (WZ2)
- Workzone Traffic Supervisor (WZ3)
- Escort mobile works(WZ 4)

### **2.5.2 Workzone Traffic Management Plan Designer (WZ1)**

The following prerequisites must be met to enable NT accreditation as a Traffic Management Plan Designer (WZ1):

- hold a valid current Australian motor vehicle driver's licence, and either
- successful completion of RII09 Resources and Infrastructure Industry Training Package unit of competency RIICWD503D Prepare Workzone Traffic Management Plans (or the replacement unit of competency if and when applicable) training course through an Northern Territory Registered Training Organisation, or
- successful completion of the RII09 Resources and Infrastructure Industry Training Package unit of competency RIICWD503D Prepare Workzone Traffic Management Plans (or the replacement unit of competency if and when applicable) training course through a Registered Training Organisation from another State or Territory AND successfully completed a bridging course through a Northern Territory Registered

Training Organisation in the above unit of competency.

### **2.5.3 Workzone Traffic Controller (WZ2)**

The following prerequisites must be met to enable NT accreditation as a Traffic Controller (WZ2):

- hold a valid current Australian motor vehicle driver's licence, and either
- successful completion of the RII09 Resources and Infrastructure Industry Training Package unit of competency RIIWHS205D Control Traffic with a STOP/SLOW Bat (or the replacement unit of competency if and when applicable) training course through an Northern Territory Registered Training Organisation, or
- successful completion of the RII09 Resources and Infrastructure Industry Training Package unit of competency RIIWHS205D Control Traffic with a STOP/SLOW Bat (or the replacement unit of competency if and when applicable) training course through a Registered Training Organisation from another State or Territory AND successfully completed a bridging course through a Northern Territory Registered Training Organisation in the above unit of competency.

### **2.5.4 Workzone Traffic Supervisor (WZ3)**

The following prerequisites must be met to enable NT accreditation as a Traffic Supervisor (WZ3):

- hold a valid current Australian motor vehicle driver's licence, and either
- successful completion of the RII09 Resources and Infrastructure Industry Training Package unit of competency RIIWHS302D Implement Traffic Management Plan (or the replacement unit of competency if and when applicable) training course through an Northern Territory Registered Training Organisation, or
- successful completion of the RII09 Resources and Infrastructure Industry Training Package unit of competency RIIWHS302D Implement Traffic Management Plan (or the replacement unit of competency if and when applicable) training course through a Registered Training Organisation from another State or Territory AND successfully completed a bridging course through a Northern Territory Registered Training Organisation in the above unit of competency.

### **2.5.5 Escort Mobile Works (WZ 4)**

The following pre requisites must be met to enable Northern Territory accreditation as an Escort mobile works (WZ 4):

- hold a valid current Australian motor vehicle driver's licence, and either
- successful completion of the RII09 Resources and Infrastructure Industry Training Package unit of competency RIICRM201E Escort mobile works (or the replacement unit of competency if and when applicable) training course through a Northern Territory Registered Training Organisation, or
- successful completion of the RII09 Resources and Infrastructure Industry Training Package unit of competency RIICRM201E Escort mobile works (or the replacement unit of competency if and when applicable) training course through a Registered Training Organisation from another State or Territory AND successfully completed a bridging course through a Northern Territory Registered Training Organisation in the above unit of competency.

### **2.5.6 Trainee Traffic Controller**

The Superintendent may grant approval for the use of a Trainee Traffic Controller within the work site. Such approval will only be considered after submission of a written request. A Trainee Traffic Controller cannot commence work until such approval has been granted and received in writing.

A Trainee Traffic Controller must meet all of the following criteria:

- be an employee of the Traffic Control Provider,
- hold a valid current Australian motor vehicle driver's licence,

- be registered with a Northern Territory Registered Training Organisation (NT RTO) to undertake the RII09 Resources and Infrastructure Industry Training Package unit of competency RIIWHS205D Control Traffic with a STOP/SLOW Bat (or the replacement unit of competency if and when applicable),
- only work under the direct supervision of a Controller (WZ2), and
- have commenced training to become a qualified Controller (WZ2) and complete all assessments of competency within 8 weeks of registration.

The direct supervision of a Trainee Traffic Controller is defined as the constant personal oversight of the work by a Workzone Traffic Controller (WZ2).

### **2.5.7 Traffic Escort Vehicle - Resealing Works**

Provide a traffic escort vehicle for all work sites where resealing works are undertaken under the contract.

The vehicle must have, as a minimum, one rotating beacon light or LED equivalent.

The escort vehicle is to be the lead vehicle for traffic permitted to pass through the work site at the direction of the traffic control personnel.

The escort vehicle is to control the speed of the traffic to ensure safety of road works personnel.

The driver of the escort vehicle is to have adequate skills and knowledge to be able to maintain safety of the public and of the roadworks personnel.

### **2.5.8 NT Accreditation in Workzone Traffic Management**

NT accreditation is provided by the following process:

- Completion of training course (or courses) as outlined above, and
- Obtain Workzone Traffic Management ID Card from NT Motor Vehicle Registry.

A list of NT Workzone Traffic Management Registered Training Organizations is accessible via <https://nt.gov.au/driving/management/work-zone-traffic-management-qualifications> .

### **2.5.9 Signs and Devices Not In Use**

Do not leave signs and devices in the Workzone if they are not in use.

Cover or remove signs and traffic control devices associated with reduced speed limits within one hour of completion of the shift if the works will continue in the next shift.

Remove signs and traffic control devices associated with reduced speed limits within one hour of completion of the work requiring the reduced limit.

Cover or remove unused signs and traffic control devices within two hours of completion of any revised traffic arrangement.

Remove unused signs and traffic control devices within two hours of completion of the works.

Keep the Workzone tidy and uncluttered.

Any failure to comply with this clause will render the Contractor liable to pay the costs incurred by the Department to procure any alternate means to have signs and devices not in use removed from site.

### **2.5.10 Reinstatement of Signs and Devices**

After any severe weather event check all signs and devices and reinstate them in accordance with the applicable TMP and TGSs if they have moved, blown over, or disappeared.

Check, and reinstate signs and devices if required, after becoming aware of any other event which may have caused the signs and/or devices to have moved from the locations shown on the applicable TMP and TGSs.

## **2.6 TRAFFIC MANAGEMENT PLAN**

Standard: To AS 1742.3 Traffic control for works on roads.

Provide a site and project specific Traffic Management Plan (TMP), and site and project specific Traffic Guidance Schemes (TGSs) of a complex and noncomplex nature per activity as required for the scheduled works.

The Traffic Management for this contract may be subject to audit. Refer to the PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### **2.6.1 Document Control**

Each TMP and TGS must have a unique identifying number and a revision number shown on it.

Each TMP must have a unique identifying number for each project.

Each revised/amended TGS is to have the revision number shown on it after the unique identifying number, and after the words "Revision number" or "Rev. No." or similar.

Provide and keep updated a register showing the TMP and a list of the TGSs to be used for each project managed by the department. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

The register is to show the names/titles of the TMP and TGSs, the name of the project for which they are to be used, the unique identifying number for each TMP and TGS, the revision number for each revised TGS, and the date and time when each revised TGS was submitted.

The register is to show the status of the document. The status will be one of the following, or another term which the Superintendent allows:

- Submitted for appraisal,
- Appraised as suitable,
- Superseded, or
- Withdrawn.

A copy of each page of the register showing the entries for the TMP(s) and/or TGSs issued must be submitted to the Superintendent on request. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

A revised TGS which has been appraised and found to be suitable for use replaces all earlier revisions of it. All earlier revisions of that TGS must be withdrawn from use at the time the new revision is implemented.

Any TMP which is amended must either have a revision number if the changes are minor, or a new unique identifying number if the changes are substantial. The Superintendent will advise which option is to be adopted.

### **2.6.2 Submission of Traffic Management Plan - Hold Point**

**Hold Point** - Submit the Traffic Management Plan (TMP), with the Traffic Guidance Schemes.

For contracts where audits of traffic control measures are required:

- Do not commence implementing traffic control measures until the TMP has been audited by a Panel Period Audit Consultant and found to be suitable.
- Do not commence the works until the TMP has been audited by a Panel Period Audit Consultant and found to be suitable.

For contracts where audits of traffic control measures are not required;

- Do not commence implementing traffic control measures until the TMP has been appraised by DIPL Road Operations and found to be suitable for use.
- Do not commence the works until the TMP has been appraised by DIPL Road Operations and found to be suitable for use.

The TMP shall be designed by a Northern Territory accredited Traffic Management Plan Designer. The TMP Designer must have visited the site, with the Contractor, before documenting the TMP. Include the details of the TMP Designer's name, accreditation number, and date of expiry of accreditation on the TMP.

Design the TMP in conformance with the requirements of AS 1742 - Manual of uniform traffic control devices Part 3: Traffic control devices for works on roads. Submit the plan, the TGSs, and other supporting documents, to the Superintendent by electronic means.

Include sufficient details on the TMP to explain the potential hazards, the assessed risks and the proposed treatments for the proposed work activities and work site which may include some or all of the following:

**2.6.2.1 Project Information**

- Purpose and Scope
- Specific Project Location
- Site Constraints/Impacts
- Traffic Management Objectives and Strategies
- Principal for the Works; Principal Contractor/Design Consultant including contact details
- Responsibilities including role responsibility and authority of key personnel, management hierarchy including site representatives and contact details of the responsible personnel
- Prior approvals (if any) granted by the Road Authority with relevant reference number

**2.6.2.2 Works on Roads**

- Project scope inclusive of works to be undertaken, staging of works, duration of works (work hours)
- Existing Traffic and Speed environment
- Roles and Responsibilities
- Traffic Management Responsibility Hierarchy
- Project Representatives
- Traffic Management Administration

**2.6.2.3 Traffic Hauling Impacts**

For worksites where machinery or hauling is required, provide the following information:

- details of haul routes,
- details of vehicle types, and configurations,
- hauling movements frequencies,
- proposed days and times of day for haulage movements,
- specific TGS(s) showing site access and site egress points,
- proposed methods to be used to prevent tracking of dirt, mud, and other materials, such as shaker bars or rumble strips,
- proposed methods of maintaining tracking prevention systems, and
- proposed methods to be used for dust suppression.

**2.6.2.4 Statutory Requirements**

- *Work Health and Safety (NUL) Act 2011* and Regulations 2011
- Provide details, on the TMP, of responsibilities and authorities of all key personnel on the project including project manager, line managers (site engineers, supervisors etc), contractors and workers, safety personnel, and traffic management personnel
- Requirements of personal protective equipment, plant and equipment
- Procedures for incidents or accidents

**2.6.2.5 After hours contact details**

Provide contact details of personnel who can be contacted outside of working hours. These people must be able to respond to situations which may arise, and must be able to rectify, or to have rectified, any problems which occur, outside of working hours.

Any failure to comply with this clause will render the Contractor liable to pay the costs incurred by the Department to procure any alternate means to have after hours rectifications made.

**2.6.2.6 Monitoring and Measurement**

- Site Inspections and Record Keeping
- TMP Auditing

- Public Feedback
- References

#### **2.6.2.7 Management Review**

- TMP Review and Improvement
- Variations to Standards and Plans
- Attention to hazards for non-motorised road users

#### **2.6.2.8 Planning**

Risk Identification and Assessment - Critical element to identify and assess foreseeable potential hazards associated with the work activities and work site

Legal and Other Requirements - Confirmation of use of up-to-date information and legislation

#### **Traffic Assessment (Vehicular Traffic)**

- Volume and Composition
- Existing and Proposed Speed Zones
- Intersection Capacity
- Existing Parking Facilities
- High Wide Loads
- Public Transport
- Special Events and Other Works

#### **Non-motorised Road Users**

- Cyclists and Pedestrians
- People with Disabilities
- School Crossings

#### **Site Assessment**

- Access to Adjoining Properties
- Environmental Conditions
- Impact on Adjoining Road Network

#### **Works Programming**

- Work Sequence
- Night Works
- Emergency Planning

#### **Consultation and Communication**

- Approvals - Road, Utility and Service Authorities
- Public Notification
- Notification to Other Agencies

#### **2.6.2.9 Implementation**

- Hazard Identification, Risk Assessment and Control
- Traffic Guidance Schemes
- Traffic Control Devices
- Signs
- Pavement Markings, including temporary pavement markings and proposed removal processes, and permanent pavement markings
- Variable Message Signs
- Delineation
- Temporary Speed Zones
- Emergency Arrangements
- Site Access
- Communicating TMP Requirements

### **2.6.3 Submission of Traffic Guidance Schemes**

Provide documented specific and/or generic Traffic Guidance Schemes (TGSs) per activity as required and/or as specified. These TGSs will be appraised on their merits.

Generic TGSs must be modified to suit the site of the works before being submitted. The modified TGSs are to be given a unique identifying number as per the Document Control clause in this worksection. Do not issue them as revisions of the generic TGSs.

Include, but do not be limited to, plans, drawings, sketches, diagrams, instructions, and after hours arrangements.

Submit the specific TGS to the Superintendent 5 working days prior to undertaking the required works.

Submitted TGSs will be appraised, or audited, for suitability for use. If the TGS(s) are considered suitable for use they may be appropriate to use for future works at that same location for the same scope of works.

Generic TGSs are only applicable in certain situations such as emergency, urgent, and/or maintenance road works, and where site conditions and identified hazards are of a similar nature. Generic TGSs must provide sufficient detailed information to enable traffic management personnel to implement site controls that comply with AS 1742.3 and which comply with this work section.

For Urgent Works, advise the Superintendent which generic TGS applies, or submit the specific TGS within 2 working days.

Provide amended TGSs, which incorporate changes which have been appraised by the Superintendent on site, or audited, within two working days of the appraisal, or completion of audit, of the change.

## **2.7 COMPLIANCE CHECKS OF WORKSITE TRAFFIC MANAGEMENT**

Department Road Projects staff may perform random compliance checks of traffic management at work sites as part of their daily routine duties.

Checks undertaken will include verification of:

- The Traffic Management Plan (TMP) held on site,
- The Traffic Guidance Scheme(s) (TGSs) held on site,
- Traffic control devices established in accordance with the TGSs,
- The correctness and currency of accreditation of all personnel associated with traffic management at the work site.
- The Permit to Work in a Road Reserve (PTW) for the project if a PTW is required for the project (generally not required for Department procured works),
- Any applicable Safe Work Method Statement,
- Any Temporary Speed Limit Authorisation issued for the project,
- Any Portable Traffic Signal Authorisation issued for the project,
- Any other applicable documents,
- Implementation of the requirements outlined in any document applicable to the project and the effectiveness of the implemented requirements.

Where personnel associated with traffic management at work sites are found not to have current accreditation to an appropriate level in Workzone Traffic Management, the Superintendent may direct the Contractor to cease work, make the site safe, and withdraw plant, equipment and personnel from the road reserve.

Where the checking officer deems modifications to Traffic Management are required for reasons of public safety or safety on the work site, an Instruction to Contractor (ITC) will be issued requesting that the TMP Designer makes immediate amendments to the TMP to manage the identified hazards. If modifications are deemed necessary but not urgent, corrections are to be made at the earliest practicable opportunity.

Resubmit revised documents for appraisal. Do not recommence work until the submitted revised documents have been appraised and found to be suitable for use and the amended traffic control measures have been implemented on site. This is to be at no cost to the Principal.

The Superintendent may direct the Contractor to cease work, make the site safe, and withdraw plant, equipment, and personnel from the road reserve if the site is deemed unsafe, and/or if the traffic control measures are not compliant. This is to be at no cost to the Principal.

When revised documents have been appraised and found suitable for use, and rectification is complete, and the site is deemed to be acceptably safe, and/or the traffic control measures are deemed to be compliant, the Contractor may return the plant, equipment, and personnel to the site, also at no cost to the Principal.

## **2.8 TRAFFIC MANAGEMENT AUDIT REQUIREMENTS**

The Traffic Management for this contract may be subject to audit. Refer to the PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ. If audits are not required under the contract this clause will not apply to the works.

### **2.8.1 Work Zone Traffic Management (WZTM) – Independent Third Party Audits**

The Principal will engage Consultants with WZ1, WZ2 and WZ3 accreditation and Road Safety Auditor accreditations to be Panel Period Audit Consultants.

The Superintendent will provide the names of the Panel Period Audit Consultants to be used for independent third party Work Zone Traffic Management audits under this contract, when the contract is awarded.

The Contractor is to advise the Superintendent immediately if any conflict of interest exists or might be perceived to exist between the Contractor and any of the nominated Panel Period Audit Consultants.

The Superintendent will select the Panel Period Audit Consultant for each traffic management audit task and will authorise the selected Panel Period Audit Consultant by issuing to that auditor an Auditor Service Request.

The Superintendent reserves the right to use other independent third party auditors to carry out specific audits of Work Zone Traffic Management Plans (TMPs), implementation of those plans, traffic management and control installations, and traffic management and control operations on site.

Only suitably experienced, qualified, and independent auditors can be a member on an audit team.

Any Contractor Performance Report (CPR) conducted on long term works projects shall include an assessment of the traffic management performance, covering all aspects of traffic management, and including traffic flow/congestion associated with the works.

Audits will evaluate compliance with reference to AS 1742.3, AGRS Part 6, NT legislation, and specifications for the project.

Refer to the clause **Time Allowed for Assessment of Submitted Documents** in MISCELLANEOUS PROVISIONS.

### **2.8.2 Suitability Audit Requirements – Hold Point**

All contracts, other than routine or specific maintenance on long term works projects, may require a suitability audit of all elements of the Traffic Management Plan to be carried out.

The Panel Period Audit Consultant will conduct a desktop audit of the Contractor's traffic management documentation.

The Panel Period Audit Consultant will provide a Draft Audit Report to the Superintendent and, concurrently, to the Contractor.

If the Draft Audit Report indicates corrective measures are required the Contractor is to amend

the traffic management documentation and submit the amended documentation to the Superintendent at no cost to the Principal.

The amended documentation will be audited by the Panel Period Audit Consultant.

Any audit of amended traffic management documentation will be at the Contractor's expense.

**Hold Point** - The Traffic Management Plan must not be implemented before it is audited for suitability and found to be suitable.

**Hold Point** - Works must not commence before the Traffic Management Plan is audited for suitability and found to be suitable.

Refer to the clause **Time Allowed for Assessment of Submitted Documents** in MISCELLANEOUS PROVISIONS.

### **2.8.3 Compliance Audit Requirements**

Compliance Audits must be undertaken within 24 hours of any Traffic Management Plan being implemented and shall reoccur at intervals no longer than 3 months.

The Panel Period Audit Consultant will conduct day time and night time on site compliance audits of the Contractor's traffic management measures.

The Panel Period Audit Consultant will provide a Draft Audit Report to the Superintendent and, concurrently, to the Contractor.

The Draft Audit Report will classify items using 3 classes – (1) No corrective measures required, (2) Minor corrective measures required, and/or (3) Substantial breach/breaches identified.

#### **2.8.3.1 No corrective measures required**

If the Draft Audit Report indicates no corrective measures are required it will be presented as an Audit Report.

#### **2.8.3.2 Minor corrective measures required**

If the Draft Audit Report indicates minor corrective measures are required the Contractor is to implement the corrections on site within 3 hours.

The Contractor is to advise the Superintendent immediately when the corrections are completed.

The Contractor is to amend the traffic management documentation to reflect the minor corrective measures implemented if they differ from what was documented, and submit the amended documentation to the Superintendent.

The Panel Period Audit Consultant will then complete the Audit Report.

#### **2.8.3.3 Substantial breach/breaches identified**

If the Draft Audit Report indicates substantial breaches the Superintendent will advise what action is required.

The Contractor is to advise the Superintendent immediately when the corrections are completed.

The Contractor is to amend the traffic management documentation to reflect the corrective measures implemented if they differ from what was documented, and submit the amended documentation to the Superintendent.

The amended traffic management documentation will be audited by the Panel Period Audit Consultant.

Any audit of amended traffic management documentation will be at the Contractor's expense.

### **2.8.4 Independent Third Party Audits**

Give 5 working days notice for audits.

The Superintendent will order the audits.

Independent Third Party Audits of site Traffic Management Plans, implementation, and operations shall be required for all significant changes to existing traffic movements such as;

- All new detours and traffic switches, where traffic is switched from an existing alignment to a revised or temporary alignment,
- First time installations for all detours, channelization and/or road geometry changes,
- New or alternate alignments, or changes to any detours, lane shifts for all long term installations to be in place for more than one shift.

If any TMP, Traffic Guidance Scheme (TGS)(formerly referred to as Traffic Control Diagram (TCD)), or site set out traffic management fail to meet DIPL requirements, AS 1742.3, other relevant associated Australian Standards, and/or Legislative requirements, when audited, all post rectification re-auditing costs shall be a negative variation to the contract.

Pursuant to the relevant clauses of the contract, the Contractor shall make good all non-conformances at no cost to the Principal.

The Contractor shall record and manage rectification of all non-conformances pursuant to its ITP requirements, including issuing of Non-Conformance Reports (NCRs) and Corrective Action Reports (Car's) according to the Quality Assurance requirements of the contract.

### **2.8.5 Process Auditing**

The Contractor is responsible for the ordering up of, and payment for, all process audits that are carried out for its own purposes to ensure its compliance with its own ITP.

### **2.8.6 Notice of Implementation – Hold Point**

**Hold Point** – Provide the Superintendent with copies of all audit reports confirming conformance, or indicating non-conformance, with specifications, Standards, and requirements for each implemented TGS within 24 hours of implementation.

**Hold Point** – Provide the Superintendent with copies of all audit reports confirming conformance, or non-conformance, with specifications, Standards, and requirements for each significant change within 24 hours of implementation.

**Hold Point** –The Contractor shall rectify the significant/urgent non-conformance in the time instructed by the Superintendent. If the Contractor fails to rectify the non-conformance the Superintendent may engage others to rectify the non-conformance, and the associated costs shall become a debt due and payable to the Principal.

### **2.8.7 Notice of Independent Third Party Audits – Witness Point - Hold Point**

Give the Superintendent 5 working days written notice in advance of each stage of the works requiring auditing.

All communication with the Panel Period Audit Consultant shall be forwarded through the Superintendent, except that on site communications are permitted for coordination of work and site safety.

**Hold Point** – Notify Superintendent and submit revised TGSs & TMPs to DIPL Road Operations for appraisal.

**Witness point** – Notify the Superintendent prior to rework arising due to failed audits.

## **2.9 CONFORMANCE AUDITING RESULTS**

The Traffic Management for this contract may be subject to audit. Refer to the PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ. If audits are not required under the contract this clause will not apply to the works.

The Panel Period Audit Consultant will provide an accredited report to the Superintendent within the scheduled times allowed listed in **Table - Auditing and Reporting Completion Times** from the time of ordering the audit/s.

For work in remote areas the Superintendent will increase the auditing and reporting completion times by a minimum of 2 days.

<b>Table - Auditing and Reporting Completion Times</b>	
<b>Attribute Being Tested</b>	<b>Time Allowed for Accredited Auditor Report in Working Days (Monday to Friday)</b>
<b>Work Zone Traffic Management</b>	
Traffic Management Plan Audit	2
Revised Traffic Management Plan Audit	2
New Site Compliance Audit (new implementation or major change or switching of traffic)	5
Site re-audit generally (not related to a major change or new implementation)	3

### **2.9.1 Reporting Monthly**

The Contractor shall ensure their Monthly report to the Superintendent clearly and accurately reports on all elements of work zone traffic management activities such as TMP/TGS status, implementations, staging (where applicable), audits, audit results, NCR's and CAR's.

### **2.9.2 Lot Auditing**

Conformance of work zone traffic control will be based on lots (made up by stages where there are multiple stages on one site).

Give each lot a lot number.

Number the lots using a logical system.

Maintain a register of all lots and lot numbers.

Include the location of each lot on the lot register.

Provide a copy of the lot register to the Superintendent upon request.

Lots defined by the contractor must be clearly marked out or clearly evident on the construction site.

Lots of work will be selected by the Contractor, based upon:

- A lot will represent differing traffic conditions and or traffic shift/s.
- A lot will be a continuous traffic guidance scheme, which either ends, or transitions in a clearly discernible way into a separate traffic guidance scheme.
- A lot will comprise of essentially a continuous traffic guidance scheme (identified on one or more Traffic Guidance Scheme documents) with no distinct changes in traffic channelling, geometry, speed environment, or risk rating.

Each lot will be subject to conformance auditing as individual lots (where applicable), and as an entire site. Where more than one traffic guidance scheme/lot is evident, these may be separated out if it is practicable to do so, however transitions between one or more traffic guidance schemes shall be assessed collectively for the site.

Non-conforming sections may be excluded from the lot to be audited if it is a distinctly different scheme and may be identified as a separate lot, and will also be subjected to lot auditing when ready.

Quality of the lot will be judged as conformance or non-conformance of each lot, however the audit report will be applicable to the entire site.

Conformance of traffic control devices will be based on the presented works when compared to the relevant Australian Standards.

When a lot, or a part of a lot, fails to satisfy the conformance requirements, either the entire lot

shall be re-audited, or a sub lot may be generated. A sub-lot may be created if the non-conforming lot is an isolated traffic guidance scheme that does not affect adjacent areas. Non-conforming lots shall be submitted for reauditing.

Should the lot under consideration be subdivided then each subdivision will be classed as a lot and each subdivided lot will be subject to lot auditing.

Non-conforming lots which are subdivided after auditing will be treated as separate lots and each and every subdivided lot will be reaudited.

**2.9.3 Examples of non-conformances that attract re-audit costs**

<b>Table – Non-conformances requiring re-audits</b>		
<b>Speed</b>	<b>Traffic Guidance Scheme (TGS) (Formerly Traffic Control Diagram (TCD))</b>	<b>Quality</b>
Failure to install and maintain speed limit signs as detailed in a TGS.	Failure to maintain any other traffic control device detailed in a TGS.	Failure to maintain and update the TMP.
Reduced speed limits introduced more than one hour prior to the commencement of the works. <b>(NOTE:</b> Speed limit signs may be installed but should be covered until immediately prior to the need for their use applies.)	Failure to maintain minimum travelled path dimensions.	Failure of the TGS to comply with the principles outlined in this specification.
Failure to cover/remove signs and traffic control devices associated with reduced speed limits within one hour of completion of the shift or of completion of the work requiring the reduced limit.	Failure to cover/remove unused signs and traffic control devices within two hours of completion of any revised traffic arrangement.	Traffic delay periods exceeding any maximum period nominated in the Contract.
Speed limits and associated control measures not implemented in accordance with the Speed Management Plan.	Failure to use other than designated construction workplace entries or exits for the works.	Failure to provide the required information/notification to the community and/or local businesses of changes to traffic movement.
<b>Other non-conformances</b>		
Failure to maintain an obstruction free travelled path.		
Failure to assist with mitigating the impacts of traffic incidents as much as is reasonably practicable.		
Undertaking traffic rearrangements without an approved TGS except where required for incident management purposes.		
Any other issue raised by the Auditor deemed to be a non-conformance.		
<b>NOTE;</b> This table does not represent an exhaustive list of non-conformances requiring re-audits.		

## 2.10 AMENDMENTS TO TRAFFIC MANAGEMENT PLANS - HOLD POINT

This clause does not refer to amendments to TMPs arising as consequence of audits.

Modify the Traffic Management Plan during the works to suit site conditions if required or requested by the nominated Departmental Contact Officer. Modify the Risk Assessment to ensure it is relevant to the modified TMP.

Changes made to the TMP must be clearly marked in the amended TMP.

In situations where immediate hazard mitigation is necessary the changes may be implemented and the Superintendent advised of the changes as soon as practicable thereafter.

**Hold Point** – Modified TMPs must be audited for suitability by a Panel Period Audit Consultant, or appraised by DIPL Road Operations if Traffic Management audits are not required under the contract, before implementation of the modified TMP.

**Hold Point** – Modified traffic management control measures must be audited for compliance by a Panel Period Audit Consultant, or appraised by DIPL Road Operations if Traffic Management audits are not required under the contract, before works resume.

Refer to the **Traffic Management Audit Requirements** clause, and to the **Conformance Auditing Results** clause, in this work section.

Refer to the clause **Time Allowed for Assessment of Submitted Documents** in MISCELLANEOUS PROVISIONS.

## 2.11 WORK IN RURAL AREAS – HOLD POINT

**Hold Point** - Undertake work during daylight hours only unless approval is given by the Superintendent. Approval will only be granted in exceptional circumstances.

## 2.12 WORK IN BUILT UP AREAS

### 2.12.1 Working Times – Hold Point

Program work, provide and install traffic management devices/controllers, equipment, materials etc accordingly so that traffic flows are not impeded during the following hours, from Monday to Friday, excluding Territory wide Public Holidays:

<b>From</b>	<b>To</b>
0700 hours	0900 hours.
1530 hours	1730 hours.

This table is only an example of peak traffic periods in urban areas.

Additional historical generic traffic data is available from the Department’s annual Traffic Report, which can be accessed via <https://dipl.nt.gov.au/data/traffic-report> . This data does not provide accurate up-to-date information on traffic volumes or traffic flows.

**Hold Point** - Obtain Superintendent approval if proposing to work during the restricted work hours.

Remove or cover existing signs or devices as appropriate to stop confusion during these hours. Further restrictions may apply should the Department deem it appropriate to do so.

Concessions to work within these hours may be approved by the Superintendent, should the need arise and the officer deems it necessary.

Do not operate construction vehicles used in conjunction with the proposed works, either SV plated or vehicles in excess of 19 metres on public roads during peak traffic times (see above, working times) or in any way impede peak traffic flow during these times. Vehicles in excess of 19 metres in length are only permitted to travel on roads designated for road trains unless an appropriate permit from the Motor Vehicle Registry has been obtained in advance of using such routes.

### **2.12.2 Traffic Lanes - Hold Point**

Maintain at least 2 lanes (one in each direction) open to traffic at all times unless permitted otherwise on duplicated roads and maintain at least one lane open on two lane roads with appropriate traffic control in place accordingly. Obtain the written permission of the Superintendent if it is necessary to fully close a road.

Only permit single lane operation of two way traffic when traffic is directed by accredited WZTM controllers and signs or portable traffic signals etc. are employed, dependant on the site conditions and obtaining the appropriate approvals.

Program works so that the closure of turning lanes is minimised.

Obtain prior written approval from the relevant Local Government or Council if traffic is to be detoured onto their road network or the proposed works affects their network/assets accordingly.

**Hold Point** - Provide a copy of all relevant approvals with the Traffic Management Plan.

### **2.12.3 Lane closures - Hold Point**

**Hold point** - Do not use bullnose or V type barriers unless no other option is available. Obtain permission from the Superintendent to use bullnose or V type barriers before placing them on site.

## **2.13 NIGHT ILLUMINATION – HOLD POINT**

**Hold Point** – Sections of the roadway, including detours and side tracks, affected by Work Zone Traffic Management, must be illuminated at night to AS 1742.3, if

- night works are in progress, and/or
- if signage left on site overnight is not illuminated by the headlights of vehicles approaching the signs.

Illumination to be 10 lux minimum at ground level.

## **2.14 WARNING DEVICES**

Take care when placing warning signs, work signs, traffic management devices, or plant and equipment within the road reserve to ensure that these do not interfere with or restrict sight lines, particularly at intersections and ensure that the devices are not obscured by trees or other objects.

Ensure that road work signs reflect the current conditions of the site. Remove or cover signs such as T1-5 (worker symbolic), temporary speed reductions and the like, when appropriate, such as when no persons are on site. Refer to AS 1742 for guidance on the appropriate use of these signs.

Any failure to comply with this clause will render the Contractor liable to pay the costs incurred by the Department staff to procure any alternate means to have the rectifications made.

### **2.14.1 Works in Progress Signs**

For proposed works which are expected to be in progress for longer than 14 calendar days, display signs, sized 1200 x 900mm with 100mm high black Helvetica medium lettering on a white background displaying the following details:

- The nature of the works.
- The start and end date of the works.
- The Contractor's business name.
- The Contractor's business phone number.
- The Contractor's after hours phone number.
- The name of the Traffic Management Plan supervisor.

Display these signs prominently at the extremities of all works in progress and in addition to the work signs requirement. The signs remain the property of the Contractor.

**2.14.2 Multi Panel Signs**

The use of multi panel sign configuration for "Traffic Controller Symbolic" & "Prepare to Stop" being mounted on one multi sign frame shall conform to AS 1742.3.

The use of the "Prepare to Stop" sign is mandatory in conjunction with the symbolic traffic controller sign where traffic are required to stop at the controllers position, therefore the Department approves making this the exception to the "No multi sign rule".

These signs must be on the one frame either side by side or one above the other. The individual signs are to be 900 mm x 600 mm minimum each when used stand alone, but may be reduced in size on a multi panel sign frame provided that the legend and / or symbol size are not reduced.

The Department will allow a multi panel sign frame for this use only in accordance with the directions herein and those contained within AS 1742.3.

**2.14.3 Multi message signs**

Do not use multi message signs. Stand-alone signs must be used.

**2.15 NT SPECIFIC DIRECTIONS FOR ROAD WORK SIGNS**

**2.15.1 Sign erection**

Refer to the **Definitions** clause in this worksection.

<b>Table - Sign erection requirements</b>	
Long term rural areas:	Place all signs a minimum 1m lateral clearance from the travelled path and a minimum of 1.5m from the lower edge of the sign to the ground.
Long term urban areas:	Place all signs a minimum of 2.2m from the lower edge of the sign to the ground in locations where they could be obscured by parked vehicles, vegetation or trees or may interfere with pedestrian routes. On traffic islands or medians the heights for signs shall conform to the "short term all areas" where it is deemed appropriate and only if they are not obscured by parked vehicles and if they do not interfere with pedestrian routes.
Short term all areas:	Display all signs prominently and place a minimum of 200mm from the lower edge of the sign to the ground, except regulatory signs such as speed, no parking signs etc, which shall be mounted a minimum of 1.5m from the lower edge of the sign to the ground. Place all signs a minimum of 2.2m from the lower edge of the sign to the ground where they could be obscured by parked vehicles, vegetation or trees or may interfere with pedestrian routes.

Mount signs on Oz Spike posts or similar, or set in concrete in accordance with the requirement for permanent speed sign installations. Ensure signs remain secure, stable, and frangible. If an Oz Spike does not have a sign in it, and no sign is required to be mounted in it, that Oz Spike is to be removed from site.

Ensure that signs are clean, free of damage and comprise of a minimum of Class 1 retroreflective material in accordance with AS/NZS 1906.1.

Duplicate all temporary work signs (place on both sides of roads within the work site) on all multilane work sites, irrespective of the duration of the works, unless there is insufficient room available to do so, such as the median width being not sufficient to accommodate the signs. Where necessary, seek direction from the Superintendent where this condition cannot be complied with.

### 2.15.2 Advance warning signs

Use T1-1 (road work ahead) signs and T2-16/17 (end road work) signs at all long term works sites and at all rural works sites.

In urban areas T1-1 (road work ahead) signs and T2-16/17 (end road work) signs at short term work sites are not mandatory, however, they may be used if deemed appropriate.

### 2.15.3 Star pickets & fence droppers

Do not use star pickets for support of road work signs, bunting, flagging, fencing, etc within 9 metres of the trafficked path.

Do not use star pickets or any other non-frangible items such as steel drums, for delineation or any other purposes within 9 metres of the edge of the trafficked lanes. Bollards, cones and flagging are appropriate alternatives.

Fence droppers may be used as sign supports or legs and bunting or flagging supports on the condition that the droppers are securely embedded into the ground and the sign, bunting or flagging is sufficiently secured to the droppers. Maintain a prudent use of end caps to ensure the minimisation of any hazards to workers and the public and the specified sign heights can be achieved.

Star pickets may be used for fencing support within the work site, provided appropriate action is taken to reduce any associated hazard for workers within the site and they are not within 9 metres of the travelled path of motorists.

### 2.15.4 Non-standard signs - Hold Point

**Hold Point** - Obtain specific approval from the Superintendent before using signs not included in AS 1742.3.

### 2.15.5 Portable Variable Message Signs (VMS) - Hold Point

Provide electronic variable message signs (VMSs) which comply with AS 1742.3 and with AS 4852.2 where major disruptions or delays to traffic or changes to the travelled path are likely to occur.

Provide the VMSs a minimum of 5 working days before any changes occur.

Provide the VMSs:

- at all approaches to intersections affected by, or likely to be affected by, the works,
- at approaches to detours associated with the works, and
- at approaches to major alterations to the existing travelled path.

Use electronic variable message signs capable of displaying a minimum text size as specified in AS 1742.3 and/or in AS 4852.2 and capable of displaying at least 3 lines, and capable of displaying at least 8 characters per line, and capable of displaying a maximum of 10 characters per line.

Colours for text, symbols, and backgrounds must conform to **Table - Permitted VMS colours**.

<b>Table - Permitted VMS colours</b>	
<b>Application</b>	<b>Permitted colours</b>
General message	White
Warning message	Yellow
Lane open (symbolic)	Yellow (Green only if approved)
Lane closed (symbolic)	Yellow (Red only if approved)
Regulatory	As required for static sign of same type
Other	As approved
Regulatory VMS displays must be a single screen, and permanently visible.	

**Hold point:** Provide details of the messages to be displayed and the locations of the variable message signs. Provide wording for advance warning message(s) and wording for message(s) to be displayed during the works. Do not use any VMS until the messages to be displayed have been approved. Do not use any VMS until the proposed location and orientation of the VMS has been approved. Provide this information not less than 5 working days before the VMSs are to be put in to service for the project.

Ensure the displayed messages are updated to reflect the actual on-site conditions and/or requirements.

VMSs are to be placed in position, and display an advance warning regarding the works, on all approaches, 5 working days before new traffic signals are put in to operation. The VMSs are to remain in situ, operating properly, displaying the approved during works message, for a minimum of 2 working days after the new traffic signals are put in to operation. These time frames may be varied by the Superintendent.

VMSs are to be placed in position, and display an advance warning regarding the works, on all approaches, 5 working days before any major disruptions or delays to traffic or changes to the travelled path are likely to occur. The VMSs are to remain in situ, operating properly, displaying the approved during works message, for a minimum of 2 working days after the works are complete. These time frames may be varied by the Superintendent.

Ensure any VMS used on site is oriented so that the message is clearly visible to motorists on the approach side.

Ensure any VMS used on site has adequate separation from the travelled path.

Ensure the VMS does not obstruct any path of travel of cyclists or pedestrians.

Ensure the VMS does not obstruct any crossover.

Ensure any VMS used on site has adequate separation from any other infrastructure, particularly overhead power lines.

Ensure any VMS used on site does not obstruct motorists' sight lines.

Ensure any VMS used on site is level, and that the screen and display elements are not damaged.

Do not have any on site VMS visible to motorists if it is not in use. Pre-positioning a VMS on site without a message being shown is only permitted if the VMS will be put in to use within a brief period of time.

Ensure the VMS does not cause any light pollution to nearby residences.

Take full responsibility for the VMSs used for the works, including prevention of theft and prevention of vandalism,

Do not, under any circumstances, use variable message signs for private advertising, within the NT Government road reserve, or visible from the NT Government road reserve, without the written approval of the Superintendent.

Any failure to comply with this clause will render the Contractor liable to pay the costs incurred by the Department to procure any alternate means to have any non-compliant VMSs removed from site.

### **2.15.6 Work Zone Speed Limits - Mandatory**

Where work zone speed limits are being proposed to be changed, the proposed temporary speed limits must be approved by the Superintendent prior to implementation of the proposed speed limits.

Erect speed limit signs in accordance with sub-clause **Sign Erection** in this clause.

All Traffic Management Practitioners must record in their Daily Diaries time, date and location of each approach, of speed limit installations and removals for legal purposes. Retain these diaries for a minimum of 12 months from completion of the works if there were no reportable incidents at the site of the works. If there was an incident, retain the logs until informed that

they can be destroyed. Provide copies of the diaries on request.

If an incident occurs within, adjacent to, on approach to or departure from the work site, make a photographic record of the traffic control devices, site conditions, placement of plant and equipment etc, as soon as practical after the event. Advise the Superintendent of the incident as soon as possible.

Provide, to the Superintendent, as soon as practicable, electronic copies of:

- the site photographs,
- the TGSs implemented at the site at the time of the incident,
- the signed incident report,
- the Daily Diaries,
- any TSLA applicable to the site at the time,
- any PTSA applicable to the site at the time, and
- any other information requested by the Superintendent.

### 2.15.7 Temporary Speed Limits - Hold Point

**Hold point** - Submit temporary speed limit authorisation applications to alter speed limits to the Superintendent, 5 working days prior to the implementation of temporary speed limits, for approval under the Control of Roads Act.

Place repeater speed limit signs along the road, which has a temporary speed limit imposed, after all intersections with other roads within the speed limited area.

Design the Traffic Management Plans so that speed limits lower than the following absolute minimums are not required;

<b>Table - Target lowest speed limits</b>	
<b>Application</b>	<b>Target speed limit not lower than</b>
Urban or built up areas.	40 km/h
Bridge works, when restricting traffic to one lane and only in conjunction with a stop-traffic situation. A safety barrier complying with the relevant Test Level in accordance with AS/NZS 3845 shall also be used.	40 km/h
All other rural works.	60 km/h unless site conditions warrant a lower speed limit.

Implement permitted controls and monitor the site for compliance.

Do not allow dangerous conditions to remain for any time before adjusting control measures to make travel through the section of road subject to the controls as safe as possible.

If there is non-compliance make adjustments to control measures and check for compliance.

Assess the options available to mitigate risk if there is non-compliance.

Assess the risks, and assess if compliance is unlikely to be achieved, before calling Police to assist.

Temporary speed limit signs may only be displayed within the times and dates stipulated in the approved TSLA, and only when they are necessary. Failure to comply with this clause will render the Contractor liable to pay for the costs incurred by the Department to have the installation made compliant.

### 2.15.8 Road Safety Barriers - Hold Point

Design, install and maintain all road safety barriers, including longitudinal channelizing devices, used within the NT Government's road reserve in accordance with AS 1742.3, AS/NZS 3845.1, AS/NZS 3845.2 and any other relevant and current Australian Standard associated with the works being proposed. Refer to the **Workzone temporary safety barriers** section at <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/road-safety-barriers> . Use only MASH tested barriers.

Failure to meet the requirements of this clause may result in the project being suspended by the Department or other relevant authorities, such as NT WorkSafe, without cost to the Department, and without cost to that authority, until the project meets the requirements of this clause.

**Hold Point:** Provide a statement, signed by your engineer, and signed by the author of the Traffic Management Plan, which states that the Road Safety Barriers proposal complies with AS 1742.3, and with AS/NZS 3845.1, and with AS/NZS 3845.2, and with the specifications and installation manuals from the manufacturers of the components proposed to be used in the Road Safety Barriers system. Provide the Traffic Management Plan with this statement.

The Traffic Management Plan must have information about the proposed Road Safety Barrier system(s), including, but not limited to:

- the barrier type(s),
- the end treatment type(s),
- the deflection zone(s),
- containment fence(s),
- offset(s) from traffic lane(s),
- width(s) and length(s) of work site(s),
- barrier(s) length(s) of need,
- barrier(s) requirements for night time,
- design layout drawing(s),
- installation methodologies, and
- a risk assessment of the use of the proposed Road Safety Barrier system(s).

### **2.15.9 Covering of Signs**

Do not cause damage to signs by covering them with incompatible materials.

Do not use plastics to cover signs.

Do not use adhesive tapes on the faces of signs.

Remove covers immediately if directed to do so by the Superintendent or another officer of the Department.

Ensure moisture does not become trapped between a sign cover and the face of the sign.

Replace any signs which are damaged by incompatible coverings at no cost to the Principal.

Any failure to comply with this clause will render the Contractor liable to pay the costs incurred by the Principal to have rectifications made.

## **2.16 EXCAVATIONS, STOCKPILES, AND GRADIENTS WITHIN WORK ZONES AND CLEAR ZONES**

### **2.16.1 NT WorkSafe Guideline in Relation to Excavations**

Provide shoring to all trenching or excavations which are deeper than 1.5 metres and where a person is required to enter unless an engineer certifies that shoring is not required. Provide a copy of the Engineer's certification on request.

Comply with the provisions of the Code of Practice for Excavation Works available from Safe Work Australia. Comply with the NT Work Safe Codes of Practice and Safe Work Australia Codes of Practice applicable to the works.

### **2.16.2 Requirements for excavations, stockpiles or other gradients**

Provide protection and delineation measures to excavations, stockpiles, or other gradients, to AS 1742.3, Protection and delineation at excavation works appendix, and to the **Road Safety Barriers** clause in this work section.

Measures to be implemented must take in to account the clearances between the hazards and traffic, and the posted traffic speed limits, and the nature of the hazard.

Where possible the site should be left without hazards outside working hours by backfilling, covering, or removing the hazards.

### **2.16.3 Containment fencing**

Containment fencing must comply with AS 1742.3, **Containment fences and road safety barrier systems** clause, **Containment fences** sub-clause.

Containment fencing is not a substitute for safety barriers.

The clearance between containment fencing and the travelled path is to be determined by the Procedures for the installation and operation of traffic control devices section of AS 1742.3.

Fix retroreflective markers on the trafficked side of steel panels which are used as containment fencing, if they are within 9m of the travelled path, or adjacent to pedestrian or cyclist access, and if they are to be in place at night.

## **2.17 TEMPORARY PAVEMENT MARKING**

Where new pavement surfacing or existing pavement resurfacing is being undertaken, install temporary raised reflective pavement markers at the end of each day and prior to the loss of daylight at 24 metres maximum spacing.

If so instructed by the Superintendent, temporary line marking at the end of each day may also be required until completion of the works when the permanent line marking is reinstated.

Only use temporary raised reflective pavement markers that comply with AS 1742.3, **Description and use of signs and devices** section, **Devices for delineating and indicating the travelled path** clause.

For long term road construction works where sealed detours merge into existing sealed pavements or where sealed side roads merge into sealed detours, line mark transition areas in accordance with the standard drawing for Line Marking, CS 3400 and in accordance with AS 1742 including the setting out of arrows, letters, numerals and chevrons.

### **2.17.1 Removal of Temporary Pavement Marking**

All line removal works must be carried out in such a manner as to not endanger the health, safety or amenity of employees, road users or the general public.

Do not paint over temporary line marking as a means of removing it.

Carry out removal of marking in such a manner as to minimise damage to pavement surfaces.

Obliterate markings so as they are no longer recognisable as marking. When arrows, letters or figures are to be removed, the removal pattern must be in the shape of a rectangle or square to minimise confusion to the motorist, particularly in wet weather and poor lighting conditions.

The removed marking and the material used to remove the marking must be contained, collected and disposed of in an environmentally acceptable manner.

Refer to the Department's Removal of Line Marking Policy at <https://dipl.nt.gov.au/policies> .

## **2.18 DETOURS, SIDE TRACKS, AND CROSSOVERS – HOLD POINT**

**Hold Point-** Obtain written approval from the Superintendent before commencing any works. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### **2.18.1 Construction - Witness Point**

**Witness Point** - Obtain advice from the Superintendent that all requirements for the construction of the detours, side tracks, and/or crossovers have been met on completion.

**Witness Point** - Provide not less than 5 days notice before opening any side track, detour, or crossover, to traffic.

Provide side tracks for detours when it is impractical to provide for traffic on the existing road system.

Side Track Type; Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Construct side tracks with a finished surface level crown height 250 mm above the natural

surface. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Design and construct side tracks to comply with AUSTROADS Guide to the Geometric Design of Rural Roads and the following minimum standards:

Side track characteristic	Roadway Type		
	National Highway	Secondary Highway	Local Road
Carriageway Width	10 m	8 m	6 m
Design Speed	80 km/h	60 km/h	40 km/h
Design Vehicle	Triple road train	Triple road train	Semi trailer
Horizontal Curve radius with 3% superelevation	250 m	150 m	50 m
Vertical Curve radius (crest)	2,500 m	1,000 m	400 m
Vertical Curve radius (sag)	1,000 m	600 m	400 m
Pavement Width	8 m	6 m	4 m
Trafficable Surface Type (over pavement width)	Sealed	Gravelled	Gravelled
Gravel Pavement Thickness (when specified)	150 mm	100 mm	50 mm
Lateral Clearance to Obstruction (from edge of carriageway)	2.5 m	1.2 m	1.0 m

Item	Requirement
Signs/Warning devices:	As in Traffic Management Plan.
Guideposts:	At all fills, curves and crests.
Flood gauge posts:	At all floodways.
Total length at any one time:	5 km max.
Side track type:	Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Compact top 150 mm to 95% relative compaction.

Match side tracks neatly to the existing road system.

Provide sufficient resources to direct and assist traffic, when side tracks become restricted.

Carry out immediate remedial works when traffic is delayed by poor side track conditions or surface condition is dangerous.

Provide and maintain adequate drainage. Ensure drainage measures do not cause or accelerate erosion.

### **2.18.2 Maintenance**

Provide contact details of personnel who can be contacted outside of working hours. These people must be able to respond to situations which may arise, and must be able to rectify, or to have rectified, any problems which occur, outside of working hours.

Any failure to comply with this clause will render the Contractor liable to pay the costs incurred by Department staff to procure any alternate means to have after hours rectifications made.

Maintain the existing road network, and all side tracks, in use by the public.

<b>Table – Side track maintenance requirements</b>	
<b>Surface type</b>	<b>Maintenance required</b>
Sealed Surfaces:	Patch and repair all surfaces. Grade and roll shoulders.
Unsealed Surfaces:	Regrade and roll to maintain a comfortable riding quality at design speed.

Prevent dust nuisance by water spraying at regular intervals to keep surface moist.

Do not use waste oil as a dust suppressant.

Remove debris and rubbish.

Maintain road signs and guide posts in a clean state.

Inspect the site regularly, particularly when there is rainfall which will affect the site, whether directly or by run-off from rain fall in upstream areas. Inspect the site regularly at times when you and/or your employees, are not, or will not be, working on site for periods of time in excess of 2 weeks. Inspections are to be carried out at least once a week.

## **2.19 ACCESS TO ADJACENT PROPERTIES AND SIDE ROADS**

Maintain access to adjacent properties and side roads at all times to a level appropriate for the type and frequency of traffic.

Provide and erect proposed and approved signs detailing alternative access, only after approval from the Superintendent is obtained.

Ensure adequate access is maintained for pedestrians and cyclists as required, including delineated access if existing paths are being closed as part of the works.

## **2.20 TEMPORARY PEDESTRIAN ACCESS**

Conform to: AS 1742.9, AS 1742.10.

Maintain access for pedestrians, cyclists and persons with disabilities passing through and around the work site. Where existing paths have been, or are to be, demolished or are, or will be, inaccessible or modified due to construction works, provide temporary access to a standard not less than the pre-existing or preconstruction standard.

Temporary access must;

- be clearly delineated and have adequate width and height clearance,
- be smooth, free draining and free of obstructions and loose material,
- provide clear guidance where paths change direction,
- be illuminated by temporary lighting in urban areas to assist path users where existing street lighting has been removed or affected by the works,
- be arranged so that path users are clearly visible to vehicle drivers and plant operators at road crossing points.

## **2.21 TEMPORARY BRIDGING – HOLD POINT**

Design and construct any temporary bridging in accordance with the AUSTRROADS Guide to Bridge Technology.

**Hold Point** - Obtain written approval from the Regional Manager, Road Projects prior to commencement of any such works.

Ensure all environmental approvals have been obtained prior to the commencement of the works.

**Hold Point** - Provide copies of approvals obtained by Contractor to the Superintendent prior to the commencement of the works.

Provide and erect signage, fencing, road safety barriers and or guard railing etc. to prevent accidental access to the feature being bridged.

## 2.22 CONTRACTOR'S PLANT AND EQUIPMENT – HOLD POINT

Provide public traffic right of way at all times unless traffic control is in use.

Keep parking and materials storage clear of trafficked areas and clear zones in accordance with applicable AUSTRROADS guides.

Do not park any vehicles, or mobile plant, machines, or equipment in the Road Reserve when it is not in use for the execution of the works without prior written approval, or explicit approval in the Request for Tender/Quotation.

Any request for approval must include, as a minimum, the reasons for the need to park in the Road Reserve, the locations affected, the durations anticipated, site conditions, lighting conditions, traffic paths of travel and anticipated volumes, access and egress points, site security measures, pedestrian and cyclist activity and safety, and effects on nearby residential properties, including the occupants of them.

Do not leave equipment or tools unattended. Do not leave any item in a location where it could be a hazard to the public.

Responsibility for maintaining the security of Contractor's plant, vehicles, machines, equipment and other items used for the execution of the works remains with the Contractor.

**Hold Point** - On roads carrying significant traffic, floodlight the road and area within 50 m of the site when working at night, if approved by the Superintendent, to a ground level luminance of 10 lux minimum.

### 2.22.1 Vehicles, plant, machines, and equipment

All vehicles, and mobile plant, machines, and equipment, used on the road must be legally registered, or otherwise permitted, to travel on Northern Territory roads, and must have compulsory third party insurance valid in the Northern Territory if that is required under Northern Territory legislation.

Comply with the Northern Territory *Traffic Act 1987*, and its Regulations.

Do not permit tracked mobile plant, equipment, machines, or vehicles, to cross public roads.

Any failure to comply with this clause will render the Contractor liable to pay the costs incurred by the Department to procure any rectifications or repairs which become necessary.

### 2.22.2 Mobile Plant - Broadband Alarm

#### Standards

AS 4742: Machine-mounted forward and reverse audible warning alarm (withdrawn but available)

ISO 9533: Earth-moving machinery - Machine-mounted audible travel alarms and forward horns - Test methods and performance criteria

#### Definition

Broadband alarm: Pulsed acoustic signal that comprises a range of frequencies and sometimes referred to as quacker, woosher, non-tonal reversing beepers or white sound.

#### Broadband/White-Sound Alarm Requirement

Provide Broadband Alarms (White Sound) fitted to all construction vehicles and mobile plant before commencement of works.

Ensure that installation and proper operations of the alarm/warning system is sufficient before commencement of works, including but not limited to:

- All alarms clearly audible above the noise level of the machinery or vehicle.
- Automatically activated when reverse gear is selected.
- Directional nature of the broadband alarm is appropriate for works.

### 2.22.3 Warning devices mounted on vehicles, plant, and equipment

Provide beacons, or other vehicle, or plant, or equipment, mounted visual illuminated warning

devices on the highest point of the cabin roof or superstructure of all vehicles, mobile plant, mobile machinery, and mobile equipment in accordance with the **Vehicle-Mounted Signs And Devices** Clause in the **Description And Use of Signs And Devices** Section of AS 1742.3 where these are being used within the road reserve.

Fit beacons with globes rated at a minimum of 55 watts, or the LED equivalent.

Do not use strobe lights.

Ensure that the light is operational whenever the plant or equipment is working on or within 9 m of the roadway.

Ensure that the light is visible from all approaches and not obscured by exhaust stacks, back hoe arms etc, and that the beacons or warning devices are not covered in dust.

Non-compliance with this clause may result in the Contractor being directed to cease work, which will be at no cost to the Principal, and which will not be grounds for an extension of time claim.

## 2.23 ROAD WORK ZONE LENGTH

Comply with the requirements of AS 1742.3.

Comply with the requirements of the Portable Traffic Signals clause in this work section.

Maximum road work zone length when using portable traffic signals is 1050-1150m.

Refer to the **Table - Zone Lengths for Temporary Speed Limits** in the **Temporary Speed Limits** sub-clause in the **NT Specific Directions for Road Work Signs** clause in this work section for length limits for temporary speed zones.

## 2.24 TRAFFIC SIGNALS, INTELLIGENT TRANSPORT SYSTEMS (ITS), VARIABLE SPEED LIMIT ZONES, AND TRAFFIC COUNT STATIONS

### 2.24.1 Traffic Signals - Hold Point

**Hold Point** - Obtain clearances from the Department's Traffic Section, ph. 8999 4402, prior to commencement of the works. Co-ordinate your works activities with the Department's Traffic Section for the duration of the works.

This includes all works;

- 150 m prior to the stop line (within trafficked lanes),
- 50 m past the stop line (within trafficked lanes),
- that affect normal daily traffic flow at any signalised intersection,
- for road reserve or median excavations greater than 150 mm,
- within 10m of an area defined by the traffic signal or ITS pedestals and associated pits, including detector loops and pits, traffic signal controller cabinet, and UPS cabinet,
- within 10m of a Department CCTV camera,
- where a Red Light Speed Camera (RLSC) is, or will be, impacted by traffic management, and
- between the traffic signal poles and associated traffic signal control cabinet.

Approvals and clearances may be varied or withdrawn at any time in response to changing circumstances.

#### 2.24.1.1 Works undertaken DURING working hours - Hold Point

**Hold Point** - Provide copies of the endorsed TGSs, and contact the Traffic Section, by phone on 8999 4402, not less than one working day prior to the commencement of work.

**Hold Point** - If the traffic signals need to be re-mapped, or other traffic controls implemented, advise the Traffic Section not less than one working day prior to the commencement of work.

Contact should be made by email to [traffic.NTG@nt.gov.au](mailto:traffic.NTG@nt.gov.au) or by phone.

**Hold Point** - Advise the Traffic Section about the planned lane closures by phone immediately before installing traffic control on the day the works are to be carried out.

Contact the Traffic Section immediately if unacceptable traffic congestion occurs during the works so that the Traffic Section can assist by adjusting traffic signal timings. If traffic congestion cannot be relieved by adjusting traffic signal timings it may be necessary to remove lane closures.

**Hold Point** - Advise the Traffic Section immediately before traffic control is removed.

Any failure to comply with this clause will render the Contractor liable to pay the costs incurred by the Department to procure any rectifications or repairs which become necessary.

#### **2.24.1.2 Works undertaken OUTSIDE working hours - Hold Point**

**Hold Point** - Provide copies of the endorsed TGSs, and contact the Traffic Section, not less than one working day prior to the commencement of work.

**Hold Point** - If the traffic signals need to be re-mapped, or other traffic controls implemented, co-ordinate directly with the Traffic Section not less than one working day prior to the commencement of work.

The name and phone number of an after-hours contact officer will be provided by the Traffic Section.

**Hold Point** - Advise the Traffic Section after-hours contact officer about the planned lane closures, using the after-hours phone number provided, immediately before installing traffic control, on the day the works are to be carried out.

Contact the Traffic Section after-hours contact officer, on the after-hours phone number provided, immediately if unacceptable traffic congestion occurs during the works so that the Traffic Section after-hours contact officer can assist by adjusting traffic signal timings. If traffic congestion cannot be relieved by adjusting traffic signal timings it may be necessary to remove lane closures.

**Hold Point** - Advise the Traffic Section after-hours contact officer, on the after-hours phone number provided, immediately before traffic control is removed.

Any failure to comply with this clause will render the Contractor liable to pay the costs incurred by the Department to procure any rectifications or repairs which become necessary.

#### **2.24.2 Variable Speed Limit Zones – Hold Point**

**Hold point** – Obtain clearances from the Department’s Traffic Section, ph. 8999 4402, not less than five working days prior to commencing works.

Co-ordinate the work activities with the Department’s Traffic Section for the duration of the works.

This includes all works:

- In the close proximity of the area defined by the VSL poles and associated pits.
- Within the VSL zone.
- On any immediate approach to the VSL zone that may require the installation of temporary speed reductions.

Provide copies of endorsed TGSs to traffic.NTG@nt.gov.au and/or contact the Traffic Section, by phone on 8999 4402, not less than five working days prior to commencement of work.

VSL control keys may be available from the Traffic Section for use.

#### **2.24.3 Traffic Count Stations - Hold Point**

The majority of the permanent count stations have in-pavement detection systems installed and cutting off or closing traffic lanes can have an impact on their operation.

In addition to the permanent count stations, there may be other count stations which are identified by the installed tubes laid across the surface of the pavement.

**Hold Point** - Prior to the commencement of work within the trafficked lanes and within 50 m of

traffic counters or within 20 m, in any direction, of any component of the traffic count equipment, whether located in or on the trafficked lanes, shoulders, nature strips, and/or medians, or located in another type of area, obtain a clearance to commence the works from Department's Maintenance Section for the region in which the works are located, and with either the Superintendent or with the Maintenance Manager (phone 8999 4660).

Co-ordinate works activities, with the Department's Maintenance Section for the region in which the works are located, for the duration of the works.

Maps showing count station locations are available from Department's Transport Infrastructure Planning Division, contact: (08) 8924 7531, or from the Annual Traffic Reports at: <https://dipl.nt.gov.au/data/traffic-report> .

Any failure to comply with this clause, and any damage caused to Northern Territory Government infrastructure, will render the Contractor liable to rectify the breach, and / or repair any damage, and / or pay the costs incurred by the Department to procure any rectifications or repairs which become necessary.

## 2.25 PORTABLE TRAFFIC SIGNALS - HOLD POINT

Use portable traffic signals (PTS) complying with AS 4191. Use portable traffic signals in a manner complying with the requirements of AS 1742.3.

Portable traffic signals are for short-term traffic control applications only. Where traffic signal control is being proposed for periods greater than 2 months in a single location, consider the installation of temporary traffic signals.

Each portable traffic signal unit must be fitted with a sign which has on it the Contractor's name and contact information, including phone numbers for contact during working hours and for contact outside of working hours.

**Hold point** - Complete and provide the Portable Traffic Signal Authorisation (PTSA) form, included in the application for a Permit to Work in the Road Reserve document, to seek formal approval from the Superintendent to use the proposed portable traffic signals and the proposed time settings, not less than 5 working days prior to the intended use of the portable traffic signals. Do not use any PTSs on site until an authorised Departmental Officer has signed off the PTSA form.

Refer to **Table - General Time Settings**, and **Table - Yellow Times**, and **Table - Red and Green Times**.

Consider the reduction of Green Times to reduce delays to traffic.

Limit the spacing between PTSs controlling each section of road to the minimum practical distance. For the area under the control of portable traffic signals, limit the spacing between PTSs controlling each section of road to no more than 1150 m.

Use the time settings in the tables in the **Time Settings** sub-clause in this clause as a guide for red time clearance and maximum green times.

Monitor the prevailing traffic conditions and vehicle speeds and amend the times for the site to suit traffic conditions and to minimise delays to traffic. Submit details of the changes to the Superintendent as soon as practicable thereafter.

Preference should be given for the use of approved vehicle activated systems.

The use of PTSs at T intersections will be considered on a case by case basis. Overall delay times are critical at these types of locations.

Inaccurate or incorrect information provided with a PTSA submission may cause delays in processing the application, and therefore may delay the start of the project.

Provide contact details of personnel who can be contacted outside of working hours. These people must be able to respond to situations which may arise, and must be able to rectify, or to have rectified, any problems which occur, outside of working hours.

Any failure to comply with this clause will render the Contractor liable to pay the costs incurred by Department staff to procure any alternate means to have after hours rectifications made.

**2.25.1 Temporary Speed Limits - Hold Point**

Impose a controlled area speed limit not exceeding 60 km/h if the portable traffic signals would otherwise be in a higher speed limit zone.

**Hold Point** - Work zone speed limits require approval from the Superintendent prior to implementation.

Refer to the **Table - Zone Lengths for Temporary Speed Limits** in the **Temporary Speed Limits** sub-clause in the **NT Specific Directions for Road Work Signs** clause in this work section for length limits for temporary speed zones.

**2.25.2 Sight Distance**

Maintain a sight distance on the approach to portable traffic signals of not less than 150 m. If this cannot be achieved, use appropriate advance warning signage to advise road users in advance of the sight line obstruction of the impending traffic signals ahead.

In cases where queuing traffic is extending past the advance warning signage, install further advance warning signs and speed zone signs further in advance, to prevent collisions at the end of the queue awaiting a green light. Avoid excessive traffic queuing by use of and adjustment of, appropriate time settings on the portable traffic signals whenever possible.

**2.25.3 Time Settings**

<b>Table – General Time Settings</b>				
<b>Mode</b>	<b>All red</b>	<b>Minimum Green</b>	<b>Maximum Green</b>	<b>Yellow</b>
<b>Manual</b>	M	F	M	S
<b>Fixed time</b>	S	F	S	S
<b>Vehicle Actuated</b>	S	F	S	S
F Fixed at 15 seconds M Set the manual control switch each cycle S Needs to be selected and pre-set by operator for each site				

<b>Table – Yellow Times</b>	
<b>Approach Speed</b>	<b>Yellow Time</b>
60 km/h	4 seconds

**Table - Red and Green Times**

Determine green period timings based on anticipated traffic conditions, and modify them to suit actual traffic conditions experienced when the works are undertaken, as green times indicated in this table are maximum times for green signals.

All Red Period (Seconds)	Max Green Period (Seconds)	Distance Between Stop Lines at traffic Signals (m) – Clearance speed 20 km/h	Distance Between Stop Lines at traffic Signals (m) – Clearance speed 40 km/h
2	30	0-30	0-50
5	35	34-45	50-90
10	35	45-75	90-150
15	40	75-105	150-210
20	40	105-135	210-270
25	45	135-165	270-330
30	45	165-195	330-390
40	50	195-250	390-500
50	50	250-310	500-620
60	60	310-365	620-730
70	70	365-415	730-830
80	80	415-465	830-930
90	90	465-525	930-1050
100	100	525-575	1050-1150

## 2.26 RESTORATION

Upon completion of works:

- Remove all temporary warning signage and other traffic control devices.
- Remove all temporary works and reinstate the areas to their original state, including the removal and disposal of seal and dragging windrows and debris back across the side track carriageway.
- Stabilize all areas impacted by the works to prevent erosion.
- Where applicable reseed with local native grasses and trees and shrubs.
- Comply with the requirements of the Environmental Approvals and Clearances issued by the Department, and by DENR, Environment Heritage and the Arts Division, Environmental Assessment and Policy Section, for the project.
- Reinstate permanent traffic control devices temporarily removed during the works.

## 2.27 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 3 CLEARING, GRUBBING AND REHABILITATION

### 3.1 GENERAL

SPECIFICATION REFERENCE; Refer to the Standard Specification for Environmental Management reference text.

BURNING; Do not light fires or burn any demolished material or vegetation either on or off the site.

### 3.2 CLEARING

DEMOLITION; Remove fencing, buildings, kerbing, debris, drainage structures, old road surfaces and other structures as required.

REMOVAL; Except for materials to be salvaged and retained by the Superintendent take possession of demolished materials and remove them from the site.

SALVAGED ITEMS; Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

EXTENT; Clear the site only to the extent shown on the drawings and specified in this section.

ACCESS; Allow 3 metre wide cleared access ways around proposed culverts, gravel pits and stockpiles.

EXCESS CLEARING; Where excess clearing has taken place beyond that specified or shown on the drawings pay compensation for the damage and rehabilitate the areas in accordance with the **Reinstatement** clause in this work section.

COMPENSATION; Pay compensation (To be charged as a negative variation to the Contract) for excess clearing at the rate of \$5 per square metre.

### 3.3 TREES TO BE RETAINED

Retain selected trees shown on the drawings or as directed.

PROTECTION; Protect from damage trees which are required to be retained. Do not remove topsoil from the areas within the dripline of the trees and keep the area free of construction equipment and materials.

DAMAGE; If a tree, which is marked to be retained, is damaged and repair work is considered impractical, or is attempted and fails, remove the tree and the root system, if so directed. Replace the tree with a tree of the same species and similar condition and size or pay compensation.

Compensation for damage to existing vegetation shall be borne by the Contractor as a negative variation to the Contract and determined as follows:

Tree valuation rate: \$10 per cm. of tree circumference at a height 1 m above the ground.

Maximum valuation: \$2500 per tree

Minimum valuation: \$250 per tree

### 3.4 MULCHING

GENERAL; Mulch all cleared vegetative matter in mechanical brush chippers to a maximum size of 100 mm as the clearing work proceeds. Do not stockpile cleared material for later mulching.

STUMPS; Stumps and other material unsuitable for mulching may be buried in disused gravel pits during rehabilitation of the pits.

GRASSES; Do not mulch grass clods, roots or other components containing viable propagules. This material may be buried in disused gravel pits.

STOCKPILES; Stockpile mulched material on the site at a maximum height of 2 m for use during reinstatement work.

URBAN AREAS; Stockpile mulch on the site for reuse and deliver surplus mulch as directed by the Superintendent (within 10 km of the site) for use in local landscaping projects.

RURAL AREAS; Stockpile mulch on the site for reuse and power blow surplus mulch into the adjacent natural vegetated areas adjacent to the works.

### 3.5 STRIPPING OF TOP LAYER

EXTENT; Strip the top layer of natural material to a depth of 100 mm, for the full formation width.

Stockpile stripped material at sites within 1 km of the point of origin. Stockpile heights not to exceed 2.0 m.

Spread stripped material on areas to be landscaped and/or on road batters and/or on other disturbed areas, following completion of earthworks.

### 3.6 TREATMENT OF EXISTING SEALED SURFACE

Rip the existing sealed surface.

Conform to the following:

Table - Treatment of existing sealed surfaces	
Specified cover over existing seal	Maximum seal fragment size
Fill depth 500 mm or greater	1 m <sup>2</sup> .
Fill depth less than 500 mm	Remove seal from site.
Pavement re-sheeting only	Remove seal from site and replace with similar volume of pavement.

### 3.7 SCARIFYING OF EXISTING ROADS

Scarify, both longitudinally and laterally, for the full width of the formation by ripping to a depth of 250 mm resulting in a maximum size of demolished seal of 100mm.

Tyne spacing to be 500 mm maximum.

Remove seal from site. Alternatively, demolished seal may be buried in table drains if approved by the Superintendent. Provide 200 mm cover to buried material.

### 3.8 GRUBBING

Grub out and remove from the site all vegetation to a depth of 200 mm below subgrade surface in cut and 200 mm below natural surface under fills.

Fill grub holes and other excavations as required with standard fill material compacted to the density of the surrounding soil.

### 3.9 REINSTATEMENT

Reinstate any clearing undertaken during the contract to rehabilitate the area back consistent with its untouched surrounds. This includes seeding, planting, watering and other measures necessary to rehabilitate the area.

MULCH; Spread mulched material over the rehabilitated area, including batters and verges, to a uniform cover of 50 mm thickness.

DETOURS; Where detours are specified in the PROVISION FOR TRAFFIC section or otherwise agreed to, rehabilitate the detour areas in accordance with the requirements of this section.

### 3.10 CLEANING UP

Remove all excess fill, rubble and other debris from the site. Dispose of the materials using a legal method.

### 3.11 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 4 EARTHWORKS

### 4.1 GENERAL

Gravel obtained from Pastoral Leasehold land is to be supplied at no cost to the Principal.

### 4.2 STANDARDS AND PUBLICATIONS

Conform to the following Standard and Publication unless specified otherwise:

AS 1289 (set) Methods of testing soils for engineering purposes.

NTMTM NT Materials Testing Manual accessible via

<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>

NTTM NT Test Methods

### 4.3 DEFINITIONS

**CARRIAGEWAY:** That portion of a road for the use of vehicles including shoulders and auxiliary lanes.

**FORMATION:** The surface of finished earthworks on which a road pavement is constructed. It includes the earthworks (cut and fill), subgrade and the general shaping of the drainage. The formation width is therefore the distance of cut or fill including table drain(s), out to the points of any batters.

**OFFLET DRAIN:** Also described as a Table Drain Offlet. Provides relief at regular intervals of run off concentration in Table Drain. Drains water from Table Drain away from formation for dispersal into catchments. Also extends under footpaths, kerb and gutter, and surface structures. Includes the associated drain block to direct flow from the table drain into the offlet drain.

**SUBGRADE:** Top 150 mm of material below subgrade surface. Also known as subgrade layer. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

**SUBGRADE SURFACE:** The prepared surface immediately beneath the pavement and shoulder layers.

**SURFACE FORMATION:** A road formation constructed from material generally cut from the table drains.

**UNPAVED AREAS:** Those areas within the road reserve boundary which are not part of the road pavement, including any medians not paved, but excluding footpaths and vehicle access strips.

**UNSUITABLE MATERIAL** Any material that does not conform to the properties specified for the replacement materials to be used. If properties of the replacement materials to be used are not specified, then UNSUITABLE MATERIALS are materials which do not conform to the properties specified for standard fill.

### 4.4 EARTHWORKS IN CUT

#### 4.4.1 Description

Operations necessary for excavation, irrespective of the type of material and subsurface conditions, including:

- working cuttings so that material meeting standard fill requirements is used for the subgrade;
- disposal of excess excavated material;
- trim and compact exposed surfaces – refer to the **Trim and Compact Unpaved Areas** clause in this work section;
- compaction of material below the subgrade surface; and
- shaping and trimming of formation within cuttings.

#### 4.4.2 Excess Material – Hold Point

Haul and dump and/or spread excess material at the site(s) specified in PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

The material is to be spread and sheeted with topsoil, or stockpiled as specified in PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Haul and dump and spread excess material:

- Not less than 125 metres from the new road centre line.
- To spoil dump sites specified. Clear site of organic material/topsoil prior to stockpiling material.
- Spread excess material and sheet with topsoil as specified.
- Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Dumped material remains the property of the Principal.

Ensure dumps shall not dam surface water and streams or damage the works or other property.

Ensure dumping is not in streams.

Haul, dump and spread the materials in legally acceptable locations using legal methods.

Comply with AAPA clearances.

Comply with Environmental Management approvals, including within the road reserve.

**Hold Point** - Obtain approval from Superintendent prior to hauling, dumping and spreading excess material.

#### 4.4.3 Rock in Subgrade – Hold Point

**Hold point** - Obtain agreement from the Superintendent to the extent of the excavation.

Excavate rock encountered in the subgrade.

Avoid forming pockets of shattered material below the level of the excavation.

Remove all loose material.

Trim the excavation to shed water.

Replace excavated material with select fill compacted to 95% relative compaction.

#### 4.4.4 Unsuitable Material Below Subgrade Surface other than Rock – Hold Point

**Hold point** - Obtain directions from the Superintendent before works commence.

Excavate subgrade material which does not conform to the properties of standard fill as specified.

Dry out material with excessive moisture content to achieve a moisture content which permits specified compaction.

Replace excavated material with standard fill compacted to 95% relative compaction.

Floodways: Replace unsuitable material with material conforming with the following:

Angular or broken rock, free from organic matter and lumps of clay, complying with the **Table – Grading - Suitable Fill Material Properties for Floodways**.

<b>Table – Grading - Suitable Fill Material Properties for Floodways</b>	
Maximum size:	100 mm.
Plasticity Index:	10 maximum.
Linear Shrinkage	5.0 maximum.
<b>AS Sieve (Mm)</b>	<b>Percentage Passing</b>
75.0	40 - 100
19.0	15 - 50
2.36	0 - 25

#### **4.4.5 Blasting and Overbreak**

Ensure blasting is not excessive. There will be no payment for overbreak beyond the limits of excavation specified.

#### **4.4.6 Stability of Works, Rock Cuttings**

Remove all loose material and rock which has been rendered unstable.

### **4.5 EARTHWORKS IN FILL**

#### **4.5.1 Description**

Earthworks in fill includes preparation prior to filling, winning, hauling, placing, compacting, and trimming material on all prepared areas including holes, pits and other depressions.

#### **4.5.2 Preparation Prior to Filling – Hold Point**

Subsequent to stripping of top layer apply a minimum of three passes with maximum mass compaction equipment.

**Hold Point** - Once moisture conditioned and compacted, subject each lot to a proof roll, with the Superintendent in attendance, as specified in the **Proof Rolling** sub-clause of the **Conformance** clause in this work section.

#### **4.5.3 Benching**

Cut a bench at the toe of the lower side batter when natural surface inclines at steeper than eight horizontal to one vertical.

Ensure the bench slopes downwards towards the centre line of the road and is 3 metres wide to provide a sound key for the toe of the fill.

Terrace the existing surface where side slopes are steeper than three horizontal to one vertical to provide a key for the fill.

#### **4.5.4 Unsuitable Material Beneath Fill – Hold point**

**Hold point** - Obtain directions from the Superintendent before works commence.

Remove unsuitable foundation material as directed before the fill is placed.

Replace excavated material with standard fill compacted to 95% relative compaction.

#### **4.5.5 Construction Methods**

Fill by either the "Compacted Layer", "Rocky Material" or "Rock Fill" method.

Select appropriate method(s). Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

##### **4.5.5.1 Compacted Layer Method**

Use where material generally does not contain cobbles, boulders or broken rock.

- Deposit and spread the material in uniform level layers to a maximum thickness of 250 mm loose measurement for the full width of fill.
- Compact each layer to the specified compaction (refer **Table - Dry Density Ratios for Conformance** in CONFORMANCE TESTING) before placing the next layer.

Use standard fill for the subgrade layer.

### 4.5.5.2 Rocky Material Method

Use where material contains some cobbles and boulders (maximum size 600 mm) with sufficient fines for the work to be free of voids.

- Break up rocks bridging between adjacent material to prevent cavities being formed.
- Maximum rock dimension: 600 mm or one-half the height of fill at the section where the rock is placed.
- Spread material in layers approximately equal to the maximum rock size.
- Work the rocky material in each layer until it is firm and unyielding.
- Construct to the bottom of the subgrade layer.
- Use standard fill for the subgrade layer

### 4.5.5.3 Rockfill Method

Use where material is predominantly cobbles or boulders with insufficient fines to fill voids.

- Place and work the material until interlock is achieved.
- Advance the fill by full width construction. Side dumping shall not be undertaken. The construction face shall be concave, with the shoulder face well in advance of the centre, except when filling in swamps or soft material when the advancing face ends shall be convex.
- Rock Dimensions;
  - Maximum vertical dimension: one-third of the height of fill being placed.
  - Maximum horizontal dimension: one-half of the height of the fill being placed.
- Construct to 300 mm below the bottom of the subgrade layer. Within 300 mm of the bottom of the subgrade layer use the Compacted Layer Method or Rocky Material Method, with a maximum particle size of 150 mm.
- Use standard fill for the subgrade layer.

## 4.6 FILL MATERIAL

### 4.6.1 General Fill

Use the best locally available material.

Use fill material, whether cut or borrow, that is free of organic matter and has a minimum soaked CBR at 95% MMDD of 20%, to AS 1289, and a plasticity index between 2% and 15%. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

**4.6.2 Standard Fill**

Conform to the following properties:

<b>Table - Standard fill properties</b>	
<b>Property</b>	<b>Default if no differing values shown in PROJECT SPECIFIC REQUIREMENTS</b>
CBR 4 day soaked at 95% MMDD to AS 1289:	20 min.
Maximum Particle Size:	For subgrade layers 50 mm
	For other than subgrade layers 100 mm
Plasticity Index:	2% - 15%

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

**4.6.3 Select Fill**

Select fill shall be comprised of gravel, decomposed rock or broken rock, free from organic matter and lumps of clay.

Conform to the following:

<b>Table - Grading - Select fill</b>	
<b>AS SIEVE (mm)</b>	<b>% PASSING (DRY WEIGHT)</b>
75.00	100
9.50	30 - 100
2.36	15 - 65
0.075	5 - 25

<b>Table – Select Fill Properties</b>	
CBR, 4 day soaked at 95% MMDD to AS 1289:	30 minimum.
Plasticity Index:	2 - 15% maximum.
Linear Shrinkage:	2 - 6%.

**4.6.4 Sand Clay Fill**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Sand clay (clayey sand) may be used as an alternative to Select Fill.

Conform to the following properties and grading:

<b>Table – Sand Clay Fill Properties</b>	
CBR: 4 day soaked and 95% MMDD to AS 1289:	30 minimum
Plasticity Index	15% maximum
Linear Shrinkage	1 - 8%

<b>Table – Grading – Sand Clay Fill</b>	
<b>AS Sieve (mm)</b>	<b>% Passing (Dry Weight)</b>
4.75	80 - 100
2.36	60 - 100
0.425	30 - 60
0.075	14 - 28

## **4.7 PREPARATION AND MAINTENANCE OF SUBGRADE SURFACE**

Trim, prepare, and maintain, subgrade surface to the required tolerances specified in this worksection, free of depressions, cracking, laminations, organic inclusions, and other defects. Surface to be formed and maintained to be free draining, and suitable for proof rolling. Maintain and repair any damage to the prepared surface prior to placing further material.

## **4.8 EARTHWORKS FOR DRAINAGE**

Comply with the requirements of the Standard Specification for Environmental Management.

### **4.8.1 Stream Diversions**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Excavate stream diversions as shown on the drawings.

Fill existing watercourses as shown on the drawings.

Divert streams temporarily where it is necessary for the construction of the work.

Ensure that existing waterways are not filled, altered, or diverted except where specified.

### **4.8.2 Levees**

Construct using standard fill with a Plasticity Index of 6% minimum for all areas.

Compact in layers not exceeding 150 mm compacted thickness.

Construct in locations, and to dimensions shown on the drawings.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### **4.8.3 Table Drains**

Construct to the dimensions shown on the drawings.

Grade to prevent ponding of water.

Trim and compact as specified in the **Trim and Compact Unpaved Areas** clause in this work section.

Discharge into culverts, offlet drains or watercourses.

### **4.8.4 Table Drain Offlets**

Divert table drains into offlet drains at intervals not exceeding 150 m, or as shown on the design drawings.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Ensure the capacity of the offlet is not less than the capacity of the table drain, and is of similar cross section.

Align and grade offlet so that the water drains away without scour and damage to disperse as sheet flow or into natural watercourses.

Table drain offlets shall be trapezoidal in shape with not less than 2 m flat bottom and batters shall not be steeper than 1 vertical to 3 horizontal.

#### 4.8.5 Table Drain Blocks

Block table drains at offlets.

Construct blocks from standard fill conforming to the following requirements:

- Plasticity Index: 6% minimum for all areas.
- Length: To extend from edge of shoulder to top of outer table drain batter.
- Width: 3 metre minimum measured parallel to the road centre line.
- Height: To edge of shoulders.
- Compaction: Layers not exceeding 150 mm compacted thickness.

#### 4.8.6 Catch Drains

Construct catch drains prior to earthworks in cut.

Depth: 500 mm (minimum) into solid ground.

Gradients: Ensure free flow, prevent ponding of water, prevent scour.

Outlets: As terrain permits construct at frequent intervals to reduce scour. Construct a block on continuous grades to divert water into culverts or drains.

Offset: 2 m (minimum) and 4 m (maximum) beyond the edge of the cutting.

Divert the drain neatly around large rocks and trees.

### 4.9 WIDENING OF EXISTING FORMATION

Cut back the existing formation and pavement as shown on the drawings by not less than 150 mm on each edge to sound densely compacted material to form a uniform edge (curved or straight where applicable).

Construct the widening by cutting and filling as specified.

### 4.10 TRIM AND COMPACT UNPAVED AREAS

Shape, grade and compact as specified.

Unpaved areas include, but are not limited to, areas beyond the shoulders, and table drains.

Refer to **Table – Test Frequencies for Soils – Part 3 of 3** in CONFORMANCE TESTING.

Refer to **Table – Dry Density Ratios for Conformance** in CONFORMANCE TESTING.

### 4.11 SURFACE FORMATION

#### 4.11.1 General

Form the road generally with material cut from the table drains, in accordance with the typical cross section.

Mix to a homogeneous material before compacting.

Allow for construction to the specified height above natural surface, either by local widening of table drains or importation of standard fill.

#### 4.11.2 Pastoral Access Roads

For in situ pavement materials comply with the following:

CBR 4 day soaked at 95% MMDD to AS 1289: 30 minimum.

Maximum particle size: 37.5 mm.

Plasticity Index: 4 - 12%.

Alternatively sheet the in situ material with 150 mm imported material complying with the above, compacted to 95% relative compaction.

## **4.12 BATTER PROTECTION BY GRASSING**

For batter protection by grassing by hydroseeding method refer to LANDSCAPE.

Fill batters to have a surface layer 100 mm minimum thickness of stripped material.

This surface layer is additional to the specified cross section. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ and/or drawings.

### **4.12.1 Grassing**

Batters to be treated from chainage to chainage as specified.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ and/or drawings.

### **4.12.2 Seed Mixture and Fertiliser**

Provide certified seed complying with the requirements in the LANDSCAPE Section.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Fertiliser to comply with the **Table - Fertilisers** in the LANDSCAPE Section.

Apply at the specified rate. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

National Parks and Wildlife Services will only allow Rhodes grass seeds and seeds native to the parks.

### **4.12.3 Grass Seed Application Technique**

Conform to the LANDSCAPE Section.

Fabric protection to be used for all slopes steeper than 3:1. Fabric protection may consist of using jute mesh or equivalent in conjunction with hydromulching or the use of matting.

Smooth batters.

Form drains to control stormwater and prevent erosion until batter is grassed.

Place "top layer" soil from clearing operations over the batters to a depth of 50 mm.

Apply seed mixture, fertiliser, and protection. Establish grass and keep damp by watering until flowering stage is reached.

Repair any erosion.

Reseed areas until establishment is achieved.

### **4.12.4 Acceptance**

The minimum quality of grassing required for acceptance is;

- Establishment shall be uniform.
- Coverage rate: 98% minimum of total area.

## **4.13 BRIDGE FOUNDATIONS**

### **4.13.1 Conditions**

The data shown on the drawings as to the character and depths of the various strata are approximate only, and no warranty, expressed or implied, is given by the Principal that the same or similar materials will be encountered during the progress of work.

Tenderers are advised to inspect copies of the bore logs and the original core samples.

Original samples are available for inspection. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 4.13.2 Excavation

### 4.13.2.1 General

The extent of foundations is specified by dimension and reduced level. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Excavate to the required lines and levels.

Dispose of excess material in accordance with the sub-clause **Excess Material** in the clause **Earthworks in Cut** in this worksection.

### 4.13.2.2 Preparation – Hold point

Inspect and record the condition of all structures and services in the adjacent area prior to using pile drivers.

**Hold point** - Obtain Superintendent's agreement with inspection record of current conditions.

Cut foundation to a firm surface either stepped or roughened, as directed.

Remove loose material.

**Hold point** - Obtain the Superintendent's approval for the foundation surface before placing the blinding concrete.

Place a 50 mm thick layer of blinding concrete. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### 4.13.2.3 Cofferdams shoring and sheeting

Design any coffer-dams required for the execution of the works.

Construct coffer-dams to adequate height and depth and as waterproof as necessary for proper performance.

Provide adequate clearance for:

- construction of forms;
- inspection of interiors; and
- pumping from outside the forms.

Remove shoring and sheeting from inside the excavation.

Remove coffer-dams, sheeting and the like from the site when no longer required.

Do not damage the finished structure or disturb adjacent in situ material.

Remove obstructions from waterways.

## 4.13.3 Backfilling

Backfill the excavation up to natural surface level with excavated material or select fill.

The excavated material may be used for backfill provided it is free of wood, other organic and other extraneous or deleterious material.

Mix to a homogeneous material before compacting.

Place in horizontal layers not exceeding 150 mm compacted thickness.

Compact to the density ratio specified in the **Table - Dry Density Ratios for Conformance** in the CONFORMANCE TESTING section.

Compact using equipment that will not damage the bridge substructure.

## 4.14 FILL ADJACENT TO BRIDGE STRUCTURES

### GENERAL

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Fill includes preparation of the fill area, supply, placing and compacting fill, drainage layers and piping, disposal of unsuitable material and trimming and protection of batters.

Place select fill against structures after 14 days from date of casting or after test results confirm 70% of characteristic concrete strength achieved.

Avoid unbalanced loading on structures.

Do not operate mechanically driven vibrating rollers exceeding 1 tonne within 3 metres of the structures.

### ABUTMENTS AND WINGWALLS

Prepare the area as specified.

Compact select fill in horizontal layers not exceeding 150 mm compacted thickness in areas adjacent to abutments and wing walls extending horizontally a distance equal to two times the height of the adjacent structure, or as specified.

Prevent water from ponding behind abutments and wing walls.

Provide weep holes and drain pipes as specified.

## 4.15 COMPACTION

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Mix to a homogeneous material and compact with no compaction planes and free of cracking to conform to the Dry Density Ratios specified in the **Table - Dry Density Ratios For Conformance** in the CONFORMANCE TESTING section and the following conformance clause.

## 4.16 CONFORMANCE

### 4.16.1 Existing Surface Levels – Witness Point

**Witness point** - Obtain inspections of any disputed existing surface levels with the Superintendent prior to any stripping or earthworks operations.

Quantities are based on the existing surface levels prior to the stripping of the top layer.

Allow for suitable material to replace the stripped layer (Cut and Fill) in the items in this Work Section. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### 4.16.2 Tolerances

Finish earthworks to a smooth compacted and uniform surface within the following limits:

Formation Width: Not less than specified.

Subgrade Surface: Maximum 25 mm below and not above specified level.

Subgrade Width: Not less than specified. Extend 150 mm minimum beyond the back of kerb. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Batter: Not steeper than the specified slope.

Maximum variation at any point from specified plane of batter shall be 150 mm in earth and 300 mm in rock.

Unpaved Areas / Table Drain Invert: Maximum 75 mm above or below specified level, free of depressions capable of ponding water. Maximum 40 mm adjacent to kerbs.

#### **4.16.3 Proof Rolling – Hold point – Witness Point**

Proof roll all areas to the satisfaction of the Superintendent.

**Hold point** - Submit a proof rolling procedure to the Superintendent for approval including the proposed method of preparing the areas, the extent of proof rolling, and details of the plant and / or equipment proposed to be used.

##### **Plant Requirements**

Use plant in proof rolling procedures that comply with the following requirements:

- For urban areas only, fully loaded water cart, minimum size 12tonne, on standard pneumatic road tyres, fully inflated.
- Fully loaded, minimum single trailer articulated heavy vehicle, on standard pneumatic road tyres, fully inflated.
- Pneumatic tyred compaction plant with a mass of not less than 20 tonnes and with a ground contact pressure under either the front or rear wheels of not less than 450 kPa per tyre and a ground contact area of not less than .035 m<sup>2</sup> per tyre.
- Do not use flat drum rollers.

**Witness point** - Give the Superintendent not less than 24 hours notice of the location and commencement time for the proof rolling. Give 48hrs notice for remote work (greater than 5hrs travel one way from regional centre).

Check areas for level tolerance and layer thickness before proof rolling.

Proof roll each layer immediately following completion of compaction. If proof rolling is carried out at a later time, water the surface and roll with the test roller prior to commencement of proof rolling.

Compliance; the proof rolling requirements are deemed to comply when an area withstands proof rolling without visible deformation or springing.

Provide uniform and stable support for rear wheel loads when at walking pace.

Remedial work; remove and reconstruct areas that deform or break up.

#### **4.16.4 Conformance Testing – Hold point**

Ordering procedures; refer to the CONFORMANCE TESTING section for testing requirements and test ordering procedures.

General Fill

Conformance testing will be carried out on each layer of fill.

Subgrade

Subgrade surface will be tested only when it is within level tolerance and conforms to proof rolling.

Check subgrade surface levels prior to testing.

**Hold Point** – Obtain the Superintendent's approval of subgrade conformance prior to placing further material.

#### **4.17 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 5 CONFORMANCE TESTING

### 5.1 GENERAL

The Superintendent will carry out all conformance testing nominated to be the Superintendent's responsibility through Panel Period Contracts.

The Contractor will be responsible for ordering the conformance tests.

### 5.2 STANDARDS, CODES, AND TEST METHODS

Northern Territory Test Methods (NTTM) and NT Codes of Practice (NTCP) for materials testing are given in the Northern Territory Road Projects Materials Testing Manual (NTMTM). The methods contained in the Materials Testing Manual shall take precedence over all other test methods and procedures, and are used in conjunction with relevant Australian Standards.

When testing cannot be performed to the test methods stated below, these methods may be substituted with State Road Authority test methods so testing can be performed.

The following standards, codes and test methods are referred to in this section;

#### AUSTRALIAN STANDARDS

- AS 1141(set) Methods for testing and sampling aggregates
- AS 1141.11.1 - Particle size distribution – Sieving method.
- AS 1141.14 - Particle shape, by proportional calliper.
- AS 1141.15 - Flakiness index.
- AS 1141.18 - Crushed particles in coarse aggregate derived from gravel.
- AS 1141.20.1 - Average least dimension - Direct measurement (nominal size 10 mm and greater).
- AS 1141.20.2 - Average least dimension - Direct measurement (nom. sizes 5 mm and 7 mm).
- AS 1141.23 - Los Angeles value.
- AS 1141.24 - Aggregate soundness – Evaluation by exposure to sodium sulphate solution.
- AS 1141.40 - Polished aggregate friction value - Vertical road-wheel machine.
- AS 1141.41 - Polished aggregate friction value – Horizontal bed machine.
- AS 1289(set) Methods of testing soils for engineering purposes
- AS 1289.3.1.1 - Soil classification tests - Determination of the liquid limit of a soil – Four point Casagrande method.
- AS 1289.3.2.1 - Soil classification tests – Determination of the plastic limit of a soil – Standard method.
- AS 1289.3.3.1 - Soil classification tests – Calculation of the plasticity index of a soil.
- AS 1289.3.4.1 - Soil classification tests – Determination of the linear shrinkage of a soil – Standard method.
- AS 1289.3.6.1 - Soil classification tests – Determination of the particle size distribution of a soil – Standard method of analysis by sieving.
- AS 1289.5.1.1 - Soil compaction and density tests - Determination of the dry density or moisture content relation of a soil using standard compactive effort.
- AS1289.5.2.1 - Soil compaction and density tests - Determination of the dry density or moisture content relation of a soil using modified compactive effort.
- AS1289.5.4.1 - Soil compaction and density tests – Compaction control test – Dry density ratio, moisture variation and moisture ratio
- AS 1289.5.8.1 - Soil compaction and density tests – Determination of field density and field moisture content of a soil using a nuclear surface moisture-density gauge – Direct transmission mode.
- AS 1289.6.1.1 - Soil strength and consolidation tests - Determination of the California Bearing Ratio of a soil – Standard laboratory method for a remoulded specimen.

- AS 2341(set) Methods of testing bitumen and related road making products.
- AS/NZS 2341.2 - Determination of dynamic (coefficient of shear) viscosity by flow through a capillary tube.
- AS 2341.3 - Determination of kinematic viscosity by flow through a capillary tube.
- AS/NZS 2341.4 - Determination of dynamic viscosity by rotational viscometer.
- AS 2341.12 - Determination of penetration
- AS/NZS 2341.13 - Long-term exposure to heat and air.
- AS 2891(set) Methods of sampling and testing asphalt.
- AS/NZS 2891.3.1 - Binder content and aggregate grading – Reflux method.
- AS/NZS 2891.3.2 - Binder content and aggregate grading – Centrifugal extraction method.
- AS/NZS 2891.3.3 - Binder content and aggregate grading – Pressure filter method.
- AS/NZS 2891.5 - Determination of stability and flow – Marshall procedure
- AS/NZS 2891.7.1 - Determination of maximum density of asphalt – Water displacement method
- AS/NZS 2891.7.3 - Determination of maximum density of asphalt – Methylated spirits displacement
- AS/NZS 2891.8 - Voids and density relationships for compacted asphalt mixes.
- AS/NZS 2891.9.1 - Determination of bulk density of compacted asphalt – Waxing procedure.
- AS/NZS 2891.9.2 - Determination of bulk density of compacted asphalt – Presaturation method.
- AS/NZS 2891.9.3 - Determination of bulk density of compacted asphalt – Mensuration method.
- AS 4049.3 Paints and related materials – Pavement marking materials Part 3: Waterborne paint – for use with surface applied glass beads.

#### NT CODES OF PRACTICE

- NTCP 102.1 Testing field compaction for conformance
- NTCP 103.1 Site selection by the stratified random technique.
- NTCP 107.1A Surface Roughness

#### NT TEST METHODS

- NTTM 204.1 Cement content of stabilised materials – Heat of neutralisation
- NTTM 204.7 Rate of spread of lime or cement
- NTTM 204.8 Stabiliser distribution
- NTTM 215.1 Standard ball penetration test
- NTTM 216.1 Measurement of layer thickness
- NTTM 304.1 Determination of skid resistance with the portable skid tester
- NTTM 305.1 Determination of pavement surface texture depth - sand patch method
- NTTM 404.1 Retroreflectivity testing of pavement marking
- NTTM 404.3 Retroreflectivity testing of pavement marking – wet condition

#### AUSTROADS TEST METHODS

AGPT04H	Austrroads Guide to Pavement Technology Part 4H: Test Methods
AGPT/T103	Pre-treatment and Loss on Heating of Bitumen Multigrade and polymer Binders (rolling thin film oven [RTFO] test)
AGPT/T111	Handling Viscosity of Polymer Modified Binders (Brookfield Thermosel)
AGPT/T112	Flash Point of Polymer Modified Binders
AGPT/T121	Shear Properties of Polymer Modified Binders (ARRB ELASTOMETER)
AGPT/T122	Torsional Recovery of Polymer Modified Binders
AGPT/T124	Toughness of Polymer Modified Binders (ARRB Extensiometer)
AGPT/T131	Softening Point of Polymer Modified Binders
AGPT/T231	Deformation Resistance of Asphalt Mixtures by the Wheel Tracking Test.

#### MAIN ROADS WESTERN AUSTRALIA, TEST METHODS (MRWATM).

WA 730.1	Bitumen Content and Aggregate Grading.
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### 5.3 DEFINITIONS

CBR California Bearing Ratio.

CONFORMANCE TESTING The testing to be carried out by the Superintendent to ensure that the work complies with the contract documents.

ITP Inspection Test Plan

NATA National Association of Testing Authorities, Australia.

NTCP Northern Territory Codes of Practice

NTTM Northern Territory Test Method

NTMTM Northern Territory Materials Testing Manual – available via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>

PROCESS TESTING Testing carried out by the Contractor to self-ensure that the work is in accordance with the contract documents.

### 5.4 ITP SUBMISSION – HOLD POINT

ITPs are required for all construction processes.

**Hold Point** - Submit ITPs, detailing all procedures and test plans to be undertaken to complete the project, before commencing work.

### 5.5 SPECIFIC TESTS

Conduct field density testing using Nuclear Density Gauges in accordance with NTCP 102.1 and AS 1289.5.8.1.

Conduct CBR moulding using a compaction rammer / hammer conforming with the requirements of AS 1289.5.1.1 or AS 1289.5.2.1.

Where tests are required that are not included in the manual use the appropriate Australian Standard.

### 5.6 PANEL PERIOD CONTRACTORS

The Principal has in place Panel Period Contracts with NATA accredited testing companies. The Superintendent will provide a list of the Panel Period Contractors to be used for conformance testing on this contract when the contract is awarded. The Superintendent reserves the right to use other NATA accredited laboratories when panel contractors are unable to carry out specific tests.

## 5.7 ORDERING TESTING

When required, in accordance with the contract documents, order the conformance testing in writing directly from the Panel Period Contractors. Order all testing using the Department's Test Request Form. Include on the order the following information:

- Lot boundaries including start and finish chainages, length and width
- Type of layer
- Type of tests required
- Date and time when lot will be ready for testing

Start with the first Contractor on the list and rotate in sequence for each set of tests. Do not bypass any Panel Period Contractor on the list unless that Panel Period Contractor provides a written explanation that he is unable to carry out the required testing to the time frames listed in the **Table - Testing and Reporting Completion Times**. In this instance, the written explanation must be provided to the Superintendent at the same time as the order for testing. Panel Period Contractors that are unable to carry out the required testing will be placed at the end of the rotation sequence.

### 5.7.1 Conformance Testing

The Superintendent will pay for all conformance testing directly to the Panel Period Contractor selected to perform the conformance tests required under this contract and nominated as the Superintendent's responsibility.

If any tests fail to meet specification, all retesting costs will be a negative variation to the contract.

Failures in bitumen tests refer to Superintendent.

When testing has been ordered and the site is not ready for testing at the time specified by the Contractor, the Contractor will bear the cost of time and travel incurred by the Panel Period Contractor and the Superintendent, where applicable.

### 5.7.2 Process Testing

The Contractor is responsible for the ordering up of, and payment for, all process tests carried out.

## 5.8 NOTICE OF TESTING – WITNESS POINT

Give the Panel Period Contractor written notice in advance of each stage of the works requiring conformance testing, including re-testing.

**Witness point** - Provide the Superintendent with a copy of the order for testing simultaneously with the order being sent to the Panel Period Contractor.

Any communication with the Panel Period Contractors, other than the ordering of testing or inquiring on the timing of test results, must be forwarded through the Superintendent.

Provide the Superintendent with the results of process control testing as identified in the relevant ITP with all requests for conformance testing.

**Witness point** - Notify the Superintendent prior to any rework of failed lots.

## 5.9 TABLES - TEST FREQUENCIES, COMPLIANCE TESTING

Test frequencies as per tables;

**Table – Test Frequencies for Bitumen Spray Sealing.**

**Table – Asphalt Testing Frequencies - During Works**

**Table – Asphalt Test Frequencies – After Works Completed**

**Table – Number of Cores per Lot**

**Table - Test Frequencies for Soils – Parts 1, 2 and 3,**

**Table - Test Frequencies for Aggregates and Pavement Surfaces,**

**Table - Sampling Frequencies for Fresh Concrete**  
**Table – Test Frequencies for Surface Roughness Testing, and**  
**Table - MMDD Minimum Curing Times.**

<b>Table – Test Frequencies for Bitumen Spray Sealing</b>					
<b>Test Method.</b>	<b>Property Tested</b>	<b>Cutback Bitumen/ Emulsions</b>	<b>Straight Run Binder - Initial Seal on New Works</b>	<b>Polymer Modified Bitumen - Initial Seals on New Works</b>	<b>Polymer Modified Bitumen -Reseal Works</b>
AS 2341.2, AS 2341.3 or AS 2341.4	Dynamic Viscosity (60°C)	1 per 15,000L	1 per 15,000L	-	-
	Dynamic Viscosity (135°C)	-	1 per 15,000L	-	-
AS 2341.12	Penetration (25°C)	-	1 per 15,000L	-	-
AGPT/T121	Consistency (60°C)	-	-	1 per 15,000L	1 per 20,000L
AGPT/T121	Stiffness at 15°C (kPa)	-	-	1 per 15,000L	1 per 20,000L
AGPT/T111	Dynamic Viscosity (165°C)	-	-	1 per 15,000L	1 per 20,000L
AGPT/T122	Torsional Recovery at 25°C, 30s (%)	-	-	1 per 15,000L	1 per 20,000L
AGPT/T131	Softening Point (°C)	-	1 per 15,000L	1 per 15,000L	1 per 20,000L
AS 2341.13	Durability of base binder	1 per project	1 per project		
AGPT/T112	Flash Point (°C) min.	1 per project	1 per project	1 per project	1 per project
AGPT/T103	Loss on Heating (%mass) max.	1 per project	1 per project	1 per project	1 per project
AGPT/T124	Toughness at 4°C, 100mm(Nm) min.	1 per project	1 per project	1 per project	1 per project

CONFORMANCE TESTING

<b>Table – Asphalt Testing Frequencies - During Works</b>			
<b>Test Method</b>	<b>Property Tested</b>	<b>Minimum Test Frequency</b>	
		<b>Daily Production &lt;100 tonnes</b>	<b>Daily Production &gt;100 tonnes</b>
-	Mixing temperature	Every mix	Every mix
-	Laying temperature	Every 30 minutes	Every 30 minutes
-	Asphalt surface temperature at commencement of compaction	Every Mix	Every mix
AS 2891.3 or WA730.1	Bitumen content	1 No.	1 per 100 t *
AS 2891.3 or WA730.1	Particle size distribution	1 No.	1 per 100 t *
AS 2891.5	Stability	1 No.	1 per 100 t *
AS 2891.5	Flow	1 No.	1 per 100 t *
AS/NZS 2891.7.1 AS/NZS 2891.7.3	Maximum Density	1 No.	1 per 100 t *
AS 2341.3	Viscosity of Binder	1 per shift	1 per shift

\* One test per nominated tonnage or part thereof.

All sampling is to be performed at the plant from safe sampling platforms.

Binder sampling is to be conducted on the binder in actual use, either at transfer to the bitumen tank on the asphalt plant or from the tank itself.

<b>Table – Asphalt Testing Frequencies - After Works Completed</b>		
<b>Test Method</b>	<b>Property Tested</b>	<b>Frequency</b>
AS 2891	Thickness of layer	1 per core
AS 2891.8	Air Voids of compacted asphalt layer	1 per core
AS 2891.9	Insitu Density	1 per core
AGPT04H - AGPT/T231	Wheel track testing (composite sample)	1 per Type or 1 per 1000 t

Carry out density testing as soon as practicable after completion of works.

Do not test within 200mm of an edge and longitudinal joint and within 1 metre of a transverse joint. Do not test odd shaped areas completed by hand placing of asphalt.

Conform to the following number of cores per lot:

<b>Table – Asphalt Testing - Number of cores per lot</b>			
<b>Area (m<sup>2</sup>)</b>	<b>&lt;100</b>	<b>100 – 1500</b>	<b>&gt;1500</b>
<b>No. of Cores</b>	1	Minimum 3	1 per 500m <sup>2</sup> (minimum 3)

CONFORMANCE TESTING

<b>Table - Test Frequencies For Soils – Part 1 of 3</b>										
<b>Type Of Test</b>	<b>General Fill</b>	<b>Standard Fill</b>	<b>Select Fill/Sand Clay Fill</b>	<b>Subgrade</b>	<b>Sub-Base</b>	<b>Basecourse</b>	<b>Bridge Backfill Using Std. Fill</b>	<b>Bridge Backfill Using Select Fill</b>	<b>Culvert Backfill Using Std. Fill</b>	<b>Culvert Backfill Using Select Fill</b>
Field Density (FDD) by NTCP 102.1 and AS 1289.5.8.1	1 in 3,000 m <sup>2</sup> (min. of 3 tests per lot)	1 in 3,000 m <sup>2</sup> (min. of 3 tests per lot)	1 in 3,000m <sup>2</sup> (min. of 3 tests per lot)	1 in 1,000 m <sup>2</sup> (min. of 3 tests per lot)	1 in 1,000 m <sup>2</sup> (min. of 3 tests per lot)	1 in 1,000 m <sup>2</sup> (min. of 3 tests per lot)	3 tests per 100 m <sup>3</sup>	3 tests per 100 m <sup>3</sup>	3 tests per 10 m <sup>3</sup>	3 tests per 10 m <sup>3</sup>
Modified Compaction (MMDD) by AS 1289.5.2.1	1 per FDD	1 per FDD	1 per FDD	1 per FDD	1 per FDD	1 per FDD	1 per FDD	1 per FDD	1 per FDD	1 per FDD
Particle Size Distribution by AS 1289.3.6.1	-	-	1 per each 2,000 m <sup>3</sup>	-	1 in 5000 m <sup>2</sup> (min.of 1 test per lot)	1 in 5000 m <sup>2</sup> (min.of 1 test per lot)	-	1 per 300 m <sup>3</sup>	-	1 per 300 m <sup>3</sup>
Plasticity Index by AS 1289.3.1.1, AS 1289.3.2.1, AS 1289.3.3.1	1 per each 2,000 m <sup>3</sup>	1 per each 2,000 m <sup>3</sup>	1 per each 2,000 m <sup>3</sup>	1 in 5,000 m <sup>2</sup> (min.of 1 test per lot)	1 in 5000 m <sup>2</sup> (min.of 1 test per lot)	1 in 5000 m <sup>2</sup> (min.of 1 test per lot)	1 per each 300 m <sup>3</sup>	1 per each 300 m <sup>3</sup>	1 per each 300 m <sup>3</sup>	1 per each 300 m <sup>3</sup>
Linear Shrinkage by AS 1289.3.4.1	1 per each 2,000 m <sup>3</sup>	1 per each 2,000 m <sup>3</sup>	1 per each 2,000 m <sup>3</sup>	1 in 5,000 m <sup>2</sup> (min.of 1 test per lot)	1 in 5000 m <sup>2</sup> (min.of 1 test per lot)	1 in 5000 m <sup>2</sup> (min.of 1 test per lot)	1 per each 300 m <sup>3</sup>	1 per each 300 m <sup>3</sup>	1 per each 300 m <sup>3</sup>	1 per each 300 m <sup>3</sup>
California Bearing Ratio by AS 1289.6.1.1	1 per each 2,000 m <sup>3</sup>	1 per each 2,000 m <sup>3</sup>	1 per each 2,000 m <sup>3</sup>	1 in 5 FDD (min.1 of test per lot)	1 in 5 FDD (min.1 of test per lot)	1 in 5 FDD (min.1 of test per lot)	1 per each 300 m <sup>3</sup>	1 per each 300 m <sup>3</sup>	1 per each 300 m <sup>3</sup>	1 per each 300 m <sup>3</sup>
* run = 1 pass of cement spreader; FDD – Field Dry Density; MMDD – Maximum Modified Dry Density										

CONFORMANCE TESTING

<b>Table - Test Frequencies For Soils – part 2 of 3</b>			
<b>Type Of Test</b>	<b>Subgrade</b>	<b>Sub-Base</b>	<b>Basecourse</b>
Pavement Layer Thickness by NTTM 216.1	-	1 per FDD	1 per FDD
Ball Embedment by NTTM 215.1	-	-	1 in 5,000 m <sup>2</sup>
Dry Back – Moisture ratio as per AS 1289.5.4.1	-	-	1 per 1,000 m <sup>2</sup>
Stabiliser Spread Rate by NTTM 204.7	1 per run	1 per run	1 per run
Stabiliser Content by NTTM 204.1	1 per 1000m <sup>2</sup> with a min. of 3 tests	1 per 1000m <sup>2</sup> with a min. of 3 tests	1 per 1000m <sup>2</sup> with a min. of 3 tests
Stabiliser Distribution by NTTM 204.8	1 per 1000m <sup>2</sup> with a min. of 3 tests	1 per 1000m <sup>2</sup> with a min. of 3 tests	1 per 1000m <sup>2</sup> with a min. of 3 tests
Soluble Salt Content of Construction Water	-	-	1 per water source
* run = 1 pass of cement spreader; FDD – Field Dry Density; MMDD – Maximum Modified Dry Density			

<b>Table - Test Frequencies for Soils - Part 3 of 3</b>	
<b>Type of Test</b>	<b>Unpaved areas (including unpaved medians, batters, table drains and blocks)</b>
Field Density (FDD) by NTCP 102.1 and AS 1289.5.8.1	1 for every 100 lineal metres or part thereof
Modified Compaction (MMDD) by AS 1289.5.2.1	1 per each 3 FDD tests
Plasticity Index by AS 1289.3.1.1, AS 1289.3.2.1, AS 1289.3.3.1	For Table Drain blocks only - 1 per each 3 blocks

CONFORMANCE TESTING

<b>Table - Test Frequencies For Aggregates And Pavement Surfaces</b>			
<b>Type Of Test</b>	<b>Aggregate</b>	<b>Pavement Marking</b>	<b>Pavement Surface</b>
Particle Size Distribution by AS 1141.11.1	1 in 250 t (Minimum of 3)	-	-
Los Angeles Abrasion Value by AS 1141.23	1 in 250 t	-	-
Particle Shape by AS 1141.14 at 2:1 ratio	1 in 250 t	-	-
Flakiness Index by AS 1141.15	1 in 250 t (Minimum of 3)	-	-
Average Least Dimension by AS 1141.20.1, AS 1141.20..2 *	1 in 250 t (Minimum of 3)	-	-
Sulphate Soundness by AS 1141.24	1 in 1,000 t	-	-
Percentage of Crushed Faces by AS 1141.18	1 in 250 t	-	-
Polished Aggregate Friction Value by AS 1141.40 or AS 1141.41	-	-	1 in 20,000 m <sup>2</sup>
Surface Texture Depth by NTTM 305.1	-	-	1 in 5,000 m <sup>2</sup>
Skid Resistance by NTTM 304.1	-	-	As nominated by Superintendent
Roughness	-	-	As nominated by Superintendent
Retroreflectivity of Pavement Marking by NTTM 404.1, NTTM 404.3	-	1 per 1,000 lin. m	-
Wear Assessment of Road Marking Paints – Image Analysis to AS 4049.3:2005, Appendix K, Method A Photographic Method	-	As nominated by Superintendent	-
* Take Average Least Dimension samples only from the stockpile on the project site.			

CONFORMANCE TESTING

<b>Table - Sampling Frequencies for Fresh Concrete</b>		
<b>Structures – excluding kerbs and gutters, and excluding floodway margins</b>		
Type of Test	Frequency	Number of samples
Slump - AS 1012.3	Per truck	Per truck as required
Making, curing and compressive strength of concrete - AS 1012.8 and AS 1012.9	1 truck pour	1 set of cylinders *
	2 truck pour	2 sets of cylinders *
	3 - 5 truck pour	3 sets of cylinders *
	6 - 10 truck pour	4 sets of cylinders *
	11 + truck pour	4 sets of cylinders plus 1 additional set of cylinders per every additional 1 to 5 trucks after the first 10 trucks *
<b>Kerbs*** and gutters, and floodway margins</b>		
Type of Test	Frequency	Number of samples
Slump - AS 1012.3	Per each set of cylinders **	Per each set of cylinders
Making, curing and compressive strength of concrete - AS 1012.8 and AS 1012.9	1 set of cylinders per 25m <sup>3</sup> , or each lot. **	1 set of cylinders *
* A set of cylinders consists of 3 cylinders unless directed otherwise.		
** Or as directed by the Superintendent.		
*** For urban projects include side entry pits and similar structures.		

<b>Table – Test Frequencies for Surface Roughness Testing</b>		
Type of test	Frequency	Required value (IRI)
Lane Roughness Value – Pavement and Shoulders – NTCP 107.1A	3 runs per constructed traffic lane	Maximum value
Lot Average Surface Roughness Value – Dense Graded Asphalt – NTCP 107.1A	3 runs per constructed traffic lane	Mean value

<b>Table – Maximum Dry Density (MDD) Minimum Curing Times (AS 1289.5.2.1:2017)</b>		
<b>Plasticity</b>	<b>Condition of Prepared Sample</b>	
	<b>Within 2% of OMC</b>	<b>Greater than 2% from OMC</b>
Sands and Granular Material (NP)	2 hours	2 hours
Low Plasticity (LL ≤ 35%)	24 hours	48 hours
Medium Plasticity (LL > 35% to ≤ 50%)	48 hours	96 hours (4 days)
High Plasticity (LL > 50%)	96 hours (4 days)	168 hours (7 days)
NP – Non plastic		
LL – Liquid limit		
OMC – Optimum moisture content		

## 5.10 CONFORMANCE TESTING RESULTS

The Panel Period Contractor will provide NATA endorsed test results to the Contractor within the following scheduled times (in days – Monday to Saturday) from the time of ordering the tests.

For work in remote areas increase the testing and reporting completion times by a minimum of 2 days. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

CONFORMANCE TESTING

<b>Table - Testing and Reporting Completion times - Part 1 of 3</b>	
<b>Attribute being tested</b>	<b>Time Allowed for NATA Endorsed Report in Days (Monday to Saturday)</b>
<b>SOILS</b>	
Field Density	5
Modified Compaction	** 5
Modified Compaction – Oversize	
Pavement Layer Thickness	4
Particle Size Distribution	5
Plasticity Index (Liquid Limit, Plastic Limit)	** 5
Linear Shrinkage	5
Moisture Content	3
CBR – Soaked (Completion time includes Modified Compaction)	** 9
Cement Content of Stabilised Materials (Heat of Neutralisation)	5
Bitumen Content of Stabilised Materials	4
Stabiliser Spread Rate	3
Soluble Salt Content of Construction Water	4
Standard Ball Penetration Test	3
Unconfined Compressive Strength (7 Day result) excluding compaction	10
<b>AGGREGATE</b>	
Specific Gravity	4
Particle Size Distribution	
Particle Shape, by Proportional Calliper	
Flakiness Index	
Average Least Dimension (Direct Measurement)	
Clay and Fine Silt (Settling Method)	
<p>** Time for completion may be extended by each additional day required for the curing of materials and each additional overnight stay.</p>	

CONFORMANCE TESTING

<b>Table - Testing and Reporting Completion Times - Part 2 of 3</b>	
<b>Attribute being tested</b>	<b>Time Allowed for NATA Endorsed Report in Days (Monday to Saturday)</b>
<b>AGGREGATES (cont'd)</b>	
Particle Density and Water Absorption of Fine Aggregate	5
Particle Density and Water Absorption of Coarse Aggregate	
Los Angeles Value	
Pavement Surface Texture Depth	4
Crushed Particles	
Sulphate Soundness	10
<b>CONCRETE</b>	
Consistency of Concrete – Slump Test	3
Making, Curing and Compressive Strength (28 day result)	*** 31
Making, Curing and Compressive Strength (7 day result)	*** 10
<b>ASPHALT</b>	
Bitumen Content and Aggregate Grading	5
Stability and Flow of Mix	
Air Voids and Density Relationship	6
Density of Thin Lift Asphalt by Nuclear Gauge	4
Bulk Density of Asphalt	6
Kinematic Viscosity of Bitumen	5
<b>BITUMEN</b>	
Dynamic Viscosity (60°C)	3
** Time for completion may be extended by each additional day required for the curing of materials and each additional overnight stay.	
*** From Date of Sampling.	

<b>Table - Testing and Reporting Completion Times - Part 3 of 3</b>	
<b>Attribute being tested</b>	<b>Time Allowed for NATA Endorsed Report in Days (Monday to Saturday)</b>
SURFACE ROUGHNESS	
IRI – Dense graded asphalt	3
IRI – Pavements and shoulders	3
Interim reports are to be issued immediately after testing	

## 5.11 LOT TESTING GENERALLY

Conformance of compaction for soils and asphalt will be based on lots.

Give each lot a lot number. Number the lots using a logical system. Maintain a register of all lots and lot numbers. Include the location of each lot on the lot register. Provide a copy of the lot register to the Superintendent upon request.

Lots defined by the contractor must be clearly marked out on the construction site.

Lots of work will be selected by the Contractor, based upon:

- A lot will represent no more than one shift's production.
- A lot will be continuous and will have been brought to completion at the same time.
- A lot will be composed of essentially homogeneous material with no distinct changes in attribute values.

Each lot will be subject to conformance testing in accordance with NTCP 102.1.

Defective sections will be excluded from the lot to be tested and identified as a separate lot, and will also be subjected to lot testing.

Quality of the lot will be judged as conformance or non-conformance of each lot. This will be based on all tests conducted on the lot in accordance with NTCP 102.1.

Conformance of materials is based on samples from the finished works.

When lots fail to satisfy the conformance criteria, reprocess the entire lot and resubmit for retesting.

Should the lot under consideration be subdivided then each subdivision will be classed as a lot and each subdivided lot will be subject to lot testing.

Non-conforming lots which are subdivided after testing will be treated as separate lots and each and every subdivided lot will be retested.

### 5.11.1 Conformance of Compaction for Soils

In situ density is expressed as a percentage of the Maximum Modified Dry Density. One Modified Dry Density test for each in situ density test will apply.

In situ density will be determined and reported in accordance with NTCP 102.1 and relevant Australian Standards.

A minimum of three tests will apply to each and every lot.

**The Mean Dry Density Ratio (R)** is calculated as follows:

$$R = \frac{\sum x_i}{n}$$

$x_i$  = an individual test result

$n$  = the number of results in the lot.

**The Characteristic Mean Dry Density Ratio (R<sub>c</sub>)** is calculated as follows:

$$R_c = R - k * s$$

where:

$R$  = the mean dry density ratio for the lot

$k$  = the multiplier in the **Table – Multiplier Values For Soils**.

$s$  = the standard deviation.

**The Standard Deviation (s)** is calculated as follows:

$$s = \sqrt{\frac{\sum (x_i - R)^2}{(n - 1)}}$$

where:

$x_i$  = an individual test result

$R$  = the mean of  $n$  results

$N$  = the number of test results in the lot.

When less than six tests are used to determine conformance of a lot the Mean Dry Density Ratios in the **Table - Dry Density Ratios For Conformance, Column A** apply.

When six or more tests are used to determine conformance of a lot the Characteristic Mean Dry Density Ratios in the **Table - Dry Density Ratios For Conformance, Column B**, apply.

### 5.11.2 Conformance of Compaction for Asphalt

Air Voids Ratio is the difference between the maximum density of a mix and the bulk density of that compacted mix expressed as a percentage of the maximum density.

A minimum of three tests will apply for each lot greater than 100m<sup>2</sup>.

The Mean Air Voids Ratio is calculated as follows:

$$R = \frac{\sum x_i}{n}$$

$x_i$  = an individual test result

$n$  = the number of results in the lot.

CONFORMANCE TESTING

<b>Table - Dry Density Ratios for Conformance</b>			
<b>Works Components</b>	<b>A Mean Dry Density Ratio (R) % ("n" is 3 to 5)</b>	<b>B Characteristic Mean Dry Density Ratio (Rc) % ("n" is 6 or greater)</b>	
Natural surface to subgrade, fill, batters, table drains, table drain blocks, fill for water course, unpaved areas	95.0 or greater	94.0 or greater	Conformance
	94.9 or less	93.9 or less	Non-conformance
Subgrade, shoulder sub-base, unsealed pavement base, shoulder base, select fill, levees, structures and culverts in fill, bridge foundation backfill, bridge abutment fill	95.0 or greater	94.0 or greater	Conformance
	94.9 or less	93.9 or less	Non-conformance
Sealed pavement basecourse	100.0 or greater	99.0 or greater	Conformance
	99.9 or less	98.9 or less	Non-conformance
Sealed pavement sub-base, Stabilised and modified basecourse, Subgrade treatment for Reconstruction and Rehabilitation of Existing Pavements clause in PAVEMENTS AND SHOULDERS, or as directed by Superintendent.	98.0 or greater	97.0 or greater	Conformance
	97.9 or less	96.9 or less	Non-conformance
Contractor to backfill all pavement layer test excavations with the material and density ratio specified for that layer, treated as follows: <ul style="list-style-type: none"> <li>- Base and sub-base layers stabilised with 3% cement.</li> <li>- Other layers may be unstabilised.</li> </ul>			

<b>Table – Multiplier Values for Soils</b>	
<b>Values of the Multiplier k for Characteristic Mean Dry Density Ratio (Rc)</b>	
<b>Number of tests per lot (n)</b>	<b>k</b>
6	0.50
7	0.54
8	0.56
9	0.59
10	0.61
15	0.68
20	0.72

## 5.12 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 6 PAVEMENTS AND SHOULDERS

### 6.1 STANDARDS, CODES AND TEST METHODS

Conform to the following Standards and Publication unless specified otherwise:

AS 1141(set) Methods for Sampling and Testing Aggregates.

AS 1289(set) Methods of Testing Soils for Engineering Purposes.

NTMTM NT Materials Testing Manual accessible via  
<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>

NTTM NT Test Methods

NTCP 107.1A Surface Roughness

### 6.2 DEFINITIONS

**BASE (BASECOURSE):** That upper-most layer of constructed material immediately above the subgrade or sub-base and below the pavement surface (sealed or unsealed) extending for the full width of the pavement and shoulder.

**IRI:** International Roughness Index

**PAVEMENT:** That portion of a road constructed for the structural support of, and to form the running surface, for traffic. The pavement structure refers to the pavement layers, in combination, above the subgrade surface, to support the traffic loadings. May be sealed or unsealed. Excludes the shoulders.

**SHOULDER:** That portion of a road carriageway adjacent to the pavement, and flush with the surface of the pavement. Provides run-off for vehicles from traffic lanes. May be sealed or unsealed.

**SUB-BASE:** One or more layers of material placed over the subgrade and below the basecourse extending for the full width of the pavement and shoulder.

### 6.3 MATERIAL PROPERTIES

#### 6.3.1 Natural Gravel

Obtain material from sources of naturally occurring deposits.

Produce required properties by crushing, screening, blending, mixing or other processes necessary.

Ensure particles are tough, durable and of a tightly binding nature free of organic or other deleterious matter.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Conform to the **Table - Natural Gravel Particle Sizes** and the **Table - Natural Gravel Properties** in the finished condition.

<b>Table – Natural Gravel Particle Sizes</b>				
<b>AS Sieve (mm)</b>	<b>Percentage Passing</b>			
	<b>Type 1</b>	<b>Type 2</b>	<b>Type 3</b>	<b>Type 4</b>
75.0	100			100
37.5	80 - 100	100		80 - 100
19.0	50 - 80	70 - 100	100	60 - 100
9.5	35 - 65	50 - 80	70 - 100	50 - 95
4.75	25 - 50	35 - 65	50 - 80	40 - 80
2.36	15 - 40	25 - 50	35 - 65	30 - 65
0.425	7 - 20	10 - 30	15 - 35	20 - 50
0.075	3 - 13	4 - 16	6 - 20	5 - 25

Grading curve numbers generally:

- 2 or 3 for Base (sealed/unsealed),
- 1, 2, 3 or 4 for Sub-base,
- 3 for Shoulder Material.

<b>Table – Natural Gravel Properties</b>				
<b>Attribute</b>	<b>Application</b>			
	<b>Northern Area - Sealed Base</b>	<b>Southern Area – Sealed Base*</b>	<b>Unsealed Base And Shoulder Material</b>	<b>Sub-Base</b>
Liquid Limit (LL)	25% max	30%	35% max	30% max
Plasticity Index (PI)	1-6%	1 - 10%	4 – 12 %	1-10%
Linear Shrinkage (LS)	0-3%	0 - 6%	2 – 8 %	0-6%
PI x % passing 0.425 mm Sieve	180 max	300 max	400 max	400 max
California Bearing Ratio (CBR) 4 day soaked (AS 1289)	80 min	80 min	50 min	30 min
at a relative density of (Highest CBR value to be reported)	100% MMDD	100% MMDD	95% MMDD	95% MMDD
Los Angeles Abrasion (LAA) Loss	50 max	50 max	60 max	60 max

\* Note: Southern Area- Sealed Base\* applies to south of a line connecting Birrindudu - Dunmarra - Wollogorang.

### 6.3.2 Fine Crushed Rock

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Manufacture from hard rock quarry operations by crushing clean, hard, durable rock, of single source, free from natural gravel, clay, organics or other deleterious materials.

Conform to the **Table - Fine Crushed Rock Particle Sizes** and **Table - Fine Crushed Rock Properties** in the finished condition.

<b>Table – Fine Crushed Rock Particle Sizes</b>	
<b>AS Sieve (mm)</b>	<b>Percentage Passing</b>
37.5	100
19.0	90 - 100
13.2	75 - 90
9.5	60 - 80
4.75	38 - 60
2.36	25 - 45
0.425	12 - 26
0.075	6 - 14

<b>Table – Fine Crushed Rock Properties</b>	
<b>Property</b>	<b>Value limit(s)</b>
Liquid Limit (LL)	25% maximum
Plasticity Index (PI)	1 - 6%
Linear Shrinkage (LS)	0 - 3%
Dust Ratio (DR) (% passing 0.075 mm)/(% passing 0.425 mm) x 100	25 - 50
CBR, 4 day soaked at 100% MMDD to AS 1289	100 minimum
Los Angeles Abrasion (LAA) Loss:   coarse grained rock fine grained rock	35 maximum 25% maximum
PI x % passing 0.425 mm sieve	180 maximum

**6.3.3 Blends of Natural Gravel and Fine Crushed Rock**

Not permitted in urban areas for sealed pavements.

Conform to the **Table - Natural Gravel Particle Sizes** and the **Table - Natural Gravel Properties** in the finished, blended condition. Use for heavily trafficked situations and where material is available.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

**6.3.4 Sand Clay**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Obtain Sand Clay from sources of naturally occurring deposits.

Produce required properties by screening, mixing or other processes necessary, to produce a material of a tightly bound nature, free of organic or other deleterious materials.

Conform to the following requirements in the finished condition:

<b>Table - Sand Clay Particle Size Distribution</b>	
<b>AS Sieve (mm)</b>	<b>Percentage Passing</b>
4.75	80 - 100
2.36	60 - 100
0.425	30 - 60
0.075	14 - 28

<b>Table - Sand Clay Properties</b>		
	<b>Property</b>	<b>Value limit(s)</b>
1.	Plasticity Index (PI) – Sealed Roads	20% maximum
2.	Plasticity Index (PI) – Unsealed Roads	15% maximum
3.	Linear Shrinkage (LS)	1 - 8%
4.	CBR, 4 day soaked at 95% MMDD to AS 1289	50 minimum

## 6.4 CONSTRUCTION OF PAVEMENT LAYERS

### 6.4.1 Process Control Testing – Hold Point

**Hold Point** - Provide the Superintendent with a program and procedure for process control testing for the project within 14 days of the awarding of the contract and before work is commenced on site. Base the process control testing on lots and comply with the clause **Conformance of Compaction of Soils** in CONFORMANCE TESTING.

Include the following activities, as applicable:

- Extraction area investigative sampling, on a grid basis
- Extraction area confirmatory sampling, on a windrow/ stockpile basis
- On-formation testing, on a lot basis.

Include the following elements of the work in the process control testing program as applicable;

- Fill
- Sub-grade
- Sub-base
- Base course
- Shoulders
- Stabilisation
- Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Rework and retest failed lots a maximum of two times subsequent to an initial test failure.

Following a third test failure rip up, remove and replace the entire failed layer before carrying out any further testing.

Where relevant, provide additional process control testing procedures for concrete, bitumen and other elements subject to conformance testing by the Superintendent.

The Contractor is responsible for the ordering up and payment of all process testing costs.

Refer to the **Conformance Testing** clauses in the MEASUREMENT AND PAYMENT section.

### 6.4.2 Production of Natural Gravel and Sand Clay Materials

#### Extraction Area

Work extraction areas to achieve conforming material. Control depth of winning to avoid contamination of gravel by clay and other fine materials.

Use front-end loaders or dozers to win, push up and windrow materials. Use of other plant requires approval from Superintendent.

Screen, blend and condition materials to achieve specified material property requirements.

### 6.4.3 On-Formation Mixing and Placing

Place material in uniform and level layers over subgrade surface or lower layers of the pavement.

Remove segregated and contaminated material from the site.

Remove organic materials such as timber, roots and the like by manual stick picking methods.

Do not place material on a previous layer that has

- become waterlogged or cracked; and/or
- otherwise deteriorated.

Condition and mix the material uniformly throughout with water to achieve a moisture content suitable for the specified Dry Density Ratio to be achieved.

Ensure water is clean and free from oil, alkali, organic or any other deleterious substances, and that the total soluble salts content is less than 3,000 mg/litre (total dissolved salts). Provide evidence of construction water salt content level.

### **Compaction**

Compact in uniform layers not less than 100 mm nor greater than 200 mm compacted thickness.

Achieve a homogeneous mass with no compaction planes.

Conform to the Dry Density Ratios specified in the **Table - Dry Density Ratios for Conformance** in the CONFORMANCE TESTING Section.

Maintain the prepared pavement layer.

## **6.5 RECONSTRUCTION AND REHABILITATION OF EXISTING PAVEMENTS**

### **6.5.1 Widening**

Saw cut back the existing pavement by not less than 150 mm width on each edge to sound material.

Excavate boxing for widening to the required depth below finished surface.

Construct subgrade as specified in the EARTHWORKS Section.

Construct pavement and shoulder as specified.

### **6.5.2 Strengthening by Granular Overlay on Existing Pavement**

Saw cut across existing pavement at each end of work. Cut shall be vertical and at least 100 mm deep to allow smooth transition to new work.

Remove seal from existing pavement.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Scarify local high spots to 75 mm below finished surface.

Construct a strengthening layer over the full width of the existing pavement and shoulder and the widening as specified.

### **6.5.3 Strengthening by Granular Overlay on Re-Worked Existing Pavement**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Saw cut across existing pavement at each end of work. Cut shall be vertical and at least 100 mm deep to allow smooth transition to new work.

Cut and/or add top-up gravel where required to achieve levels and grade lines.

Wet mix existing seal into existing base layer, with pulveriser-mixing plant, to nominal depth specified.

Moisture condition and compact re-worked existing pavement to the Dry Density Ratios specified in the **Table - Dry Density Ratios For Conformance** in the CONFORMANCE TESTING Section for sub-base requirements.

Construct a new strengthening basecourse layer over the full width of the re-worked pavement and shoulder, and any widening, to thickness specified. Moisture condition and compact pavement to the Dry Density Ratios specified in the **Table - Dry Density Ratios For Conformance** in the CONFORMANCE TESTING Section for sealed basecourse requirements.

## **6.6 SUPPLY TO STOCKPILE**

Comply with the following stockpile requirements;

- Clear the site.
- Ensure the area is free draining.
- Spread and compact a 75 mm thick layer of sub-base gravel to 95% relative compaction.
- Trim stockpile to a uniform shape for ease of measurement.

## 6.7 PAVEMENT ACCEPTANCE

### 6.7.1 Pavement Acceptance Requirements – Hold Point

**Hold point** – Obtain the Superintendent’s approval for pavement and shoulders acceptance prior to any surfacing work, including satisfying all requirements for:

- Proof Rolling
- Conformance testing
- Dry back
- Final Pavement Layer Integrity
- Surface Roughness
- Other Tolerances

For unsealed pavements, obtain the Superintendent’s approval for pavement conformance at conclusion of pavement works.

### 6.7.2 Proof Rolling Requirement – Witness Point

Proof roll all areas of final pavement surface to the satisfaction of the Superintendent.

Submit a proof rolling procedure to the Superintendent for approval including the method of preparing an area and the extent of proof rolling.

**Witness Point** - Give the Superintendent not less than 24 hours notice of the location and commencement time for the proof rolling. Give 48hrs notice for remote work (greater than 5hrs travel one way from regional centre).

**Plant Requirements;** use plant in proof rolling procedures that comply with the following requirements:

- For urban areas only, fully loaded water cart, minimum size 12 tonne, on standard pneumatic road tyres, fully inflated.
- Fully loaded, minimum single trailer articulated heavy vehicle, on standard pneumatic road tyres, fully inflated.
- Pneumatic tyred compaction plant with a mass of not less than 20 tonnes and with a ground contact pressure under either the front or rear wheels of not less than 450 kPa per tyre and a ground contact area of not less than .035 m<sup>2</sup> per tyre.
- Do not use flat drum rollers.

Check areas for level tolerance and layer thickness before proof rolling.

Proof roll each layer when the pavement is green. If proof rolling is carried out at a later time, water the surface and roll with the test roller prior to commencement of proof rolling.

**Compliance;** The proof rolling requirements are deemed to comply when an area withstands proof rolling without visible deformation, cracking, heaving, or springing. Provide uniform and stable support to rear wheel loads, at walking pace.

**Remedial work;** Remove and reconstruct areas that deform, break up or show signs of distress.

### 6.7.3 Conformance Testing Requirement

Ordering procedures; Refer to the CONFORMANCE TESTING section for testing requirements and test ordering procedures.

Only the finished compacted base, sub-base and shoulder will be subject to conformance testing. Test in the green condition prior to dry back.

Pavements and shoulders will be considered as separate lots.

Backfill test holes in accordance with CONFORMANCE TESTING section.

**Remedial work;** rework or reconstruct areas that do not conform.

**6.7.4 Surface Roughness Requirement**

Surface Roughness: IRI less than 2.4.

Test Method: NTCP107.1A

Surface Roughness requirements represent an absolute upper limit and all Lane Roughness Values to be less than value specified.

Lotting and averaging out of field values not permitted.

Rectify all areas where Surface Roughness exceeds specified value.

**Ordering procedures:** Refer to the CONFORMANCE TESTING section for test ordering procedures.

**Roughness testing sequence:** Roughness testing must be collected in the sequence shown in the table within 7 days of completion of testing of the relevant pavement layer. Multiple adjacent lots can be tested.

Ensure that the pavement is free of loose material and debris when testing is done, for unbound granular bases, measurements must be undertaken prior to brooming of the pavement, and free water is not present on the pavement when testing is undertaken.

<b>Table - Testing sequence for pavement type</b>	
<b>Pavement type</b>	<b>Testing sequence</b>
Spray seal on granular base	Before application of spray seal.
Asphalt surface on new granular pavement (thickness 40 mm and over)	On finished base layer, to meet requirements of PAVEMENTS AND SHOULDERS. On final wearing surface, to meet requirements of DENSE GRADED ASPHALT.

Refer to NTCP 107.1A for exclusions to surface roughness testing. In these locations, the requirements of the **Other Tolerance Requirements** sub-clause, in this clause, still apply. Undertake best efforts to achieve a smooth ride to minimise driver discomfort in the finished condition.

**6.7.5 Final Pavement Layer Integrity Requirement – Witness Point**

Final pavement layers must be homogeneous in appearance, uniformly bonded, free from layering, cracking, disintegration or surface tearing, uniformly hard and dense, free of laminations and roller indentations, with the coarse fraction slightly exposed.

The pavement layer must retain these characteristics after rotary brooming and be suitable to receive bituminous surfacing.

Slurried up surfaces are not permitted.

Remove sticks and any loose material.

Do not introduce new material to the surface after final compaction.

**Witness Point** - Give the Superintendent not less than 24 hours notice of the location and commencement time for the inspection of the prepared layer. Give 48hrs notice for remote work (greater than 5hrs travel one way from regional centre).

**Remedial work;** remove and reconstruct areas that do not conform.

Ball Penetration testing to conform to **Other Tolerance Requirements** sub-clause in this clause, ordered as detailed in CONFORMANCE TESTING.

**6.7.6 Dry Back Requirement**

Allow the top 75 mm of the pavement layer to dry back to a Moisture Ratio (Rm) equal or less than 65% for FCR and 70% for natural gravel.

Moisture Ratio (Rm) is defined as follows:

$$Rm = \frac{(100 \times wf)}{wr}$$

where:

Rm = Moisture Ratio, in percent

wf = field moisture content, in percent

wr = adjusted optimum moisture content, in percent.

The Superintendent will carry out all testing to determine the Moisture Ratio.

### 6.7.7 Remedial Work

Where pavement thickness is 200 mm or greater, scarify to not less than 100 mm depth and recompact where finish not achieved. Where pavement thickness is less than 200 mm scarify and recompact to full depth where finish not achieved.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### 6.7.8 Other Tolerance Requirements

Refer MISCELLANEOUS PROVISIONS, Level Checking and Level Auditing.

Refer to **Table – Final Surfaces Tolerances**.

<b>Table - Final Surfaces Tolerances</b>	
<b>Final surfaces shall conform to the following:</b>	
ALL AREAS / SECTION TYPES	
	<b>Tolerance</b>
<b>Straight edge deviation</b>	5 mm in 3 m
<b>Compacted thickness</b>	Not less than specified
<b>Width</b>	Not less than specified
<b>Surface roughness</b>	IRI less than 2.4 (averaging not permitted)
<b>Ball Penetration test (before priming)</b>	Less than or equal to 3mm, for any individual test result (averaging not permitted). Not required for asphalt surfacing, when thickness 50mm or greater.
URBAN (KERBED AND ASPHALT)	
	<b>Tolerance</b>
Kerb level	-0 mm to +10 mm
Asphalt level	-0 mm to +10 mm
Base surface level	-5 mm to +10 mm
Sub-base surface level	-10 mm to +10 mm
Sub-grade surface level	Refer to EARTHWORKS, Tolerances sub-clause
RURAL (UNKERBED)	
	<b>Tolerance</b>
Base surface level	-20 mm to +20 mm

## 6.8 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 7 STABILISATION AND MODIFICATION

### 7.1 STANDARDS AND PUBLICATIONS

Conform to the following Standards and Publication unless specified otherwise:

AS 1141	Methods for sampling and testing aggregates.
AS 1160	Bitumen emulsions for construction and maintenance of pavements.
AS 1289(set)	Method of testing soils for engineering purposes.
AS 1478.1	Chemical admixtures for concrete, mortar and grout – Admixtures for concrete.
AS 1672.1	Limes and lime stones - Limes for building.
AS 2157	Cutback bitumen.
AS 3972	General purpose and blended cements.
NTMTM	NT Materials Testing Manual accessible via <a href="https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual">https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual</a>
NTTM	NT Test Methods

### 7.2 DEFINITIONS

**BOUND MATERIALS:** Materials including natural gravels, crushed materials or insitu materials stabilised with an introduced binder, such that substantive tensile strength is imparted to the treated material.

**OPTIMUM MOISTURE CONTENT:** The amount of water by mass, expressed as a percentage of the dry mass of the material, at which maximum modified dry density is obtained with the stabiliser added.

**MODIFICATION:** A lighter form of stabilisation that treats an unbound material with small quantities of binder or granular material, to improve its unbound properties.

**STABILISATION:** Process used to enhance material properties for pavement design purposes to overcome deficiencies in available materials, by incorporation of a binder or granular material (or both).

### 7.3 MATERIALS

#### 7.3.1 Binders

##### 7.3.1.1 Lime

Use Calcium Hydroxide (hydrated lime/lime slurry), as  $\text{Ca}(\text{OH})_2$ .

Obtain Superintendent's approval for use of Calcium Oxide (quicklime), as  $\text{CaO}$ .

Do not use dolomite limes ( $\text{CaMg}(\text{CO}_3)_2$ ). Do not use agricultural lime (Calcium Carbonate ( $\text{CaCO}_3$ )).

Conform to AS 1672.1

##### 7.3.1.2 Cement

Use type GP (general purpose Portland cement) or GB (general purpose blended cement).

Supply and store in a manner that protects against the weather and moisture.

Conform to AS 3972.

##### 7.3.1.3 Bitumen

Conform to bitumen classes in SPRAY SEALING clauses for straight run and emulsion grades.

### **7.3.2 Granular Modification**

For pavement layers, final blended material to conform to requirements of PAVEMENTS AND SHOULDERS clauses in the finished condition.

For subgrade and fill layers, final blended material conform to requirements of EARTHWORKS clauses, in the finished condition.

### **7.3.3 Additives**

Obtain Superintendent's approval for additive use.

Follow manufacturer's recommendations when using retarders and water reducing additives.

### **7.3.4 Water**

Ensure water is clean and free from oil, alkali, organic matter and other deleterious substances, and that it conforms to:

- a total soluble salts content of less than 3,000 mg/litre (total dissolved salts), and
- 1% maximum by mass of undissolved solids, in accordance with AS 3550.4

For areas with high salt levels in water refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

For materials to be stabilised refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## **7.4 IN SITU STABILISATION AND MODIFICATION**

### **7.4.1 Preliminary Field Trial**

Preliminary field trials generally not required for small projects – less than 1000 m<sup>2</sup> of treated area. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Locate trial section within the works area.

Carry out a preliminary trial of the proposed operation to determine:

- effectiveness of mechanical plant;
  - passes necessary to achieve the specified mixing;
  - optimum curing time between preliminary and final mixing (lime binder only); and
  - field moisture content and plant pattern to achieve final compaction.
- Carry out all necessary process control testing for this purpose.

Conform to Dry Density Ratios specified in the **Table - Dry Density Ratios For Conformance** in the CONFORMANCE TESTING Section.

### **7.4.2 Preparation of Layer**

Scarify existing pavement sections and new material, where necessary, full depth before spreading binder or granular modifier.

Tyne the surface lightly when quicklime is used.

Compact lightly to reveal irregularities in the spread material and to permit the stabilising equipment to traverse the area without excessive displacement of the surface.

Shape and trim the surface to the alignment, levels and cross-sections necessary to produce the final levels and compacted thickness.

### **7.4.3 Commencement and Continuity of Work**

Complete full width stabilisation/modification in one day.

Cease stabilising during the following conditions:

- Wet weather or if rain is likely to fall.
- Windy periods which could cause loss of binder, or dust nuisance.

#### 7.4.4 Binder Spreading

For small jobs where bag spotting is necessary refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

##### 7.4.4.1 Binder Field Application Rates – Hold Point

The Contractor is responsible for determining the binder field application rate.

Use PROCESS CONTROL TESTING, in accordance with NTTM 204.7 (with project field samples, source binder and field water) to determine field application rate, for layer specified, to achieve the following 28 day strength, as applicable in the RFT:

Table – Binder Rate Design Criteria	
Layer Treatment	Laboratory Test Parameters
Cement Stabilised Layer (Bound)	UCS between 1.5 and 2.0MPa
Cement Modified Layer	UCS between 0.7 and 1.5MPa
Lime Modified Layer	Lime demand test to determine quantity to reduce PI and increase CBR to limits in PAVEMENTS AND SHOULDERS for natural gravel.

**Hold point** - Determine field application rate for spreading based on laboratory testing of materials. Obtain the Superintendent's approval of the field application rate for each source material for the project.

##### 7.4.4.2 Spread Rates for Tender Purposes

Adopt the following binder spread rates for tender purposes (based on a 200mm thick layer):

Cement Stabilisation: 10 kg/sq.m.

Cement Modification: 5 kg/sq.m.

Hydrated Lime Modification: 12 kg/sq.m.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

##### 7.4.4.3 Spreading Requirements

Calibrate mechanical spreader and check spread rate prior to commencement.

Spreading must be visually uniform throughout each spreader run.

Obtain approval from the Superintendent for bag spotting and spreading.

#### QUICKLIME

Water the spread material sufficiently to allow full slaking.

Avoid overwatering and avoid underwatering.

#### LIME SLURRY

Initial mixing in separate paddle mixer or similar.

Use mechanical sprayer with agitation to maintain a lime/water ratio within  $\pm 10\%$  of initial ratio.

Lime/water ratio to be between 1:2 and 1:0.8 (by mass) equivalent to 1 tonne of hydrated lime mixed with 2,000 and 800 litres of water respectively. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

#### **7.4.5 Binder Mixing**

Use plant capable of:

- mixing the binder with the nominated layer of material uniformly over the full depth to be treated; and
- adding water uniformly to the materials while mixing with application rate between 0 to 10% (by mass) of the material being mixed.

Resultant mix to be uniform in colour and free of lenses, pockets or clumps of binder.

Prevent segregation.

Pulverise clayey material until at least 90% passes 19 mm sieve.

Add water to the materials during mixing to achieve a moisture content suitable for compaction.

For small works the Superintendent may allow the use of rotary hoes or graders. Obtain approval before using this type of equipment for this purpose.

##### **7.4.5.1 Cement Treated Layers**

Commence compaction and finishing immediately following satisfactory mixing.

##### **7.4.5.2 Lime Treated Layers**

Shape the treated layer to the approximate cross-section after satisfactory mixing and lightly compact.

Cure for a period of 24 to 72 hours.

Commence final mixing.

Add water during mixing to achieve moisture content suitable for compaction.

Resultant mix to be uniform in colour and free of lenses, pockets or clumps of lime.

#### **7.4.6 Granular Modification – Hold Point**

The Contractor is responsible for determining the blending ratios of materials to achieve the requirements of the PAVEMENT AND SHOULDERS clauses, in the finished condition.

Use PROCESS CONTROL TESTING.

**Hold Point** - Determine blending ratios based on laboratory testing of materials. Obtain the Superintendent's approval of determined blending ratio.

#### **7.4.7 Compaction**

Compact parallel to the centre line of the pavement and for the full depth of the treated layer.

Commence compaction at the lower edge of the pavement and work progressively towards the crown or the higher edge.

Allow for progressive and uniform overlap between passes.

Wet the surface lightly after compaction to reduce moisture loss and lay the dust when necessary.

#### **CEMENT STABILISATION**

Complete the mixing, compacting and finishing within two hours of adding binder and water, or within working time limits, whichever is the lesser.

#### **7.4.8 Finishing**

Final surface shall be smooth, dense, closely knit, free from compaction planes and cracks and finished to the tolerances specified.

Filling or addition of material to the surface of the pavement to meet tolerance requirements will not be permitted.

Maintain the surface material at not less than its specified optimum moisture content during all finishing operations.

Reconstruct non-complying areas at no cost to the Principal.

### 7.4.9 Construction Joints

#### LONGITUDINAL JOINTS

Minimise longitudinal joints by stabilising the full width of traffic lanes or wider as one continuous operation.

Joints to be straight or follow road curvature as appropriate.

#### TRANSVERSE JOINTS

Form joints following any break in excess of two hours in the continuity of the stabilisation operations.

Cut the end of the material to a plane face at an angle not exceeding 45 degrees from the vertical.

Check the surface adjacent to the joint with a straight edge prior to recommencement and further cut back the joint as necessary to achieve surface tolerance.

### 7.4.10 Curing of Cement Treated Layers

For cement treated layers (stabilised or modified), cure using either of the following methods:

- Keep the finished surface damp (without leaching) until further construction or other curing operations are carried out.
- Alternatively cure by applying a bitumen emulsion or a bitumen primer as specified.

For bituminous curing, apply the bituminous curing membrane as soon as possible after mixing and compaction but no later than 24 hours after relative compaction results are available.

Use:

- Bitumen emulsion ARS Grade 320, or
- Cut-back bitumen Class AMC 2 or Class AMC 3.

Application rate for bitumen emulsions to be 0.3 to 0.45 litres per square metre.

Maintain clear of vehicular traffic for four days.

## 7.5 PLANT MIX STABILISATION

### 7.5.1 Binder Content – Hold Point

Adopt a cement content of the percentage stated in PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ for tender purposes.

**Hold point** - Assess the cement content based upon test results of materials to be stabilised. Obtain the Superintendent's approval for the cement content.

### 7.5.2 Preliminary Trial

Preliminary trial not required for small projects – less than 1000 m<sup>2</sup> of treated area. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Locate trial section within the works area.

Carry out a preliminary trial of the proposed operation to determine:

- effectiveness of mechanical plant; and
- field moisture content and plant pattern to achieve final compaction.

Test stabilised material for conformance to the **Table - Dry Density Ratios for Conformance** in the CONFORMANCE TESTING Section.

### 7.5.3 Commencement and Continuity of Work

Complete full width stabilisation of pavement in one day.

Do not stabilise during wet weather or if rain is likely to fall.

#### **7.5.4 Care of Existing Surface**

Avoid damage to existing surface on which the mix is placed.

Repair any damage.

#### **7.5.5 Mixing**

Mixing plant to be capable of maintaining the mix proportions.

Add cement and water to material to be stabilised and mix for a minimum period of 30 seconds.

Material to be uniform and without segregation.

##### **BATCH MIXER**

Scales used for weighing cement for batching plants must be used solely for that purpose.

Proportion the dry materials by mass.

##### **CONTINUOUS MIXER**

Proportion the dry materials by volume.

Use a continuous feeder which allows feed rate of different aggregate sizes to be adjusted separately.

#### **7.5.6 Delivery**

Minimise segregation during loading and unloading and discharge directly into the hoppers of paving machines without spillage.

Provide open trucks with tarpaulins.

#### **7.5.7 Laying**

##### **PAVING MACHINE**

Deposit and spread the pavement material in one operation using self-propelled mechanical tamper-spreader.

Lay material uniformly without segregation to produce a uniform surface texture and required thickness.

##### **GRADER LAYING**

Use only for minor jobs. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Spread the material in one layer not less than 75 mm nor more than 200 mm compacted thickness.

#### **7.5.8 Compaction, Finishing, Construction Joints and Curing**

Conform to the requirements specified for in situ stabilisation.

## 7.6 CONFORMANCE

### 7.6.1 Tolerances

For stabilised and modified layers, conform to the tolerances specified in the PAVEMENTS AND SHOULDERS Section and with the following:

Table – Stabilised and Modified Layer Conformance		
Attribute		Requirement
Dry Density Ratio:		Refer to the <b>Table - Dry Density Ratios For Conformance</b> in the CONFORMANCE TESTING Section.
Binder Application Rate/Content		±10% of the field application rate averaged for each lot
Binder Distribution:	[i]	Binder content shall not vary by more than 0.5% absolute between top and bottom half of a layer at any location as determined in accordance with NTTM 204.8.
	[ii]	Binder content shall not vary by more than ±0.5% from the field application rate in any point.
Moisture Content during Compaction:	[i]	±1.5% of moisture content determined at preliminary trial.
	[ii]	±1.5% of optimum moisture content.
[i] apply if a preliminary trial is carried out (i.e. total area over 1000m <sup>2</sup> ) [ii] apply if a preliminary trial is not carried out (i.e. areas under 1000m <sup>2</sup> ) Take samples for Liquid Limit, Plastic Limit, Linear Shrinkage, California Bearing Ratio from the unstabilised pavements.		

For Binder Distribution value for other types of binding agent refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### 7.6.2 Conformance Testing – Hold Point

Refer to the CONFORMANCE TESTING Section for Test Frequencies.

Correct application deficiencies by the application of additional stabiliser and remixing if mixing has already commenced.

#### BINDER CONTENT

The Superintendent will carry out conformance testing of the layers in the finished condition

#### COMPACTION

The Superintendent will carry out conformance testing.

Check areas for level tolerance and layer thickness before testing.

Only the finished compacted pavement will be tested.

Dry Density Ratios will be determined 24 hours after final compaction.

Backfill test holes within 24 hours of testing with new stabilised material.

**Hold point** - Superintendent to approve conformance of stabilised layer prior to commencing surfacing work.

### 7.6.3 Surface Roughness Requirement

Surface Roughness: IRI less than 2.4.

Test Method: NTCP 107.1A

Surface Roughness requirements represent an absolute upper limit and all lane roughness

values to be less than value specified.

Lotting and averaging out of field values not permitted.

Rectify all areas where Surface Roughness exceeds specified value.

Exclusions are listed in Test Method NTCP 107.1A

Ordering procedures; refer to the CONFORMANCE TESTING section for test ordering procedures.

When lots fail to meet the conformance criteria, rejection of the lot or payment adjustments will be applied. Refer to **Table - Rate of Payment Adjustments** in MEASUREMENT AND PAYMENT, **Rate of Payment Adjustment** sub-clause.

## **7.7 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 8 SPRAY SEALING

### 8.1 STANDARDS, CODES, GUIDES, TEST METHODS, AND ACTS

Conform to the following Standards and Publications unless specified otherwise:

- AS 1141(set) Methods for sampling and testing aggregates
- AS 1141.14 - Particle shape, by proportional caliper
- AS 1141.15 - Flakiness index
- AS 1141.18 - Crushed particles in coarse aggregate derived from gravel
- AS 1141.20.1 - Average least dimension - Direct measurement (nominal size 10 mm and greater)
- AS 1141.20.2 - Average least dimension - Direct measurement (nominal sizes 5 mm and 7 mm)
- AS 1141.23 - Los Angeles value
- AS 1141.24 - Aggregate soundness - Evaluation by exposure to sodium sulphate solution
- AS 1141.25.1 - Degradation factor - Source rock
- AS 1141.26 - Secondary minerals content in igneous rocks
- AS 1141.29 - Accelerated soundness index by reflux
- AS 1141.40 - Polished aggregate friction value - Vertical road wheel machine
- AS 1141.41 - Polished aggregate friction value - Horizontal bed machine
- AS 1141.50 - Resistance to stripping of cover aggregates from binders
- AS 1160 Bitumen emulsions for the construction and maintenance of pavements
- AS 1742.3 Manual of uniform traffic control devices - Traffic control for works on roads
- AS 1906.3 Retroreflective materials and devices for road traffic control purposes - Raised pavement markers (retroreflective and non-retroreflective)
- AS 2008 Bitumen for pavements
- AS 2106.2 Methods for the determination of the flash point of flammable liquids (closed cup)  
– Determination of flash point - Pensky Martens closed cup method
- AS 2157 Cutback bitumen
- AS 2341(set) Methods of testing bitumen and related roadmaking products
- AS 2341.6 - Determination of density using a hydrometer
- AS 2341.9 - Determination of water content (Dean and Stark)
- AS/NZS 2341.13 - Long-term exposure to heat and air
- AS 2758.2 Aggregates and rock for engineering purposes - Aggregate for sprayed bituminous surfacing
- AS 2809.5 Road tank vehicles for dangerous goods - Tankers for bitumen based products
- AS 3568 Oils for reducing the viscosity of residual bitumen for pavements
- AS 3706 Geotextiles - Methods of Test
- AS 3706.1 - General requirements, sampling, conditioning, basic physical properties and statistical analysis
- AS 3706.2 - Determination of tensile properties - Wide strip and grab method
- AS 3706.3 - Determination of tearing strength - Trapezoidal method

NORTHERN TERRITORY TEST METHODS

NTTM 215.1 Standard bell penetration test

NTTM 304.1 Determination of skid resistance with the portable skid tester

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM D86 Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure

ASTM D445 Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

ASTM D1298 Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

AUSTROADS

AGPT04H-08 Austroads Guide to Pavement Technology - Part 4H: Test Methods

AGPT04K-09 Guide to Pavement Technology - Part 4K: Seals

AGPT/T103 Pre-treatment and Loss on Heating of Bitumen Multigrade and polymer Binders (rolling thin film oven [RTFO] test)

AGPT/T108 Segregation of Polymer Modified Binders

AGPT/T109 Ease of Remixing of Polymer Modified Binders

AGPT/T111 Handling Viscosity of Polymer Modified Binders (Brookfield Thermosel)

AGPT/T112 Flash Point of Polymer Modified Binders

AGPT/T121 Shear Properties of Polymer Modified Binders (ARRB ELASTOMETER)

AGPT/T122 Torsional Recovery of Polymer Modified Binders

AGPT/T131 Softening Point of Polymer Modified Binders

AGPT/T132 Compressive Limit of Polymer Modified Binders

AGPT/T142 Rubber content of digested crumb rubber binders - Trichlor bath method

AGPT/T190 Specification Framework for Polymer Modified Binders and Multigrade Bitumens

AP-C87-15 Austroads Glossary of Terms

AP-G41-08 Bituminous Materials Sealing Safety Guide

AP-T68/06 Update of the Austroads Sprayed Seal Design Method

AP-T235-13 Guide to the Selection and Use of Polymer Modified Binders and Multigrade Bitumens

AP-T236-13 Update of Double/Double Design for Austroads Sprayed Seal Design Methods

NT *Weeds Management Act 2001*

## 8.2 DEFINITIONS

Reference should be made to AUSTROADS - AP-C87-15 Austroads Glossary of Terms to give definitions on all aspects of Bituminous Surfacing works where required.

AADT Average annual daily traffic

ADHESION AGENT: A substance used for the purpose of promoting the adhesion between binder and aggregate.

ASTM American Society for Testing and Materials

COARSE GRAINED AGGREGATE: Where the average grain size of the constituent minerals is greater than 1mm. The average grain size is determined optically under a petrographic microscope or by calibrated hand lens.

**CUTTER (Kerosene):** A light petroleum distillate added to bitumen to temporarily reduce its viscosity.

**DEPARTMENT, THE / DIPL** Department of Infrastructure, Planning and Logistics.

**FINE GRAINED AGGREGATE:** Where the average grain size of the constituent minerals is less than 1 mm. The average grain size is determined optically under a petrographic microscope or by calibrated hand lens.

**FLUX OIL:** A petroleum distillate added to bitumen to produce a long term reduction in its viscosity.

**mPa.s** Milli Pascal seconds – a unit of measure of viscosity

**NATA** National Association of Testing Authorities

**NTCP** Northern Territory Code of Practice

**NTMTM** Northern Territory Materials Testing Manual - available at

<https://transport.nt.gov.au/infrastructure/technical-standards-guidelines-and-specifications/materials-testing-manual>

**NTTM** Northern Territory Test Method

**Pa.s** Pascal seconds – a unit of measure of viscosity

**PMB** Polymer Modified Binder

**PRECOATING MATERIAL:** A material used for pre-coating aggregate to promote adhesion of bitumen. Do not use diesel.

**PRIME:** An application of a Primer to a prepared base, without cover aggregate, to provide penetration of the surface, temporary waterproofing and to obtain a bond between the pavement and the subsequent seal or asphalt. It is a preliminary treatment to a more permanent bituminous surface.

**PRIMERSEAL:** An application of primer binder with a fine cover aggregate to a prepared base to provide penetration of the surface and retain a light cover aggregate.

**RESEAL:** A seal applied to an existing sealed, asphalt or concrete surface.

**SAMI** Strain Alleviating Membrane Interlayer

**SEAL:** A sprayed application of bituminous binder into which aggregate is incorporated. May include more than one application of binder and aggregate, and may include geotextile fabric.

**TBA** To be advised (by Superintendent).

**TBR** To be reported (by Contractor).

**VPD** Vehicles per day

### 8.3 SCOPE

Spray sealing treatments include:

- Prime
- Primerseal
- Enrichments
- Initial Seal or Reseal:
  - With conventional bitumen, cutback bitumen or bitumen emulsion binder
  - With modified binder
  - Incorporating geotextile fabric reinforcement.

Spray sealing work consists of:

- Supply and delivery of materials.
- Storage and handling of raw materials.
- Precoating of aggregate.
- Final preparation of surface to receive spray seal treatments.
- Preparation of bituminous materials.
- Recording of spray sealing works.
- Sampling of Bituminous Products
- Application of primer and/or primerbinder and/or binder.
- Spreading and rolling of aggregate.
- Removal of loose aggregate.
- Traffic Control
- Installation of temporary pavement markers
- Installation and retrieval of after-care signage
- Traceability of works and materials

## 8.4 MATERIAL REQUIREMENTS

### 8.4.1 Aggregates

Aggregates must be clean, hard, durable, skid resistant, dry crushed stone, or gravel of uniform quality free from noxious weeds and other deleterious material, and conform with the properties specified. Minimum 3 crushed faces.

Nominate source of aggregate supply. Submit to the Superintendent current NATA endorsed test result certificates providing evidence that the nominated aggregate supply conforms to specified properties. Aggregate used for testing must be sampled from project site and must conform to the **Table - Aggregate Grading and Average Least Dimension (ALD)**, and must conform to the **Table - Aggregate Properties – Construction**.

<b>Table - Aggregate Grading and Average Least Dimension (ALD)</b>						
<b>Sieve Size (mm)</b>	<b>% Passing (Dry Mass)</b>					
	<b>Nominal Size of Aggregate</b>					
	<b>20 mm</b>	<b>16 mm</b>	<b>14 mm</b>	<b>10 mm</b>	<b>7 mm</b>	<b>5 mm</b>
26.5	100					
19.0	85 - 100	100				
16.0	-	80 - 100	100			
13.2	0 - 15	0 - 20	85 - 100	100		
9.5	0 - 5	0 - 2	0 - 15	85 - 100	100	
6.7	0 - 2		0 - 5	0 - 15	85 - 100	100
4.75			0 - 2	0 - 5	0 - 15	85 - 100
2.36				0 - 2	0 - 5	0 - 15
1.18					0 - 2	0 - 5
Min. ALD (1)	12.0mm	9.5mm	8.0mm	5.5mm	3.5mm	2.5mm

Note: (1). Test Methods AS 1141.20.1, AS 1141.20.2 - Direct Measurement.

<b>Table – Aggregate Properties - Construction</b>			
<b>Aggregate Property</b>	<b>Traffic Count (AADT: Two Lanes)</b>		
	<b>Less Than 300 VPD</b>	<b>300 to 6,000 VPD</b>	<b>More Than 6,000 VPD</b>
AS 1141.14 Misshapen Particles: Caliper Ratio 2:1	25% maximum	15% maximum	12% maximum
AS 1141.15 Flakiness Index	25 maximum	25 maximum	25 maximum
AADT - Annual Average Daily Traffic VPD - Vehicles Per Day			

<b>Table – Aggregate Source Rock Properties Requirements</b>			
AS 1141.23 Los Angeles Abrasion (LAA):			
- Fine Grained Aggregate	30% maximum	25% maximum	20% maximum
- Coarse Grained Aggregate	40% maximum	35% maximum	30% maximum
AS 1141.24 Sulphate Soundness	15% maximum	12% maximum	10% maximum
AS 1141.40, AS 1141.41 Polished Aggregate Friction Value	40 minimum	40 minimum	45 minimum
AS 1141.18 - Crushed particles in coarse aggregate derived from gravel. Ensure 80% minimum by mass are classified as crushed particles.			
AS 1141.25.1 - Degradation factor – Source rock (Washington Degradation Test). Igneous rocks shall have a minimum value of 50.			
AS 1141.26 - Secondary minerals content in igneous rocks shall not exceed 25%.			
AS 1141.29 - Accelerated soundness index by reflux. Igneous rocks shall have a minimum value of 94.			
AS 1141.50 - Resistance to stripping of cover aggregates from binders. Binder to be S10E with 1% adhesion agent. Precoat to be 100/0/100 with 1% adhesion agent. The maximum wet stripping (saturated, surface dry) value of the precoated aggregate shall no exceed 10%.			

#### 8.4.2 Cutter

Cutter is to be Kerosene or Jet A1 Aviation Turbine Fuel - conform to **Table - Cutter Oil Properties**.

<b>Table – Cutter Oil Properties</b>			
Refer AS 3568 – 1999 Table 1 for complete specification requirements.			
<b>Property</b>	<b>Min.</b>	<b>Max.</b>	<b>Test Method</b>
Density at 15 °C, kg/m <sup>3</sup>	775	830	ASTM D1298, AS 2341.6
Distillation Initial Boiling Point °C Final Boiling Point °C	140	280	ASTM D86
Flash Point °C (Penksy Martens closed)	38		AS 2106.2
Water content, % by volume	-	0.1	AS 2341.9
Viscosity, mPa.s at 40 °C		2.0	ASTM D445

### 8.4.3 Precoat and Adhesion Agents

Adhesion Agents are to be in the concentrated form and not contain Diesel as part of the mixture.

Precoat all aggregates to conform to the following:

Precoat mixture is to be 100/0/100/1 and not contain Diesel as part of the mixture.

Bitumen residue (by mass): 50%.

Kerosene (by Mass) 50%

Adhesion agent (by mass): minimum 1%

### 8.4.4 Bitumen

Standard Classes of bitumen to conform to the requirements of AS 2008.

Manufacture all AS 2008 bitumens in a refinery and have NATA endorsed certificates of manufacture.

Durability Value in accordance with AS/NZS 2341.13 is to be a minimum of 7 days with no maximum value.

Multigrade bitumen to comply with AGPT/T190.

### 8.4.5 Cut Back Bitumen

Conform to the requirements of AS 2157 and **Table - Cut Back Bitumen Properties**.

Designation is by AMC class.

<b>Table - Cut Back Bitumen Properties</b>			
<b>Class (AS 2157)</b>	<b>Viscosity (Dynamic) at 60°C (Pa.s)</b>	<b>Approximate Parts Bitumen to Cutter</b>	<b>Spraying Temperature (°C)</b>
<b>Prime Coats</b>			
AMC 00	0.008 - 0.016	100 - 100	Ambient
AMC 0	0.025 - 0.05	100 - 80	35 - 55
<b>Primer Seal Coats</b>			
AMC 5	5.5 - 11.0	100 - 12	120 - 150
AMC 6	13.0 - 26.0	100 - 7	135 - 160
AMC 7	43.0 - 86.0	100 - 3	150 - 175

### 8.4.6 Bitumen Emulsion

Conform to the requirements of AS 1160.

Bitumen emulsion to be;

Type; CRS

Binder Grade; 170

%Binder; 60

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Utilise within 90 days of manufacture.

Spraying temperature: 60% bitumen content 30 to 60°C.

### 8.4.7 Polymer Modified Binder

A mixture of Standard Class bitumen and elastomeric polymer or crumb rubber additive.

All conformance testing to be carried out in accordance with Austroads and Australian Standard Test Methods.

Base binders for the production of PMB must meet the specification limits outlined in **Table - Base Binder for Polymer Modified Bitumen**, from the refinery. All base binders must be process tested for conformance to ensure compliance before manufacture into PMB's.

<b>Table – Base Binder for Polymer Modified Bitumen</b>		
<b>Property</b>	<b>Specification limit minimum</b>	<b>Specification limit maximum</b>
Viscosity at 60°C, Pa.s	140	380
Viscosity at 135°C, Pa.s	0.25	0.65
Penetration at 25°C (100g, 5s), <i>pu</i> ( <i>pu</i> unit is 0.1mm)	40	
Flashpoint °C	250	N/A
Matter Insoluble in toluene, percent mass	N/A	1.0
Short Term effect of heat and air (Rolling Thin film Oven Test) Viscosity of residue at 60°C as a percentage of original	N/A	300
Long term effect of Heat and air, days	7	
Density at 15°C, t/m <sup>3</sup>	To be reported	To be reported

Polymer Modified Binders must conform to the requirements outlined in **Table - Polymer Modified Binders for Sprayed Sealing Applications**.

Manufacture of Polymer Modified Binders must meet the requirements of the Guide to the Manufacture, Storage and Handling of Polymer Modified Binders, Australian Asphalt Pavement Association, 2013.

SPRAY SEALING

<b>Table – Polymer Modified Binders for Sprayed Sealing Applications</b>							
<b>Test Method</b>	<b>Binder Property</b>	<b>PMB CLASS</b>					
		<b>S10E</b>	<b>S15E</b>	<b>S20E</b>	<b>S25E</b>	<b>S35E</b>	<b>S45R</b>
AGPT/T121	Consistency at 60°C (Pa.s) min.	250	700	700	5000	300	1000
AGPT/T121	Underlying Viscosity at 60°C (Pa.s)	TBR	TBR	TBR	TBR	TBR	TBR
AGPT/T121	Stiffness at 15°C (kPa) max.	140	140	140	95	180	180
AGPT/T142	Rubber Content by analysis (%) min	NA	NA	NA	NA	NA	10
AGPT/T132	Compression Limit at 70°C, 2kg (mm) min.	NA	NA	NA	NA	NA	0.2
AGPT/T121	Elastic Recovery at 60°C, 100s (%) min.	NA	NA	NA	85	NA	25
AGPT/T111	Viscosity at 165°C (Pa.s) max.	0.55	0.55	0.55	0.8	0.55	4.5
AGPT/T112	Flash Point (°C) min.	250	250	250	250	250	250
AGPT/T103	Loss on Heating (% mass) max.	0.6	0.6	0.6	0.6	0.6	0.6
AGPT/T122	Torsional Recovery at 25°C, 30s (%).	22 - 50	32 - 62	45 - 74	54 - 85	16 - 32	25 - 55
AGPT/T131	Softening Point (°C).	48 - 64	55 - 75	62 - 88	82 - 100	48 - 56	55 - 65
AGPT/T108	Segregation value (%) max.	8	8	8	8	8	8

Notes:

1. Class of PMB: S=Sealing, E=Elastomeric Polymer, R=Granulated Crumbed Rubber
2. NA means not applicable for that PMB class, TBR = To be reported
3. AGPT Test Methods are available from Austroads Guide to Pavement Technology Part 4H: Test Methods
4. S35E must be manufactured with Polybutadiene (PBD) polymers (To be used only if approved by the Superintendent, as an alternative to S10E).

### 8.4.8 Geofabric

Use non-woven, polyester, isotropic, needle punched fabric for geotextile reinforced seals. Conform to the **Table - Geofabric Properties**.

Supply certificate of compliance with the respective AE Lot data. Include Traceability of Batch Numbers with the respective AE Lot data.

<b>Table – Geofabric Properties</b>			
<b>Property</b>	<b>Test Method</b>	<b>Units</b>	<b>Value</b>
Mass per unit area	AS 3706.1	g/m <sup>2</sup>	140 min
Wide strip tensile strength in both directions.	AS 3706.2	kN/m	8.0 min
Elongation range in both directions.	AS 3706.2	%	40 – 60
5% Secant modulus in both directions.	AS 3706.2	kN/m	5.0 min
Trapezoidal tear strength in both directions.	AS 3706.3	N	240 min
Melt temperature	-	°C	250 min
Supply certificate of compliance with the respective AE Lot data. Include Traceability of Batch Numbers with the respective AE Lot data.			

## 8.5 SPRAYERS AND PERSONNEL

Sprayers must have current calibration accredited by a tester nominated on the Australian Asphalt Pavement Association (AAPA) website. All calibrated sprayers must be listed on the AAPA website. A copy of the calibration certificate must be with the vehicle at all times.

Calibrate sprayers yearly.

Ensure sprayer driver and operator are skilled and trained with an understanding of sprayer calibration and an appreciation of the requirements of the work.

Ensure relevant personnel understand the types and quantities of the various materials and mixtures to be used.

Bitumen Spraying plant and equipment must be in good working condition at all times.

## 8.6 FINAL PREPARATION OF PAVEMENT SURFACE

Remove raised reflective pavement markers. Repair any damage to the pavement surface caused by the removal of raised reflective markers with an emulsion/sand mixture before sealing.

Remove deleterious materials, rocks, refuse and organic materials such as timber, branches, leaves, and exposed roots and the like.

Immediately before spraying, sweep the entire pavement surface to remove all loose stones, dust, dirt and foreign matter.

Do not sweep Fine Crushed Rock type, or low plasticity type materials, or Airstrips, with steel brooms.

Maintain the prepared final surface to be free of loose foreign objects.

Remove adherent patches of foreign material with a steel scraper.

Dampen the prepared surface lightly immediately before spraying (for priming and primersealing only)

Remove water from the surface of primed or sealed pavements before applying binder.

Do not allow traffic on the prepared surface.

## 8.7 SETTING OUT

New works to be set out by a qualified surveyor.

Include pavement widening.

Resealing works to follow existing seal.

## 8.8 BINDER COAT REQUIREMENTS

### 8.8.1 General

Rectify bleeding or flushing seals during the defined defects period at no cost to the Principal.

#### 8.8.1.1 References

DIPL Technical Standard - Bituminous Surfacing Works Treatment and Selection

<https://dipl.nt.gov.au/infrastructure/technical-standards-guidelines-and-specifications/road-surfacing-standards>

Austrroads Guide to Pavement Technology Part 4K Selection and Design of Sprayed Seals  
AS 2008 - Bitumen for Pavements

#### 8.8.1.2 Definitions

**S10E** - A class of polymer modified bitumen, used for spray seal work, with an elastomeric modifier, conforming to binder properties in this specification. It must be manufactured from bitumen that conforms to the classes in AS 2008.

**SAMI** - Strain Alleviating Membrane Interlayer. A layer of seal sprayed onto an existing cracked surface, prior to asphalt resurfacing.

#### 8.8.1.3 Requirements

Selection of binder type other than those specified above can be considered in special circumstances and to the approval of the Executive Director Civil Services. For example, resealing a heavily cracked surface may require a S20E or S25E binder type or crumb rubber S45R.

Emulsion primes require the approval of the Executive Director Civil Services before use.

Material properties for S10E binders and other binder types are contained in the **Table – Polymer Modified Binders for Sprayed Sealing Applications** in **Polymer Modified Binder** sub-clause in **Material Requirements** clause in this work section.

For further guidance refer to Austrroads - Guide to the Selection and Use of Polymer Modified Binders and Multigrades (TT1357 - 2012)

Heat to spraying temperature, generally between 180°C and 200°C, but do not exceed the maximum. Avoid heating bitumen in quantities excess to requirements

Prevent foaming.

Ensure product meets the requirements of the specification at point of delivery.

<b>Table - Binder Type Requirements</b>	
PRIMING AND PRIMER SEALING	
<b>Region</b>	<b>Binder Type</b>
All	Class C240 / C320 Applied in cutback form.
TACK COAT AND ENRICHMENT	
<b>Region</b>	<b>Binder Type</b>
All	CRS170/60 Applied in emulsion form.
INITIAL SEAL WORK	
<b>Region</b>	<b>Binder Type</b>
Darwin, Katherine, East Arnhem, Tennant Creek, Alice Springs	S10E
RESEALING WORK	
<b>Region</b>	<b>Binder Type</b>
All	S10E
SAMI WORK (Using 14 mm aggregate)	
<b>Region</b>	<b>Binder Type</b>
All	S25E

### 8.8.2 Prime, primer seals and enrichment coats

Provide bitumen complying with **Table - Base Binder for Polymer Modified Bitumen** in the **Polymer Modified Binder** sub-clause in the **Material Requirements** clause in this work section.

Cut back requirements are:

Prime: AMC 0 to AMC 00

Primer Seal: Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Enrichment Coat: Emulsion based – To be advised. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Cut-back bitumen to be mixed on site.

Heat bitumen to a temperature appropriate for achieving final spraying temperature making allowance for incorporation of the unheated cutter.

Add unheated cutter to heated bitumen and circulate until a homogeneous mixture is achieved.

Spray immediately circulation is complete.

Allow at least three days to elapse after priming before applying the binder coat.

Keep traffic off the primed surface for this period.

Use a primer seal if traffic cannot be kept off surface for 3 days.

### 8.8.3 Straight Run Binder Coats

Do not use Straight Run Binder Coats unless you have prior approval from the Executive Director Civil Services.

Provide bitumen Class 320 complying to AS 2008

Ensure product meets the requirements of the specification at point of delivery.

### 8.8.4 Polymer Modified Binder Coats

Provide bitumen in conformance with **Table - Base Binder for Polymer Modified Bitumen** blended with the required polymer as follows:

Prepare the product in a manufacturing or blending plant that complies with the Guide to the Manufacture, Storage and Handling of Polymer Modified Binders, Australian Asphalt Pavement Association, 2013.

Ensure product meets the requirements of the specification at point of delivery.

Store, mix, heat and spray the polymer modified binder as recommended by the polymer manufacturer.

Both coats of two coat seals shall contain polymer. Do not vary from this requirement unless an exemption is permitted by the Executive Director Civil Services prior to carrying out the affected works.

Initial seal coat: Class S10E

Reseal coat: Class S10E

### **8.8.5 Binder Coats, Tender Quantities**

For spray rates used as a basis for calculating tender quantities refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## **8.9 SAMPLING OF BINDER**

### **8.9.1 Test Request**

Darwin Urban areas - Test requests are to be sent to the panel period contractor to witness sampling and arrange testing.

All other areas - the supplier is to sample and deliver the sample to Departmental staff within 48 hours.

### **8.9.2 Supply of Sampling Containers**

Supply all sampling containers as required for sampling purposes.

Sample containers are to be leak proof and having a capacity of not less than one litre.

Sample containers must be clean, rust free and capable of receiving a product at high temperatures.

### **8.9.3 Definition of Sampling**

A sample is three containers of product collected at the same time from the same supply source.

One sample container is for the Contractor's analysis.

Two sample containers are for the Department to analyse.

Note: Refer to the Superintendent for requirements if samples are non-conforming.

### **8.9.4 Frequency of Samples**

Refer to CONFORMANCE TESTING.

### **8.9.5 Collection of Samples – Witness Point**

Take samples prior to addition of adhesion agents.

Conformance test sampling is to be collected at point of delivery.

Ensure bulkers and road tankers have adequate sampling cocks installed so that samples can be taken on transfer from the bulker to the sprayer. Do not take bituminous samples from the spray wagon, except for prime samples.

**Witness Point** - Take samples from the point of delivery on transfer from the bulker to the sprayer or as directed. Where transfer is for works in the urban area or for small works ensure that conformance testing is ordered and samples are taken at the point of transfer from bulker to sprayer. All sampling must be in accordance with Australian or Austroads standards. The supplier is to perform the sampling. Ensure staff carrying out sampling are competent in sampling methods.

Ensure sampling techniques do not allow contamination of the samples.

Where samples are not collected, 10% reduction adjustments (**Table - Payment Adjustments** in MEASUREMENT AND PAYMENT) will apply to the total materials represented.

### **8.9.6 Sample Identification**

Samples must be clearly identified with permanent marker on adhesive labels on each tin. Mark samples with the following information on the container at the time of collection.

- Container number.
- Sample number.
- Date and time of sample taken.
- Designation or Classification of Materials.
- Sample Temperature.
- Tanker/Sprayer Identification Number.
- Name of Supplier.
- Road Name and number.
- Site Identification.
- Location and Chainage.

Reseals - Maintain an electronic register of all samples which includes the information listed above. Provide a copy of this register to the Superintendent on request.

### **8.9.7 Storage and Delivery of Samples**

Store all samples taken to prevent accidental damage or contamination. Submit sample containers at the completion of each days spraying.

## **8.10 STOCKPILE SITES**

### **8.10.1 Stockpiles of materials**

Stockpiles in urban areas are not permitted.

Urban areas for Darwin region is nominated as - North of Cox Peninsula Road (Stuart Highway), West of Trippe Road (Arnhem Highway) and the end of seal on Gunn Point Road. Other urban areas are nominated as being within, and extending to, town boundaries.

Existing stockpile sites - clean existing stockpile site to suit at no cost to the Principal.

Provide a separate site for each aggregate size. Allow 15 metres between adjacent sites.

Ensure sites are well drained and on hard ground. Avoid contamination by dust.

Maintain access roads and stockpile sites.

Do not allow stockpiled aggregates to become wet due to rain. Cover all stockpiles with sheet plastic or similar material.

Avoid sites under trees, telephone lines, overhead transmission lines or where overhead clearance is less than 6 metres.

Clear all vegetation within the existing stockpile boundary only.

Remove from site any non-conforming aggregate.

For work in or close to regional centres, towns and urban areas (50 km), remove all unused aggregate from stockpile sites at conclusion of work.

For rural work, prepare unused aggregate into one neat and tidy stockpile, per aggregate size.

Aggregate remaining in stockpiled areas becomes property of the Northern Territory Government at Practical Completion stage.

Neatly stockpile all waste materials from the screening process.

## **8.11 PRECOATING AGGREGATE**

All aggregates used must be dry before precoating.

No precoat is required for SAMI and Emulsion seals, unless stated in the response schedules.

Apply a uniform film of precoating material to all the aggregate used for sealing purposes.

Do not load directly into trucks from a precoater machine.

Aggregate which has been excessively pre-coated will be rejected.

Pre-coating is to take place at pre-approved site stockpile locations unless otherwise approved by the Superintendent.

All pre-coating must be performed with a powered shaking screen deck pre-coater, which removes dust, dirt and oversize materials and evenly applies pre-coat to the aggregate.

### 8.12 ADHESION AGENT

Adhesion agent must be used. Do not use diesel based adhesion agents.

Use 1% adhesion agent in the binder. Written Superintendent approval must be obtained for variation of this rate.

Circulate in binder for 20 minutes before spraying.

Provide the Superintendent a copy of the Safety Data Sheet information of the adhesion agent prior to its intended use.

### 8.13 SPRAYING – WITNESS POINT

**Witness Point** - Give the Superintendent 48 hours notice of intention to spray bitumen.

Store bitumen at lowest practical temperature and for the shortest possible duration.

Comply with **Table - Temperature Control Requirements for Polymer Modified Binders**.

Seek approval to vary these requirements.

Remove bitumen from the site when temperature limits are exceeded.

<b>Table – Temperature Control Requirements for Polymer Modified Binders</b>		
<b>Property</b>	<b>Straight Run Binder</b>	<b>Polymer Modified Binder</b>
Temperature at point of spraying	175 to 185°C	180 to 200°C
Holding time at spraying temperature	7 days maximum	2 days maximum
Temperature for medium term storage	130 to 150°C	140 to 160°C
Holding time for medium term storage	30 days	7 to 10 days

#### 8.13.1 Atmospheric Conditions

Commence spraying only when pavement temperature

- is in excess of 20°C, or
- has been in excess of 15°C for at least one hour.

For cutback work, commence spraying when pavement temperature is in excess of 10°C.

For emulsion work, commence spraying when pavement temperature is in excess of 5°C.

Cease spraying if rain threatens, or in windy or dusty conditions.

Protect the work in the event of a sudden change in weather by closing the affected section of road or by rigidly controlling traffic speed.

### 8.13.2 Preparing the Sprayer

Circulate the mixture.

Check the horizontal and vertical alignment and the cleanliness of the spraybar and its extensions.

Determine the appropriate number of nozzles for the width to be sprayed. Ensure the end nozzles fitted are EAN18W.

Check that the nozzles in use are symmetrical about the sprayer.

Check the alignment and setting of the nozzle to ensure that the fans of material from intermediate nozzles are parallel and at an angle of 30 degrees to the centre line of the spraybar. Ensure that the fans from the end nozzles are parallel to each other and at an angle of 45 degrees to the centre line of the spraybar.

Set the height of the spraybar so that the lower faces of the nozzles are 250 mm (or that specified on the calibration certificate) above the pavement when the sprayer is full.

Fit an end shield to the spraybar when necessary to prevent spraying material on the kerb, or to counter any wind effects which would compromise uniform spraying.

Position the guide rod to conform to the setting out and edges of spray. Check by making a dummy run.

### 8.13.3 Application Spray Rates - Hold Point

Application spray rates shall be determined by the Superintendent; using Austroads Guide to Pavement Technology Part 4K Selection and Design of Sprayed Seals.

For new seals and reseals, supply the following to the Superintendent, 3 working days prior to the planned commencement of sealing, to allow the spray rates to be calculated:

- Particle Size Distribution (1 per 250 tonne - minimum 3 tests)
- Average Least Dimension (ALD) (1 per 250 tonne - minimum 3 tests)
- Flakiness Index (FI) of the aggregate, (1 per 250 tonne - minimum 3 tests)
- Ball Penetration testing (for new seal work)
- Dryback results (for new seal work)

Refer to Conformance Testing for sampling requirements of aggregates.

**Hold Point** - Do not commence spraying until the spray rates are advised by the Superintendent.

Spray rates to be at 15°C adjusted in accordance with **Table - Bitumen Equivalent Volumes** in **Calculation of Equivalent Volumes for Spray Rates** clause in this work section.

For primers, primer seals and polymer modified binders, the rate of application refers to the whole of the mixture, including all modifiers, cutback materials, combining oils and adhesion agents. For enrichments and emulsion seals, the rate of application refers to the whole of the mixture.

### 8.13.4 Preparation for Sprayer Run - Witness Point

**Witness Point** - Record the volume and temperature of the sprayer contents before each run, while sprayer is on level ground. Dip Sprayer Tank before and after each sprayer run. Record the dip readings, and the temperature of the sprayer contents at the time the dip was done. Provide copies of records of Sprayer Tank dips and temperatures of tank contents within one day of the completion of a day's work.

**Witness Point** - Allow visual inspection when requested.

**Witness Point** – Check that the spray bar is at the correct height before spraying begins.

Determine the length of sprayer run from the available quantity in the sprayer and the application rate. Ensure the area to be sprayed is not greater than the area that can be covered by aggregate in the loaded trucks.

Start and finish each spray run on a protective strip of paper placed on the pavement. The paper to be wide enough to ensure the sprayed material is being discharged correctly over the full width of spray. Place sufficient protective paper to protect road fixtures.

Place paper on the pavement and masking around areas to be sprayed or wherever the sprayer is stationary on the road pavement.

Seal joints are only allowed where linemarking is to be placed. No joints are allowed in wheel paths.

Excess overspray and spills must be removed before sealing works proceed.

### **8.13.5 Installation of Temporary Pavement Markers**

Temporary Pavement Markers to conform to AS 1906.3.

Spacings of temporary pavement markers to be in accordance with AS 1742.3 or as directed by the Superintendent.

### **8.13.6 Sprayer Run**

Attain uniform spraying speed before spraying commences.

Avoid an excess or deficiency of material due to faulty overlap at longitudinal joints when spraying a road in half-widths.

Overlap to be 300 mm with an intermediate nozzle.

Do not use end nozzles on an overlap.

Make allowances for "Fog Spraying" when joining to existing seals.

Cease spraying before the level of material in the tank falls to a level which reduces the full discharge of the pump.

Remove and dispose of all paper as per the Environmental Management Plan.

Clean off any sprayed material from road fixtures.

### **8.13.7 Hand Spraying**

Plan work to minimise the requirement for the use of a hand sprayer.

Any strips of pavement not adequately covered with sprayed material to be sprayed later with the hand attachment.

## **8.14 APPLICATION OF GEOFABRIC – HOLD POINT**

**Hold Point** - Submit details of proposed machinery and method of application.

Overlap longitudinal and transverse joints 150 mm minimum.

Place longitudinal joints in the fabric along lane boundaries within 100 mm of lane marker. Trim the fabric as required to achieve this.

Bond the fabric to the pavement with a tack coat sprayed 100 mm wider than the fabric and in accordance with the Superintendent's directions for location. Use Standard Bitumen Class C320 for the tack coat.

Place the fabric under tension when laying, using suitable machinery, ensuring that folds or creases do not occur. Use equipment to place fabric that does not cause undue migration of the underlying tack coat into the fabric.

Upon completion of placing of fabric and prior to application of the second/top binder coat, roll the fabric with minimum 4 passes of a pneumatic multi-wheel roller. Carry out rolling of the geofabric at a constant roller velocity with no acceleration or deceleration.

## **8.15 APPLICATION OF AGGREGATE – HOLD POINT**

Load aggregate into appropriate aggregate spreading trucks using an approved loader which does not contaminate the aggregate with dust, dirt and oversize stone.

**Hold Point** - Obtain approval from the Superintendent for use of the proposed aggregate loader before commencing loading operations.

Apply aggregate to sprayed binder within:

- 10 minutes where the pavement temperature is 20°C or greater.
- 5 minutes where the pavement temperature is between 15°C and 20°C.

Polymer Modified Binders: Apply aggregate within 5 minutes irrespective of pavement temperature.

Apply aggregate to emulsion coat before the emulsion breaks.

Use "cut off plates" on spreader boxes to ensure that the correct widths are covered in aggregate, without overlap.

Apply both coats of a two coat seal on the same day. Do not allow traffic until the second coat has been applied.

### 8.15.1 Aggregate Spread Rates

Spread the aggregate evenly and uniformly over the sprayed surface at a rate complying with **Table - Aggregate Spread Rates**.

Use a mechanical spreader, manual spreader boxes are not to be used.

Rerun or hand cover bare or insufficiently covered areas after the first spreading.

Remove all excess aggregate.

<b>Table – Aggregate Spread Rates</b>	
<b>SINGLE / SINGLE SEALS</b>	
Straight Run Binder Coats Multi Grade And Polymer Modified Binders	900/ALD m <sup>2</sup> /m <sup>3</sup>
Emulsions And Cut Back Binders	800/ALD m <sup>2</sup> /m <sup>3</sup>
SAMI	1000/ALD to 1100/ALD m <sup>2</sup> /m <sup>3</sup>
<b>DOUBLE / DOUBLE SEALS – FIRST COAT APPLICATION</b>	
Straight Run Binder Coats Multi Grade And Polymer Modified Binders	950/ALD m <sup>2</sup> /m <sup>3</sup>
Emulsions And Cut Back Binders	850/ALD m <sup>2</sup> /m <sup>3</sup>
<b>DOUBLE / DOUBLE SEALS – SECOND COAT APPLICATION</b>	
All Binders	900/ALD m <sup>2</sup> /m <sup>3</sup>

### 8.15.2 Rolling Rate

Roll the treated surface with self-propelled rubber tyred rollers with a minimum tyre pressure of 600 kPa and a minimum wheel load of 1 tonne.

Roller speed on the first pass to be between 5 and 10 km/h, with subsequent passes between 15 and 25 km/h.

Conform to the following:

- Entire area to receive one roller pass immediately after covering.
- 75% of rolling within 1 hour of covering.
- 100% of rolling within 2 hours of covering.

Minimum Rolling Rate: 1 roller hour per 2,000 litres of binder.

Ensure a uniform distribution of aggregate. Drag broom to distribute surplus aggregate but do not dislodge embedded aggregate. Drag broom before 50% of rolling is complete. Drag brooms are not to be rotary brooms.

For two coat treatments, double the specified rolling rate for the second coat.

Roll in daylight hours only.

Sweep all loose aggregate from the carriageway at completion of rolling.  
Ensure aggregate on the final surface is uniformly distributed and firmly held by the binder.  
Adjust drag broom to distribute surplus aggregate, but not to dislodge embedded aggregate.  
Re-roll the surface after sweeping to ensure uniform bedding of aggregate in binder.

### **8.15.3 Rolling Rate for Airstrips**

Roll the treated surface with at least one self-propelled rubber tyred roller with a minimum weight of 20 tonnes.

Roll the treated surface with self-propelled rubber tyred rollers with a minimum tyre pressure of 600kPa and a minimum wheel load of 1 tonne.

Rubber Tyred Minimum Rolling Rate: One roller hour per 800 litres of binder.

Steel Drum Roller Minimum Rolling Rate: One pass on the final coat.

For two coat treatments, double the rolling rate on the final coat only.

Ensure a uniform distribution of aggregate. Drag broom to distribute surplus aggregate but do not dislodge embedded aggregate. Drag broom before 50% of rolling is complete. Drag brooms are not to be rotary brooms.

Ensure aggregate on the final surface is uniformly distributed and firmly held by the binder.

Roll in daylight hours only.

Use a suction type broom to sweep all loose aggregate from the airstrip and surrounds at completion of rolling, and remove the collected aggregate from site.

Re-roll the surface after sweeping to ensure uniform bedding of aggregate in binder.

### **8.15.4 Self-Propelled Multi Rubber Tyred Vibrating Rollers – Hold Point**

**Hold Point** – Obtain Superintendent’s approval for the use of self-propelled multi rubber tyred vibrating rollers before using them.

Do not use steel drum rollers fitted with rubber covers.

Self-propelled multi rubber tyred vibrating rollers must not be used on works other than resealing works.

All self-propelled multi rubber tyred vibrating rollers must meet the same requirements as are required for self-propelled multi rubber tyred non-vibrating rollers in respect to rolling speeds, tyre pressures, and wheel loadings.

If the self-propelled multi rubber tyred vibrating rollers meet all the above requirements, one self-propelled multi rubber tyred vibrating roller will be considered to be equivalent to 2 self-propelled multi rubber tyred non-vibrating rollers for calculations of rolling times.

A minimum of 2 self-propelled multi rubber tyred non-vibrating rollers must be on site at all times during execution of the works.

## **8.16 TRAFFIC ON RESEALS**

Cross reference; PROVISION FOR TRAFFIC, **Workzone Traffic Management** clause, **Traffic Escort Vehicle - Resealing Works** sub-clause.

Co-ordinate work to minimise traffic delays.

Prohibit traffic;

- until at least 1 pass of the rollers has taken place, or until sufficient rolling has taken place to prevent damage to the applied seal, whichever is greater; and
- from adjacent strip of roadway during spraying.

## **8.17 WASTE MATERIAL – HOLD POINT**

In urban areas, remove all excess aggregate by suction broom. Ensure no aggregates are distributed onto the verge.

**Hold Point** – Obtain written approval from the Superintendent for use of rotary type brooms to windrow the loose aggregate in the urban area. Suction type brooms are still to be used to remove the waste aggregate.

Remove from the site and dispose of all waste material.

Clean and remove all aggregate from the shoulders and verges in urban areas.

Urban areas aggregate removal / sweeping regime:

- **Initial** sweep after rolling has concluded
- **Second** sweep after 24 hours
- **Third** sweep after 48 hours.

## 8.18 REPORTING

### 8.18.1 Spraysheets – Witness Point

**Witness Point** - Supply spraysheets (paper or electronic formats are acceptable) to the Superintendent at the end of each day's production. Record the following information for all spray runs conducted.

- Contractors Name
- Project Details
- Contract Number
- Specification schedule number
- Road Name
- Product Type Sprayed
- Precoat type used, Precoat litres / m<sup>3</sup>
- Aggregate supplier, Aggregate Type, Aggregate size
- Run number, Start Time of spray run
- Pavement Temperature, Ambient Temperature
- Start Chainage of spray run - actual km of road
- End chainage of spray run - actual km of road
- Total Length, Width of spray run
- Total area of spray run
- Temperature of product at spraying
- Start Dip, End Dip
- Total sprayed hot, Correction factor, Total sprayed cold
- Application rate cold
- Ordered application rate
- Percent of application rate ordered
- Number of rollers used
- Bitumen sample number
- Signature of contractor representative
- Signature section for client representative

## 8.19 CONFORMANCE - TOLERANCES

Final surfaces shall conform to the following:

Aggregates are to conform to **Table - Aggregate Properties** in **Material Requirements** clause, **Aggregates** sub-clause in this work section.

Skid Resistance determined by NTTM 304.1.

Skid resistance testing may be carried out by the Superintendent.

Final surfaces with non-conforming skid resistance will be rejected.

Rectify non-conforming work by methods approved by the Superintendent. Rectification work

be at the Contractor's expense, including the cost of testing and re-testing.

Remove from the site binder which has been overheated or has deteriorated or become contaminated prior to its application to the road.

Spray rates applied at less than 95% or more than 105% of the rate indicated in the procedure will be rectified by resurfacing at the Contractor's expense inclusive of all materials.

## 8.20 CALCULATION OF EQUIVALENT VOLUMES FOR SPRAY RATES

This includes the prime coat, enrichment coat, emulsion coat, primerseal and seal coats.

Refer to MEASUREMENT AND PAYMENT for schedules of adjustments.

### 8.20.1 Bitumen Equivalent Volumes

Equivalent volumes of bituminous material measured at higher temperature are to be converted to an equivalent volume at 15°C (15°C converted higher temperature).

Interpolate to determine equivalent volumes at temperatures other than those specified in the **Table – Bitumen Equivalent Volumes**.

<b>Table - Bitumen Equivalent Volumes</b>				
<b>Temp. (°C)</b>	<b>Factor</b>		<b>Temp. (°C)</b>	<b>Factor</b>
15	1.0000 (1.0000)		120	0.9356 (1.0688)
40	0.9844 (1.0158)		130	0.9296 (1.0757)
50	0.9782 (1.0223)		140	0.9237 (1.0826)
60	0.9720 (1.0288)		150	0.9178 (1.0896)
70	0.9659 (1.0353)		160	0.9119 (1.0966)
80	0.9597 (1.0420)		170	0.9060 (1.1038)
90	0.9537 (1.0486)		180	0.9002 (1.1109)
100	0.9476 (1.0553)		190	0.8944 (1.1181)
110	0.9416 (1.0620)		200	0.8886 (1.1253)
			210	0.8829 (1.1326)

## 8.21 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 9 DENSE GRADED ASPHALT

### 9.1 CONTRACTOR'S RESPONSIBILITIES

The Contractor is responsible for the production and placing of the registered and approved design mix in accordance with the technical requirements of this specification.

The Contractor must undertake quality control testing in accordance with CONFORMANCE TESTING and maintain a record of test results in accordance with the Contractor's Quality System.

### 9.2 STANDARDS AND PUBLICATIONS

Conform to the following Standards and Publications unless specified otherwise:

AS 1141(set) Methods for sampling and testing aggregate.

AS 1141.5 Particle density and water absorption of fine aggregate

AS 1141.6.1 Particle density and water absorption of coarse aggregate - Weighing-in-water method

AS 1141.14 Particle shape, by proportional calliper

AS 1141.22 Wet/dry strength variation

AS 1141.23 Los Angeles value

AS 1141.24 Aggregate soundness – Evaluation by exposure to sodium sulphate solution

AS 1141.41 Polished aggregate friction value – Horizontal bed machine

AS 1141.42 Pendulum friction test

AS 1160 Bitumen emulsions for the construction and maintenance of pavements.

AS 2008 Bitumen for pavements.

AS 2150 Hot mix asphalt- A guide to good practice.

AS 2157 Cutback bitumen.

AS 2758.5 Aggregates and rock for engineering purposes – Coarse asphalt aggregates.

AS 2891(set) Methods of sampling and testing asphalt.

#### AUSTRALIAN ASPHALT PAVEMENT ASSOCIATION (AAPA)

Advisory Note 7 Guide to the manufacture, storage and handling of binders for spray sealing (and hot mix asphalt). Available via <http://www.aapa.asn.au/technology-and-publications/advisory-notes>

Guide to the manufacture, storage and handling of polymer modified binders.

#### AUSTROADS

AGPT04B Austroads Guide to Pavement Technology Part 4B: Asphalt

AGPT04H Austroads Guide to Pavement Technology Part 4H: Test Methods

AGPT/T103 Pre-treatment and Loss on Heating of Bitumen Multigrade and polymer Binders (rolling thin film oven [RTFO] test)

AGPT/T108 Segregation of Polymer Modified Binders

AGPT/T111 Handling Viscosity of Polymer Modified Binders (Brookfield Thermosel)

AGPT/T112 Flash Point of Polymer Modified Binders

AGPT/T121 Shear Properties of Polymer Modified Binders (ARRB ELASTOMETER)

AGPT/T122 Torsional Recovery of Polymer Modified Binders

AGPT/T131 Softening Point of Polymer Modified Binders  
AGPT/T190 Austroads Framework Specification for Polymer Modified Binders and Multigrade Bitumen

#### NT PUBLICATIONS

NTCP 103.1 Site selection by the stratified random technique  
NTCP 107.1A Surface Roughness  
NTMTM Northern Territory Materials Testing Manual - available via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>  
NTTM Northern Territory Test Method

#### OTHER PUBLICATIONS

MRWA Main Roads Western Australia, Test Methods

### 9.3 DEFINITIONS

COARSE GRAINED AGGREGATE:	Where the average grain size of the constituent minerals is greater than 5 mm. The average grain size is determined optically under a petrographic microscope.
FINE GRAINED AGGREGATE:	Where the average grain size of the constituent minerals is less than 5 mm. The average grain size is determined optically under a petrographic microscope.
IRI	International Roughness Index (IRI <sub>qc</sub> )
JOB MIX	Adjusted blend composition of registered mix design based on production trial.
NTCP	Northern Territory Code of Practice
RAP	Reclaimed Asphalt Pavement – a recycled material
REGISTERED MIX DESIGN:	An asphalt mix which has been placed on the Department's Asphalt Mix Design Register and approved for use by the Superintendent.
SHALL	Is indicative of a mandatory requirement unless the context clearly indicates otherwise.
VLD	Vehicles per lane per day
WARM MIX ASPHALT	Warm Mix Asphalt (WMA)" is asphalt that contains a warm mix additive, or utilises a warm mix process, that has the ability to reduce the mixing and compaction temperature requirements below the typical temperatures used for that application.

## 9.4 TRAFFIC CATEGORIES

Unless specified otherwise, the following traffic categories shall be used to determine the required mix design level and binder type.

Traffic Category	Mix Type	Application	Binder Type
Light	1 & 2	Cycle paths and pedestrian traffic	Class 320 or S10E
Medium	2, 3 & 6	Car parking and low volume Traffic and Car Parks	Class S10E
Heavy	3	Regional rural subdivisions outside urban areas, and regional rural asphalt	A20E
Heavy	5	All Urban Roads and Intersections and Industrial Estates	A15E
All	4	Structural layers	A15E

Urban areas are defined as follows:

- Darwin region urban area is nominated as North of Cox Peninsular Road (Stuart Highway), west of Trippe Road (Arnhem Highway) and the end of seal on Gunn Point Road
- Katherine, Tennant Creek and Alice Springs urban areas are defined as the areas within the respective town boundaries.

Mix Type	1	2	3	4	5	6
Aggregate size (mm)	7	10	14	20	14 (A15E)	10 (Car Park)

## 9.5 MATERIALS

### 9.5.1 Coarse Aggregates

Ensure coarse aggregates are clean, hard, high strength, angular, skid resistant, durable crushed stone of uniform quality and free from; laminated particles, clay and other aggregations of fine material, soil, organic matter and any other deleterious material. Coarse aggregates must conform to the requirements of **Table - Properties - Coarse Aggregates**:

Property	Acceptance Criteria	Test Method
Proportion of misshapen particles	15% maximum at 2:1 calliper ratio	AS 1141.14
Los Angeles Abrasion	35% maximum loss	AS 1141.23
Polished Aggregate Friction Value	45 minimum	AS 1141.41 & AS 1141.42
Wet Strength	150 kN minimum	AS 1141.22
Wet/Dry Strength Variation	35% maximum	AS 1141.22
Dry Density	Report	AS 1141.6.1
SSD Density	Report	AS 1141.6.1
Water Absorption	2.5% maximum	AS 1141.6.1

### 9.5.2 Fine Aggregates

Fine aggregates must consist of clean, hard, sharp, washed, durable natural sand and/or material manufactured from crushed stone of uniform quality, free from; clay and other aggregations of fine material, soil, organic matter and any other deleterious material.

Where crushed fine materials are from sources other than the source of the coarse material used in the asphalt mix the parent rock must meet all the requirements listed in the **Table - Properties - Coarse Aggregates**.

Fine aggregates must conform to the requirements of the **Table - Properties - Fine Aggregates**

Table - Properties - Fine Aggregates		
Property	Acceptance criteria	Test Method
Soundness	≤ 12% weighted loss	AS 1141.24
Dry Density	Report	AS 1141.5
SSD Density	Report	AS 1141.5
Water Absorption (crushed materials)	3.0% maximum	AS 1141.5
Water Absorption (Quartz Sands)	1.5% maximum	AS 1141.5

### 9.5.3 Mineral Filler

Filler must consist of mineral material, natural or crushed mineral materials, hydrated lime or cement with a particle size smaller than 0.075mm.

Filler must be dry, free from lumps, clay, organic material or any other deleterious material, and must comply in all other respects with the requirements of AS 2150.

### 9.5.4 Bituminous Binder - Witness Point

Refined bitumen must be Class 320, conforming to requirements of AS 2008.

Polymer Modified Binders (PMB) must conform to the requirements of Austroads Framework Specification for Polymer Modified Binders and Multigrade Bitumen, AGPT/T190. Properties of PMB grades referred to in this specification are outlined in **Table – Polymer Modified Binders for Asphalt Applications**.

Table – Polymer Modified Binders for Asphalt Applications			
Test Method	Binder Property	CLASS	
		S10E	A15E
AGPT/T111	Viscosity at 165°C (Pa.s) max.	0.55	0.9
AGPT/T122	Torsional recovery at 25°C, 30 s (%)	22–50	55–80
AGPT/T131	Softening point (°C)	48–64	82–105
AGPT/T121	Consistency at 60°C (Pa.s) min.	250	5000
AGPT/T121	Stiffness at 25°C (kPa) max.	na	30
AGPT/T121	Stiffness at 15°C (kPa) max.	140	na
AGPT/T112	Flash point (°C) min.	250	250
AGPT/T103	Loss on heating (% mass) max.	0.6	0.6
AGPT/T108	Segregation value (%) max.	8	8

Bitumen handling and storage must be in accordance with the AAPA publication *Guide to the manufacture, storage and handling of polymer modified binders* and with the AAPA Advisory Note 7 *Guide to the manufacture, storage and handling of binders for spray sealing (and hot mix asphalt)*.

**Witness Point** - Demonstrate that the binder used for asphalt manufacture has been handled according to these requirements.

### 9.5.5 Bitumen Emulsion

A rapid setting bitumen emulsion, conforming to requirements of AS 1160 must be used in the works when applied as a tack coat.

### 9.5.6 Additives

Additives such as bitumen adhesion agents, hydrated lime and the like may be proposed to be used in the mix, provided that full details of the type of additive are provided. The material must be nominated and shown as part of the mix design in accordance with the **Asphalt Mix Design** clause in this work section.

### 9.5.7 Reclaimed Asphalt Pavement (RAP)

Crush and screen reclaimed asphalt pavement (RAP) from milling or excavation of existing asphalt as necessary to achieve a well graded, free flowing and consistent product. Ensure a maximum size no greater than the maximum size of the asphalt being produced.

RAP material must not contain tar binder and must be free of contaminants such as unbound granular base material, concrete, clay, soil, organic matter or any other deleterious material.

Processed RAP material must be placed in separate stockpiles prior to use. Where RAP material has been stockpiled for some time and is no longer in a free-flowing condition, reprocessing must be undertaken to ensure that it is free flowing at the time of incorporation into the manufacturing of new asphalt materials.

RAP addition in manufactured asphalt must not exceed:

- 15% by mass in base layers, and
- 10% by mass in the wearing course.

## 9.6 ASPHALT MIX DESIGN

### 9.6.1 Mix Type and Design Traffic Category

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ for:

- Mix Type for Wearing Course,
- Mix Type for Structural Course,
- Mix Type for Correction Course,
- Mix Type for Patching Work, and
- Traffic Category.

### 9.6.2 Design Mix Requirements – Hold Point

All asphalt mixes proposed for use on works for the Northern Territory Government shall be registered in accordance with Department's Code of Practice for Registration of Asphalt Mix Designs (NTCP 106.1).

**Hold Point** - No asphalt shall be supplied until the mix has been registered and the Superintendent has approved the mix for use.

Approval of a registered asphalt mix for use under the Contract does not relieve the Contractor from employing suitable manufacturing and handling techniques to ensure performance of the mix. Satisfy all contractual obligations in regards to rectification of defects.

The manufacturer must notify the Superintendent of any proposed changes to the components or proportions of components used in the registered mix.

**Hold Point** - Where it is proposed to change the source grading or nature of the components or binders, new mix designs must be carried out in accordance with the Department's Code of Practice for Registration of Asphalt Mix Designs.

Registration of mix designs must be renewed every 2 years from the date of acceptance.

If a registered mix has unsatisfactory handling or field performance, the Contractor or Superintendent may request the mix be de-registered.

## 9.7 SURFACE PREPARATION

### 9.7.1 New Construction – Witness Point

**Witness Point** - Give the Superintendent not less than 24 hours notice of the location and scheduled commencement time of surface preparation works.

The contractor must prepare existing surfaces to ensure that asphalt construction can be completed in accordance with the requirements of this specification.

The Contractor must:

- ensure that the surface has been adequately prepared so that the specified asphalt material density can be achieved. If the Contractor suspects that the base layer is inadequate for asphalt construction the Contractor must inform the Superintendent;
- ensure that the surface has been adequately prepared to achieve shape and level requirements where required;
- ensure that the exposed granular base layer is tightly bound and free from vegetation and other foreign matter;
- ensure there are no laminations or false pavements within the exposed surface;
- remove all foreign matter by sweeping or other means; and
- ensure that exposed granular layers have sufficiently dried back to the requirements of the **Final Pavement Surface** clause in PAVEMENTS AND SHOULDERS.

The Contractor must apply a bituminous spray seal prime coat to the exposed granular surface as specified in SPRAY SEALING.

Prior to laying base or wearing surface asphalt all depressions greater than 15 mm must be filled with an asphalt correction course layer. Minimum asphalt layer thicknesses must be observed during this procedure.

### 9.7.2 Resurfacing of Existing Bitumen and Concrete Surfaces

All vegetation and loose and extraneous matter must be removed prior to the application of bituminous resurfacing materials.

Depressions greater than 25 mm must be filled with an asphalt correction course layer. Minimum asphalt layer thicknesses must be observed during this procedure.

### 9.7.3 Cold Planing

Unless otherwise specified, or directed by the Superintendent, cold planing shall be carried out in such a manner as to leave a uniform surface parallel with the specified ultimate finished surface of the pavement.

Use at a minimum a 2 metre profiler drum.

All loose materials must be removed from the planed surface prior to placing asphalt.

Exposed granular materials must be watered, re-compacted to form a tight and hard surface and, where specified, must be primed or resurfaced with a 7 mm emulsion bituminous seal prior to paving asphalt. The bituminous seal must be supplied and applied in accordance with SPRAY SEALING.

### 9.7.4 Shape and Surface Roughness

Where surface shape of an existing pavement is corrected by cold planing, the application of the resurfacing asphalt layer is considered to be new work. For the purposes of measuring surface roughness, the asphalt surfacing following correction of surface shape by cold planing will be designated as new work and roughness limits specified in **Table – Finished Pavement Properties** in **Finished Pavement Properties** sub-clause, in **Conformance** clause in this work section, must be achieved.

### 9.7.5 Temporary Works – Hold Point

Where the cold planed surface is to be opened to traffic, the surface must be cleaned of all loose material and both transverse and longitudinal ramps must be installed in accordance with the **Temporary Ramps** sub-clause in the **Spreading** clause in this work section or other means to provide for the safe passage of traffic.

**Hold Point** -This work must be approved by the Superintendent before the section is opened to traffic.

All temporary ramping materials and/or other measures must be removed prior to placing new asphalt.

### 9.7.6 Tack Coat

Apply a fine spray of bitumen emulsion lightly and evenly over the whole of the area to be covered with asphalt.

The pavement must be dry and dust free before any application of tack coat.

Apply tack coat by spray bar fitted to mechanical sprayer. Hand spray only in areas where it is impractical to use a spray bar.

Protective splash boards or spray skirts must be used to eliminate over spray beyond the surface where tack coat is being applied.

Application rate of Residual Binder must be between 0.1 - 0.2 litres/square metre unless otherwise directed by the Superintendent.

Allow the tack coat to 'break' before laying the asphalt.

Clean and tack coat existing surfaces against which new work is to be laid.

Re-apply Tack coat where damaged by construction traffic or weather.

## 9.8 MIXING

Asphalt materials must be manufactured in a plant capable of consistently producing asphalt that complies with the approved registered mix design. The asphalt material must meet manufacturing temperature requirements out lined in **Table - Acceptable Temperature Ranges by Materials**.

<b>Table – Acceptable Temperature Ranges by Materials</b>		
<b>Material</b>	<b>Minimum Temperature (°C)</b>	<b>Maximum Temperature (°C)</b>
Class 320 Bitumen	150	170
S10E PMB	150	175
A15E PMB	160	175
Asphalt at discharge from asphalt mixing plant	135 *	170
* Minimum of 130°C when produced as warm mix asphalt		

### 9.8.1 Asphalt Material Storage

Asphalt may be stored in hot storage facilities for a period not exceeding 24 hours from the time of manufacture.

## 9.9 TRANSPORT AND SUPPLY

### 9.9.1 Transport

All transport vehicles must be free from oil and/or fuel leaks.

Asphalt materials must be transported by trucks with clean trays which permit seamless discharge of the asphalt material to the receiving hopper.

The asphalt material must be covered with suitable tarps to reduce the rate of cooling during transport.

Delivery trucks must be fitted with adjustable tailgate(s) to allow control of the mix during discharge into the receiving hopper.

All delivery dockets must provide information that can trace each load to the manufacturing cycle and also to the point of placement.

Delivery dockets must record:

- Unique Docket Number,
- Time of Departure,
- Temperature at point of discharge from the manufacturing plant,
- Product Type and Bitumen Type, and
- Mass of Materials - Individual load tonnage and cumulative tonnage.

### **9.9.2 Rate of Supply**

The frequency of asphalt material deliveries must be planned to achieve a uniform rate which is in line with the capacity of spreading and compaction processes.

Rate of delivery must allow continuous placing of the asphalt material having regard to;

- the number of haulage vehicles available; and
- the haulage distance to the work site.

Cooling must be minimised by prompt delivery and placement of the asphalt material at the site.

## **9.10 SPREADING**

### **9.10.1 General - Witness Point**

**Witness Point** - Give at least 24 hours notice before commencement of asphalt material spreading.

The asphalt material must be laid at a uniform thickness to the tolerances listed in **Table – Finished Pavement Properties** in **Finished Pavement Properties** sub-clause, in the **Conformance** clause in this work section. The paving operation must be one continuous operation where practical. Where a break in paving occurs due to a planned stop or prolonged delay period a transverse joint must be constructed.

Asphalt that has cooled below acceptable initial rolling temperature(s) must be removed from site and replaced prior to initial rolling.

Asphalt must not be laid when rain is imminent. Paving must cease during heavy or continuous rain, or in wet conditions where the material will not adhere or key to existing surfaces.

Remove from site all rain affected and/or temperature depleted materials at no cost to the Principal.

### **9.10.2 Mechanical Spreading**

The spreading machine must have a capacity of placing not less than 250 tonnes of asphalt material per shift.

Paving machines must be self-propelled and equipped and operated with an electronic levelling apparatus.

Where limited quantities of asphalt are required, or the area to be paved is restricted or of limited width, such as footpaths or parking areas, other spreaders approved by the Superintendent may be used. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### **9.10.3 Hand Spreading**

Hand spreading will be permitted only in locations where spreading with a paving machine is impractical. Hand work may be used to correct localised depressions and/or irregularities.

Spreading of excess material over newly placed asphalt during joint matching is not permitted. All excess material must be removed and discarded from the site. Broadcasting of asphalt over the mat is not permitted at any time.

#### **9.10.4 Laying Pattern - Witness Point**

Work must be completed as one continuous operation where practical.

**Witness Point** - Provide a construction program and paving plan at least 7 working days prior to commencement of works. Paving plans must be confirmed prior to the commencement of each shift.

Laying patterns are not to have longitudinal joints programmed to be left as cold joints. Full width paving shall be programmed.

#### **9.10.5 Construction Joints**

Paving plans must detail the construction processes and procedures. Use processes and procedures which minimise longitudinal and transverse construction joints.

Longitudinal joints must be located within the lane line of the pavement or the traffic sump line. Longitudinal joints must not be located under wheel paths.

Longitudinal joints must be laterally off-set by 100 mm and transverse joints by 500 mm when paving multiple layers.

Construction joints must be minimised within intersections, and within braking zones in approaches to intersections, and within acceleration zones of intersections.

During paving overlap each adjoining lane by at least 25 mm to form an even transverse surface. Proud asphalt material must be raked back immediately to form a ridge along the top of the joint. Where excess material remains in place, this material must be removed from the joint area prior to compaction rolling. Following rolling the resultant joint must be smooth and of similar texture to the pavement in general.

#### **9.10.6 Transverse Joints**

Form transverse joints by cutting with a purpose-built asphalt cut off wheel, or diamond saw, or profiler, to form a vertical face. All waste asphalt is to be removed from site.

When constructing transverse joints, in new works, and in resurfacing works, ensure that the joint and the approaches to the joint do not deviate more than 5 mm under a 3 metre straight edge. Cut back existing pavement to a true level surface with no deviation. Cut back must be a minimum of 200 mm or be sufficient in length to match existing pavement levels and to also maintain cross falls.

Transverse joints include joints created where a paving machine has stopped in any surfacing works.

Exposed joint faces must be treated with bitumen emulsion tack coat prior to placing asphalt against them.

Offset transverse joints in adjacent runs by 1m minimum.

Transverse Match of Overlay to Existing Pavement:

- Saw cut existing asphalt pavement 20 mm depth along the match line of joint.
- Remove taper wedge of existing asphalt pavement along the overlay side of match joint.
- Feather the asphalt overlay down to the existing pavement to achieve a maximum slope of 1 in 10 and for the full width of the pavement.
- Ensure depth of overlay above existing pavement in taper wedge area is not less than 20 mm.

#### **9.10.7 Longitudinal Joints – Hold Point**

**Hold Point** – Provide a plan showing all proposed longitudinal joints. The plan must be approved by the Superintendent prior to works depicted commencing.

Do not leave unfinished longitudinal joints. Where in unforeseen circumstances longitudinal joints must be left unfinished the site must have traffic management in place, with traffic management personnel on site, until the joint is finished, at no cost to the Principal.

All longitudinal joints must be parallel to and follow the shape of the road alignment unless directed otherwise by the Superintendent.

Edges must not remain unsupported unless directed otherwise by the Superintendent.

Unsupported edges must be cut back at least 75 mm if adjacent runs are not paved within the time taken to cool below acceptable paving temperatures.

All unsupported edges left over-night must have tapered edges and must be cut back prior to paving adjacent runs.

All open faces must be treated with bitumen emulsion tack coat prior to paving.

### **9.10.8 Temporary Ramps**

Provide compacted asphalt ramps measuring a maximum 1% grade relative to existing surrounding pavement grades, where transverse joints are left overnight under traffic.

Longitudinal Ramps must be a minimum of 300 mm wide under traffic, and must be visually monitored at all times for the period the ramps are in use.

All costs relating to temporary works must be included in the Contractor's cost proposal and will be deemed to have been included in the contract price. No additional payment will be made for temporary works.

## **9.11 COMPACTION**

### **9.11.1 Compaction Generally**

All plant and equipment used for the execution of the works must be free of oil and fuel leaks.

Compaction methodology must be used so that rollers do not stop on the hot new asphalt surface.

Defer rolling if excessive displacement of the asphalt occurs but only until the asphalt has cooled sufficiently to permit rolling to continue.

The depth of each layer compacted must not exceed 5 times the nominated aggregate maximum size.

### **9.11.2 Compaction Temperatures - Witness Point**

Compaction must be completed prior to cooling of the asphalt material below temperatures at which point the material may be damaged by rolling or at the point at which densification ceases.

**Witness Point** - The Contractor must advise the Superintendent of temperature limits relating to compaction.

### **9.11.3 Initial Rolling**

Initial breakdown rolling must commence immediately following asphalt placement behind the spreader using a steel wheeled roller. Initial rolling must not result in adverse displacement or cracking.

Steel wheeled rollers must be fitted with adjustable scrapers and the drums must be kept moist with water to prevent the mix from sticking to the drums.

### **9.11.4 Intermediate Rolling**

Self-propelled pneumatic tyred rollers with the same tyre pressure in all compacting tyres must be used for intermediate rolling. Rollers must be fitted with water lubricant systems that stop the asphalt sticking to the rubber tyres. Do not use detergents or other chemicals for lubrication. Sand may be spread on the new asphalt to prevent the asphalt sticking to the tyres. Rolling must be completed during applicable material temperatures.

### 9.11.5 Final Rolling

A static steel wheeled roller must be used during final rolling. This procedure must remove all roller marks from the surface to ensure a smooth even surface.

### 9.11.6 Joint Compaction

All joints and free edges must be constructed and compacted to obtain acceptable surface texture.

Offset transverse joints in adjoining runs by 1m minimum.

Rolling of unsupported edges must not result in shape loss and/or excessive lateral displacement.

Finished joints must obtain a smooth even surface which does not exceed 5 mm deviation under a 3 m straight edge.

### 9.11.7 Hand Tampers

Compact asphalt materials by vibratory plates or hand tampers in locations inaccessible to rollers. Finish hand tamped surfaces to a smooth even surface conforming with machine finished areas.

All free edges not laterally supported are to be pushed up with a heavy hand rake and tamped, to form a firm and cohesive edge of not less than 60° slope prior to rolling the free edge or applying the adjacent paving run.

## 9.12 CONFORMANCE

### 9.12.1 Conformance Testing

The Contractor must undertake internal process control testing.

The Superintendent will carry out all conformance testing of materials and completed pavement properties through the Conformance Testing Panel Period Contract.

Bitumen used in the Asphalt production shall be tested in accordance with SPRAY SEALING and CONFORMANCE TESTING.

The Contractor must formally request conformance testing using the "Conformance Test Request" form not less than 2 working days prior to sampling and/or testing taking place.

Surface roughness testing will be carried out at the discretion of the Superintendent.

When lots fail to satisfy the conformance criteria, payment adjustments or rejection of the lot shall be in accordance with **Table - Rate of Payment Adjustments** in MEASUREMENT AND PAYMENT, in the **Rate of Payment Adjustments** sub-clause.

### 9.12.2 Process Testing

Provide test reports for all process testing performed on the works when requested by the Superintendent to provide the reports.

### 9.12.3 Finished Pavement Properties

The works must conform to the requirements listed in this work section, and **Table - Surface Shape Requirements**, and **Table - Finished Pavement Properties**.

<b>Table - Surface Shape Requirements</b>		
<b>Layer</b>	<b>All Roads – Maximum Deviation Below 3m Straight Edge (mm)</b>	
	<b>Parallel to Centreline</b>	<b>Transverse to Centreline</b>
Wearing Course	5	7
Intermediate and Base	8	12

<b>Table - Finished Pavement Properties</b>	
<b>Finish pavement surfaces smooth, dense, true to shape and to the following tolerances;</b>	
Thickness:	Average not less than specified.
Surface levels:	Maximum deviation from design level 0 to +10 mm
Surface roughness (NTCP 107.1A):	2 IRI – Mean Surface Roughness for new works 2.3 IRI – Mean Surface Roughness for resurfacing work.
Contamination from chemicals, petroleum (including oils, petrol and diesel) or solvents	Non-compliance - Remove and replace affected areas

<b>Table - Testing Sequence for Surface Roughness for Pavement Type</b>	
<b>Pavement type</b>	<b>Surface Roughness Testing sequence</b>
Deeplift asphalt pavements	On final wearing surface
Asphalt Overlays and Thin Shape correcting Surfaces (thickness < 50 mm )	On final wearing surface.
Asphalt surface on new granular pavement (thickness 40 mm and over)	On finished base layer, to meet requirements of PAVEMENTS AND SHOULDERS. On final wearing surface.

#### 9.12.4 Conformance of Asphalt Production

Conform to the variation limits to the approved Job Mix Design shown in **Table - Variation Limits To The Approved Job Mix Design**

<b>Table - Variation Limits To The Approved Job Mix Design</b>	
<b>Grading:</b>	
<b>AS SIEVE (mm)</b>	<b>% PASSING (by mass)</b>
4.75 or larger	+ or - 7
2.36	+ or - 5
1.18 to 0.30	+ or - 4
0.15	+ or - 3
0.075	+ or - 2
Bitumen Content:	Maximum variation 0.3% by mass to the Approved Job Mix Design
Maximum Density:	Maximum variation 5% by mass to the Approved Job Mix Design

When lots fail to satisfy the conformance criteria payment, adjustments, or rejection of the lots, will be in accordance with the **Rate of Payment Adjustments** sub-clause in MEASUREMENT AND PAYMENT.

#### 9.12.5 Conformance Sampling and Testing Frequencies

The Superintendent will undertake conformance sampling of bitumen, and asphalt, materials taken from trucks, and tanks, at the mixing plant, and of the finished asphalt pavement, in accordance with the requirements of CONFORMANCE TESTING.

Bitumen used for asphalt production shall be sampled daily.

**9.12.6 Asphalt Compaction**

The contractor must provide details of work lots to Superintendent, including:

- map of lot location(s) relative to land marks including direction;
- lot numbers; and
- lot register.

Work lots must:

- consist of no more than one shift's production;
- be continuous; and
- consist of homogeneous material without distinct changes in characteristic properties.

Each lot will be subject to conformance testing including:

- asphalt material testing;
- in-situ compaction;
- level compliance where appropriate:
- roughness; and
- visual assessment.

When lots fail to satisfy the conformance criteria, payment adjustments, or rejection of the lots, will be in accordance with the **Rate of Payment Adjustments** sub-clause in MEASUREMENT AND PAYMENT.

Should the lot under consideration be subdivided then each sub-lot will be subjected to separate testing.

Non-conforming lots, which are subdivided must be retested individually following subdivision.

Core sample locations will be selected by the laboratory on a stratified random basis in accordance with NTCP 103.1. Supply copies of the completed stratified random selection with each compaction report.

Carry out density testing as soon as practicable after completion of works. The work represented by a lot will be assessed as the mean value of in-situ air voids where the Mean Value of Air Voids is calculated in accordance with CONFORMANCE TESTING.

Conform to **Table - Mean Value of Air Voids**.

The **Conformance of Compaction** clause only applies for asphalt thickness greater than or equal to 30 mm.

<b>Table - Mean Value of Air Voids</b>			
<b>Reduction Level</b>	<b>Light Traffic</b>	<b>Medium Traffic</b>	<b>Heavy Traffic</b>
Conformance	3.0 – 8.0	3.0 – 8.0	3.0 – 7.0
Reduction Level 1	8.1 – 9.5	8.1 – 9.5	7.1 – 8.5
Reduction Level 2	9.6 – 10.0	9.6 – 10.0	8.6 – 9.0
Reduction Level 3	10.1 – 11.0	10.1 – 11.0	9.1 – 10.0

**9.13 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 10 SLURRY SURFACING

### 10.1 GENERAL

This section specifies the materials, equipment and procedures for slurry surfacing of existing sealed surfaces.

### 10.2 STANDARDS AND PUBLICATIONS

Conform to the following Standards and publications unless specified otherwise.

AS 1160 Bitumen emulsions for the construction and maintenance of pavements.

AS 1289.3.3.1 Methods for testing soils for engineering purposes – Calculation of the plasticity index of a soil.

AS 1289.3.7.1 Methods for testing soil for engineering purposes – Determination of the sand equivalent of a soil using a power operated shaker.

AUSTROADS

AGPT/T272 Determination of Abrasion Loss of Bituminous Slurry (Wet track abrasion test)

INTERNATIONAL SLURRY SURFACING ASSOCIATION (ISSA)

TB 114 Test method for wet stripping of cured slurry surfacing mixtures.

### 10.3 COMMENCEMENT OF WORK – WITNESS POINT

**Witness point** - Give the Superintendent at least 7 days notice of the date and time of the commencement of work. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### 10.4 TRAFFIC CONTROL

Refer to PROVISION FOR TRAFFIC.

Take all necessary steps to ensure:

The safety of traffic during the progress of the work until completion of the final operation or curing, whichever is the latter.

That traffic does not damage the work on newly treated sections of pavement.

### 10.5 MATERIALS

#### 10.5.1 Binder – Hold Point

Use bitumen emulsion binder complying with AS 1160.

**Hold point** - Additives to improve the workability of the mix, or to accelerate or retard setting of the mix may be used with the approval of the Superintendent.

#### 10.5.2 Aggregates

Use mineral aggregate consisting of crushed stone, clean, sharp, angular sand and mineral filler combined to meet the grading as specified in the **Mix Requirements** clause in this work section and as set out in the **Table - Standard Mixes**.

Use clean aggregate free from vegetable matter, oversize stone and other deleterious substances.

Use combined aggregate and mineral filler having a sand equivalent value of not less than 45 when tested in accordance with AS 1289.3.7.1. and a plasticity index less than 5 when tested in accordance with AS 1289.3.3.1.

#### 10.5.3 Water

Use only potable water and free from harmful soluble impurities.

#### **10.5.4 Mineral Filler**

Use an approved mineral product having a minimum of 85% passing a 0.075 mm sieve, thoroughly dry and free from lumps, organic matter and clay particles.

#### **10.5.5 Samples**

Supply at any time when requested, sufficient quantities of sample material used or to be used in the work.

Allow the Superintendent to take such samples at any time and provide facilities and any assistance required for this purpose.

#### **10.5.6 Stockpiles**

Provide a separate site for each aggregate size and allow 15 metres between adjacent sites.

Ensure sites are well drained and on hard ground. Avoid contamination by dust.

Maintain access roads and stockpile sites.

Avoid sites under trees, telephone lines, overhead transmission lines or where overhead clearance is less than 6 metres.

Clear all vegetation to 5 m beyond stockpile boundary.

Construct gravel foundation for stockpiles with 100 mm compacted thickness. Trim and compact to 95% relative compaction in accordance with the PAVEMENTS AND SHOULDERS Section.

Construct stockpiles at least 1 metre high and batter sides 1 vertical to 1.5 horizontal and trim neatly to facilitate measurement.

Remove from site any non-conforming aggregate.

### **10.6 PLANT & EQUIPMENT**

#### **10.6.1 Mixing Machine**

Use a self-propelled slurry mixing machine with a continuous flow pugmill able to accurately proportion and deliver mineral aggregate, filler, bitumen emulsion, water and additive to the mixing chamber and discharge the thoroughly mixed product on a continuous basis.

DIP STICKS; Use dipsticks on the emulsion and water tanks calibrated in intervals of 50 litres and on the additive tank use a dipstick calibrated in intervals of 10 litres.

FINES FEEDER; Equip the mixing machine with a suitable fines feeder which provides an accurate metering device to introduce a predetermined amount of mineral filler into the mixer at the same time and in the same location as the mineral aggregate. Provide calibrated controls capable of accurately proportioning the materials.

WATER PRESSURE SYSTEM; Equip the mixing machine with a water pressure system and a fog type spray bar capable of completely fogging the road surface preceding the spreading equipment to a maximum application of 0.3 litres per square metre.

MACHINE STORAGE; For truck or semi-trailer mounted slurry surfacing machines provide sufficient machine storage capacity to allow the adequate mixing and application of a minimum of 7 cubic metres of slurry mixture. This provision does not apply to continuous run slurry surfacing machines.

GUIDE ARM; Fit the machine with a guide arm and chain to assist the driver in following the correct line. Mount the guide arm on the driver's side of the vehicle, forward of, and in full view of the driver.

### 10.6.2 Spreading Equipment

Attach to the mixing machine a mechanical spreader box distributor, equipped with flexible material in contact with the pavement surface to prevent loss of the slurry surfacing mix from the spreader and capable of distributing the slurry surfacing mix across the width of the box without segregation or overflow while assuring by its design and adjustments that the required width and depth of spread are maintained on varying grades, crowns and superelevations.

**SPREADER BOX;** Use a spreader box with an adjustable width, capable of spreading up to 4.0 metres in width and equipped with skis or other levelling device to enable it to fill traverse depressions up to 1.5 metres across.

**STEERING;** Use a spreader box with an adjustable steering device and a flexible strike-off.

### 10.6.3 Ancillary Plant

Provide all ancillary plant such as rotary road brooms, signs, lamps, barricades, hand squeegees, shovels, hand brooms and any other equipment necessary for the performance of the work.

## 10.7 MIX REQUIREMENTS

### 10.7.1 General

Blend the bitumen emulsion with the mineral aggregate and filler in the proportions, by dry mass of aggregate, including filler, to give the required bitumen content of the slurry surfacing mix as specified in the **Table - Standard Mixes**.

Add sufficient water to provide a mix of workable consistency and this may be varied slightly to suit the surface texture of the pavement and the pavement temperature.

Table - Standard Mixes		
Sieve Size (mm)	Percentage Of Mineral Aggregate Passing Sieve By Mass	
	Nominal Mix Size	
	7 mm	5 mm
13.2	100	100
9.5	100	100
6.7	85-100	100
4.75	70-90	90-100
2.36	45-70	50-70
1.18	28-50	35-50
0.60	19-34	20-35
0.30	12-25	12-25
0.15	7-18	7-18
0.075	5-15	4-10
Residual binder content as % mass of aggregate	6.5-9	7-9.5

### 10.7.2 Mix Design – Process Testing and Endorsement – Hold Point

Make trial batches to determine the final blend of water, additive and cement to be used for the best results.

**Hold point** - At least 14 days before commencing work, forward the details of the mix design, and copies of test reports to the Superintendent.

Testing is to be carried out in a NATA accredited laboratory and at is to be carried out at no cost to the Principal. Once the mix design is endorsed by the Superintendent it becomes the specified job mix.

Tests required are:

- Wet stripping test; ISSA TB 114 (minimum 90% coating) to assess the system's coating compatibility with the aggregate source.
- Wet track abrasion test; by AGPT/T272, SST 04 (maximum 800g/m<sup>2</sup> loss). If the wet track abrasion re-test value exceeds 800g/m<sup>2</sup>, halt production until the mix design is corrected and endorsed by the Superintendent.

### 10.7.3 Departures from the Job Mix – Table

The following table provides the maximum mean departures from the job mix for any day's work.

Table - Maximum Mean Departures From The Job Mix		
	Sieve Size In mm	% By Mass
Aggregate	6.7	7
	4.75	7
	2.36	5
	1.18	5
	0.60	4
	0.30	4
	0.15	3
	0.075	2
Bitumen Content		+ 1.0 - 0.5

If the mix gradings and binder content depart from the job mix by more than any of the maxima shown in the table, halt production until the mix is corrected.

## 10.8 PREPARATION AND SET OUT

### 10.8.1 Sweeping Pavement – Hold Point

Immediately prior to any application of slurry surfacing mix, sweep the pavement as necessary to ensure that the surface is free of loose material, stones, dirt, dust and foreign matter by the use of a mechanically operated rotary road broom, unless otherwise authorised by the Superintendent. Carry out additional sweeping necessary to obtain a satisfactory clean surface by hand using stiff brass or similar brooms.

**PREVIOUSLY SEALED AREAS;** Prior to the application of slurry surfacing mix adjoining previously sealed areas, sweep the edges of the previously sealed areas to remove loose material for at least 150mm from the edge.

**FOREIGN MATERIAL;** Remove adherent patches of foreign material from the surface of the road by steel scraper or other suitable methods. Do not remove any large deposits of foreign material that cannot be removed by reasonable use of the mechanical broom, steel scrapers or other suitable methods. Report the existence of any such deposits to the Superintendent prior to the commencement of spreading.

**Hold point** - Do not commence spreading of the slurry surfacing mix until the prepared pavement has been endorsed by the Superintendent.

**SET OUT;** Unless following a satisfactory edge line or centre line place pavement marks on the surface at intervals of not more than 8 metres for the slurry surfacing machine to follow, while mixing and spreading.

## 10.9 APPLICATION

Do not apply slurry surfacing if it is raining or if rain is expected.

Deposit the slurry surfacing mix at the optimum consistency into the spreading box and add nothing more to it. Ensure that the mixing time is sufficient to produce a complete and uniform coating of the aggregate and direct the mixture into the moving spreader box at a sufficient rate to maintain an ample supply across the full width of the strike-off squeegee at all times.

**SLURRY BUILD UP;** If required, squirt minor amounts of water into the corners of the spreader box to overcome temporary build up of slurry surfacing mixture. This has no detrimental effect on the performance of the slurry.

**END OF RUN;** Square off the end of each run at the point where feathering commenced ( ie. that point where there is insufficient material in the spreader box to maintain the full width of spread). Alternatively, the successive run may be lapped, but by no more than 100mm, if it can be demonstrated that no loss of riding surface or fattiness will result.

**INACCESSIBLE AREAS;** Use suitable hand squeegees to spread the mix in areas inaccessible to the machine.

**JOINTS;** Make longitudinal joints coincide with lane or centreline markings. Provide suitable width spreading equipment to produce a minimum number of longitudinal joints throughout the work. Half passes and odd width passes may be used where necessary for shape correction but must not be used as the last pass of any paved area. Do not allow excessive build up or unsightly appearance on longitudinal or traverse joints.

**KERBS AND SHOULDERS;** Take care to ensure straight lines along kerbs and shoulders and do not allow run off on those areas.

**TEMPERATURE;** If the pavement temperature exceeds 40°C., immediately prior to the application of the slurry surfacing mix thoroughly wet the surface of the pavement and all crack faces with water. Ensure that all surfaces are uniformly damp and no free water is present on the surface or in the cracks when the slurry surfacing mix is applied.

**DAMAGED WORK;** Replace slurry surfacing damaged by rain after spreading.

### **10.10 CONFORMANCE TESTING**

**MATERIALS TESTING;** Sampling of the mixed material will be requested randomly by the Superintendent during each day's production.

The sample material will be tested by the Principal's NATA accredited testing laboratory contractor using accredited NATA technicians and test results will be provided to the Contractor.

**EXCESS AGGREGATE LOSS;** Should the Superintendent identify excess aggregate loss from the surface after the slurry has fully cured, and the mix proportions are within the specified limits, suspend work until tests are taken and the problems rectified.

**Wet stripping test;** ISSA TB 114 (minimum 90% coating) to assess the system's coating compatibility with the aggregate source.

**Wet track abrasion test;** by AGPT/T272, SST 04 (maximum 800g/m<sup>2</sup> loss). If the wet track abrasion re-test value exceeds 800g/m<sup>2</sup>, halt production until the mix design is corrected and endorsed by the Superintendent.

### **10.11 SURPLUS, WASTE AND DEFECTIVE MATERIALS**

Remove from the work prior to its application to the road any bitumen emulsion which has deteriorated or become contaminated in any way. Bear the cost of replacing any such emulsion for use in the works.

**SURPLUS MATERIALS;**

Remove surplus materials in stockpiles and elsewhere from the job at the completion of the work.

**WASTE;**

Dispose of waste aggregate, bitumen emulsion, empty containers or other materials remaining

after completion of the work in an acceptable manner, at a legal waste disposal site, and leave the work site in a neat and tidy condition.

### **10.12 MAINTENANCE**

Maintain the completed work in a satisfactory condition for a period of one month after completion of the whole of the work. Maintenance is limited to work which results from failures attributable to the operations of the Contractor.

### **10.13 RECORDS – WITNESS POINT**

Record the particulars of the slurry surfacing work, as required by the Superintendent, on the Department's standard "Daily Record Sheet – Spray Surfacing". Record the details of aggregate, added filler, emulsion and additive used together with the length and width of run immediately each run is completed.

**Witness point** - Forward a copy of the slurry surfacing Daily Record Sheet to the Superintendent daily.

### **10.14 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 11 MISCELLANEOUS CONCRETE WORKS

### 11.1 STANDARDS AND PUBLICATIONS

Conform to the following Standards and Publication unless specified otherwise:

AS 1012(set) Methods of testing concrete

AS 1141(set) Methods for sampling and testing aggregates

AS 1289(set) Methods of testing soils for engineering purposes

AS 1379 The specification and manufacture of concrete

AS 1478.1 Chemical admixtures for concrete, mortar and grout – Admixtures for concrete

AS/NZS 2350.0 Methods of sampling portland and blended cements – General introduction and list of methods

AS/NZS 2350.1 Methods of sampling portland, blended and masonry cements - Sampling

AS 2758.1 Aggregates and rock for engineering purposes - Concrete aggregates

AS 2876 Concrete kerbs and channels (gutters) - Manually or machine placed

AS 3600 Concrete structures

AS 3610.1 Formwork for concrete - Specifications

AS 3972 General purpose and blended cements

AS/NZS 4671 Steel reinforcing materials

NTMTM NT Materials Testing Manual accessible via

<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>

NTTM NT Test Methods

### 11.2 GENERAL

This section specifies miscellaneous minor concrete works and does not apply to buildings, pavements, or bridges.

### 11.3 MATERIALS

Provide manufacturer's test certificates for quality of cement, aggregate and reinforcement.

#### 11.3.1 Cement

Type GP or GB to AS 3972.

Store cement in watertight containers or shelters until used.

Do not mix or store special cement with normal Portland cement.

#### 11.3.2 Fine Aggregate

Clean, hard, tough, durable, uncoated grains, homogeneous in quality, free from clay, dirt and organic material.

#### 11.3.3 Coarse Aggregate

Clean, hard, durable, crushed stone or gravel, free from clay, dirt and organic material.

#### 11.3.4 Water

Clean and free from oil, alkali, organic or other deleterious substances.

#### 11.3.5 Chemical Admixtures - Hold Point

**Hold Point** - Do not use admixtures without obtaining prior written approval from the Superintendent.

Admixtures and their use must conform to AS 1478.1.

Where two or more chemical admixtures are proposed for incorporation into a concrete mix, their compatibility must be certified by the manufacturers.

Store admixtures in accordance with the manufacturer's recommendations.

### 11.3.6 Reinforcement – Hold Point

Standard: To AS/NZS 4671

Supply, cut, bend and fix steel reinforcement as specified.

Secure reinforcement and bar supports to prevent displacement during construction and concrete placement.

**Hold Point** - Do not place concrete until the reinforcement has been inspected by the Superintendent.

### 11.3.7 Recycled Crushed Glass (RCG)

Clean, hard, durable RCG free from clay, dirt and organic material. Source the material from glass food and beverage containers, drinking glasses, and window (or flat) glass and plain ceramic. Do not use glass from hazardous waste containers, reinforced and laminated glass, light bulbs, fluorescent tubes and cathode ray tubes. The source glass must be free of debris and contaminants such as paper and cardboard, plastic, fabrics, residues from original contents and toxins.

Use RCG conforming to Specifications for Recycled Crushed Glass as an Engineering Material Section 9 available via

[http://tu cows.nt.gov.au/infrastructure/techspecs/documents/ARRB\\_specifications\\_RCG.pdf](http://tu cows.nt.gov.au/infrastructure/techspecs/documents/ARRB_specifications_RCG.pdf)

## 11.4 CONCRETE

Refer to CONFORMANCE TESTING for sampling frequencies for fresh concrete.

### 11.4.1 Ready-mix Concrete

Unless otherwise specified, Production Assessment in accordance with AS 3600 shall be used.

Register the project with the concrete supplier for submittal of Production Assessment data and nominate the Superintendent for receipt of this information.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Supply concrete with the following properties unless specified otherwise:

<b>Table – Concrete properties</b>	
<b>Property</b>	<b>Required measure</b>
Compressive strength	N25
Aggregate size, generally	20 mm
Aggregate size, machine extruded kerbs and gutters	10 mm
Slump, generally	80 mm, + or - 15 mm
Slump, machine extruded kerbs and gutters	40 mm

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Conduct slump testing on site for each and every truck.

### 11.4.2 Job-mixed Concrete

Use Project Assessment in accordance with AS 3600.

The Contractor will be responsible for sampling and testing.

Provide Project Assessment reports that encompass the period of concrete works.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Provide concrete with properties as specified for ready-mix concrete.  
 Determine the quantities of materials to be used by mass or by equivalent dry loose volume.  
 Provide and maintain gauges for measurement of the materials.

**11.4.3 Addition of Admixtures**

Refer to the **Chemical Admixtures** clause in this worksection.  
 Chemical admixtures may only be added subsequent to slump test compliance confirmation. A further slump test post admixture addition may also be required.  
 Where Superintendent approval has been granted for the addition of superplasticisers at the plant prior to dispatch of concrete, a slump test of each batch must be performed and recorded by a NATA accredited testing laboratory prior to the addition of the superplasticiser. The slump test report shall record the time of the addition of the superplasticiser, amount of superplasticiser added and product identification.  
 Do not add chemical admixtures unless the exact amount required is measured using a regularly maintained and calibrated device of the required accuracy.  
 Make allowance for the reversion time of superplasticisers. Delay the addition of superplasticisers as long as practicable before the concrete is discharged from the mixer.  
 Agitate concrete for at least 5 minutes following the addition of superplasticiser before dispensing.

**11.5 FOUNDATIONS**

Provide a foundation compacted to 90% relative density within 150 mm of the base of concrete.

**11.6 CONSTRUCTION**

**11.6.1 Kerbs and Gutters**

Construct kerbs and gutters as integral units.

**11.6.2 Formwork – Witness Point**

Design and construct forms so that they are mortar tight and can be removed without damaging the concrete.  
 Build forms true to line and braced in a substantial and non-yielding manner.  
**Witness Point** - Do not place concrete until the formwork has been inspected by the Superintendent.

**11.6.3 Placing of Concrete – Witness Point – Hold Point**

**Witness Point** - Give the Superintendent sufficient notice so that inspection may be made before and during pouring concrete.  
**Hold Point** - Provide verification that all constituent materials, formwork, falsework, reinforcement, and environmental conditions comply with all requirements. Do not cast any concrete without that verification.  
 Do not place concrete if the temperature of the concrete exceeds 35°Celsius, or if the ambient air temperature exceeds 40°C.

Place and compact concrete within the following time after the addition of the mixing water to the mix:

<b>Table - Maximum Time To Place Concrete After Mixing</b>	
<b>Concrete Temperature At Time Of Placing</b>	<b>Maximum Time (minutes)</b>
25°C to 28°C	75
28°C to 32°C	60
32°C to 35°C	45

Place concrete in a continuous operation between construction joints so that the face of the concrete is in a plastic state when succeeding concrete is placed against it.

Do not allow concrete to free-fall from a height greater than 1.5 metres.

Place all concrete in dry weather unless otherwise approved.

For each truck of premixed concrete provide an identification certificate on delivery listing the information required by AS 1379 and any other particular requirements for special class concrete.

#### 11.6.4 Jointing

##### CONSTRUCTION JOINTS

Roughen and clean face of hardened concrete before placing fresh concrete against it. Remove soft material, foreign matter and laitance. Thoroughly moisten the joint surface.

##### EXPANSION/CONTRACTION JOINTS

Joints to be 10 mm wide over full length and filled with a bitumen impregnated fibrous filler.

Provide vertical transverse expansion/contraction joints as follows:

- Footpaths: 6 m spacing maximum.
- At junctions with other concrete structures
- Inverts: 15 m spacing maximum.
- All other works: As shown on the drawings.

##### TOOLED JOINTS

Provide tooled joints as follows:

- Transverse vertical grooves 20 mm depth minimum.
- Joints at right angles to outer edge of concrete works.
- Footpaths: 2 m spacing maximum.
- Kerbs/Inverts: 3 m spacing maximum.
- All other works: As shown on the drawings.

#### 11.6.5 Surface Finishes

Finish surfaces to a smooth and even colour.

Remove free surface water during final screeding of unformed surfaces.

Round off exposed edges and corners.

Protect exposed surfaces from rain until final set has occurred.

Smooth tumbled RCG used as an exposed aggregate surface finish.

Conform to the **Table - Concrete Finishes**.

<b>Table – Concrete Finishes – Part 1 of 2</b>		
<b>Type</b>	<b>Description</b>	<b>Application</b>
S1	Left rough to give key but not honeycombed or porous	Surfaces to be rendered.
S2	Wood float	As specified.
S3	Steel trowel without polish	Internal surfaces subject to foot traffic. Kerb and gutter.
S4	Wood float and broomed finish - broom finish - broom across direction of traffic	Surfaces subject to vehicular traffic.
S6	Steel float followed by moist hair broom	Surfaces subject to foot traffic.

<b>Table – Concrete Finishes – Part 2 of 2</b>		
<b>Type</b>	<b>Type</b>	<b>Type</b>
F1	Remove mortar fins, etc., repair minor blow holes by bagging where approved or rub down with Carborundum stone	Formed surfaces exposed to view.
F2	Off forms	-
F3	Exposed RCG	Application of RCG to be hand spread once application of the exposed mix has been bull floated. RCG to be measured 1000 grams per square meter, or as otherwise specified by the Superintendent. Colour and size of RCG to be specified by Superintendent.

### **11.6.6 Curing**

Protect and cure all exposed surfaces immediately after the concrete has taken its initial set. Maintain all surfaces, including those within loosened formwork, in a moist condition by:

- Flooding, or
- continuous spraying with water, or
- other methods approved by the Superintendent.

Prevent staining during the curing process of all concrete surfaces that will be visible in the completed works.

Continuously maintain the protection and curing of each element for the minimum time specified by AS 3600 to provide the concrete with durability corresponding to the specified exposure classification.

Do not use curing compounds in lieu of moist curing unless approved.

### **11.6.7 Backfilling**

Backfill areas around the concrete with specified material.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Compact the backfilling in layers not exceeding 150 mm compacted thickness.

Reinstate damaged grassed areas with topsoil and grass seed.

## **11.7 RAIN DAMAGE**

Remove and replace rain damaged concrete.

## **11.8 EXISTING SERVICES – HOLD POINT**

**Hold point** - Obtain the Superintendent's approval before altering the line or level of existing services.

Place an expansion joint between concrete works and service.

## 11.9 CONFORMANCE

Refer to the DRAINAGE WORKS Section for culvert structures and pits.

Conform to the following:

<b>Table – Tolerances for Miscellaneous Concrete Works</b>	
<b>Aspect measured</b>	<b>Tolerance</b>
Finished level	+ or -15 mm from the specified level
Invert level	+ or -5 mm from the specified level
Straight edge deviation of surface	3 mm maximum in 3 m
	6 mm maximum in 15 m
Alignment	+ or -10 mm from the specified alignment
Chainage at vehicle crossing	+ or -150 mm
Width of vehicle crossing	+ or -25 mm

## 11.10 DEFECTIVE CONCRETE AND MATERIALS

Concrete which is not placed, cured or finished as specified, does not have the specified strength or other specified properties, is not sound, dense, durable or crack-free will be considered defective.

Bear all cost and delays resulting from the rejection of concrete and subsequent rectification.

Remove the concrete to a point agreed with the Superintendent at which a visually and structurally acceptable construction joint can be made, and the defective element rebuilt.

Repair defective surface finishes if approved by the Superintendent. Approval will not be given if the defective area is too extensive or the techniques proposed are not adequate to ensure a visually acceptable and durable repair.

## 11.11 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 12 DRAINAGE WORKS

### 12.1 STANDARDS AND PUBLICATIONS

Conform to the following Standards and Publications unless specified otherwise:

- AS 1012(set) Methods of testing concrete.
- AS 1141(set) Methods for sampling and testing aggregates.
- AS 1289(set) Methods of testing soil for engineering purposes.
- AS 1348 Road and traffic engineering – Glossary of terms
- AS 1379 Specification and supply of concrete.
- AS 1478.1 Chemical admixtures for concrete, mortar and grout – Admixtures for concrete.
- AS 1597(set) Precast reinforced concrete box culverts.
  - AS 1597.1 Small culverts (not exceeding 1200 mm span and 1200 mm height)
  - AS 1597.2 Large culverts (exceeding 1200 mm span or 1200 mm height and up to and including 4200 mm span and 4200 mm height)
- AS/NZS 2350.0 Methods of testing portland and blended cements - General introduction and list of methods
- AS/NZS 2350.1 Methods of testing portland, blended and masonry cements - Sampling
- AS 2439.1 Perforated plastics drainage and effluent pipe and fittings - Perforated drainage pipe and associated fittings.
- AS 2758.1 Aggregates and rock for engineering purposes - Concrete aggregates.
- AS 3600 Concrete structures.
- AS 3610.1 Formwork for concrete - Specifications.
- AS 3706(set) Geotextiles - Methods of test.
- AS/NZS 3725 Design for installation of buried concrete pipes.
- AS 3972 General purpose and blended cements.
- AS/NZS 4058 Precast concrete pipes (pressure and non-pressure).
- AS/NZS 4671 Steel reinforcing materials
- AS 5100.5 Bridge Design - Concrete

NTMTM NT Materials Testing Manual accessible via  
<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>

NTTM NT Test Methods

#### AUSTROADS

AGBT (set) Guide to Bridge Technology.

#### ARRB

Specifications for Recycled Crushed Glass as an Engineering Material

#### WORK SAFE AUSTRALIA

Excavation Work Code of Practice

## 12.2 DEFINITIONS

**CULVERT:** An underground pipe, box or arch constructed in an embankment or trench.

Typically located in a trench, embankment or road formation in a transverse crossing or in a longitudinal drainage line.

**CULVERT SKEW ANGLE:** The angle between a line drawn perpendicular or radial to the road centre line and the centre line of the culvert.

**CULVERT CHAINAGE:** The chainage measured along the road centre line at its intersection with the culvert centre line.

**LARGE BOX CULVERTS:** Precast box culverts and link slabs having spans greater than 1200 mm, heights greater than 1200 mm or fill heights exceeding 1600 mm.

**RECYCLED CRUSHED GLASS (RCG):**

RCG conforming to Specifications for Recycled Crushed Glass as an Engineering Material Section 9. A copy is available via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/technical-specifications>

**SHALL:** Is indicative of a mandatory requirement unless the context clearly indicates otherwise.

**TOM(S):** Devices used to hold pipe culverts in place during backfilling of trenches.

Also;

Horizontal device(s), such as timbers, metal struts, hydraulic spreaders, etc, spanning across an excavation for holding soldiers (vertical timbers) or walings (horizontal timbers) in place against the sides of trenches before and during trench backfilling.

**UNSUITABLE MATERIAL:** Any material that does not conform to the properties specified for the replacement materials to be used. If properties of the replacement materials to be used are not specified, then UNSUITABLE MATERIALS are materials which do not conform to the properties specified for standard fill.

## 12.3 GENERAL

This section applies to the construction of precast concrete pipe culverts not exceeding 1950 mm nominal diameter, precast concrete box culverts and other drainage items.

## 12.4 CLEARING

Clear the site as specified in the CLEARING, GRUBBING AND REHABILITATION Section.

## 12.5 MATERIALS

Conformance testing will be the responsibility of the Contractor.

Ensure that all pipes and box culverts are indelibly marked with a Standards Australia conformance stamp.

Pipes and box culverts not stamped shall be removed from site at the Contractor's expense.

### 12.5.1 Precast Reinforced Concrete Pipes

Pipes to be flush joint type with external rubber bands.

Pipes to be clearly marked as to their class.

### 12.5.2 Rubber Ring Joint Pipes

Pipes to be clearly marked as to their class.

### 12.5.3 Precast Reinforced Concrete Box Culverts – Hold Point – Witness Point

Use box culverts of the inverted U type suitable for installation on a cast-in-situ concrete slab. Design and supply box culverts which have a span not greater than 1200 mm, height not more than 1200 mm and a fill height not more than 1600 mm in accordance with AS 1597.1.

Design all other box culverts in accordance with AS 1597.2.

Use Standard Vehicle Loadings including NT Standard Road Train, with addition of the HLP 400 Abnormal Vehicle Loading on all National Highways, and HLP 320 on all other routes. Provide culverts designed for the Exposure Classification appropriate to the site of the works. To AS 5100.5 Exposure Classifications table. Refer to NT CLIMATE ZONES TABLE.

**Hold point** - Provide drawings showing complete reinforcement and dimensions with tolerances and obtain the Superintendent's approval prior to fabricating any units. Provide manufacturer's certification that the provided culverts comply with the applicable sections of AS 5100.5 and with AS 1597. Certify that the design is reflected accurately by the shop drawings and that the design is adequate to resist all specified loads and the soil loads pertaining to the site.

Provide a table of construction axle loads versus minimum required cover for each box culvert size.

**Witness point** - Give the Superintendent notice prior to casting concrete.

### 12.5.4 Bedding

Bedding material to be one of the following:

- A clean granular material free from sticks, stones and other deleterious material with a Plasticity Index less than 6, conforming to the **Table - Material Size**, or
- RCG conforming to Specifications for Recycled Crushed Glass as an Engineering Material Section 9, or
- Mix blend of RCG conforming to Specifications for Recycled Crushed Glass as an Engineering Material Section 9, and clean granular material free from sticks, stones and other deleterious material with a Plasticity Index less than 6, conforming to the **Table - Material Size**.

Table - Material Size	
AS Sieve (mm)	Percentage Passing By Dry Mass
19.0	100
2.36	50 – 100
0.60	20 – 90
0.30	10 – 60
0.15	0 – 25
0.075	0 – 10

### 12.5.5 Concrete

Conform to the requirements of the MISCELLANEOUS CONCRETE WORKS Section.

### 12.5.6 Mortar

Use one part fresh cement and three parts clean sharp sand mixed with potable water to yield a stiff but workable mixture.

### 12.5.7 Select Fill

Conform to the requirements of the EARTHWORKS Section.

## 12.6 CONSTRUCTION OF CULVERTS AND STRUCTURES

### 12.6.1 Setting Out – Hold Point

Measure culvert length along the invert to the outside face of headwalls.

Measure pits and/or manholes to the inside face of the wall.

Finished surface levels for kerbside structures are measured at the top of the kerb.

Set out the culvert and/or structure with pegs before construction.

**Hold Point** - Obtain the Superintendent's approval for the setting out before construction.

### 12.6.2 Excavation – Witness point

Excavate in whatever material is encountered.

Use of explosives shall be in accordance with the MISCELLANEOUS PROVISIONS Section.

Pump, bail, sheet, shore and brace as necessary.

Divert water when necessary.

Rectify foundations which are affected by rain or surface water entering the excavation.

The total width of trench at and below the level of the top of the culvert shall be in accordance with the Department's civil standard drawings or the project drawings.

Backfill with select fill up to the specified level if the trench is excavated too deep. Any such backfilling shall be at the Contractor's expense.

**Witness point** - Excavate unsuitable material below specified level if directed by the Superintendent. Replace with select fill, compacted as specified.

### 12.6.3 Bedding

Place bedding 75 mm compacted thickness for the full width of the trench or 0.6 m greater than the width of the culvert for non-trench conditions.

Compact bedding to 90% relative compaction.

Shape the bedding to hold pipes in position during compaction of additional fill.

Place and compact a further (haunching) layer of bedding in accordance with the Department's civil standard drawings or the project drawings, and AS/NZS 3725.

### 12.6.4 Culverts in Fill under Construction

Refer to EARTHWORKS, **Earthworks in Fill** clause, **Construction Methods** sub-clause, Compacted Layer Method paragraph.

Place and compact fill to Manufacturer's instructions and design specifications. Use select fill.

Conform to Compacted Layer Method in EARTHWORKS.

Excavate the fill in accordance with the **Excavation** sub-clause in this clause to permit the construction of the culvert.

### 12.6.5 Construction Loading on Culverts

Provide the minimum compacted thickness of cover specified in the **Table - Minimum Required Cover Thickness (Metres)** before allowing traffic to cross a culvert.

Do not permit construction vehicles having axle loads greater than 10 tonnes to cross large box culverts, having spans greater than 1200 mm, or heights greater than 1200 mm, under any depth of fill unless specific certification is provided by the culvert crown unit manufacturer that the culverts have been designed to cope with those loads.

Table – Minimum Required Cover Thickness (Metres)							
Maximum Construction Vehicle Axle Load (Tonne)	Type, Size And Class Of Culvert						
	Concrete Pipes, By Pipe Class						Boxes
	Less Than 1200 mm Nominal Diameter			1200 mm Nominal Diameter Or More			Less Than 1200 mm Span, 1200 Height And 1600 Final Fill Height
	Concrete Pipe Class (AS/NZS 4058)						
X(2)	Y(3)	Z(4)	X(2)	Y(3)	Z(4)		
9	0.4	0.4	0.4	0.4	0.4	0.4	0.1
20	0.8	0.6	0.4	0.5	0.4	0.4	0.6
35	1.3	0.8	0.6	1.3	0.4	0.4	0.9
50	1.0	0.8	--	1.0	0.4	--	1.2

Concrete pipe classes to AS/NZS 4058 **Table - Test loads for load classes 2 to 10 (circumferentially reinforced concrete pipes)**. Class2 (X), Class3 (Y), Class4 (Z)

### 12.6.6 Laying Generally

Lay culverts commencing from the downstream end.

End caps, when used, shall provide a tight waterproof seal.

### 12.6.7 Laying Pipe Culverts

Face rebates or sockets upstream.

Rest the full length of the pipe barrel on the bedding.

Position pipes so that the 'TOP' markings on the pipes are visible on the tops of the pipes and the pipes are orientated so that the markings are within 5 degrees of the vertical axis.

Fill all joints with stiff mortar firmly rammed into openings. Remove excess mortar from barrel of culvert. Apply external rubber bands.

Brace pipes of 1200 mm diameter and greater with toms until the completion of the embankment and pavement. The toms shall bear against a sill along the invert and a cap against the crown of the pipe. Provide toms opposite every pipe joint.

Cast collars and blocks in one operation. Restrain the culvert prior to constructing the collars or blocks by partially backfilling with bedding around the barrel of the culvert to one-half of the pipe diameter.

### 12.6.8 Laying Box Culverts

Lay precast box culverts on a cast-in-situ reinforced concrete base slab.

Ensure concrete base slab exceeds external width of box culverts as shown on the typical details.

Butt box culverts firmly together.

Cut away lifting hooks and seal over the affected area with an approved epoxy resin.

Fill all joints with a stiff mortar firmly rammed into the openings. Remove excess mortar from the barrel of the culvert and apply external joint seals to all joints, Densopol HT60 or equivalent, 150 mm wide.

### 12.6.9 Connection to Existing Systems - Witness Point

Repair all cut openings and make watertight.

Demolish existing headwalls to make way for the extension of the culvert.

Clean out new work and existing work affected by the new work.

**Witness Point** - Advise the Superintendent within 2 days when cleaning out is completed.

### **12.6.10 Backfill – Witness Point – Hold Point**

**Witness point** - Notify the Superintendent before backfilling where holes or fissures occur in rock trenches.

**Hold point** - Do not place backfill against any in-situ concrete structure until the concrete has attained 80% characteristic strength and approval has been given.

Place backfill in layers not exceeding 150 mm compacted thickness.

Ensure the maximum difference in height of backfill on each side of a culvert is 300 mm.

Backfill around the culvert for the full width of the trench, and for a minimum 300 mm above the top of the culvert, or to subgrade surface if less, with select fill.

Backfill the remainder of the trench with standard fill.

Stabilise all backfill with 2% cement by mass and compact to 95% relative compaction where the trench or embankment is located, or will be located, beneath a road pavement.

Produce a uniform mix. Complete compaction within one hour of adding mixing water.

Use compaction equipment which will not damage the culvert and in-situ structures.

Carry out conformance testing using the Department's Panel Period Contractors for Testing.

Stabilise top 150 mm of backfill, for a distance of 1 m adjacent to culvert headwalls and wing walls, so as to be erosion resistant.

Remove surplus material from the site.

Reinstate to subgrade level trenches cut through pavements and other construction by backfilling the trench with stabilised select fill compacted to 95% relative compaction.

Construct base/sub-base layers of the pavement in accordance with the PAVEMENTS AND SHOULDERS Section.

Reinstate surface.

Reinstate trenches cut outside of pavements and other construction by backfilling with standard fill compacted to 90% relative compaction.

## **12.7 INLET AND OUTLET STRUCTURES, PITS, HEADWALLS, AND OTHER STRUCTURES**

Construct in accordance with the specifications.

Compact foundations to 95% relative compaction to a depth of 150 mm minimum.

Replace unsuitable material as specified in the **Excavation** sub-clause, in the **Construction of Culverts and Structures** clause in this work section.

## **12.8 INLET AND OUTLET CHANNELS - WITNESS POINT**

Excavate the inlet and outlet of all culverts to facilitate the flow of water.

Conform to the following:

Bed width: Minimum 150 mm greater than overall width of culvert.

Side batters: 45 degrees maximum to horizontal.

Bed grade: 0.5% in the direction of flow for a minimum distance of 50 metres.

Clean out new work and existing work affected by the new work.

**Witness Point** - Advise the Superintendent within 2 days when cleaning out is completed.

## **12.9 OPEN UNLINED DRAINS**

Excavate and dispose of all excess material as specified in the EARTHWORKS Section.

Trim drains to form neat levees.

Compact levees to 95% relative compaction.

Allow natural surface runoff.

## **12.10 REMOVAL OF EXISTING CULVERTS AND DRAINAGE STRUCTURES**

Demolish and remove from the site, as specified, existing culverts and drainage structures.

## **12.11 SUBSOIL DRAINS**

### **12.11.1 Excavation**

Excavate to the depths indicated on the applicable Civil Standard Drawings and/or the project drawings.

Line the trench with geotextile fabric. Refer to PROTECTION WORKS.

Place a bedding layer of 50 mm of filter material in the trench and compact with a vibrating plate or similar.

### **12.11.2 Filter Material**

Shall be a hard durable stone having a Los Angeles Abrasion Loss not greater than 35%.

For Type B subsoil drains, backfill material is to consist of a single sized aggregate of 20mm particle size, with a maximum of 5% passing the AS 0.15mm sieve.

### **12.11.3 Geotextile Fabric**

Conform to the requirements of **Geotextile Fabrics** clause in PROTECTION WORKS.

### **12.11.4 Subsoil Drain Pipe**

Use 100 mm diameter Class 400.

Use compatible couplings and fittings.

Connect solid wall pipe to the subsoil drain pipe for the disposal of collected water.

### **12.11.5 Laying and Backfilling – Hold Point**

Fit the pipelines with inspection openings, flushing points, and appropriate caps, supported in concrete collars suitable for Class D loading.

**Hold point** - Obtain Superintendent's approval of the pipe installation before backfilling.

Place filter material around the barrel of the pipe and to a height of 200 mm above the pipe.

Compact with a vibrating plate compactor or similar.

Place and compact remaining layers of the filter in layers not exceeding 300 mm.

Prevent contamination of the filter.

Place and compact basecourse gravel, as specified in the PAVEMENTS AND SHOULDERS Section in the top 300 mm of trench.

Place the material in two equal layers compacted to 95% relative compaction.

Where trench excavated through pavement compact upper layer of basecourse gravel to 100% relative compaction and reinstate surface.

Backfill above solid wall pipes as specified in the **Backfill** sub-clause, in the **Construction of Culverts and Structures** clause in this work section.

### **12.11.6 End Walls - Witness Point**

Construct end walls at the outlet of subsoil drains as specified.

Secure 19 mm galvanised wire mesh over the opening.

Mark end walls with guide posts.

Clean out new work and existing work affected by the new work.

**Witness Point** - Advise the Superintendent within 2 days of when cleaning out is completed.

## 12.12 CONFORMANCE

Conform to *Table - Drainage Works Tolerances*.

<b>Table - Drainage Works Tolerances</b>	
<b>Property/dimension</b>	<b>Tolerance</b>
Invert level and grade line	No ponding of water.
Open unlined drains	+ or - 50 mm.
Culverts or lined drains	+ or - 20 mm
Plan position	+ or - 200 mm.
Culverts parallel to kerbs	+ or - 50 mm.
Concrete structure dimension	+ or - 5 mm.
Concrete thickness:	Not less than specified.
Subsoil drain slope	25 mm maximum sag in 8 m.

## 12.13 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 13 PROTECTION WORKS

### 13.1 STANDARDS AND PUBLICATIONS

Conform to the following Standards and Publication unless specified otherwise:

AS 1012(set) Methods of Testing Concrete.

AS 1141(set) Methods of Sampling and Testing Aggregates.

AS 1141.25.1 - Degradation factor – Source rock (Washington Degradation Test).

AS 1141.26 - Secondary minerals content in basic igneous rocks

AS 1141.29 - Accelerated soundness index by reflux - Basic igneous rocks

AS 1289 Methods of Testing Soils for Engineering Purposes.

AS 1725(set) Chain link fabric fencing.

AS 2001.2.3.2 Methods of test for textiles - Physical tests - Determination of maximum force using the grab method (ISO 13934-2:1999, MOD)

AS 2423 Coated steel wire fencing products for terrestrial, aquatic and general use.

AS 2758.1 Aggregates and rock for engineering purposes - Concrete aggregates.

AS 3706(set) Geotextiles - Methods of Test.

AS 3972 General purpose and blended cements.

AS 4133(set) Methods of Testing Rocks for Engineering Purposes.

AS/NZS 4671 Steel Reinforcing Materials

AS /NZS 4680 Hot Dip Galvanized (Zinc) on Coatings Fabricated Ferrous Articles.

NTMTM NT Materials Testing Manual accessible via  
<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>

NTTM NT Test Methods

### 13.2 FOUNDATIONS

Excavate, fill and trim the site to the required shape prior to commencing the protection works.

Compact the top 150 mm of earthworks, on which protection works are to be laid to 90% maximum dry density ratio (modified).

### 13.3 GEOTEXTILE FABRICS

#### 13.3.1 General

Supply and lay non-woven polypropylene or polyester geotextile fabric, consisting of long chain synthetic polymers composed of at least 95% by mass of polyolefins or polyesters. The geotextile filaments must be rot-proof, chemically stable and must have low water absorbency. Filaments must resist delamination and maintain their dimensional stability in the geotextile.

Non-woven geotextiles must have filaments bonded by needle punching, heat or chemical bonding processes.

Woven geotextiles must have filaments interlaced in two sets, mutually at right angles. One set must be parallel to the longitudinal direction of the geotextile.

Geotextiles must be free of any flaws which may have an adverse effect on the physical and mechanical properties of the geotextile.

Geotextiles must be stabilised against ultra-violet radiation such that, when tested in accordance with AS 3706.11, must have a retained strength of at least 50% after 500 hours of exposure.

### 13.3.2 Storage, Packaging and Handling

Geotextiles must be stored under protective cover or wrapped with a waterproof, opaque UV protective sheeting to avoid damage prior to installation.

Geotextiles must not be stored directly on the ground or in any manner in which they may be affected adversely by heat, water or soil. The method of storage must be in accordance with recommendations by the manufacturer.

The protected geotextile rolls must be clearly labelled showing manufacturer, type of geotextile, and batch identification number.

Handle rolls with forklifts or similar, using dedicated slings, free of sharp hooks or tongs. Rolls that are dropped, dragged or pushed around on the ground will be rejected.

### 13.3.3 Delivery and Product Certification

Geotextile must be delivered to site at least 5 days prior to commencement of installation.

Provide a Certificate of Compliance that the geotextile complies with all the requirements as specified, together with test results reported on NATA endorsed test documents. The certificate must not be more than 12 months old.

The Certificate of Compliance to include: quality control documentation for the relevant batch/lots, physical properties sheet, and manufacturer's letter of certification stating compliance.

### 13.3.4 Construction

Prepare smooth surfaces for placement of the geotextile, free of sharp objects, large rocks and protruding vegetation.

Place geotextiles just ahead of the advancing face of construction work, with a maximum of 48 hours of placement prior to covering.

Repair punctures and tears.

Where used in trenches or other drainage configurations, place the geotextile to the shape of the prepared surface, folding and overlapping where required. Fully envelope drainage materials in trenches.

Unless specified elsewhere in the contract, the overlap must be minimum 300 mm. Overlap to be minimum 500 mm where large ground deformations are expected. Sewing may be permitted provided the seam strength exceeds the parent material grab strength.

Direct travel of machinery over geotextile not permitted.

Where required, conform to the following initial layer of material thicknesses:

<b>Table - Minimum Initial Layer Thickness (mm)</b>	
<b>Nominal Maximum Particle Size <math>D_{85}</math> of Initial Fill Layer (mm)</b>	<b>Minimum Initial Layer Thickness (mm)</b>
< 150	300
150 - 300	400
300 - 500	500

Rock armour placed directly on geotextiles must be placed with a drop height of less than 1.5 m, and placed in such a manner so as not to damage, puncture or tear the geotextile.

Obtain Superintendent approval for use of vibratory compaction methods on the initial layer.

### 13.3.5 Geotextile Grades

Unless specified elsewhere in the contract, use: non-woven, Strength Grade C.

All strength grades, where specified, based on a Characteristic Values (Q), to conform to the **Table - Geotextile Strength Grade Properties**.

<b>Geotextile Strength Grade</b>	<b>Elongation <sup>(1)</sup></b>	<b>Grab Strength <sup>(2)</sup> (N) <sup>(3)</sup></b>	<b>Tear <sup>(2)</sup> (N) <sup>(3)</sup></b>	<b>G Rating <sup>(2)</sup></b>
A	>30%	500	180	900
	<30%	800	300	1350
B	>30%	700	250	1350
	<30%	1100	400	2000
C	>30%	900	350	2000
	<30%	1400	500	3000
D	>30%	1200	450	3000
	<30%	1900	700	4500
E	>30%	1600	650	4500

Notes:

(1) % Elongation corresponding to max CBR burst strength as per AS 3706.4. Generally <30% for wovens, >30% for non-wovens.

(2) Property value is 80<sup>th</sup> percentile characteristic value (mean strength – 0.83 x standard deviation), as per relevant AS test.

(3) N = Newtons

Filtration properties relevant to each grade to be certified as part of **Delivery and Product Certification** sub-clause requirements.

### 13.3.6 Conformance Testing

Where project requirement is less than 15,000 m<sup>2</sup>, sampling and testing is not required.

Provide samples to independent, NATA accredited testing laboratory when project exceeds 15,000 m<sup>2</sup>, to the following test frequencies:

<b>Description</b>	<b>Units</b>	<b>Test Method</b>	<b>Test Frequency</b>
Tensile Strength	kN/m	AS 3706.2	1 per 15,000 m <sup>2</sup>
Tear Strength	N	AS 3706.3	1 per 15,000 m <sup>2</sup>
CBR Burst Strength	N	AS 3706.4	1 per 15,000 m <sup>2</sup>
Grade Tensile Strength	N	AS 2001.2.3.2	1 per 15,000 m <sup>2</sup>
Flow Rate	l/m <sup>2</sup> /s	AS 3706.9	1 per 90,000 m <sup>2</sup>

Samples to be 15 m<sup>2</sup> in size, cut across full width of the roll, not within 2 m of the end of a roll.

## 13.4 ROCK PROPERTIES

The rock properties specified in this clause apply to the rock, stone, aggregate and boulders specified in the following clauses in this section;

- Stone Pitching
- Dumped Rock
- Quarter Tonne Dumped Rock
- Rubble
- Gabion Rock
- Reno Mattresses

REQUIREMENTS; Clean, dry, durable crushed stone of uniform quality, free from weeds, vegetable matter and other deleterious materials.

Particles must have at least 2 crushed faces and comply with the following standards;

AS 1141.25.1 Degradation factor – Source rock (Washington Degradation Test). Basic igneous

rocks, eg. Basalt aggregates, shall have a minimum value of 50.

AS 1141.26 Secondary minerals content in basic igneous rocks, eg. Basalt aggregates, shall not exceed 25%.

AS 1141.29 Accelerated soundness index by reflux. Basic igneous rocks, eg. Basalt aggregates, shall have a minimum value of 94.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 13.5 STONE PITCHING

### 13.5.1 Stone Pitching

The stone used is to be spalls of hard durable rock complying with the **Rock Properties** clause and with dimensions not less than 150 mm and not larger than 200 mm.

Hand place the stones so that they are firmly bedded interlocked.

Place the stones so that the exposed faces of the stones are between 50 mm and 100 mm above the finished surface being protected. The depth of the stone pitching is to be as shown on the drawings. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### 13.5.2 Grouted Stone Pitching – Hold Point

Place stones as specified in the **Stone Pitching** sub-clause.

**Hold point** - Obtain Superintendent's approval before grouting.

Grout stone pitching with waterproof, high strength cement mortar.

Cement mortar to consist of one part cement to three parts of clean sand mixed with potable water to form a workable mixture.

Work the mortar into the gaps between the stones of the stone pitching to bind the stones..

Work from the lower end of the slope of the pitching up the slope.

Cure the mortar for at least 48 hours.

Remove defective mortar and regrout any loose stones.

Provide 75 mm diameter uPVC pipe sections to form weep holes penetrating the full thickness of the stone pitching and grout, at the rate of one weep hole every 5 square metres of stone pitching.

## 13.6 DUMPED ROCK PROTECTION

Large spalls or boulders complying with the **Rock Properties** clause and having a least dimension as specified. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Dump into the specified area.

Protect adjacent areas from damage due to dumping.

The average plane of the exposed rock face to be within 100 mm of the specified position.

## 13.7 QUARTER TONNE CLASS DUMPED ROCK PROTECTION

Large spalls or boulders complying with the **Rock Properties** clause and having the following grading.

Table – Rock - Size and grading	
Rock Size (weight)	Minimum % Larger Than Specified Size
35kg	90
250kg	50
500kg	0

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Dump into the specified area.

Protect adjacent areas from damage due to dumping.

The average plane of the exposed rock face to be within 100 mm of the specified position.

## 13.8 RUBBLE

Broken rock complying with the **Rock Properties** clause.

Maximum size of rubble to be 200 mm.

At least 30% by mass to have a nominal size of 100 mm or greater.

No more than 20% by mass to pass the 2.36 mm sieve.

Dump rubble without segregation onto the prepared area.

Compact rubble to a tight finish.

The average plane of the exposed face to be within 100 mm of that specified.

The exposed face to be within 100 mm of the average plane.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 13.9 GABIONS

### 13.9.1 General

A flexible, hexagonal woven steel wire mesh box, filled with packed stone, complying with the **Rock Properties** clause and securely laced with steel wire.

### 13.9.2 Steel Wire Mesh for Gabions

Use galvanized steel wire, Grade W15Z380 to AS 2423.

Zinc coating; 250 g/sq.m Galvanization to be carried out prior to weaving of the mesh.

Minimum tensile strength of wire: 380 MPa

Mesh openings to be 80 mm x 100 mm maximum, hexagonal in shape with flexible joints consisting of not less than two full turns.

All wire to be coated with average thickness of 0.55 mm extruded grey PVC firmly attached to the wire. The minimum thickness of coating to be 0.40 mm in accordance with AS 2423.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Conform to the following wire sizes and galvanizing weights:

<b>Wire Type</b>	<b>Minimum Diameter(mm)</b>
Body wire	2.7
Binding and lacing wire	2.2
Selvedge wire	3.4

Selvedge wire shall be woven integrally along all edges of the mesh, in accordance with the manufacturer's instructions, and such that the mesh shall not unravel.

The steel wire mesh shall be sized so that it can be folded into regular boxes, complete with diaphragms, having dimensions specified. Diaphragms to be at 1,000 mm spacings. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### 13.9.3 Construction of Gabions

Assemble and erect in accordance with the manufacturer's instructions.

Pretension the wire framework against a firm anchor or adjacent units.

Retain the shape of the wire framework with spreaders.

Fill with hard durable stone, complying with the **Rock Properties** clause and placed in stages to achieve the tightest packing of stone.

Maximum stone dimension: 250 mm.

Minimum stone dimension: 100 mm.

Overfill the framework by 20 mm to 50 mm to allow for subsequent movement of the stone.

Perform lacing operations using specified lacing wire. Wire to pass round the edges being joined using alternative single and double loops through each mesh in turn. Tightness of the mesh and wiring is essential.

Ensure a tightly packed, neat and uniform construction.

## 13.10 RENO MATTRESSES

### 13.10.1 General

A flexible, hexagonal woven steel wire mesh box, filled with packed stone, complying with the **Rock Properties** clause and securely laced with steel wire.

### 13.10.2 Steel Wire Mesh for Reno Mattresses

Use galvanized steel wire, Grade W15Z380 to AS 2423.

Zinc coating; 250 g/sq.m Galvanization to be carried out prior to the weaving of the mesh.

Minimum tensile strength of wire: 380 MPa.

Mesh openings to be 60 mm x 80 mm maximum, hexagonal in shape with flexible joints consisting of not less than two full turns.

All wire to be coated with average thickness of 0.55 mm extruded grey PVC firmly attached to the wire. The minimum thickness of coating to be 0.40 mm in accordance with AS 2423.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Conform to the following wire sizes and galvanizing weights:

<b>Table – Wire properties – Reno mattresses</b>	
<b>Wire Type</b>	<b>Minimum Diameter (mm)</b>
Body wire	2.0
Binding and lacing wire	2.2
Selvedge wire	2.4

Selvedge wire to be woven integrally along all edges of the mesh, in accordance with the manufacturer's instructions.

Cut to shape where necessary.

### MATTRESS PANELS

Bottom panel: Includes both sides and both end panels.

Top panel: Shall have the same dimension as the bottom, without the sides and ends, and be supplied separately.

Diaphragms: Extend over the full width of the mattress from top to bottom at maximum intervals of 1 m.

### 13.10.3 Construction of Reno Mattresses

Assemble and erect in accordance with the manufacturer's instructions.

Align diaphragms perpendicular to the direction of flow unless otherwise specified.

Pretension the wire framework against a firm anchor or adjacent units.

Retain the shape of the wire framework with spreaders.

Fill with hard durable stone complying with the **Rock Properties** clause and placed in stages to achieve the tightest packing of stone.

Maximum stone dimension:

- 120 mm when mattress depth 170 mm.
- 150 mm when mattress depth 230 mm.
- 200 mm when mattress depth 300 mm or greater.

Minimum least stone dimension: 80 mm.

Overfill the framework by 20 mm to 50 mm to allow for subsequent movement of the stone.

Perform lacing operations using specified lacing wire. Wire to pass round the edges being joined using alternative single and double loops through each mesh in turn. Tightness of the mesh and wiring is essential.

Last panel on downstream side, or at base of slope, shall be a whole unit (i.e. not cut).

Ensure a tightly packed, neat and uniform construction.

## 13.11 REVETMENT MATTRESSES

### 13.11.1 General

A nylon fabric material filled with mortar with filter points for the relief of hydrostatic uplift pressure.

Conform to the manufacturer's instructions.

### 13.11.2 Materials

Mortar mix proportions:

<b>Table – Mortar Mix Proportions – Revetment Mattresses</b>			
<b>Cement Type GP or GB</b>	<b>Fine Sand</b>	<b>Coarse Sand</b>	<b>Water</b>
1 (500 kg)	1.2 (600 kg)	2.2 (1,100 kg)	450 l/m <sup>3</sup>

Adjust fine sand/coarse sand proportions if required to provide workable mix.

### 13.11.3 Construction of Revetment Mattresses

Toe-in to provide cut-off walls minimum 300 mm deep and width not less than maximum thickness of mattress.

Lay, cut and stitch mattress on prepared surface. Make allowance for take up of fabric resulting from filling mattress with mortar.

All stitching and seams to be neat in appearance and strength to withstand filling pressure.

Ensure mattress is anchored prior to mortar pumping to prevent creep during placement of mortar.

Provide openings in fabric at a maximum of one every 50 m<sup>2</sup> for placement of mortar. Opening to match size of pumping hose.

Make good openings on completion of mortar pumping.

All areas of mattress to be hard filled with mortar with smooth surface.

Do not permit any loading on the mattress until one hour after mortar pumping has been completed.

Remove spilt mortar from surface of mattress by hand only. Do not use water to wash spilt mortar.

Make good any defective areas.

### **13.12 EMBANKMENT PROTECTION - CONCRETE**

Construct embankment protection from concrete reinforced with a single layer of centrally located SL62 mesh. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Overlap the mesh by 200 mm at joints.

Make construction joints in the vertical plane, at 2 m maximum spacing.

Continue reinforcement mesh across construction joints.

Construct the embankment protection and the margins as an integral unit. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Construct the toe of the embankment protection and the adjacent protection work as an integral unit. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Drainage holes to be 75 mm diameter penetrating the full thickness of the protection works. Install the drainage holes at 3 m intervals just above the toe.

Install additional rows of drainage holes parallel to the first, and at 3 m intervals and spacings, where the scope of work requires it.

The exposed surface to be within 50 mm of the specified position.

### **13.13 MARGINS**

Construct margins with reinforced concrete. Conforming to the requirements of the MISCELLANEOUS CONCRETE WORKS Section.

Make construction joints at 3 m maximum spacing.

Form the top 75 mm of the vertical face nearer the pavement, and any exposed outer face, true to line and level.

Wood float and broom finish the upper surface of the margin. Finish flush with the top of the pavement.

Overlap the bituminous seal on the margins by not less than 100 mm. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

#### **TOLERANCES**

Width: Not less than specified.

Level: + or - 10 mm of top of adjacent pavement.

### **13.14 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## **14 ROAD FURNITURE AND TRAFFIC CONTROL DEVICES**

### **14.1 CROSS REFERENCE**

PAVEMENT MARKING for Audio Tactile Pavement Marking.

### **14.2 STANDARDS AND PUBLICATIONS**

Conform to the following Standards and Publications unless specified otherwise:

- AS 1012(set) Methods of testing concrete
- AS 1074 Steel tubes and tubulars for ordinary services
- AS 1111(set) ISO metric hexagon commercial bolts and screws
- AS/NZS 1112(set) ISO metric hexagon nuts, Including thin nuts, slotted nuts and castle nuts
- AS/NZS 1252(set) High strength steel bolts with associated nuts and washers for structural engineering
- AS 1273 Unplasticised PVC (UPVC) downpipe and fittings for rainwater
- AS 1397 Continuous hot-dip metallic coated steel sheet and strip - Coatings of zinc and zinc alloyed with aluminium and magnesium
- AS 1428.4.1 Design for access and mobility – Means to assist the orientation of people with vision impairment - Tactile ground surface indicators
- AS/NZS 1554(set) Structural steel welding
- AS/NZS 1594 Hot rolled steel flat products
- AS 1604.1 Specification for preservative treatment – Sawn and round timber
- AS 1722 Pipe threads of Whitworth form – Fastening pipe threads
- AS 1725(set) Chain link fabric fencing
- AS/NZS 1734 Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate
- AS 1742(set) Manual of uniform traffic control devices
- AS 1743 Road signs - Specifications
- AS 1744 Standard alphabets for road signs
- AS/NZS 1906(set) Retroreflective materials and devices for road traffic control purposes
- AS/NZS 1906.1 Retroreflective sheeting
- AS/NZS 1906.2 Retroreflective devices (non pavement application)
- AS 2423 Coated steel wire fencing products for terrestrial, aquatic and general use
- AS 2700 Colour standards for general purposes
- AS 2759 Steel wire rope – Use, operation and maintenance
- AS/NZS 3750.9 Paints for steel structures - Organic zinc rich primer.
- AS/NZS 3845.1 Road safety barrier systems and devices - Road safety barrier systems
- AS/NZS 4680 Hot dip galvanized (zinc) coatings on fabricated ferrous articles
- AS 4687 Temporary fencing and hoardings
- EN 1317 Road restraint systems
- NCHRP 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features
  
- APAS 1441/1 Permanent graffiti barrier, clear, exterior
- APAS 1442/1 Temporary graffiti barrier, clear, exterior
- APAS 1443 Graffiti Remover

APAS 2916 Organic zinc rich coating for protection of steel

Department of Infrastructure, Planning and Logistics accepted road safety barriers at <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/road-safety-barriers>

NTMTM NT Materials Testing Manual accessible via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>

NTTM NT Test Methods

## 14.3 DEFINITIONS

CS: Civil Standard drawing. Use the most recent version.

GRAFFITI: The name for images or lettering scratched, scrawled, painted or marked in any manner on property.

LONGITUDINAL LINES: Any line which runs parallel to the road centre line, e.g. broken line, edge line, separation line, barrier line.

OTHER MARKINGS: All diagonal lines, chevron markings and messages on the pavement, including symbols, words, numerals, arrows, and kerb markings.

TACTILE GROUND SURFACE INDICATOR (TGSi) A device, or a number of devices, installed on a surface in a pedestrian path of travel, designed to provide pedestrians who are blind or vision-impaired with warning or directional orientation information.

TRAFFIC CONTROL DEVICE: Any sign, signal, pavement marking or other installation placed or erected for the purpose of regulating, warning, guiding or providing for the safety of road users. It does not include temporary warning devices and control measures erected only for the construction period.

TRANSVERSE MARKINGS: Any line which is at right angles to the centre line of the road, e.g. stop line, hold line, pedestrian cross walk

## 14.4 TACTILE GROUND SURFACE INDICATORS – WITNESS POINT

Devices used must conform to AS 1428.4.1.

Use precast concrete units.

**Witness Point** – Provide a 5 year warranty for the materials used, and for the devices installed as tactile ground surface indicators. Provide a 5 year warranty for the workmanship for the installation of the tactile ground surface indicators. Both warranties to be in the name of the Principal.

## 14.5 FENCING

### 14.5.1 General

Clearing fence lines includes the removal of trees, shrubs, vegetable matter and debris. Grub out all roots that interfere with the placement of posts.

Erect fences so that the line of the tops of the posts is uniform.

Adjust the position of posts to compensate for the irregularities of the ground.

Provide gates where specified and across existing access tracks or roads.

### 14.5.2 Existing Fences

Install a post at the intersection of new fence with existing fence and fix the wiring of both fences to that post.

Complete the necessary sections of new fencing before removing or opening a boundary or

internal fence. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Obtain owner's agreement to proposed removal.

Notify the occupier in writing of the date the fence will be removed.

Erect gates or grids at fence openings as specified.

#### **14.5.3 Materials**

Barbed wire: 1.57 mm diameter minimum, high tensile.

Plain wire: 2.50 mm diameter minimum, high tensile.

Wire mesh: Galvanized 3.15 mm diameter x 50 mm chain mesh.

#### **14.5.4 Stock Fence**

Stock fencing to consist of tubular steel strainer assemblies with star pickets and galvanized wire. Construct as specified on Civil Standard Drawing CS 3310.

Include the crossing of gullies, watercourses and hollows on the ground.

#### **14.5.5 Security Fence**

Security fencing to consist of tubular steel posts complete with post caps, cable straining wires, chainwire mesh and three barbed wires. Construct as specified on Civil Standard Drawing CS 3308.

#### **14.5.6 Temporary Site Safety Fence**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Materials, construction, and installation to AS 4687.

Erect the fence in accordance with manufacturer's and/or supplier's specifications. Ensure installation methods are consistent with possible local weather events.

This sub-clause is not applicable to temporary road safety barriers for works. Refer to PROVISION FOR TRAFFIC, **NT Specific Directions for Road Work Signs** clause, **Road Safety Barriers** sub-clause, for temporary road safety barriers.

#### **14.5.7 Pedestrian Fence**

To civil standard drawing CS 3307.

Refer to AS 1742.10, **Pedestrian Fencing** clause.

#### **14.5.8 Log Barrier Fence**

Refer to Recycled Plastic Bollards sub-clause.

Provide log barrier fencing consisting of close spaced vertical bollards.

Use recycled plastic bollards or Stringybark, Woollybutt or Pine timber, pressure impregnated with ACQ preservative formulation, copper oxide (CuO) and quaternary ammonium compound (DDAC) to Category H4 of AS 1604.

Do not use preservative treatments that contain arsenic or chromium.

#### **14.5.9 Vehicle Movement Barriers/Fences**

As per Civil Standard Drawing CS 3305.

Supply stock & half stock length pipe barriers.

Erect fences as ordered, so that the line of the tops of the posts is uniform.

Make allowance for excavation and concreting of anchor/footings.

Adjust the position of posts to compensate for the irregularities of the ground.

Minor clearing fence lines may include the removal of trees, shrubs, vegetable matter and debris. Grub out all roots that interfere with the placement of posts.

#### **14.5.10 Cyclist Holding Rails**

Supply and erect new cyclist holding rails and delineators as per Civil Standard Drawings numbered CS 3302 and CS 3305,

Or

Remove damaged rail and replace with new rail as per drawing.

Make allowance for excavation and concreting of anchor/footings.

Make allowance for minor clearing of fence lines

#### **14.5.11 Recycled Plastic Bollards**

Supply round pre-moulded recycled plastic bollards, 1.5 m length x 150 mm dia with built in colours and UV stabilised, resistant to termites, microorganisms and moisture.

Install and ensure security of recycled plastic bollards as per manufacturer's recommendations.

Make allowance for excavation and concreting of anchor/footings.

Make allowance for minor clearing of fence lines.

#### **14.5.12 Culvert Crossing Fences**

Supply and erect Culvert Crossing Fences and delineators as per drawing.

Make allowance for Hot Dip galvanising and masonry chemical anchorage to headwalls.

Make allowance for excavation and concreting of anchor/footings. Refer to Civil Standard Drawing CS 3306.

Make allowance for minor clearing of fence lines.

Or

Remove damaged Culvert Crossing Fences and replace with new fences as per drawing.

Make allowance for excavation, removal and rehabilitation of anchor/footings.

### **14.6 FLEXIBLE GUIDE POSTS**

#### **14.6.1 General**

For the purposes of these Flexible Guide Posts clauses the following definitions apply:

- **Delineator:** Small retroreflectors or panels of retroreflective sheeting attached to guide posts to provide a coherent pattern of delineation of carriageway edges as an aid to night driving.
- **Flexible guide post:** A guide post that when impacted by a vehicle, deflects and returns to the vertical position without maintenance intervention.

Guide posts shall be constructed so that they do not constitute a hazard if struck by a vehicle.

Guide posts shall be constructed of plastic, rubber, or similar proprietary product capable of recovering from an impact by returning to, or returning to within a margin of 5 degrees, of their original vertical state, post impact, without maintenance intervention, for the life of the guide post.

#### **14.6.2 Product data – Witness Point**

**Witness Point** - Submit details of the proposed flexible guide post including the following:

- Manufacturer's details on the materials, and the properties of the materials, used in the manufacture of the guide posts.
- Manufacturer's recommended installation procedures.
- Technical specifications.
- Test results per the test sub-clauses

### **14.6.3 Warranties – Witness Point**

**Witness Point** – Submit the manufacturer’s published product warranties in the name of the Principal.

### **14.6.4 Samples – Hold Point**

**Hold Point** - Provide a sample flexible guide post from each batch purchased for this contract for inspection and approval before installing any posts.

### **14.6.5 Materials**

Flexible guide posts shall be composed of material which is:

- Heat resistant.
- Fire retardant.
- Capable of retaining 85% of its colour, appearance and physical properties for at least five years when exposed to weather conditions existing in the Northern Territory.
- Resistant to mould growth, and mildew.
- Not be affected by hydrocarbon solvents.
- Corrosion resistant or treated to resist corrosion.
- Resistant to ultraviolet light.
- Termite resistant.

#### **14.6.5.1 Surface finish**

Durable gloss or semi-gloss opaque white which is smooth and easy to clean. Free of sharp edges and burrs and discolouration or other defects that may affect its appearance and/or serviceability.

#### **14.6.5.2 Colour**

Whiter than Y35 Off White of AS 2700.

#### **14.6.5.3 Dimensions**

Minimum width: 100 ± 5 mm.

Minimum thickness: 4 mm.

Minimum height above ground surface: 1000 ± 100 mm.

#### **14.6.5.4 Markings**

Traceability: Mark each post legibly and indelibly with the following:

- Name of the manufacturer
- Name of the supplier (optional)
- Month and year of manufacture
- Batch number
- Product code or model/type identifier (to differentiate the supplied product from other similar products of different type or model)
- End of warranty date

Letter size: 5 to 10 mm high.

Marking of ground level: Mark 1000 mm from the top of the post.

#### **14.6.5.5 Anchorage**

Resistance to impact: Resistant to overturning, twisting and displacement from wind and impact forces when installed in the ground to manufacturer’s recommendations.

Resistance to removal: Installation must be resistant to vertical removal by persons other than authorised personnel using approved removal tools.

#### 14.6.5.6 Delineators

##### Rectangular retroreflectors

Class 1A retroreflective material to AS/NZS 1906.1.

Size to be 200 mm x 50 mm for red delineators, white delineators, and for yellow delineators. Area minimum 100 cm<sup>2</sup> (10,000 mm<sup>2</sup>).

##### Discrete device type retroreflectors

Maximum projected face area for delineator devices to be 100 cm<sup>2</sup> (10,000 mm<sup>2</sup>). Minimum length of shortest projected dimension to be 60 mm.

Not to be used except to denote special hazards. Refer to drawings. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT.

##### Installation of delineators

Fix the delineators to the flexible guide post so that they are weatherproof and vandal resistant and so that they can be replaced if necessary without damaging the guide post.

Centrally locate delineators between the edges of the guide post and 50 mm from the top of the guide post.

The red delineator to be attached to the convex side of curved or shaped flexible guide posts where applicable.

On a two way single carriageway, attach one red delineator to the face of the road edge flexible guide post on the left hand side of the carriageway and one white delineator to the face of the road edge flexible guide post on the right hand side of carriageway. Note that these road edge flexible guide posts will have delineators on both sides.

On a single direction, single carriageway, attach red delineators to the face of the road edge flexible guide posts on the left hand side of the carriageway and yellow delineator to the face of the road edge flexible guide post on the right hand side of carriageway facing the traffic. Note that these road edge flexible guide posts will have delineators on one side only.

Attach any required discrete device type retroreflectors to manufacturer's recommendations. Refer to drawings. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT.

#### 14.6.6 Installation of guide posts

Installation of the guide posts is to be to AS 1742.2.

Installation of the guide posts is to be to CS 3500.

Installation of the guide posts is to be to the manufacturer's written installation guide or manual.

Curved or shaped guide posts installed on the left hand side of traffic lanes must be installed with the convex surface facing the traffic.

#### 14.6.7 Tests – Hold Point

All testing specified in this clause shall be undertaken by a NATA accredited laboratory. The vehicle impact testing can be undertaken by a non NATA accredited laboratory.

Testing and associated reports must not be more than three years old as of the date of tenders.

This requirement is to take in to account that manufacturing processes and materials used during manufacture may change. The tests must be done on posts which are proposed to be provided under the contract. Guide posts of each type or model from each batch must be tested.

Test reports must verify that the tested samples have been marked as required by the **Markings** sub-clause. The reports must include photos of the markings, which must be clearly legible in the reports. At least one photo of the markings of each type or model of guide post from each different batch must be included in the reports.

**Hold Point** - Submit test results to the Superintendent in respect to the following characteristics before ordering the guide posts:

- Heat resistance.
- Cold resistance.
- Rigidity
- Vehicle impact.

#### **14.6.7.1 Heat resistance testing**

Heating: Condition posts at  $60 \pm 2^\circ\text{C}$  for 2 hours in an oven.

Test procedure: Conform to the following:

- After conditioning, remove the post from the oven and clamp the base so that the post is vertical and protruding 1000 mm from the post top.
- Bend the conditioned post adjacent to the clamp in the direction of the adjacent traffic flow to form a  $90^\circ$  angle.
- Subject the post to 3 cycles of bending through  $180^\circ$  within 2 minutes of its removal from the oven so that the post is bent in a right angle. Release the post after the third cycle.
- Record the physical condition and horizontal deflection at the top of the post from a vertical line 30 seconds after release from the bent position. The deflection must not exceed 50 mm.

#### **14.6.7.2 Cold resistance testing**

Cooling: Condition post at  $0 \pm 2^\circ\text{C}$  for 2 hours in an ice bath.

Test procedures: Conform to the following:

- After conditioning, remove post from the ice bath and clamp in a vertical position with the top of the post protruding 1000 mm.
- Bend the conditioned post adjacent to the clamp in the direction of the adjacent traffic flow to form a  $90^\circ$  angle within 30 seconds of its removal from the ice bath.
- Release the post from the clamp 60 seconds after removing it from the ice bath and place in the ice bath for an additional 60 seconds.
- Repeat the bending and ice bath procedure a further three times and release post from the bent position and record the horizontal deflection at the top of the post from a vertical line 60 seconds after release. The deflection must not exceed 50 mm.
- Return the post to ice bath for 60 seconds minimum.
- Remove the post from ice bath and place in a horizontal position, securely clamped so that the minimum clear length between supports is 1000 mm.
- Drop a 1 kg steel ball for a distance of 1500 mm vertically through a low friction guide so that it impacts the centre face of the post displayed towards the traffic.
- Recondition post in ice bath for 60 seconds.

Repeat ball dropping and reconditioning procedures. After the fifth ball drop, record the condition of the post. The flexible guide post must show no signs of fractures, cracks or splits.

#### **14.6.7.3 Rigidity testing**

Testing conditions: Conduct tests under the following conditions:

- Temperature: At  $35^\circ\text{C} \pm 2^\circ\text{C}$ .
- Clamps: Shape jaws of clamps to suit post profile so that the post cannot rotate in the clamp.
- Test procedures: Conform to the following:
- Securely clamp post to a bench in a horizontal position with the top of post unsupported and protruding 1000 mm.
- Bend the post adjacent to the clamp in the direction of adjacent traffic flow to  $90^\circ$  and straighten. Repeat this procedure 10 times with maximum 3 minute intervals between procedures.
- Apply a 0.9 kg mass to a point 50 mm from the top of the post, in the direction of adjacent traffic flow. Record the vertical deflection of post top from its original position. The deflection must not exceed 130 mm

- Remove the mass and record the final deflection. The top of the flexible guide post must return unassisted to no more than 10 mm from its initial position within 10 minutes of the removal of the mass. Record the final deflection.

Alternative testing procedures: Conduct testing as for standard testing procedures. Instead of applying a mass, conduct testing in a wind tunnel with a wind speed of 12.5 m/s applied in the direction of the adjacent traffic flow with a maximum horizontal deflection at the top of 130 mm. After the wind is removed, the top of the flexible guide post must return unassisted to no more than 10 mm from the vertical position.

#### **14.6.7.4 Maximum rigidity of flexible guide posts**

Test procedures: Conform to the following:

- Securely clamp post to a bench in a horizontal position with the top of post unsupported and protruding 1000 mm.
- Apply a 10 kg mass to a point 50 mm from the top of the post, in the direction of adjacent traffic flow.
- Record the vertical deflection of post top from its original position. The deflection must exceed 500 mm.

#### **14.6.7.5 Vehicle impact testing**

Flexible guide post shall be capable of self-erecting and remaining serviceable after being subjected to a series of direct impacts by a typical passenger vehicle at temperatures between 15°C and 30°C.

Flexible guide posts to be tested shall be installed in accordance with manufacturer's recommendations, and shall be furnished complete with delineators.

The guide post shall be capable of withstanding a series of 10 bumper bar impacts at a speed of 60 km/h and five bumper bar impacts at a speed of 100 km/h directed at 90 degrees to the face of the guide post which has the red delineator attached to it.

The impacting vehicle shall suffer little or no damage during the impact tests. The guide post shall return to within five degrees of vertical within ½ hour of impact.

Test results which show the flexible guide posts are capable of withstanding the above vehicle impacts are to be provided to the Superintendent upon request. Test results to include video or photographic evidence. A minimum sample of three flexible guide posts must be tested.

## **14.7 ROAD SIGNS**

### **14.7.1 General**

This subsection specifies the manufacture, supply, delivery and erection of road signs.

### **14.7.2 Anti-spear fixings for hazard markers (sight boards)**

Anti-spear fixings and stiffener rails must be installed for hazard markers (D4-1-1A), and other signs at similar heights and with similar dimensions, which are installed parallel to the path of travel of traffic.

Hazard marker signs are to comprise two unidirectional D4-1-1A signs, mounted end to end.

The stiffener rails are to be aluminium extrusions, each made up of two equal length sections, spliced at the centre line. The aluminium extrusions are to be of alloy and temper as shown on the drawings.

Refer to Civil Standard Drawings CS-3516, CS-3517, and CS-3518, accessible via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/standard-drawings> .

**14.7.3 Materials – Hold Point****NON -REFLECTIVE MATERIALS**

In accordance with AS 1743.

**REFLECTIVE MATERIAL**

Use high intensity Class 1 standard in accordance with AS 1906.1 for all signs, including temporary signs, and hazard markers with the exception that all black legends are to be non-reflective.

**BLANKS**

Use aluminium marine grade alloy designation 5052 - H38. Thickness 1.6 mm.

Steel sheets may only be used for temporary signs.

**MANUFACTURE**

Chemically clean aluminium blanks before painting or bonding of reflective material.

Stamp the month and year of manufacture and the symbol DIPL on the backs of all signs.

**POSTS**

Post sizes to conform to the **Table - Roadside Signs - Mounting Selection** unless specified otherwise.

Road signs mounting pole sizes other than the sizes shown in the **Table - Roadside Signs - Mounting Selection** are shown in the **Table - Roadside Signs – Non Standard Mounting Poles Selection** in PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Posts to be medium grade galvanized pipe with plain ends and constructed from a single length of pipe. Cap each post with a galvanized cap. Do not use “Ingal” posts.

Standard; to AS 1074.

**ANTI-GRAFFITI COATING**

**Hold Point** – Obtain Superintendent’s approval for the use of anti-graffiti film or coating products. Apply anti-graffiti products only to the new road signs specified by the Superintendent.

Ensure anti-graffiti products used do not compromise or void any warranty on the road signs on which the anti-graffiti products are used.

<b>Table – Roadside Signs – Mounting Selection</b>					
<b>Sign Size W x D</b>	<b>No. and NB Gal. Pipe Posts</b>	<b>Sign Attachment Brackets (Or M8 Bolts) Per Post</b>	<b>Bracing</b>	<b>Footing</b>	
				<b>Depth (mm)</b>	<b>Dia. (mm)</b>
300 x 300	1 x 50	2	No	600	300
300 x 450	1 x 50	2	No	600	300
450 x 450	1 x 50	2	No	600	300
450 x 300	1 x 50	2	No	600	300
450 x 600	1 x 50	2	No	600	300
450 x 750	1 x 50	2	No	600	300
450 x 900	1 x 50	2	No	600	300
600 x 450	1 x 50	2	No	600	300
600 x 600	1 x 50	2	No	600	300
600 x 750	1 x 50	2	No	600	300
600 x 900	1 x 50	3	No	600	300
600 x 1050	1 x 50	3	No	600	300
750 x 450	1 x 50	2	No	600	300
750 x 600	1 x 50	2	No	600	300

<b>Table – Roadside Signs – Mounting Selection</b>					
<b>Sign Size W x D</b>	<b>No. and NB Gal. Pipe Posts</b>	<b>Sign Attachment Brackets (Or M8 Bolts) Per Post</b>	<b>Bracing</b>	<b>Footing</b>	
				<b>Depth (mm)</b>	<b>Dia. (mm)</b>
750 x 750	1 x 50	2	No	600	300
750 x 900	1 x 50	2	No	1500	300
750 x 1200	1 x 50	3	No	1000	300
900 x 300	1 x 50	2	Yes	600	300
900 x 600	1 x 50	2	Yes	600	300
900 x 900	1 x 50	3	Yes	600	300
900 x 1350	1 x 50	4	Yes	1000	300
1050 x 600	1 x 50	2	Yes	1000	300
1050 x 900	1 x 50	3	Yes	1000	300
1200 x 600	2 x 50	2	Yes	600	300
1500 x 800	2 x 50	2	Yes	1000	300
1800 x 600	2 x 50	2	Yes	1000	300
1800 x 1200	2 x 80	4	Yes	1000	300
2400 x 1200	2 x 80	4	Yes	1200	450
2400 x 1800	2 x 100	5	Yes	1200	450
3000 x 600	2 x 50	2	Yes	1000	300
3000 x 1200	2 x 80	4	Yes	1200	450
3000 x 1800	2 x 100	5	Yes	1500	450
3700 x 600	2 x 80	2	Yes	1000	300
3700 x 1200	3 x 80	4	Yes	1200	450
3700 x 1800	3 x 100	5	Yes	1500	450
3700 x 2400	4 x 100	7	Yes	1500	450
4300 x 600	2 x 80	2	Yes	1000	300
4300 x 1200	3 x 80	4	Yes	1200	450
4300 x 1800	3 x 100	5	Yes	1500	450
4900 x 600	3 x 80	2	Yes	1000	300
4900 x 1200	3 x 100	4	Yes	1200	450
4900 x 1800	3 x 100	5	Yes	1500	450
5500 x 600	3 x 80	2	Yes	1000	300
5500 x 1200	3 x 100	4	Yes	1200	450
5500 x 1800	4 x 100	5	Yes	1500	450
6100 x 600	3 x 80	2	Yes	1000	300
6100 x 1200	3 x 100	4	Yes	1200	450
6100 x 1800	4 x 100	5	Yes	1500	450

#### **14.7.4 Supply and Delivery**

Supply all brackets, bolts, nuts and bracings.

Fix bracings to the signs prior to delivery.

#### **14.7.5 Location**

Signs to be located clear of vegetation and be clearly visible under headlight illumination.

##### **LATERAL PLACEMENT**

Ensure signs are located to allow easy sighting, for ease of road maintenance, and in compliance with design requirements.

Lateral placement to be measured to the edge of the sign nearest the road.

Lateral placement to be as follows:

Unkerbed roads: 2 to 4 m clear from the edge of the traffic lane, and 600 mm minimum clear from the outer edge of the road shoulder.

Kerbed roads: 500 mm to 1000 mm from the front face of the kerb.

**HEIGHT**

Height to be measured as the clearance to the lowest edge of the lowest sign in an assembly.

Heights for signs to be as follows:

<b>Table – Heights for signs</b>	
<b>Unkerbed Roads</b>	
Fingerboard (G3) and street name signs (G5):	2 m above the near edge of the pavement.
Other signs:	1 m to 1.5 m above the near edge of the pavement.
<b>Kerbed Roads:</b>	
Signs overhanging a footway:	2.5 m minimum above footway.
Signs not overhanging a footway:	1 m to 1.5 m clearance except for those specific signs on medians and islands given below.

<b>Table – Height of specific signs on medians and islands</b>	
The following signs, when used on medians and islands, to have a clearance 150 mm above the kerb:	
D4-1-2 Hazard Marker	
D4-2-2 Hazard Marker	
D4-3 Hazard Marker	
R2-3 (Keep Left) (Keep Right)	
R2-5 (No U Turn)	
R2-6 (No Right Turn) (No Left Turn)	
R2-15 (U Turn Permitted).	

**14.7.6 Installation**

Conform to the **Table Roadside Signs - Mounting Selection** in **Materials** sub-clause in **Road Signs** clause in this work section.

Install posts vertically.

Provide and install a galvanised steel sleeve when installing sign posts in concreted or paved medians.

Sleeves, when specified, to be 50 mm longer than the specified ground anchor (footing) depth and extend 50 mm above the finished surface level.

Attach the post to the sleeve with a galvanized M10 bolt, 25 mm from the top of the sleeve. Encase the post, or sleeve when used, in a footing of 20 MPa concrete.

Orientation of sign face: Vertical, and turned 3 degrees to 5 degrees horizontally from oncoming traffic on straight sections. On curves, at right angles to centre line of road.

Exception: Parking signs to be oriented 5 degrees from parallel to the kerb to face oncoming traffic.

**14.7.7 Reinstatement and Relocation of Existing Signs**

Dismantle existing post and signs carefully.

Store in a manner to prevent damage.

Backfill the hole left by the post and its footing and compact the fill to the same density as the surrounding area.

Erect signs in new locations as shown on the drawings.

#### GENERAL REQUIREMENTS

- Spacing between posts:
  - 2 post signs - 0.6 times sign width.
  - 3 post signs - 0.4 times sign width.
  - 4 post signs - 0.3 times sign width.
- Brace spacing to be 380 mm maximum.
- Adopt the nearest size in the list for intermediate sizes.
- Post sizes for galvanized pipe posts are for sign clearance of less than 2 m above the pavement. For sign clearances greater than 2 m, increase the nominal diameter of the pipe size by a percentage equal to the percentage increase in height above 2 m.
- Where signs are erected in groups treat the overall dimensions of the group as one sign size to determine the post requirement from the **Table Roadside Signs - Mounting Selection** in **Materials** sub-clause in **Road Signs** clause in this work section.

### 14.8 FLOOD GAUGE POSTS

#### 14.8.1 Posts and Gauges

Use a standard flood gauge in accordance with Civil Standard Drawing CS 3501.

Use galvanized posts, single length 150 mm x 50 mm x 3 mm RHS with a 3 mm end cap welded to the top.

Paint welds with zinc rich organic paint to APAS specification 2916.

#### 14.8.2 Installation

Erect the post vertically at the outer edge of the road shoulder or margin, on the left hand side when viewed in the direction of travel.

Install a concrete anchor, of 20 MPa concrete, with a depth of 650 mm and a diameter of 300 mm.

Cast a suitable galvanized sleeve, 650 mm in length, in the anchor so that the sleeve extends 50 mm above the finished surface level.

Attach post to sleeve with a galvanized M10 bolt 25 mm from the top of the sleeve.

Secure gauge to post with No 10 galvanized Tek screws or 4 mm blind pop rivets at 300 mm centres staggered alternately each side.

Position gauge zero to comply with lowest spot on floodway along the centre line.

### 14.9 CATTLE GRIDS

Construct grids to the details shown on the Civil Standard Drawings CS 3310, CS 3313, CS 3314, and CS 3315.

Place the grid centre line on the centre line of the road pavement.

The grid grade and levels to conform to the grade and levels of the adjacent road pavement.

Place and compact select fill behind the abutments of the grid, up to the base of the pavement.

Reinstate pavement layers with base material.

Reinstate surface.

Tighten all hold down bolts as specified.

Paint the portion of guardrails above ground with one coat zinc phosphate primer and two coats of white alkyd paint.

Fix width markers with epoxy adhesive to each guardrail.

Construct strainer post assemblies as specified.

Fix the stock fence to the strainer assembly.

Supply and install a gate in the fencing adjacent to the grid as specified.

Refer to Civil Standard Drawings CS 3310 and CS 3312.

## **14.10 ROAD SAFETY BARRIERS - STEEL BEAM GUARDRAIL SYSTEM**

### **14.10.1 Materials**

Refer to Civil Standard Drawing CS 3200 and <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/road-safety-barriers> for the installation of accepted MASH tested products.

#### **RAILS**

Use accepted MASH tested steel beam rail to AS/NZS 3845.1 and per the Department's Safety Barrier Technical Conditions of Use, which are accessible via the link shown above, and the related Manufacturer's product manual.

#### **TERMINAL SECTIONS**

Use accepted MASH tested terminals as per the Department's Safety Barrier Technical Conditions of Use and the related Manufacturer's product manual.

#### **POSTS**

Use posts and block outs as detailed in the Manufacturer's product manual of accepted MASH tested safety barriers as per the Department's Safety Barrier Technical Conditions of Use.

#### **GALVANIZING**

All accepted MASH tested steel rail product components as per the Department's Safety Barrier Technical Conditions of Use and the related Manufacturer's product manual shall have been hot dip galvanized, after fabrication, to AS 4680.

Where the galvanising on guard rail or associated fittings has been damaged, the coating shall be repaired by regalvanising or by painting with a minimum of two coats of a zinc-rich inorganic paint in accordance with AS/NZS 3750.9 and one coat of aluminium paint.

Provide certificate(s) of compliance from the galvanizer that the galvanizing complies with AS 4680.

### **14.10.2 Compliance**

**Traceability of components** - To AS/NZS 3845 Part 1.

(a) All steel rails, posts and other critical components shall be permanently marked in lettering at least 10 mm high with the name of System Manufacturer, the date and month of manufacture the grade of steel and base metal thickness (BMT) to allow the product to be traced.

(b) Where plastic components make up a key element of the system, they shall be permanently marked clearly indicating the month and year of manufacture in a location that can be easily inspected.

(c) Bolts shall be marked in accordance with AS 1111.1 or AS/NZS 1252.

### **14.10.3 Installation**

Erect the rail in a manner that produces a smooth, continuous, taut rail closely conforming to the line and grade of the roadway.

Lap rails so that the exposed ends of the rails do not face oncoming traffic from the adjacent lane.

Attach retroreflective delineators to the guardrail in accordance with the manufacturer's specification.

Delineator heights to match heights of delineators on guide posts.

Delineator dimensions shown in **Flexible Guide Posts** clause, **Delineators** sub-clause in this work section.

#### **14.11 ROAD SAFETY BARRIERS – STEEL WIRE ROPE SYSTEM – HOLD POINT**

Materials and installation to AS/NZS 3845.1, to AS 2759, to the Department's Safety Barrier Technical Conditions of Use, and to the manufacturers' product manuals.

Use only accepted MASH tested steel wire safety systems

Hold Point – Obtain Superintendent's approval for any proposed Steel Wire Rope Road Safety Barrier System before ordering any components.

#### **14.12 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 15 PAVEMENT MARKING

### 15.1 STANDARDS AND PUBLICATIONS

Conform to the following Standards and Publications unless specified otherwise:

- AS/NZS 1580(set) Paints and related materials - Methods of test  
     AS/NZS 1580.205.4 - Application properties - Airless spraying
- AS 1742(set) Manual of uniform traffic control devices  
     AS 1742.3 - Traffic control for works on roads
- AS 1744 Standard alphabets for road signs
- AS 1906(set) Retroreflective materials and devices for road traffic control purposes  
     AS/NZS 1906.1 - Retroreflective sheeting  
     AS/NZS 1906.3 - Raised pavement markers (retroreflective and non-retroreflective)
- AS/NZS 2009 Glass beads for road marking materials
- AS/NZS 2310 Glossary of paint and painting terms
- AS/NZS 2433 Plastics - Method for exposure to ultraviolet lamps
- AS 2700(set) Colour standards for general purposes  
     AS 2700S(N14) - White  
     AS 2700S(N61) - Black  
     AS 2700S(Y14) - Golden yellow  
     AS 2700S(Y35) - Off-white
- AS 2890 Parking facilities  
     AS 2890.1 - Off-street car parking  
     AS 2890.2 - Off-street commercial vehicles facilities  
     AS 2890.3 - Bicycle parking  
     AS 2890.5 - On-street parking  
     AS 2890.6 - Off-street parking for people with disabilities
- AS 4049(set) Paints and related materials – Pavement marking materials  
     AS 4049.1 - Solvent-borne paint – For use with surface applied glass beads  
     AS 4049.2 - Thermoplastic road marking materials - For use with surface applied glass beads  
     AS/NZS 4049.3 - Waterborne paint - For use with surface applied glass beads  
     AS/NZS 4049.4 - High performance pavement marking systems.  
     AS 4049.5 - Performance assessment of pavement markings

#### APAS Specifications

- APAS AP-S0041/2 Pavement marking paint, solvent-borne
- APAS AP-S0041/3 Pavement marking paint, cold applied plastic
- APAS AP-S0041/4 Pavement marking paint, thermoplastic
- APAS AP-S0041/5 Pavement marking paint, water borne
- APAS AP-S0041/6 Airport runway markings
- APAS AP-S0042 Glass beads for pavement marking paint

## Test Methods

- NTTM 401.1 Operation of wet film thickness comb  
 NTTM 402.1 Field procedure for measurement of the rate of application of spherical glass beads  
 NTTM 405.1 Certification of pavement line marking apparatus

### 15.1.1 Civil Standard Drawings

- CS 3400 Line marking  
 CS 3401 Pavement markings – Chevrons and raised retroreflective pavement markers – Sheet 1  
 CS 3402 Pavement markings – Chevrons and raised retroreflective pavement markers – Sheet 2  
 CS 3403 Edge line with audio-tactile ribs

## 15.2 DEFINITIONS

- AADT: Annual Average Daily Traffic  
 ATLM: Audio Tactile Line Marking.  
 APAS: Australian Paint Approvals Scheme.  
 APPROVED: Approved by the Superintendent  
 CS and C(S): Civil Standard drawings. Use the most recent version. These are accessible via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/standard-drawings>  
 CSR: Contractor Service Report  
 GPS: Global Positioning System  
 LONGLIFE MATERIALS: Generally thermoplastic, cold applied plastic or pliant polymer materials, with lifespans between 2 to 5 times that of waterborne paint.  
 LONGITUDINAL LINES: Any line which runs parallel to the road centre line, e.g. broken line, edge line, separation line, barrier line.  
 NTMTM: NT Materials Testing Manual accessible via <https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>.  
 NTTM: NT Test Methods, found in NT Materials Testing Manual.  
 OTHER MARKINGS: All diagonal lines, chevron markings and messages on the pavement, including symbols, words, numerals, arrows and kerb markings.  
 PCCP: Painting Contractors Certification Program.  
 PRP: Permanent Reference Point  
 RETROREFLECTIVITY: The reflectivity provided by glass beads expressed as minicandela per lux per square metre (mcd/lux/m<sup>2</sup>) as measured by a reflectometer approved by the Superintendent.  
 RRPM: Raised retroreflective pavement marker.  
 RURAL: Rural areas are areas not defined as urban.  
 TRAFFIC CONTROL DEVICE: Any sign, signal, pavement marking or other installation placed or erected for the purpose of regulating, warning, guiding or providing for the safety of road users. It does not include temporary warning devices and control measures erected only for the construction period.  
 TRANSVERSE MARKINGS: Any line which is at right angles to the centre line of the road, e.g. stop line, hold line, pedestrian cross walk.  
 TYPE B-HR: Highly retroreflective spherical glass beads of Type B to AS/NZS 2009

TYPE D-HR: Highly retroreflective spherical glass beads of Type D to AS/NZS 2009  
URBAN: Urban area for Darwin region is nominated as – North of Cox Peninsula Road (Stuart Highway), West of Trippe Road (Arnhem Highway) and the end of seal on Gunn Point Road. Other urban areas are nominated as being within, and extending to, town boundaries.

### 15.3 SCOPE

This section specifies the materials, testing and standards of workmanship for marking of pavements.

Pavement Marking treatments include, but are not limited to:

- Supply of estimate of works to be undertaken (not for new works)
- Traffic control
- Set out of pavement markings to Australian and Northern Territory Standards
- Painting of Markings with waterborne, thermoplastic and cold applied paints
- Installation and removal of raised reflective pavement markers
- Removal and disposal of temporary pavement markers
- Removal and storage of temporary road signs after resealing works
- Coordination of works with resealing contractor (for new works only)
- Reporting of works performed
- Remarketing of aerodromes (if applicable)

### 15.4 CONTRACTOR ACCREDITATION

All pavement marking work shall be carried out by a contractor accredited to the “Painting Contractor Certification Program” (PCCP) in a class or category applicable to the work. The PCCP is administered by the CSIRO. Information regarding the PCCP can be obtained via <http://www.apas.gov.au/>.

The Superintendent may give an exemption for this clause at his discretion.

### 15.5 PAVEMENT MARKING PAINT – HOLD POINT

Use approved water based white pavement marking paint conforming to APAS AP-S0041/5 and suitable for application by spray equipment in accordance with Test Method AS/NZS 1580.205.4 to asphalt and bituminous seal road surfaces and for use with Type B HR and/or Type D HR drop-on spherical glass beads.

**Hold Point** - Submit Certificates of Compliance, issued by an accredited testing authority, stating that all paints being used comply with the relevant Australian Standards and/or APAS specifications.

Pavement marking paint colours:

The standards for pavement marking paint colours are:

- White pavement marking paint must have a white colour to AS 2700S(N14),
- Yellow pavement marking paint must have a golden yellow colour to AS 2700S(Y14),
- Black pavement marking paint must have a black colour to AS 2700S(N61).

White pavement marking paint with an off-white colour to AS 2700S(Y35) may be accepted by the Superintendent.

Pavement marking paint is acceptable for remarketing aerodromes.

## 15.6 GLASS BEADS – HOLD POINT

Use glass beads conforming to AS/NZS 2009 and APAS specification AP-S0042

**Hold Point** - Submit Certificates of Compliance, issued by an accredited testing authority, stating that the glass beads being used comply with, the relevant Australian Standards and APAS specifications.

**In urban areas** use: Type B-HR for initial new works application  
Type D-HR beads for subsequent remark and all remarking works

**In rural areas** use: Type B-HR beads for initial new works application  
Type B-HR beads for subsequent remark and all remarking works.

Refer to **Table – Application Times – All Longitudinal and Transverse Pavement Markings**.

## 15.7 PAVEMENT MARKING SETTING OUT

The location of all pavement markings on new surfaces, including reflective raised pavement markers, shall be set out by spotting with paint or other approved method prior to application of the markings.

Ensure the distance between the centre line of the marking and the centre line of the set out mark is less than 30 mm. The apparent line of the markings is a smooth continuous alignment when viewed in the direction of the line.

**Roads New work:** Set out line marking to the line pattern specified in accordance with AS 1742 and the Standard Drawings for Line Marking CS 3400, CS 3401, CS 3402, and CS 3403, including the setting out of arrows, letters, numerals and chevrons and RRPMs.

**Aerodromes New work:** Set out pavement marking to the line pattern specified in accordance with the specification drawing for Aerodrome Pavement Marking, and in accordance with the Manual of Standards Part 139— Aerodromes Chapter 8: Visual Aids Provided by Aerodrome Markings, Markers, Signals and Signs

The Superintendent will supply the design drawings for aerodromes when the work order is issued.

### **Existing Pavement Markings (including aerodromes)**

Remark along the line of the existing line marking as per **Table – Dimensional Tolerances of Pavement Markings**.

## 15.8 PAVEMENT MARKING APPLICATION – WITNESS POINT

Apply the marking materials using a self-propelled mobile sprayer, hand sprayer, hand painting or hand screeding as directed by the Superintendent

**Witness Point** - Obtain approval from the Superintendent for the type of equipment to be used for applying pavement marking materials.

**Witness Point** - Produce documented evidence to show that the spraying equipment has been calibrated in accordance with PCCP requirements and is certified by PCCP as being suitable for the works to be carried out under this contract.

**Witness Point:** Obtain Superintendent's approval for variation to the any of the above requirements.

**Substrate:** Ensure that the pavement surface is free from dirt, loose detritus, mud and other extraneous matter, and is dry before and after painting operations

Protect all applications from traffic until the binder has hardened sufficiently to retain the glass beads.

Produce markings so that they are straight, with smooth even curves where necessary.

Remove any marking material beyond the defined marking leaving a neat and smooth marking on the pavement.

Produce markings free from ghosting and raggedness on the sides and ends and parallel with the general alignment of the carriageway with the lines level, uniform and free from streaks. Reinststate pavement markings that are damaged by traffic during paint drying time and remove all tyre pickup marks.

#### **15.8.1 Longitudinal Application**

Apply the marking materials using a self-propelled mobile sprayer having a minimum capacity of 200 litres of paint.

Apply paint evenly to the pavement surface at the specified film thicknesses and immediately after apply an even application of glass beads at the specified rates.

On all new work, apply one coat of paint and glass beads to the pavement in the direction of traffic flow.

For remarking, apply one coat of paint and glass beads to the pavement surface in the direction of traffic flow.

#### **15.8.2 Transverse and Other Marking Applications**

Apply the marking materials using a self-propelled or hand sprayer with a capacity of 20 litres of paint or a different capacity as directed by the Superintendent.

Apply paint evenly to the pavement surface to the specified film thickness and immediately after apply an even application of glass beads at the specified rates.

#### **15.8.3 Markings on Concrete Pavement**

Prime the concrete pavement surface with an approved primer before applying markings. Allow sufficient time for primer to cure to manufacturer's recommendations before applying markings.

#### **15.8.4 Glass Beads**

Apply glass beads by low pressure or delivered by gravity dispenser, D-HR beads may require application by static drop method in conjunction with air pressures to retain beads.

Maximum application speed for glass beads shall be as per manufacturer's recommendations.

The application rates specified for glass beads are the amounts that are retained in the painted surface after three weeks of trafficking.

Ensure that the loss in glass beads after three weeks traffic does not exceed ten per cent of total applied.

### **15.9 PAVEMENT MARKING CONFORMANCE TOLERANCES – HOLD POINT**

**Hold Point** – Provide evidence that the pavement marking complies with the requirements of this specification.

Pavement marking for road and aerodrome work shall conform to the following tables:

- **Table – Application Rates – All Longitudinal and Transverse Pavement Markings**
- **Table – Application Times – All Longitudinal and Transverse Pavement Markings**
- **Table – Dimensional Tolerances for Pavement Markings**

PAVEMENT MARKING

Location	Works	Wet film paint thickness	Dry film paint thickness	Glass beads type	Rate of glass beads to be retained
URBAN	Initial marking	> 0.360 mm	> 0.230 mm	B-HR	> 300g/m <sup>2</sup>
	Remarking	> 0.515 mm	> 0.330 mm	D-HR	> 400g/m <sup>2</sup>
RURAL	Initial marking	> 0.360 mm	> 0.230 mm	B-HR	> 300g/m <sup>2</sup>
	Remarking	> 0.360 mm	> 0.230 mm	B-HR	> 300g/m <sup>2</sup>
AERODROMES	Initial marking	> 0.360 mm	> 0.230 mm	Not required	> 300g/m <sup>2</sup>
	Remarking	> 0.360 mm	> 0.230 mm	Not required	> 300g/m <sup>2</sup>

**Note:** Paint film thickness tolerances exclude surface applied glass beads.

Location		Works	Longitudinal markings	Transverse markings
URBAN	New Pavement Marking	Initial marking	Before opening of works to traffic	Before opening of works to traffic
		Resurfacing and/or resealing	Within 2 days	Hold lines – 1 day. Other lines within 2 days
		Remarking	9 months maximum	9 months maximum
	Existing Pavement Marking	Remarking	Within 7 days of issue of a CSR or as extended by the Superintendent	Within 7 days of issue of a CSR or as extended by the Superintendent
RURAL	New Pavement Marking	Initial marking	Before opening of works to traffic	Before opening of works to traffic
		Resurfacing and/or resealing	Within 21 days	Within 21 days
		Resurfacing and/or resealing - Overtaking lanes	Within 5 days	Within 5 days
		Remarking	3 to 6 months of issue of a CSR or as extended by the Superintendent	3 to 6 months
	Existing Pavement Marking	Remarking	Within 7 days of issue of a CSR or as extended by the Superintendent	Within 7 days of issue of a CSR or as extended by the Superintendent
AERODROMES		Resurfacing and/or resealing	As directed by the Superintendent. To comply with CASA safety requirements	As directed by the Superintendent. To comply with CASA safety requirements
		Remarking	As directed by the Superintendent.	As directed by the Superintendent.

<b>Table – Dimensional Tolerances for Pavement Markings</b>		
<b>Properties</b>	<b>Tolerances</b>	
	<b>New work</b>	<b>Remarking work</b>
Locations of centrelines of markings	< 20 mm from locations as shown on drawings	+/- 5 mm
Widths of lines	+/- 5 mm	+/- 10 mm
Lengths of lines	+/- 50 mm	+/- 100 mm
Locations of arrows, chevrons, letters, numerals	+/- 50 mm	+/- 50 mm
Deviation and/or trueness of lines	< 15mm in 2 metres	< 15mm in 2 metres

## 15.10 FIELD TESTING

The Department, at the Superintendent’s discretion, will perform on site conformance testing using the panel period contractors. The Contractor shall assist the testing laboratory with sampling and other requirements of the testing in the field.

The Superintendent will perform random reflectivity testing in all regions to measure performance of the pavement marking on different surfaces and bead types.

**Wet film thickness:** Check the thickness of the wet film applied to the pavement by the method NTTM 401.1 - Operation of Wet Film Thickness Comb.

**Glass bead application:** Check the application rate of glass beads to the surface of the marked line by the method NTTM 402.1 - Field Procedure for Measurement of the Rate of Application of Spherical Glass Beads.

**Wear assessment limits:** The degree of wear is defined as the area of pavement marking remaining after a period of time, relative to the initial area of the pavement marking.

**Degree of wear:** At the Superintendent’s discretion determine the degree of wear using Image Analysis in accordance with AS 4049.3:2005 Appendix K, Method A, Photographic Method.

Wear limits for pavement marking: 95% intact area after six months.

Remark pavement marking that does not conform to the specified limits, including the costs of all testing, at no cost to the Principal.

## 15.11 THERMOPLASTIC MATERIALS – HOLD POINT

**Hold Point:** Approval from Director of Engineering and Environment Services is required before thermoplastic materials are used.

Thermoplastic pavement marking materials must comply with AS 4049.2 and with APAS specification AP-S0041/4.

Thermoplastic road marking material must consist of aggregate, pigment, binder, glass beads and extenders, capable of being softened by heating and hardened by cooling.

For continuous thermoplastic pavement marking, 100 mm drainage gaps shall be provided, at a maximum spacing of 3m, to allow adequate drainage of the pavement surface. Nominate the method of identifying the location and spacing for these gaps.

## 15.12 COLD APPLIED PLASTIC MATERIALS – HOLD POINT – WITNESS POINT

Use approved plastic pavement marking materials to APAS AP-S0041/3 Cold applied plastic.

**Hold Point:** Approval from Director of Engineering and Environment Services is required before cold applied plastic materials are used.

**Witness Point** - Provide evidence that all proprietary products such as epoxy or plastic products have demonstrated satisfactory field performance for a period of at least three years.

**Material** - Generally: A two part Poly Methyl Methacrylate resin based pavement marking material that complies with the requirements for colour, luminance and bead content of AS 4049.2, and which complies with AS 4049.4, sprayed or screeded onto the pavement, containing pre-mixed glass beads, with additional drop-on beads being added during application, conforming with the following requirements of AS 4049.2: Clause 5.1 – Colour, Clause 5.2 - Luminance and Clause 7 - Field Testing. The material shall have a maximum no-pick-up time of 60 minutes.

Do not use cold applied plastic materials on new asphalt works.

## 15.13 AUDIO TACTILE LINE MARKING (ATLM) – HOLD POINT

**Hold Point:** Approval from Director of Engineering and Environment Services is required before audio tactile line marking materials are used.

Use approved plastic pavement marking materials.

### 15.13.1 Site Preparation

The area to be marked is to be dry and free of dirt, gravel, oil and other loose or foreign material to ensure the best possible adhesion of new material. Remove existing paint or other material which is flaking or chipped. Cleaning may be carried out by brooming, blowing or washing.

Use a tack coat or primer material for surface or other conditions requiring it in accordance with the Manufacturer's Specification to ensure satisfactory adhesion of the material.

### 15.13.2 Application

Apply by extrusion methods, including application of glass beads and anti-skid material, in a single uniform layer.

For longitudinal lines and transverse markings, apply material at a rate to achieve a minimum final tolerances and dimensions as stated in drawing CS 3403.

Glass beads that are to be mixed in are to be Class C (intermix 20 to 30 % by mass).

Additional Type B-HR beads shall be uniformly applied to the surface of thermoplastic at the rate of > 300g/m<sup>2</sup> (retained) as part of the application process and before the material has commenced to set.

The marking produced shall be uniform in texture, width and thickness and the surface substantially free from blisters, streaks, lumps and other defects.

Remove any occurrence of overspray, gun dribble and defective ribs.

Audio tactile line marking tolerances must conform to **Table - Audio Tactile Line Marking Tolerances** and to civil standard drawing CS 3403.

<b>Table - Audio Tactile Line Marking Tolerances</b>		
<b>Aspect</b>	<b>Dimension</b>	<b>Tolerance (mm)</b>
Length of raised rib	150 mm	+/- 10 mm
Width of raised rib	50 mm	+/- 10 mm
Height of raised rib	12 mm	+ 1 mm
Spacing of raised rib	250 mm	+/- 20 mm

### 15.13.3 Retro-reflectivity

When tested in accordance with AS 4049.2:2005 Appendix K marking must achieve a minimum level of reflectivity of 350 mcd/lux/m<sup>2</sup> at time of application.

## 15.14 RAISED RETROREFLECTIVE PAVEMENT MARKERS (RRPMS)

### 15.14.1 Raised Reflective Pavement Markers – Hold Point

Use raised reflective pavement markers conforming to AS/NZS 1906 Retroreflective materials and devices for road traffic control purposes

**Hold Point:** Submit details in relation the manufacturer’s warranties, performance, durability and maintenance of the raised retroreflective pavement markers.

Provide raised retroreflective pavement markers with the following attributes:

<b>Table – Raised Retroreflective Pavement Markers Dimensions</b>	
<b>Aspect</b>	<b>Dimension</b>
Height (above pavement level when installed)	18 – 25 mm
Width at right angles to the direction of the traffic	110 – 130 mm
Length parallel to the direction of the traffic	80 – 110 mm

### 15.14.2 Materials

Use markers fixed to the pavement surface as recommended by the manufacturer of the marker.

Use adhesives as recommended by the manufacturer.

Use adhesives within the time recommended by the adhesive manufacturer.

### 15.14.3 Pavement Preparation

Clean the pavement.

Ensure each RRPM site is free of dirt, oil, grease, paint and any other material that would affect the bond of adhesive to the pavement.

Abrasive blast, chip, or burn pavements that cannot be cleaned by sweeping.

Do not place markers if moisture is present. Ensure pavement is dry before applying markers.

### 15.14.4 Placing Markers

Place markers in accordance with AS 1742.3 and Standard Drawings CS 3401, CS 3402.

Place the reflectors to face the oncoming traffic.

Do not obscure the reflective faces by adhesive.

Ensure that the surface finish is smooth.

Discard markers which are not positioned correctly within the time recommended by the manufacturer for use of the adhesive. Remove stale adhesive from the pavement surface.

Do not place markers over joints in concrete pavement.

Wear limits for pavement markers: 95% intact area after six months.

Replace markers that have dislodged within 12 months of installation.

## **15.15 REMOVAL OF PAVEMENT MARKINGS – HOLD POINT**

**Hold Point** – Obtain approval from the Superintendent on the proposed method used for pavement marking removal before commencing removal operations.

Removal of pavement marking must not adversely affect the integrity of the pavement surface.

When longitudinal and transverse lines are removed, the marks left on the pavement surface must not confuse the motorist with ghosting or incorrect directions. Where removal is outside of 100 mm of the existing lines then the entire width of the lane is to be consistent with the line removal texture.

When arrows, letters or figures are to be removed or temporarily blacked out, the removal pattern must be in the shape of a rectangle or square to minimise confusion to the motorists.

Remove all materials and debris from removal operations and dispose at an authorised legal disposal site. Repair any surface defect caused by the removal process at no additional cost to the Principal.

The following methods may be considered and will be dependent on the type of surface, extent and application.

### **15.15.1 Resealing and asphaltting**

Spray sealing and or Asphalt replacement is the preferred method for replacement.

Determination of materials shall be in accordance with existing materials.

Where this method is used the reworking needs to be for the full width of the pavement.

### **15.15.2 Sandblasting or water blasting**

This methodology is the preferred method for marking removal on asphalt and concrete surfaces.

Use a skirt or guard around the blaster to minimise the spraying of material away from the immediate work area.

Remove waste material before it can be transported by rain, wind or traffic. This will generally require the use of a vacuum attachment operating concurrently with the blasting operation or alternative method approved by the Superintendent.

### **15.15.3 Machine Grinding**

This method may be considered for use on smaller removal jobs where surface finish is not a concern. It can be used on most asphalt and concrete surfaces.

### **15.15.4 Paint Blackout – Hold Point**

Paint blackout may be considered as a temporary measure only and must be removed upon completion of the works.

**Hold Point** – Obtain Superintendent's approval before using this methodology.

### **15.15.5 Other Methods**

Other methods such as heat lance or paint stripping may also be considered by the Superintendent.

### **15.15.6 Raised Retroreflective Pavement Marker Removal**

Where required, remove raised retroreflective pavement markers by breaking the bond between the adhesive, the pavement surface and the base of the raised retroreflective pavement marker.

Repair all divots caused by the removal of raised retroreflective pavement markers with hot melt adhesive or epoxy adhesive to the level of the surrounding pavement.

## **15.16 RESURFACING CONTRACTS**

### **15.16.1 New Pavement Marking on Asphalt Resurfacing and Resealing Works Contracts**

Where works are ordered under a period contract, then conform to the requirements of the Period Contract documents.

The Principal will pay the Pavement Marking Period Contractor direct for the pavement marking work associated with resurfacing contract works.

### **15.16.2 Co-ordination of Pavement Marking Work**

The Pavement Marking Period Contractor is responsible for co-ordination of the pavement marking work with the Resurfacing Contractor.

The Superintendent will advise of the name and contact details of the Resurfacing Contractor to the Pavement Marking Period Contractor

The Superintendent will issue a direction to work.

The works shall require co-ordination with the resealing contractor to ensure all new asphalt and or resealing scheduled works have pavement marking reinstated within the allocated timeframes. Refer to **Table – Application Times – All Longitudinal and Transverse Pavement Markings**

### **15.16.3 Removal of Temporary Pavement Markers**

The Pavement Marking Period Contractor shall remove all temporary pavement markers that have been placed on the new pavements for delineation and safety reasons, and dispose of them at an authorised legal disposal site.

### **15.16.4 Removal of Temporary Traffic Control Signage**

The Pavement Marking Period Contractor shall remove all temporary traffic control warning devices and posts that have been left at new works site for safety reasons, and return signage and posts to the following locations:

- Darwin – Government storage yard
- Katherine – Government storage yard
- Tennant Creek – Government storage yard
- Alice Springs – Government storage yard

The Pavement Marking Period Contractor contractor will be responsible for the safe keeping of the signage and must ensure no damage occurs to the signage during transport.

## **15.17 REPORTING – HOLD POINT**

**Hold Point** – Submit to the Superintendent the following information, in Microsoft Excel spreadsheet format, every quarter for panel contract works, for all works carried out under this contract:

- CSR number (for panel contract works)
- Contract number (for new works)
- Date
- Road number
- Chainages – start point and finish point of each section of works
- PRP numbers - start point and finish point of each section of works
- GPS coordinates in Decimal Degrees - start point and finish point of each section of works
- Type of carriageway – inbound outbound (for duel carriageways) and full width (for two way carriageway) and
- Bead size used and Paint application rate.

## **15.18 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 16 LANDSCAPE

### 16.1 STANDARDS AND PUBLICATIONS

Conform to the following Publications unless specified otherwise:

- AS 2303 Tree stock for landscape use
- AS 2698(set) Plastics pipes and fittings for irrigation and rural applications
- AS 2698.2 - Polyethylene rural pipe
- AS 2698.3 - Mechanical joint fittings for use with polyethylene micro-irrigation pipes
- AS/NZS 3500(set) Plumbing and drainage
- AS 4373 Pruning of amenity trees
- AS 4419 Soils for landscaping and garden use.
- AS 4454 Composts, soil conditioners and mulches

Specification Reference

Refer to the Northern Territory Government Standard Specification for Environmental Management.

Landscape Defects Liability Period

The defects liability period for the Landscaping portion of the works is detailed in PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

### 16.2 DEFINITIONS

**CERTIFIED SEED:** Seed by record of origin, purity, and strain and conforming in character to the parent stock.

**EXOTIC PLANTS:** Any plants not native to Australia.

**FINE TILTH:** The friable soil resulting from cultivation.

**GERMINATION PERCENTAGE:** The proportion of pure seed germinating in a fixed time under standard laboratory conditions.

**MULCH:** Stable material spread as a surface treatment to reduce soil erosion, water loss, and weed invasion.

**NATIVE PLANTS:** Plants that are natural to Australia.

**NPK RATIO:** The ratio of Nitrogen (N), Phosphorus (P), and Potassium (K) in a fertiliser compound.

**ROOT BALL:** The finely bound fibrous root and soil removed intact from the container with the plant.

**SHALL:** The term 'shall' is indicative of a mandatory requirement unless the context clearly indicates otherwise.

**SOIL BINDING AGENT:** Material which stabilises and conditions soil and aids moisture retention.

### 16.3 MATERIALS

Refer to AS 2303 for tree stock requirements.

#### 16.3.1 Trees, Shrubs and Ground Covers

Provide trees, shrubs and ground covers which have the following characteristics:

- Trunks/stems to be sturdy and well hardened.
- A well developed vigorous root system.
- A minimum of three months in their container.
- Be sound, healthy, vigorous, and free from insect pests, plant diseases, sun scalds, fresh abrasions of the bark, or other disfigurements.

### 16.3.2 Grass

Seed shall be covered by an appropriately numbered seed analysis report or certificate cross referenced to the number on the seed sacks.

Seed shall be used only if its report or certificate has been issued within the previous six months.

Seed used shall be true to label.

Seed shall have minimum germination of 80%.

Seed shall comply with the following purity characteristics:

- Clean seed, minimum 94% by weight.
- Weed seed, maximum 0.2% by weight.
- Other crop seed, maximum 0.8% by weight.
- Inert matter, maximum 5.0% by weight.
- Shall not contain any Hyptis Sauveolens, Sida Acuta, Sida Cordifolia.

Seed mixes shall conform to the **Table - Seed Mixes**.

<b>Table – Seed Mixes</b>					
<b>Water Regime</b>	<b>General Latitude</b>	<b>Seed Type</b>	<b>Percentage By Weight</b>	<b>Mixture Application Rate</b>	
Irrigated areas	All	Cynadon dactylon (Couch)	30	Minimum 100 kg per hectare	
		Paspalum notatum pensicola	35		
		Paspalum notatum argentina	35		
Dry grassland areas	North of Adelaide River	Paspalum notatum pensicola	20	Minimum 100 kg per hectare	
		Paspalum notatum argentina	80		
	Adelaide River to Katherine		Paspalum notatum pensicola	20	Minimum 50 kg per hectare
			Bothriochloa petusa	10	
			Cynadon dactylon	20	
			Chloris Gayana	30	
			Urochloa mosambicensis (Sabi Grass)	20	
	Katherine to Mataranka		Paspalum notatum pensicola	20	Minimum 50 kg per hectare
			Bothriochloa petusa	10	
			Chloris Gayana	30	
			Urochloa mosambicensis (Sabi Grass)	20	
			Urochloa mosambicensis	20	
Cenchus Setiger (Birdwood Grass)			20		

### 16.3.3 Fertiliser

Fertilisers shall be stored in waterproof sealed bags under shelter away from water and direct sunlight.

Fertilisers shall conform to the **Table - Fertilisers**.

<b>Table - Fertilisers</b>			
<b>Use</b>	<b>General Plant Category</b>	<b>Where Used</b>	<b>Component Requirements</b>
Planting	Native	Surface	Native Plant Feed Mix
	Exotic	Surface	Exotic Planting and Feeding Mix
	Native and/or Exotic	Hole	Granular or Tablet Slow Release (6 month minimum) 20:10:10 NPK ratio
Feeding	All existing plants	Surface	As for Planting - Surface
Grassing	All seeding, both new and existing	Surface	Fast Release 15:7:7 NPK ratio Trace Elements
Do not use fertiliser with Grevillia and Banksia plant varieties.			

#### **16.3.4 Imported Soils - Hold Point - Witness Point**

Imported topsoil shall conform generally to AS 4419 and the following requirements:

- Be free draining.
- Be red-brown or black sandy loam.
- Contain no grass or weed growth.
- Maximum stone size of 50 mm.

**Hold Point** - Advise the name of the proposed supplier. Do not order soils without Superintendent's approval of the supplier.

**Witness Point** - Provide a 5 kg sample of topsoil proposed for the works. Do not order soils without Superintendent's approval of the sample. Provide copies of delivery dockets for the topsoil delivered to site for the works.

#### **16.3.5 Insecticide**

Use Fipronil for termite control.

Insecticide shall be used strictly in accordance with the manufacturer's instructions.

#### **16.3.6 Mulch - Hold Point - Witness Point**

##### **ORGANIC**

- Shall be stable, free from impurity, and be sufficiently heavy to prevent dispersal by wind.
- Shall be shredded bark, wood chips, hay or similar.
- Wood chips shall be a maximum size of 50 mm, inert, and shall be free of resinous toxins and termites.
- Shall conform generally to AS 4454.

**Hold Point** - Advise the name of the proposed supplier. Do not order mulch without Superintendent's approval of the supplier.

**Witness Point** - Provide a 5 kg sample of mulch proposed for the works. Do not order mulch without Superintendent's approval of the sample. Provide copies of delivery dockets for the mulch delivered to site for the works.

##### **INORGANIC**

- Shall be washed and screened lateritic gravel or brick chips with particle sizes in the range 6 mm minimum to 25 mm maximum.

## **16.4 SITE PREPARATION**

### **16.4.1 Setting Out**

The Contractor shall be responsible for accurately setting out the works in accordance with the drawings.

In particular, trees shall not be planted:

- within 30 m of the end of a central median for trees, or 10 m for shrubs, and not
- within 5 m of a road light pole, and not
- within 1.5 m of a fire hydrant, and not
- where their location will ultimately obscure traffic signs, signals, or other essential roadside features.

### **16.4.2 Protection of Existing Vegetation**

Ensure all trees, shrubs, and other vegetation to be retained within the limits of work are not damaged. Conform to the conditions shown below.

Protect vegetation prior to commencing construction work in the vicinity of that vegetation.

Do not place or dump any chemical type materials including oil, paint, bituminous products, fuels, and cement/concrete near the vegetation - even for short periods. Prevent windblown chemical type materials, such as cement, from affecting vegetation.

Do not stockpile bulk materials - such as spoil from excavation, boulders, cleared vegetation - under or near vegetation. Ensure such spoil is never placed against trunks, even for short periods.

Do not remove topsoil from within the dripline (i.e. canopy area) of vegetation unless essential to the works. For any excavation within the dripline keep open as short a period as possible, and use excavation methods that preserve the root system intact and undamaged.

Cut roots only where it is absolutely necessary. When cutting roots use a means which does not disturb the remaining root system.

Backfill excavation around tree roots with material of at least comparable quality to that excavated. Consolidate backfill and do not backfill around trunks above the original level. Thoroughly water backfilling.

Avoid damage to overhead limbs by machinery. Only remove the minimum amount required if limbs must be removed to allow machinery to work.

Where branches are to be removed, cut them back to the branch collar.

Compensation for damage to existing vegetation shall be borne by the Contractor and determined as follows:

Trees (including palms and cycads)

Valuation rate of \$10 per centimetre of trunk circumference at a height of 1 metre above the ground level, within the following limits:

- Minimum valuation: \$250 per tree.
- Maximum valuation: \$2,500 per tree.

Shrubs - Valuation rate of \$8 per centimetre of trunk circumference at a height of 1 metre above the ground level.

### **16.4.3 Earthworks**

Remove from site all unwanted vegetation. Backfill and regrade over areas where trees have been removed.

Regrade all areas of excavation to ensure all finished surface levels are free draining.

Excavate or fill to lines and levels shown on the drawings.

Fill placed on areas to be landscaped shall be free from inorganic, deleterious material and stones greater than 100 mm nominal size.

Compact fill sufficiently to ensure initial settlement and provide a firm base.

Clear all subgrade surfaces of stones exceeding 100 mm diameter and rubbish, weeds and roots.

No excavation shall be allowed within 1.5 m of the canopy area of an existing tree.

#### **16.4.4 Topsoil**

Excavate and stockpile material which is suitable for reuse as topsoil.

Imported topsoil shall be as specified in the **Imported Soils** sub-clause in the **Materials** clause in this work section.

Stockpile topsoil in a free draining area in stockpiles not exceeding 2.0 m in height.

Ensure stockpiles are properly maintained.

### **16.5 PLANTING**

#### **16.5.1 Setting Out of Holes – Hold Point**

Accurately set out the locations for trees/shrubs to be planted in accordance with the drawings.

**Hold point** - Obtain approval of the set out from the Superintendent before commencing any planting.

#### **16.5.2 Preparation and Treatment of Holes**

Identify all cable and services locations prior to excavating any holes.

Prepare holes initially in accordance with the **Table - Initial Hole Preparation Chart** appearing below.

Remove excess excavated material, rubbish and cut vegetation from site.

Excavate planting holes by mechanical/manual means.

Size of planting holes shall be twice the diameter and twice the depth of the plant container, unless shown otherwise on the drawings.

Break up glazed sides of holes.

Treat planting holes in hard, dense material prior to planting by

- placing 1 kg Gypsum or Claybreaker around the sides and bottom of the hole; and
- filling hole with water and allowing to drain.

Treat holes with Fipronil in accordance with manufacturer's instructions prior to planting.

<b>Table – Initial Hole Preparation Chart</b>				
<b>Land Categories And Soil Characteristics</b>				
	<b>Marine Sediments</b>	<b>Soil And Gravel (depth greater than 600 mm)</b>	<b>Shallow Soils</b>	<b>Surface Rock (soil depth overlaying rock less than 600 mm)</b>
Visual appearance	Grey and brown muds, silts and clays: occasionally pale beach sands	Usually red, yellow and brown sandy loams to sandy clay loams with varying amounts of ironstone gravel; occasionally siltstone and quartz gravel	Soil material similar to Category 2, overlaying laterite on siltstone*	Very little or no soil; extensive areas out of cropping laterite on siltstone*
<b>Operational Steps</b>				
Initial Rock Break	-	-	-	Rip and rock break.
Initial Excavation	Hole size dependent upon species and area	Excavate to 600 mm.	Excavate hole till machine rejection (commonly bed rock layer).	Excavate hole to 600 mm minimum.
Secondary Rock Break	-	-	Rock break bottom to a depth of 1200 mm.	Rock break bottom further 600 mm down.
Secondary	-	Excavate rocks.	Excavate rocks greater than 150 mm.	Excavate rocks greater than 150 mm.
Excavation Hole Backfilling	In situ excavated material	If excavated soil has less than 30% gravel, then no additive is required.	Backfill with imported topsoil.	Backfill with imported topsoil.
		If excavated soil has 30 to 70% gravel, then a 50% mixture with imported topsoil is required. If excavated soil has greater than 70% gravel, then backfill of imported topsoil is required.	NOTE If existing soil is free draining or humic, then it may be substituted for imported topsoil.	
* Laterite - rough textured rock, reddish brown in colour, with orange and yellow mottles (splotches of colour), contains ironstone gravels and pores.				
* Siltstones - relatively smooth textured, white, reddish and yellowish layered rock, often with mottles. No ironstone gravel and pores.				

### 16.5.3 Supply of Plants

Place an order with an approved nursery for the supply of all plants required to complete the works within seven days of acceptance of tender.

Ensure that a minimum of five or 5%, whichever is the greater number, additional plants of each species nominated is available if necessary for replacement purposes.

Remove immediately from the site all dead, dying or diseased plants and replace with new plants of the same species.

### 16.5.4 Treatment of Plants

Do not use chemicals on site.

Containerised plantings shall be well watered prior to despatch from the nursery and shall remain in the containers until required for planting.

Protect all plants during transportation, against excessive sunlight, wind and drought.

Trees and shrubs which are not immediately planted shall be stood upright on level ground, protected and maintained in good condition by the Contractor.

Replace immediately all plantings which have become damaged, missing or fallen below the specified standard.

Drive any tree stakes required into the ground before planting so as not to damage the root ball.

Check regularly for any termite/insect attack or fungal infestation. Carry out eradication by use of sprayed insecticide or fungicide in accordance with the manufacturer's instruction.

### 16.5.5 Planting of Trees, Shrubs and Ground Cover

Planting shall take place only in conditions where temperature range is below 32°C.

Maintain the integrity of the plant root zone and the surrounding earth mould.

Place fertiliser in the hole adjacent to, but not in contact with, the root zone of the plant. Fertiliser shall be in accordance with the **Table - Fertilisers** in **Fertilisers** sub-clause in **Materials** clause in this work section. Application rates in accordance with the **Table - Fertiliser Application Rates** appearing below.

LANDSCAPE

<b>Table - Fertiliser Application Rates</b>			
<b>Plant Type, Use, Planting Method</b>	<b>Size of container or plant</b>	<b>Application Rate per container or per plant</b>	
Native, Planting, Surface	Tube stock	10 g	
	150 mm container	30 g	
	200 mm container	80 g	
	250 mm container	100 g	
	300 mm container	150 g	
	20 litre bag	300 g	
Exotic, Planting, Surface	Plant height:		
	0.5 m	100 g	
	1.0 m	200 g	
	2.0 m	300 g	
Native and/or Exotic, Planting, Hole	Ground covers and shrubs 10 cm tall	10 g	
	Ground covers and shrubs 20 cm tall	20 g	
	Plants to 1 m	40 g	
	Plants to 2 m	80 g	
	Plants to 3 - 4 m	120 g	
	Advanced trees and palms 2 m -	200 g	
	Advanced trees and palms 3 m -	300 g	
	Advanced trees and palms 4 m -	400 g	
	These rates apply to both granular compound and equivalent products.		
	Native, Feeding, Hole and/or surface	Ground covers:	
up to 300 mm wide		30 g	
300 - 600 mm wide		50 g	
600 - 900 mm wide		75 g	
900 - 1000 mm wide		100 g	
Thereafter		100 g per metre	
Shrubs:			
up to 300 mm high/wide	50 g		
300 - 600 mm high/wide	75 g		
600 - 900 mm high/wide	100 g		
900 - 1000 mm high/wide	150 g		
Thereafter	200 g/metre of height or width		
	Trees	200 g/metre of height	
Exotic, Feeding, Hole and/or surface	Plants	250 g/metre of plant height	

### 16.5.6 Backfilling

Backfill material shall be in accordance with the **Table - Initial Hole Preparation Chart** in **Preparation and Treatment of Holes** sub-clause in this clause.

Backfill the hole so that the plant is contained firmly in the ground in a vertical position.

Backfill the hole to finish surface level and dish to retain water.

Work surface fertiliser into top 50 mm of backfill. Fertiliser shall be in accordance with **Table - Fertilisers** in **Fertilisers** sub-clause in **Materials** clause in this work section. Application rates in accordance with the **Table -Fertiliser Application Rates** in **Planting of Trees, Shrubs and Ground Cover** sub-clause in this clause.

Water backfill material immediately after surface fertilisation to ensure no air voids or loose material surround the plant root zone.

### 16.5.7 Watering and Maintenance

Maintain each planting area in a moist condition to promote healthy growth.

Weed and prune as required to maintain plants in a healthy condition.

### 16.5.8 Mulching

Supply mulch as specified that is free from weeds, seeds, sticks, stones, insects, diseases and other deleterious matter.

Provide, where specified, organic mulch in a 100 mm thick compacted layer for a 500 mm radius from the main stem.

Ensure a gap of 50 mm is retained between the main stem and the mulch.

## 16.6 GRASSING

### 16.6.1 Ground Preparation

Bring the area to a fine tilth. Conform to the prescribed finished levels prior to the placement of grass seed.

Remove all stones over 50 mm diameter, debris and deleterious material.

Backfill with topsoil all voids created by the removal of obstructions and deleterious material.

Provide loose depth of topsoil to achieve a minimum topsoil thickness of 100 mm after natural settlement.

Compact the topsoil lightly to minimise subsidence.

Placement and spreading of topsoil shall not take place during periods of heavy rain.

Protect the area to prevent further compacting and trafficking once topsoiling is complete.

Take preventative measures to control erosion and siltation and restore/replace any portion which erodes, silts up or is otherwise damaged.

Apply fertiliser as specified in the **Table - Fertilisers** in **Fertilisers** sub-clause in **Materials** clause in this work section, at an application rate specified in PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ, to the finished topsoiled surface and lightly work into the soil. The fertiliser may be applied simultaneously with the grass seed.

### 16.6.2 Supply

Supply fresh seeds of the species nominated in the sub-clause **Grass** in the clause **Materials**.

### 16.6.3 Application

Refer to the **Table - Fertiliser Application Rates** in **Planting of Trees, Shrubs and Ground Cover** sub-clause in **Planting** clause

Apply seed uniformly by mechanical means. Hand distribution shall only be in areas inaccessible to machinery.

### 16.6.4 Reseeding

Reseed areas that fail to germinate and propagate after 28 days.

Bring areas requiring reseeding to a fine tilth by hand raking only.

Grass seed application to be in accordance with the **Table - Seed Mixes** in sub-clause **Grass** in the clause **Materials**.

### 16.6.5 Irrigation

Water seeded areas as often as is required to keep the ground moist.

### 16.6.6 Establishment

Maintain grassed area free of all weeds and insects.

Ensure grass has and maintains complete uniform coverage with active growth.

### 16.6.7 Mowing

Mow the grass as follows:

- First cut when height reaches 150 mm.
- Further cuts to maintain grass height in range 50 - 100 mm.

## 16.7 BATTER PROTECTION BY HYDROSEEDING

### 16.7.1 General

Use an approved hydraulically-applied proprietary erosion control Engineered Fibre Matrix (EFM) product.

The EFM is to be 100% biodegradable, and is to be composed of 100% recycled, thermally refined (within a pressurized vessel) virgin wood fibres, crimped interlocking biodegradable fibres, mineral activators and wetting agents (including high-viscosity colloidal polysaccharides, cross-linked biopolymers, and water absorbents).

The EFM is to be phytosanitized, free from plastic netting, and when cured is to form an intimate bond with the soil surface to create a continuous, porous, absorbent and flexible erosion resistant blanket that allows for rapid germination and accelerated plant growth.

The EFM is to perform as a Bonded Fibre Matrix (BFM) product and may require a 4-24 hour curing period to achieve maximum performance.

### 16.7.2 Contractor Submissions – Witness Point

Product Data: Submit manufacturer's product data and installation instructions. Include required substrate preparation, list of materials and application rates.

### 16.7.3 Delivery, Storage, and Handling

Deliver materials and products in UV and weather-resistant factory labelled packages.

Store and handle in strict compliance with manufacturer's instructions and recommendations.

Protect from damage, weather, excessive temperatures and construction operations.

### 16.7.4 Materials

The EFM must conform to the following typical property values when uniformly applied at a rate of 3,900 kilograms per hectare under laboratory conditions.

<b>Table – Engineered Fibre Matrix Properties</b>		
<b>Property</b>	<b>Test Method</b>	<b>Required Tested Value</b>
<b>Physical</b>		
Mass Per Unit Area	ASTM D6566 <sup>1</sup>	≥ 390 g/m <sup>2</sup>
Thickness	ASTM D6525 <sup>1</sup>	≥ 4 mm
Ground Cover	ASTM D6567 <sup>1</sup>	≥ 98%
Water Holding Capacity	ASTM D7367	≥ 1,400%
Material Colour	Observed	Green
<b>Performance</b>		
Cover Factor <sup>2</sup>	Large Scale Testing	≤ 0.05
% Effectiveness <sup>3</sup>	Large Scale Testing	≥ 95 %
Cure time	Observed	4 – 24 hours
Vegetation Establishment	ASTM D73221	≥ 600 %
Functional Longevity <sup>4</sup>	ASTM D5338	≤ 12 months
<b>Environmental</b>		
Ecotoxicity	EPA 2021.0 (USA)	48-hr LC50 > 100%
Biodegradability	ASTM D5338	Yes
<b>NOTES</b>		
<p>1. ASTM test methods developed for Rolled Erosion Control Products and have been modified to accommodate Hydraulically-Applied Erosion Control Products.</p> <p>2. Cover Factor is calculated as soil loss ratio of treated surface versus an untreated control surface.</p> <p>3. % Effectiveness = One minus Cover Factor multiplied by 100%.</p> <p>4. Functional Longevity is the estimated time period, based upon ASTM D5338 testing and field observations, that a material can be anticipated to provide erosion control and agronomic benefits as influenced by composition, as well as site-specific conditions, including; but not limited to – temperature, moisture, light conditions, soils, biological activity, vegetative establishment and other environmental factors.</p>		

### 16.7.5 Composition

All components of the EFM shall be pre-packaged by the Manufacturer to assure both material performance and compliance with the following values. Under no circumstances shall field mixing of components be permitted. No chemical additives with the exception of fertilizer, soil neutralizers and biostimulant materials should be added to this product.

- Thermally Processed\* (within a pressurized vessel) Virgin Wood Fibres – 77%
  - \*Heated to a temperature greater than 193 degrees Celsius for 5 minutes at a pressure greater than 345 kPa.
- Wetting agents (including high-viscosity colloidal polysaccharides, cross-linked biopolymers, and water absorbents) – 18%
- Crimped Biodegradable Interlocking Fibres – 2.5%
- Micro-Pore Granules – 2.5%

### 16.7.6 Packaging

Bags: Net Weight – 22.7 kg, UV and weather-resistant plastic film

Pallets: Weather-proof, stretch-wrapped with UV resistant pallet cover

Pallet Quantity: 40 bags/pallet or 909 kg/pallet

### 16.7.7 Soil Testing – Witness Point

Soil Samples shall be taken and sent to a third-party, independent lab for analysis.

The tests shall include analysis and interpretation of results.

The soil testing methods used shall be compliant with recognized agronomic testing standards, for revegetation of disturbed sites.

Soil Analysis shall include results for:

- Soil pH
- Soluble Salts
- Excess Carbonate
- Organic Matter
- Nutrient readings for:
  - Nitrogen, Phosphorus, Potassium
  - Magnesium, Calcium, Sodium, Manganese, Sulphur, Zinc, Copper, Iron, Boron
- Cation Exchange Capacity
- Percent Base Saturation Sodium

**Witness Point** – Obtain Superintendent’s approval before using additives not listed above in **Composition** sub-clause. Approved additives are to be applied with the hydroseeding slurry at Manufacturer recommended rates based on soil test results.

### 16.7.8 Vegetation Species Selection

Once soils have been analysed for agronomic potential and amendment recommendations, selection of suitable plant species for achieving sustainable growth and effective erosion control shall be determined by a qualified seed supplier, consulting professional and/or regulatory agency. Species selection and establishment shall be compliant with LANDSCAPE.

Site and project specific information considered for species selection shall include:

- Project Location and Planning
  - Climate
  - Elevation
  - Aspect
  - Slope/Gradient
  - Permanent or Temporary Planting
  - Installation Date(s)
- Soil Conditions
  - Soil Texture
  - Soil pH
  - Toxicities/Deficiencies noted in the previous section.
- Site Maintenance Requirements
  - Mowing
  - Irrigation
  - Animal grazing preference
- Preferred Vegetation
  - Drought Tolerant
  - Native Vegetation
  - Shrub Species
  - Turf Grasses

- Cool Season
- Warm Season
- Blend of Cool and Warm Season
- Legume Species
- Cover Crops

### **16.7.9 Substrate and Seedbed Preparation**

Examine substrates and conditions where materials will be applied.

Apply products to geotechnically stable slopes that have been designed and constructed to divert runoff away from the face of the slope.

Do not proceed with installation until satisfactory conditions are established.

Depending upon project sequencing and intended application, prepare seedbed in compliance with other specifications.

#### **16.7.10 Installation**

Strictly comply with equipment manufacturer's installation instructions and recommendations.

Use approved hydroseeding machines with fan-type nozzle (50-degree tip).

To achieve optimum soil surface coverage, apply EFM from opposing directions to soil surface.

Rough surfaces (rocky terrain, cat tracked and ripped soils) may require higher application rates to achieve 100% cover.

Slope interruption devices or water diversion techniques are recommended when slope lengths (3H:1V) exceed 15m. Slope interruption intervals may need to be decreased based on steeper slopes or other site conditions.

EFM is not recommended for channels or areas with concentrated water flow unless used in conjunction with a rolled erosion control product designed to accommodate the anticipated hydraulic conditions.

Unless approved by the Manufacturer and the Superintendent, no chemical additives with the exception of fertilizer, soil neutralizers and biostimulant materials should be added to this product.

For Erosion Control and Revegetation: To ensure proper application rates, measure and stake area.

For maximum performance, apply EFM in a two-step process\*:

Step One: Apply fertilizer with specified prescriptive agronomic formulations and typically 50% of specified seed mix with a small amount EFM for visual metering. Do not leave seeded surfaces unprotected, especially if precipitation is imminent.

Step Two: Mix balance of seed and apply EFM at a rate of 22.7 kg per 316 litres of water over freshly seeded surfaces. Confirm loading rates with equipment manufacturer.

*\*Depending upon site conditions EFM may be applied in a one-step process where all components may be mixed together in single tank loads. Consult with Manufacturer for further details.*

*Best results and more rapid curing are achieved at temperatures exceeding 15°C. Curing times may be accelerated in high temperature, low humidity conditions with product applied on dry soils.*

**Mixing:** Use a mechanically agitated hydroseeding machine:

- Fill 1/3 of mechanically agitated hydroseeder with water. Turn pump on for 15 seconds and purge and pre-wet lines. Turn pump off.
- Turn agitator on and load low density materials first (i.e. seed).
- Continue slowly filling tank with water while loading fibre matrix into tank.
- Consult application and loading charts to determine number of bags to be added for desired area and application rate. Mix at a rate of 22.7 kg per 316 litres of water.

- All EFM should be completely loaded before water level reaches 75% of the top of tank.
- Top off with water and mix until all fibre is fully broken apart and hydrated (minimum of 10 minutes — increase mixing time when applying in cold conditions). This is very important to fully activate the bonding additives and to obtain proper viscosity.
- Add fertilizer and any other approved additives.
- Shut off recirculation valve to minimize potential for air entrainment within the slurry.
- Slow down agitator and start applying with a 50-degree fan tip nozzle.
- Spray in opposing directions for maximum soil coverage.

**Application Rates:** These application rates are for standard conditions. Increase application rates on rough surfaces.

<b>Table – Application Rates</b>	
<b>Slope Gradient / Condition</b>	<b>Application rate</b>
≤ 4H to 1V	2,800 kg/ha
> 4H to 1V and ≤ 3H to 1V	3,360 to 3,400 kg/ha
> 3H to 1V and ≤ 2H to 1V	3,900 to 3,920 kg/h
> 2H to 1V and ≤ 1H to 1V	4,480 to 4,500 kg/ha
For slopes steeper than 1H to 1V use alternative stabilization methods.	
H = horizontal	
V = vertical	

Refer to Manufacturer’s information for additional details including mixing ratios/loading rates for specific machine sizes and visual keys for proper application.

**16.7.11 Cleaning and Protection**

After application, thoroughly flush the tank, pumps and hoses to remove all material. Wash all material from the exterior of the machine and remove any slurry spills. Once dry, material will be more difficult to remove. Clean spills promptly. Advise Superintendent of methods for protection of treated areas. Do not allow treated areas to be trafficked or subjected to grazing.

**16.7.12 Inspection and Maintenance**

All inspections and maintenance recommendations shall be conducted by qualified professionals. Initial inspections shall insure installations are in accordance with the project plans and specifications with material quantities and activities fully documented. Subsequent inspections shall be conducted at pre-determined time intervals and corrective maintenance activities directed after each significant rainfall event or other potentially damaging weather or site event.

## 16.8 IRRIGATION

### 16.8.1 Irrigation System - Hold Point

#### General

Standard: To AS/NZS 3500.1

Place a high priority on avoiding surface runoff when selecting system components. Use low trajectory sprinklers where possible. Select components to keep the sprinkler precipitation rate below the infiltration rate of the soil and/or use repeat cycles to allow water to soak into the root zones.

Where possible, separate station/zones for irrigation at the top and bottom of sloped areas.

#### Materials

Pipework upstream of control valves: Use uPVC class 12.

Pipework downstream of control valves: Use uPVC class 9 or high density polyethylene.

#### Performance

Coverage (mm of water over area to be watered): 50 mm per week during the establishment period and then progressively hardening off to the local conditions. Ensure that final water usage is such that plant health and vigour is maintained without wastage of water.

#### Backflow

Fit a backflow prevention device; To AS/NZS 3500.1 and as required to meet the approval of Power and Water Corporation.

#### Pressure regulating valves

Provide a pressure regulating valve at the take-off point which is adjustable between 100 and 700 kPa. Install an 800 mm filter sized to suit the flow immediately upstream from the pressure regulating valve, and provide gate valves upstream from the filter and downstream from the pressure regulating valve. Mount the assembly in an accessible position in a valve box or access pit as required.

#### Irrigation Controller

Use electric solenoid valves wired to an irrigation controller.

In the Darwin Region, the irrigation controller is to be compatible with a "Toro Irrinet" irrigation telemetry system. At the completion of the defects liability period, liaise with the Department's landscape maintenance contractor to have the irrigation system handed over and included into the telemetry control system.

Mount the controller in a weatherproof lockable cabinet.

Include the following features:

- Variable timer for each station with a range from 1 minute to not less than 30 minutes.
- Manual cycle and individual station operation.
- Manual on-off operation of irrigation without loss of program.
- 240 V input and 24 V output capable of operating 2 control valves simultaneously.
- 24 hour battery program backup.
- Power surge protection.

Electrical connection: Connect to a 240 V supply and provide an isolating switch at the controller.

Automatic control valves: 24 V solenoid actuated hydraulic valves with flow control and a maximum operating pressure rating of at least 1 MPa. Provide valves able to be serviced without removal from the line. Install a gate valve of the same size immediately upstream from each automatic control valve. House both valves in a valve box with high impact plastic cover at finished ground level.

Control wires: Connect the automatic valves to the controller with building wire laid in sealed conduits, with the mainline where possible. Lay intertwined for their full length without joints except within valve boxes. Use waterproof connection. Provide expansion loops at each solenoid lead or joint.

**Hold Point** - Backfill trenches only after inspection and approval of wiring.

Minimum size active 1.5 mm<sup>2</sup>. Minimum size common 2.5 mm<sup>2</sup> laid in closed loop.

**Sprinkler Heads**

Provide heads which maintain a preset arc of throw, adjustable for radius, during watering operations and which are vandal-resistant.

Pop-up type heads: Heads designed to rise out of their housings under supply pressure to a minimum "pop-up" height of 50 mm.

**Risers**

Mount all in-ground heads on reticulated risers. Mount above ground on fixed risers.

Micro irrigation system

Polyethylene irrigation pipe: To AS 2698.1 Class IRRIG with barbed fittings of similar pressure rating fastened with ratchet type clamps. Lay pipe on finished ground surface under planting bed mulch and anchor at minimum 1.5 m intervals with U-shaped stakes. Connect micro-tube laterals with proprietary push in or screw in fittings.

Microsprays: Mount microsprays on stakes 300 mm above ground and connect to the pipework with microtubes.

Drippers: Use drippers which are turbulent flow types, easily dismantled for cleaning. Connect directly into the pipework or with microtubes.

Micro irrigation valve box: Use micro irrigation valve boxes which are of high impact plastic with snap lock covers at finished ground level, each housing a stop cock, filter (200 mm for microsprays, 100 mm for drippers), pressure reducing valve (170 kPa outlet pressure) and automatic control valve.

<b>Table – Irrigation Schedule</b>			
<b>Fittings and attachments include but are not limited to those scheduled below for specific locations or fixtures:</b>			
<b>Location</b>	<b>Item</b>	<b>Requirement</b>	
At points shown on drawings	External hose cocks	Type	To AS/NZS 3500(set)
		Size	20 mm
As on approved design plan	Sprinkler	Type	Gear driven
As on approved design plan	Automatic valve	Type	Solenoid operated
		Size	Maximum pressure loss 20 kPa
As shown on drawings	Quick coupling valve	Type	Polypropylene
		Size	25 mm
As required to achieve uniform coverage	Microsprays	Type	No moving parts
At each plant	Drippers	Type	Turbulent flow
At each plant	Bubblers	Type	Adjustable from 0 - 10 litres per minute.

**16.8.2 Design plans – Hold Point**

**Hold Point** - Submit drawings to Superintendent for approval indicating design proposals showing all pipework, sprinklers, valves and control systems.

### **16.8.3 Setting Out**

Mark out the positions of the main irrigation lines, sprinkler heads, and valves prior to excavation, and:

- ensure completed surface levels are in accordance with the design plans; and
- obtain information about the locations of existing services, including underground services, from the relevant authorities, and mark these locations on the ground prior to excavation.

### **16.8.4 Excavation**

Excavate in accordance with AS/NZS 3500.1.

Excavate to the lines, levels and grades as required for irrigation trenches. Trench depths and widths as required by AS 3500.1.

Liaise with relevant authorities to locate existing services.

Excavate within one metre from existing underground services only by hand or by hydro excavation.

Damage to existing services and vegetation to be rectified at Contractor's expense.

The Contractor shall be deemed to have allowed for the cost of performing the required excavations in whatever material may be encountered, and no extra payment shall be paid for excavation in rock.

Cut back roots encountered in trenches to not less than 600 mm clear of the pipework. Remove such other obstructions including stumps, boulders and the like which may, in the opinion of the Superintendent, interfere with the pipework.

At road crossings, provide under road boring at right angles to the road centre line, by an approved specialist subcontractor. Place all pipeline beneath roadways in heavy duty conduit casing. Refer to DIRECTIONAL BORING section.

Stockpile topsoil on site.

### **16.8.5 Installation**

Install pipework in straight lines and uniform grades. Keep the number of joints to a minimum. Install conduits and pipes having grade or class identification marking so that the marking is visible for inspection.

Lay all pipework under paths, paving or slabs in conduits.

Install according to the approved irrigation design and specifications.

Obtain approval from Power and Water Corporation before connecting to water supply system.

Installation of all pressurised pipework, fittings, Class 12 UPVC and above pipework, and other fixtures, and connection to an existing water supply system, is to be carried out by a qualified plumber licensed in the Northern Territory.

Provide 50 mm thick compacted bedding of clean granular sand free from stones and other debris over the total width of all excavations.

Clean all surfaces of UPVC joints with an approved cleaning fluid prior to jointing.

Solvent weld all UPVC joints, unless otherwise specified.

Flush all pipework prior to the attachment of sprinklers, drip emitters and the capping of pipeline ends.

Install and connect all fixtures shown on the design plans neatly, with waterproof joints. Install in accordance with the manufacturer's instructions.

Installation of all 240 volt electrical work must be carried out by a qualified electrician licensed in the Northern Territory. All wiring and jointing shall use Power and Water Corporation approved materials. Join 240 V electrical wiring with a waterproof jointing kit.

Install all solenoid valve wiring beside the appropriate pipework in the conduit. Size conduit to allow free movement of wiring and draw wire.

Run all electrical wire in continuous lengths between the controller and valve. Ensure the wire is not kinked.

Ensure adequate length of wire is available at valves during installation to enable future replacement of valves.

#### **16.8.6 Water Source**

Liaise with Power and Water Corporation as the Department's service liaison consultant in relation to water supply requirements associated with this contract.

Carry out the excavation necessary to locate and expose the connection point. On completion, reinstate surfaces and elements which have been disturbed such as kerbs, footpaths and nature strips.

Obtain approval from Power and Water Corporation before connecting to the water supply system.

#### **16.8.7 Testing – Hold Point**

Check pipe joints, valve seats, tap washers, strainers and other elements for leaks. Repair or replace if damaged, and retest.

Provide all equipment necessary for testing.

All joints and connections are to remain visible during the test.

Measure pressure at the lowest section of pipework being tested.

Pressure minimum of 800 kPa shall be maintained for a minimum period of two hours in all pressure pipework and fittings up to and including the solenoid valves, except in spray, drip, and micro sprinklers.

Repair and retest all leaks prior to acceptance.

**Hold Point** - Obtain Superintendent's approval to proceed with backfilling other than spot filling to retain pipework from movement during pressure testing.

#### **16.8.8 Backfilling**

Generally: Backfill trenches as soon as possible after approval of laid and bedded service.

Provide clean granular sand cover around the pipe and to a compacted thickness of 100 mm above the pipe.

Compact the sand with a vibrating plate or similar.

Place and compact select fill conforming to the PAVEMENTS AND SHOULDERS section to 100 mm below existing surface. Compact to density of surrounding material.

Place 100 mm of topsoil over select fill and treat similar to existing surface.

Remove all surplus material from site.

Ensure the surface of all backfilling does not pond water.

Remedy any surface settlement due to backfilling during the maintenance period.

### **16.9 TELEMETRIC CONTROL STATION DETAILS**

Telemetric operated Irrigation control stations shall be constructed to comply with the following requirements. Refer to drawing CS 3317. Refer to REFERENCED DOCUMENTS.

#### **16.9.1 Materials**

##### **Mounting post**

- 3600 mm (length) x 75 mm square hollow section (SHS) of 3 mm gauge steel, sealed at both ends with welded steel plates.
- It shall have two horizontal metal brackets, 300 mm x 60 mm x 3 mm gauge, welded to it in the positions specified on the design drawings for mounting a control box. When

constructed it shall be hot dip galvanized.

**Lockable stainless steel control cabinet**

- 600 mm (height) x 400 mm (width) x 200 mm (depth)
- The lock shall be incorporated into the design and the box shall be of sturdy 'vandal-proof' construction.

**Stainless steel whip aerial**

RF Industries model CD 28-41-70.

**Irrigation controller**

Must be compatible with Motorola IRRInet

**Radio**

Motorola Model GP328

Frequency - one of either of the following frequencies, depending on the location of the irrigation system within the Greater Darwin area (details of which can be obtained from the Superintendent).

- Area A – 150.825mhz
- Area B – 155.425mhz

**Solar panel**

Must have sufficient capacity to maintain the charge in the batteries of the control station equipment.

**16.9.2 Installation**

- Position the control station in the location specified in the design drawings.
- Position the post 600 mm into a concrete footing. The footing shall have minimum dimensions of 350 mm diameter x 650 mm deep. The post must be vertical.
- Affix the control box securely to the mounting brackets
- The base of the box shall be 1350 mm above the ground
- Use 4 x 316 stainless steel bolts with round heads to prevent theft
- Bolt head must be on the outside of the box with the nuts inside
- Control equipment will be affixed securely to the inside of the box and arranged neatly for ease of operation.
- Cabling
- cabling shall be run internally through the mounting post
- Flexible conduit shall be inserted in the entry and exit points to prevent chafing
- Conduits will be joined with a weatherproof seal
- Conduit shall be used between the post and the control box to provide weather proofing.
- Aerial shall be mounted vertically on top of the post.
- Solar panel
- Mount on top of the post
- Mount at an angle of 11 degrees to the horizontal with the cells facing north.

**16.10 AS CONSTRUCTED INFORMATION**

Drawings are to show as installed locations of all pipework, fittings, sprinklers, control valves, controllers, wiring, accessories etc. Refer to **As Constructed Information** clause in MISCELLANEOUS PROVISIONS.

## 16.11 ESTABLISHMENT PERIOD

- Keep the site neat and tidy at all times.
- Ensure the irrigation system is maintained and performs in accordance with the design plans. The operating schedule is to be adjusted to suit wet/dry season conditions. Prevent excessive watering.
- Keep the root ball of all plants moist at all times.
- Keep all plants and grass in a healthy actively growing state.
- Keep the whole site weed free.
- Repair eroded areas and re-establish to maintain the design.
- Replace all damaged, dying or dead plants within 10 working days.
- Maintain all plantings free from insects, pests and diseases.
- Fertilise all plantings and grass in accordance with the **Table - Fertilisers** in **Fertilisers** sub-clause in **Materials** clause in this work section and with the **Table -Fertiliser Application Rates** in **Planting of Trees, Shrubs and Ground Cover** sub-clause in **Planting** clause in this work section, ensuring to work any fertilizer into the soil around the base and dripline of the plant to prevent runoff.
- Ensure mulch is maintained at the specified levels.
- Ensure all stakes and ties remain secured with adjust ties to suit plant growth. Replace broken stakes and ties immediately.
- Prune trees and shrubs as required, or as directed by the Superintendent, to encourage dense bushy growth; use only qualified personnel.
- Prune established trees for a 3 m clearance where high profile machinery will be required to use the area regularly.
- Remove all branches sweeping the ground.
- Remove all pruning within 2 m of the ground to within 10 mm of the main stem.
- Keep ground cover plants free of dead vegetation.
- Mow grass when grass height exceeds 100 mm and in accordance with the **Mowing** sub-clause in the **Grassing** clause in this worksection.
- Remove grass cuttings from site.
- Trim neatly all edges of grassed areas at the same time as mowing.
- Keep all stormwater drains clean of debris and silt to allow unrestricted flow of stormwater run-off.
- Remove termite mounds and treat the specific site with Fipronil.
- Use all insecticides and fungicides for the control of termites/insects and other infestations in accordance with the manufacturer's instruction.

### 16.11.1 Establishment Period Records

Maintain accurate current records of all maintenance work during the establishment period, including; the number of employees on site and the work conducted.

Unscheduled audits may be conducted by the Superintendent throughout the 13 week period.

Records shall be provided upon request.

## 16.12 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 17 DUCTING AND CONDUITS

### 17.1 CROSS REFERENCES

EARTHWORKS

PAVEMENTS AND SHOULDERS

TRAFFIC CONTROL SYSTEMS AND INTELLIGENT TRANSPORT SYSTEMS

### 17.2 STANDARDS AND PUBLICATIONS

Conform to the following Standards and Publications unless specified otherwise, and comply with the requirements of the Power and Water Corporation, the NBN Co., and Telstra Australia:

AS 1345	Identification of the contents of pipes, conduits and ducts.
AS/NZS 2053(set)	Conduits and fittings for electrical installations.
AS/NZS 3000	Electrical installations (Australian/New Zealand Wiring Rules)
AS/NZS 3500(set)	Plumbing and drainage

NTMTM NT Materials Testing Manual accessible via  
<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>

NTTM NT Test Methods

### 17.3 SUPPLY AND INSTALLATION

Terminate duct crossings 500 mm behind kerbs unless specified otherwise.

Terminate duct crossings clear of the pavement as specified.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Excavate trench to a width appropriate for the ducting and which allows compaction of the backfill to be readily undertaken.

Provide the specified minimum cover required by the relevant authority but not less than 750 mm.

Locate ducts to avoid other services.

Lay at right angles to the road centre line and with straight lines and grades unless specified otherwise.

Minimum fall to be 1% to the lower side of the road.

Lay ducting on 50 mm thick sand bedding.

Install 4 mm galvanised draw wires in all conduits. One draw wire to remain in place in conduit.

Cap all conduits with standard UPVC caps.

Place marker tape from each end of the conduit to the surface.

Backfill the trench with select fill to subgrade level and compact to 95% relative compaction.

Where trench excavated through pavement, backfill above subgrade level with base gravel, as specified in the PAVEMENTS AND SHOULDERS Section, compacted to 100% relative compaction. Reinststate the surface.

## 17.4 MARKINGS

Mark kerbs with a letter to identify the type of ducts which pass under them as follows:

Electrical: 'E'.

Telstra: 'T'.

Water: 'W'.

Height of letter: 50 mm.

Width of letter: 30 mm.

Stamp the letter into new kerb after the concrete has taken its initial set and before final set.

Mark existing kerb with an aluminium plate containing the identification letters as specified.

If there are no kerbs:

- Place a star picket 1300 mm long, painted white and set 300 mm into the ground directly over each end of the conduit.
- Attach an identification letter in red paint on a 50 mm x 30 mm aluminium plate fastened securely to the picket.

## 17.5 CONDUIT MARKERS

Erect 600 mm x 600 mm signs at locations specified to highlight the existence of conduits.

Sign legend to be:

"Service Conduits Laid. Opening of Road Surface Prohibited."

## 17.6 ELECTRICAL DUCTING ('E')

Ducting conduit shall be heavy duty uPVC coloured light orange and solvent cement jointed.

Lay a copper earth strap (3 mm x 25 mm) in a continuous strip along the bottom of each trench.

Supply and install orange PVC cable marker tape over the ducts as specified. Refer to **Cable Installation** and **Cable Marker Tapes** in STREET LIGHTING.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Liaise with Power and Water Corporation regarding the installation of the ducts.

## 17.7 WATER DUCTING ('W')

Ducting conduit to be heavy duty PVC, 100 mm diameter, coloured white and solvent cement jointed.

Use uPVC class 9

Lay conduits two to a trench opposite each alternate lot boundary.

Service each lot by a separate conduit.

Liaise with Power and Water Corporation regarding the installation of the ducts.

## 17.8 TELSTRA DUCTING ('T')

Telstra Australia will excavate for, supply, install and backfill over all Telstra ducting.

Liaise with Telstra and give minimum 14 days notice prior to the need for ducting to be installed.

The locations of Telstra ducts are shown on the drawings or will be indicated by Telstra personnel.

## 17.9 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## **18 TRAFFIC CONTROL SIGNALS AND INTELLIGENT TRANSPORT SYSTEMS**

### **18.1 CROSS REFERENCES**

PROVISION FOR TRAFFIC  
DUCTING AND CONDUITS

### **18.2 STANDARDS AND PUBLICATIONS**

Conform to the following Standards and Publications unless specified otherwise:

#### **18.2.1 Australian Standards**

AS/NZS 1163	Structural steel hollow sections
AS 1231	Aluminium and aluminium alloys - Anodized coatings for architectural applications
AS/NZS 1477	PVC pipes and fittings for pressure applications
AS/NZS 1554(set)	Structural steel welding
AS/NZS 1594	Hot rolled steel flat products
AS 1742(set)	Manual of uniform traffic control devices
AS 1743	Road signs – Specifications
AS/NZS 2053(set)	Conduits and fittings for electrical installations
AS/NZS 2144	Traffic signal lanterns
AS/NZS 2276(set)	Cables for traffic signal installations
AS/NZS 2276.1	- Multicore power cables
AS/NZS 2276.2	- Feeder cable for vehicle detectors
AS/NZS 2276.3	- Loop cables for vehicle detectors
AS 2339	Traffic signal posts and attachments
AS 2353	Pedestrian push button assemblies
AS 2700(set)	Colour standards for general purposes
AS 2703	Vehicle loop detector sensors
AS 2979	Traffic signal mast arms
AS/NZS 3000	Electrical installations (Australian/New Zealand Wiring Rules)
AS/NZS 3100	Approval and test specification - General requirements for electrical equipment
AS/NZS 3191	Electric flexible cords
AS/NZS 3678	Structural steel - Hot-rolled plates, floorplates and slabs
AS/NZS 3679.1	Structural steel - Hot rolled bars and sections
AS/NZS 4680	Hot dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 5000.1	Electrical cables – Polymeric insulated – For working voltage up to and including 0.6/1 (1.2)kV
AS/NZS 61558(set)	Safety of power transformers, power supplies, reactors and similar products
AS/NZS 61558.1	– General requirements and tests

#### **18.2.2 British Standard**

BS 381C-637	Medium sea grey
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### **18.2.3 Civil Standard Drawings**

CS 1501	Standard drawing Signal details Pole foundation
CS 1502	Standard drawing Signal details Mast arm foundation
CS 1503	Standard drawing Signal details Controller foundation
CS 1504	Standard drawing Communication isolation pillar
CS 1505	Standard drawing Signal details Lantern mounting details
CS 1506	Standard drawing Signal details Pedestrian push button
CS 1507	Standard drawing Signal details Detector installation

## **18.3 CONCRETE**

Refer to the MISCELLANEOUS CONCRETE WORKS Section of this Specification for concrete footings and the reinstatement of concrete footways.

## **18.4 GENERAL EQUIPMENT AND INSTALLATION**

### **18.4.1 Safety**

Provide for the safety of vehicle and pedestrian traffic as specified in the PROVISION FOR TRAFFIC Section.

Enforce safety precautions with regard to power cables.

### **18.4.2 Lightning Strikes and Power Surges**

Supply and install a 25A surge reduction filter.

Connect in a series configuration with the primary 240 V AC power supply prior to the main circuit breaker, as recommended by manufacturer.

### **18.4.3 Pedestals and Supports**

Use galvanized posts and fittings. Provide posts in one continuous length without joints.

All welds to be continuous and carried out prior to galvanizing.

Construct footings as specified.

Refer to CS 1501 and CS 1502.

Reinstate footways once footing concrete has cured and pedestals and/or mast arms are installed.

Provide 450 x 450 x 50 lean mix concrete support collar around pedestals. Box out where pedestals are in concrete islands or footways.

### **18.4.4 Vehicle Signal Lanterns**

Position lantern assemblies (including cowls, louvres, and target boards) so that:

- no part is within 300 mm of the line of the kerb face;
- the top of the assembly is 4.0 metres above the pavement level;
- any arrow aspects are located to the left or right side (as appropriate) of the associated round aspects; and
- they are as specified.

Provide a rectangular target board for all lantern assemblies.

Blank out the unused aspect positions of target boards with a material of similar colour and finish to the target board.

Signal lantern doors to be capable of opening through 90 degrees without having to alter the adjustment of any signal lantern.

Signal Lanterns to be NT Standard LED Type by Aldridge Traffic Systems Pty. Ltd., or a similar product approved by Superintendent before installation.

Maintain the vehicle signal lanterns with a cover of suitable heavy duty material immediately after erection of the signal lantern and prior to commissioning.

Attach the temporary covers neatly so that they remain in place during all weather conditions.

Provide an inspection hole in the cover, to allow for testing of lantern wiring with covers in place.

### **18.4.5 Pedestrian Signal Lanterns**

Use lanterns with 200 mm diameter lens.

Use symbolic displays.

Position lantern so that

- no part is within 300 mm of the line of the kerb face;
- centre of green lens is 2.2 m above the footway; and
- the signal is clearly visible from the opposite side of the carriageway.

Signal lantern doors to be capable of opening through 90 degrees without having to alter the adjustment of any signal lantern.

Pedestrian Signal Lanterns to be NT Standard LED Type by Aldridge Traffic Systems Pty. Ltd., or a similar product approved by Superintendent before installation.

### **18.4.6 Traffic Signal Controller**

Locate the controller as specified.

Mount the controller on a concrete foundation block as specified.

Refer to CS 1503.

Arrange and connect power to the controller, and supply and provide additional plant, equipment or work required by the Power and Water Corporation.

Transport and install the controller in accordance with the manufacturer's specifications.

Supply and install an earth stake.

Test and commission the completed installation.

### **18.4.7 Painting**

Finish colours for:

- lantern assemblies including backing plates to be matt black; and
- terminal assembly finial caps and controller housing to be Medium Sea Grey (BS 381C-637; Hex #899194 or #8a9194; CMYK 7:2:0:42; RGB 137:145:148).

## **18.5 TRAFFIC SIGNAL CABLING – HOLD POINT**

**Hold Point** – Submit documentation of proposed cable layout for approval prior to commencing installation of cabling.

### **18.5.1 Multicore Connecting Cable**

Cable used shall be 51 core multicore as per AS/NZS 2276.1 and shall have a polyamide jacket termite sheath installed.

Terminate the cabling of signal lanterns and multicore cable in each associated terminal assembly.

### **18.5.2 Loop Detector Feeder Cables**

Cable used shall be as per AS/NZS 2276.2 and shall have a polyamide jacket termite sheath installed.

Install and connect feeder cables from detector loops to detector sensors units located in the controller housing.

Feeder cables to be Telcon - type B3102 CS/NJ/PVC or equivalent.

Feeder cables to be indelibly marked with the loop detector number at each end.

### **18.5.3 Loop Cable for Vehicle Detectors**

Cable used shall be as per AS/NZS 2276.3

Cable will be V90 HT, 30/0.25.

Supply and install the cable for the loop in a saw cut in the pavement surface.

Clean the saw cut of debris and sharp edges before installing the cable.

Twist loop feeder cable one turn every 200 mm between each loop and junction in the detector pit.

Backfill around the loop cables with polymer modified bituminous emulsion filler.

House cables in conduits where they pass under kerbs.

Refer to CS 1507.

#### **18.5.4 Power Supply Cable**

Supply and Install 2x 1C 25 sq mm Cu XLP/Nj/PVC cable or Power and Water Corporation approved equivalent.

Power and Water Corporation to approve cable type and connection details

Provide connection of the Power and Water Corporation cable to controller.

Provide Notice of Intent to Power and Water Corporation for un-metered connection

#### **18.5.5 Cable Conduit**

Terminate the ends of conduits at pits 25 mm - 75 mm inside the pit.

Provide a draw wire in each conduit at completing of wiring.

Provide a residual length of at least one metre of draw wire in junction pits.

Install conduits in accordance with the DUCTING AND CONDUITS Section, with the exception that the copper earth strap to be deleted.

#### **18.5.6 Conduit Junction Pit**

Provide conduit junction pits and covers to house conduit ends, and 1.5 metres of residual cable for each cable in the pit.

Place conduit junction pits on 100 mm thick coarse gravel bed.

Conduits shall have minimum 100 mm clearance from coarse gravel bed.

Drill neat holes for the entry of cable conduits not greater than 10 mm larger than the outside diameter of the conduit.

Install pits so that lids are level with the adjacent finished surface and backfill in accordance with the DUCTING AND CONDUITS Section.

#### **18.5.7 Detector Pits**

Provide detector pits to house joints in loop detector feeder cable.

Pits to be HR Products Model No. 1420 or similar.

Bed the pits on 75 mm thickness of compacted sand.

Backfill in accordance with the DUCTING AND CONDUITS Section.

#### **18.5.8 Inspections – Witness Point**

**Witness point** - Give 24 hours notice to the Superintendent for inspection of excavations for pedestals, bases and conduits.

### **18.6 PEDESTRIAN PUSH BUTTON ASSEMBLIES**

Pedestrian push button assemblies to be NT Standard LED Type by Aldridge Traffic Systems Pty. Ltd., or a similar product with prior approval by Superintendent.

Refer to CS 1505 and CS 1506.

Install pedestrian push buttons onto pedestal and mast arms as specified.

## **18.7 AUDIO-TACTILE TRAFFIC SIGNAL EQUIPMENT**

### **18.7.1 General**

Provide equipment additional to the provisions of AS 2353 to generate audio and tactile signals at stations.

Audio-tactile driver to be NT Standard LED Type by Aldridge Traffic Systems Pty. Ltd., or a similar product with prior approval by Superintendent.

## **18.8 SCATS FACILITIES**

### **18.8.1 Communications Isolation Pillar**

Supply and install pillar including foundation and mounting facilities as specified.

Refer to CS 1504.

Install Zephyr Products model A4 isolation device as compatible with Telstra approval number R82/101. Provided by the Principal.

### **18.8.2 Connections Between Controller and Communications Isolation Pillar**

Supply and install Class 12 white PVC conduit with 300 mm radius bends and draw wire.

Supply and install Telcon type P3102 CS/NJ/PVC cable or equivalent.

Complete all connections between intersection controller and communications isolation pillar.

### **18.8.3 Connection to Telstra Pit – Hold Point**

Connection to Telstra Pit from Communications Isolation Pillar

Supply and install Class 12 white PVC conduit with 300 mm radius bends and draw wires.

Connection into Telstra point of entry shall be undertaken under Telstra supervision and as per Telstra requirements.

Provision and connection of Telstra cable from Telstra pit to the isolation pillar is the responsibility of Telstra.

**Hold Point** - Provide documentary evidence that the installation is approved by Telstra.

## **18.9 DOCUMENTS AND PLANS – HOLD POINT**

**Hold Point** - Submit to the Superintendent one complete set of As Constructed Drawings and completed Cable Layout and Connection Chart before the issue of the Certificate of Practical Completion.

Refer to the **As Constructed Information** clause in MISCELLANEOUS PROVISIONS.

## **18.10 CHECKING AND TESTING – WITNESS POINT**

**Witness Point** - Give 24 hours notice for checking and testing signal controllers, cabling and lanterns.

## **18.11 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 19 TRAFFIC COUNTING STATIONS

### 19.1 CROSS REFERENCES

PROVISION FOR TRAFFIC

EARTHWORKS

DUCTING AND CONDUITS

### 19.2 STANDARDS AND PUBLICATIONS

Conform to the following Standards and Publications unless specified otherwise.

#### 19.2.1 Australian Standards

AS 1012 Methods of testing concrete.

AS 1160 Bitumen emulsions for the construction and maintenance of pavements.

AS /NZS 1252 High strength steel bolts with associated nuts and washers for structural engineering.

AS 1397 Continuous hot-dip metallic coated steel sheet and strip - Coatings of zinc and zinc alloyed with aluminium and magnesium

AS /NZS 2053(set) Conduits and fittings for electrical installations.

AS/NZS 2276(set) Cables for traffic signal installations.

AS 2700 Colour standards for general purposes.

AS 2703 Vehicle loop detector sensors.

AS /NZS 3000 Electrical installations (Australian/New Zealand Wiring Rules).

AS /NZS 3191 Electric flexible cords.

AS 3600 Concrete structures.

AS/NZS 4671 Steel reinforcing materials

AS/NZS 5000.1 Electric cables – Polymetric insulated – For working voltages up to and including 0.6/1 (1.2) kV

#### 19.2.2 Civil Standard Drawings

CS 1550 Standard traffic counting station Post mounted Detector loop and pit details

CS 1551 Standard traffic counting station Post mounted Detector loop layout

CS 1552 Standard traffic counting station Post mounted Piezo tube layout

CS 1553 Standard traffic counting station Post mounted Foundation details

CS 1554 Standard traffic counting station Post mounted Cabinet wiring diagram

CS 1555 Standard traffic counting station Post mounted Post assembly

#### 19.2.3 Materials Testing

NTMTM NT Materials Testing Manual accessible via

<https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/materials-testing-manual>

NTTM NT Test Methods

### 19.3 CABINETS

Cabinets will be provided by the Principal.

Install as specified.

Refer to CS 1554.

Cabinets to open away from, and be aligned square to, the road.

### **19.3.1 Terminal Blocks**

Provide two terminal blocks for the termination of loop detector feeder cables similar to Clipsal 543.

Mount the terminal blocks on the front edge of the cabinet lower shelf.

Supply two copies of drawing showing labelled loop layout and terminal blocks.

### **19.3.2 Switchboard for Solar Power Site**

Provide and connect a 10 amp on-off switch with the up position as off and clear marks for on and off.

Provide a four terminal strip similar to Clipsal 543.

Mount and connect voltage regulator as specified.

Refer to CS 1554.

Clearly label terminal strip '+' and '-'.

Wire solar panel to terminal strip via switch and regulator.

Mount the switch regulator and terminal strip on a non-hygroscopic, non-inflammable base 6 mm Bramite or similar.

Separate the switch and strip a minimum of 100 mm.

## **19.4 CABLING**

Provide detector loop cable of 30/025 V105 type or similar.

Twist loop feeder cable one turn every 20 cm between each loop and junction in the detector pit.

Provide loop detector feeder cable of Telcon B3102 CS/NJ/PVC type or similar.

Provide Piezo detector feeder cable of 75 ohm co-axial cable type RG59.

Provide solar power feed cable of 30/025 V105 type or similar, red and black.

Join cables by soldering.

Insulate and seal against ingress of water by using mastic filled heatshrink Sigmaform SST 12-04 or similar.

Ensure heatshrink covers at least 25 mm of insulation beyond the join.

## **19.5 CONDUIT**

Provide and lay 50 mm HD PVC conduit and one P20 white PVC conduit as specified.

Allow 25 mm clearance between adjacent conduits.

Provide sand cover minimum 100 mm above conduit.

Provide electrical marker tape 150 mm below natural surface in conduit trenches. Refer to **Cable Installation** and **Cable Marker Tapes** in STREET LIGHTING.

Terminate the conduits 25 mm inside detector pit, and 100 mm above natural surface within pole assembly as specified.

Refer to CS 1550 and CS 1553.

Ensure minimum cover of 450 mm over conduits.

## **19.6 POLE ASSEMBLY**

The pole assembly including solar panel will be provided by the Principal.

Provide opening in solar panel backing plate to allow passage of wires inside the post as specified.

Refer to CS 1555.

## **19.7 INSTALLATION - GENERAL**

Installation shall include the following civil works:

- Excavation.
- Backfilling.
- Reinstatement.
- Directional (Thrust) boring.

Provide for the safety of traffic in accordance with the PROVISION FOR TRAFFIC Section.

### **19.7.1 Excavation**

Excavate roadways to a maximum of 100 mm wide.

Saw cut excavations through paved footways.

Cut excavation vertically.

Provide bridging of excavations to maintain vehicular access at all times.

### **19.7.2 Backfilling**

Backfill all excavations.

Remove all rubbish and foreign material from the excavation prior to backfilling.

Backfill with select fill and compact to 95% relative compaction, in accordance with the EARTHWORKS Section.

### **19.7.3 Concrete Foundation for Pole Assembly**

Compact the bottom of excavation prior to pouring foundation.

Align rag bolts to ensure cabinet is square to the road.

Use Class N20 concrete for the foundation.

Reinstate by compacting surrounding soil to match existing.

Refer to CS 1553.

### **19.7.4 Detector Pits**

Provide pits for detector terminations as specified.

Refer to CS 1550 and CS 1551.

## **19.8 INSTALLATION - VEHICLE DETECTION**

### **19.8.1 Detector Loop - Witness Point**

Install cable for loop in saw cut in pavement surface.

Minimum depth of cut to be 30 mm, except in zone where axle sensors are to be fitted when minimum depth of cut to be 80 mm as specified.

Width of cut to be 6 mm (+ or - 2 mm).

Provide diagonal cut across each right angled corner as specified.

Provide additional cut from one side of loop to detector pit.

Clean the cuts with compressed air.

Install one loop comprising four turns per cut as specified.

Press the cable to the bottom of the cut using a piece of softwood or similar material.

Ensure the insulation of the cable is not damaged.

Backfill around the cable to the pavement surface with bitumen emulsion such as Pabkote Bitumen Emulsion Type 3 or similar.

Backfilling to be undertaken immediately after laying the cable and prior to allowing vehicular traffic. Remove all loose material from the opening immediately prior to backfilling.

Ensure minimum cover of backfill of 20 mm over top of cable, except where axle sensors are to be fitted where minimum cover of filling compound to be 70 mm over top of cable.

Remove excess compound from road surface.

House loop wires in conduit between road and detector pit.

Install and connect loop detector feeder cable between each loop and terminal block in the cabinet.

Ensure one metre of cable is available in the cabinet.

Terminate each loop detector feeder cable to a terminating block.

**Witness Point** -Provide 24 hours notice to the Superintendent prior to installation of vehicle detector loops.

Refer to CS 1550 and CS 1551 and CS 1552.

### **19.8.2 Piezo Axle Sensors**

Axle sensors and guides will be supplied by the Principal.

#### **AXLE SENSOR GUIDE INSTALLATION**

Refer to CS 1552.

Cut two slots across the carriageway 60 mm wide (+ or - 2 mm) 50 mm deep (+ 5 mm) with centres of each slot 1.0 m (+ or - 5 mm) apart.

Cut feeder cable slots from the centre line of each slot to the carriageway edge 6 mm wide (+ or - 2 mm) and 25 mm (+ 5 mm) deep.

Prevent ingress of adhesive during installation by covering guide ends, securing screw holes and area between the guide and feeder cable slots with plasticine or similar material.

Cover upper surface of the guides with masking tape or other material to prevent ingress of adhesive.

Insert ten 65 mm square by 10 mm thick foam polystyrene packing pieces into each slot.

Place guides temporarily into slots pressing down until top of guide is flush with road surface.

Remove the guides after polystyrene has deformed leaving the compressed polystyrene in the slots.

Fill the slot to a depth of 20 mm with "Hermetite" epoxy resin or "Epirez 214" or similar.

If the carriageway surface is not level, this may be performed in stages.

Fit the guide into the slot with securing screws downstream of the traffic flow.

Push the guide down to allow the epoxy to flow up the sides of the slot.

Remove excess epoxy from the guide or road surface before it hardens.

Fill any gaps with epoxy.

Place weights on guide to hold it in proper position during curing process.

Install countersunk 'dynabolt' fixings in base of guide after curing is complete.

Space the fixing 0.25 m from each end and 0.5 m spacing along the guide.

Drill 10 mm hole through base of guide and 100 mm into road pavement for each fixing.

Countersink and clear each hole.

Pour epoxy into holes and insert 100 x 10 mm 'dynabolt' fixings.

Retighten the dynabolts after the epoxy has hardened.

Tighten the batten fixing after epoxy has hardened.

#### **AXLE SENSOR INSTALLATION**

Do not flex the Piezo detectors about the x axis shown on drawing CS 1552.

Do not remove Piezo detector after installation.

Remove plasticine or similar from guide ends and securing screw holes.

Undo securing screws sufficient to clear the inside of the guide slot.

Clean the guide slot of all foreign material.

Wipe each sensor with liquid soap to ease the sensor into the slot.

Insert sensor tapered side down.

Tap sensor into slot with large faced rubber mallet starting from both ends working to the middle.

Tighten securing screws after sensor has been firmly inserted into slot.

House sensor "tails" in conduit between carriageway and detector pit.

Install and connect Piezo detector feeder cable between each sensor tail and terminal block in the cabinet.

Ensure one metre of cable is available in cabinet.

Fill all cable slots flush with carriageway surface using a bituminous emulsion such as Pabkote Bitumen Emulsion No. 3 or similar.

Remove excess compound from carriageway surface.

## **19.9 SOLAR POWER SUPPLY**

Provide stand off sleeves 16 mm LD electrical conduit or similar.

Mount the solar panel on the sleeves in the tray.

Provide 50 mm clearance from the back of the solar panel to the mounting plate.

Use stainless steel metal thread screws to secure solar panel to mounting plate.

Provide electrical wiring from the solar panel to the cabinet consisting of two wires, one red and one black. Wires to be protected using 16 mm flexible conduit and adaptors between solar panel junction box and solar panel tray.

Wires to be supported to minimise loading on terminals.

Run the wires internal of the post and enter the cabinet through the access hole provided.

Seal the access hole with silicon sealant.

Erect solar panel facing north.

## **19.10 TESTING AND INSPECTION**

### **19.10.1 General – Witness Point**

**Witness Point** - Test the installation in the presence of the Superintendent.

### **19.10.2 Detector Loops**

Ensure detector loops and loop feeder cables have a minimum insulation resistance of 200 Mohm between the conductors and earth.

### **19.10.3 Inspection – Witness Point**

**Witness point** - Provide 24 hours notice to the Superintendent for inspection of excavations for foundations and conduits.

## **19.11 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## **20 STREET LIGHTING**

### **20.1 OUTLINE DESCRIPTION**

Supply, install, test and commission new street lighting as specified herein and as shown on the drawings.

Modify and replace existing street lighting as specified herein and as shown on the drawings.

### **20.2 CROSS REFERENCES**

EARTHWORKS for excavation and trenching.

MISCELLANEOUS CONCRETE WORKS for pole footings.

### **20.3 STANDARDS AND PUBLICATIONS**

Conform to the following Standards and Publications unless specified otherwise:

AS/NZS 1158(set) Lighting for roads and public places.

AS/NZS 1158.1.1 -Vehicular traffic (Category V) lighting – Performance and design requirements

AS/NZS 1158.1.2 - Vehicular traffic (Category V) lighting – Guide to design, installation, operation and maintenance

AS 1742(set) Manual of uniform traffic control devices.

AS/NZS 3000 Electrical installations (Australian/New Zealand Wiring Rules).

Power and Water Corporation - Power Networks Design and Construction Guidelines.

Power and Water Corporation - Power Supply Volumes, Volume 3, Street Lighting Manual.

### **20.4 MATERIALS**

#### **20.4.1 Columns**

Requirement: Provide columns in accordance with Power and Water Corporation Street Lighting Manual, standard drawings, to suit the individual street lighting design requirements.

Erection: Upon erection ensure columns stand vertically, in all directions, under final loading conditions

#### **20.4.2 Foundations and Ragbolt Assemblies**

Construct column concrete footings and ragbolt assemblies in accordance with the Power and Water Corporation Street Lighting Manual.

#### **20.4.3 Terrain Category**

Columns footings and ragbolt assemblies shall be suitable for the terrain category cyclonic conditions of the area in which they are to be installed.

#### **20.4.4 Luminaires**

Provide street light luminaires of the types specified on the drawings.

Install lamps in all luminaires to the sizes and types specified on the drawings.

#### **20.4.5 Control Equipment**

Control Panels: Control luminaires via time switch controllers located in nominated substations in underground areas or in distribution pillars or pole mounted control panels in overhead areas.

Control Packs: Provide control switch pack in the base of each pole

In each control pack provide a terminal strip for terminating the active, neutral and earthing conductors, and an automatic circuit breaker, and surge protection for LED lighting.

Size each termination on the terminal strip to readily accommodate three street lighting conductors without undue bunching.

Protect the street lighting cables with a 10 Amp single pole miniature DIN type automatic circuit breaker with a rated interrupting capacity of 9 kA at 240V AC symmetrical.

Residual Current Device (RCD) to be installed at the RODP, at the point of supply.

Multiple Earth Neutral (MEN) to AS/NZS 3000 at the RODP.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## **20.5 EXCAVATION**

### **20.5.1 General**

Excavate for footings and trenches as shown on the drawings.

Column footings

Vertically excavate all column footing holes.

Excavate footing holes 150 mm greater than the maximum dimension of the footing. Avoid larger than necessary excavations.

Where necessary carry out pumping to remove ground, storm and /or surface water.

If for any reason, the final hole is larger than required backfill with concrete to the undisturbed soil.

In areas where unrippable rock is encountered, and the use of explosives becomes necessary, the depth of excavation may be reduced, subject to acceptance by the Superintendent.

Advise the Superintendent immediately rock is encountered.

### **20.5.2 Trenches – Witness Point**

Nominal trench width: 300 mm.

Nominal trench depth: 1000 mm.

**Witness point** – Notify the Superintendent when trench excavation is complete and before backfilling has commenced.

### **20.5.3 Existing Services**

Excavate with care when crossing existing underground services. Increase the trench depth to provide a minimum of 150 mm clearance between the lowest part of the service and the first layer of marking tape.

Ramp the trench back from the obstruction.

## **20.6 FOOTINGS**

### **20.6.1 Concrete**

Supply and place concrete in accordance with the MISCELLANEOUS CONCRETE WORKS Section.

## **20.7 BACKFILLING**

### **20.7.1 Material**

Backfill with select fill as specified in the EARTHWORKS Section.

Bedding sand: Clean washed river sand.

Provide samples of bedding sand and select fill if requested by the Superintendent.

### **20.7.2 Cable Installation**

Carry out backfilling of the trenches in accordance with the following:

- All underground power cables to be enclosed in suitably sized heavy duty orange uPVC underground conduit
- Cover the bottom of the trench with a 50 mm tamped sand bed.
- Lay conduits and earth conductor on the sand bed.
- Top up with sand to form a layer 150 mm minimum over cables.
- Lay the first marker tape.
- Complete the backfilling of the trench with a second marker tape at a depth of 300 mm below finished ground level.

### **20.7.3 Cable Marker Tapes**

Lay two cable marker tape strips as follows:

- Strip 1: Directly on top of the 150 mm sand layer covering the conduit.
- Strip 2: 300 mm below the finished ground level.

Lay marker tapes with a 600 mm minimum overlap at joins.

### **20.7.4 Placing Backfill**

Place backfill in 150 mm maximum layers and compact to 95% MMDD (Maximum Modified Dry Density).

## **20.8 INSTALLATION OF LIGHT COLUMNS**

Install light columns, outreaches, lanterns and fittings in accordance with the Power and Water Corporation standard drawings.

## **20.9 CONNECTION**

Connect service cables between new street lighting poles in accordance with the design drawings.

Arrange with Power and Water Corporation to connect the new street lighting installation to the existing Power and Water Corporation network and pay all associated costs.

## **20.10 EXISTING STREET LIGHTING**

### **20.10.1 Disconnection and removal**

Make safe, disconnect and remove existing wiring.

Dismantle existing street lighting installations, taking care to avoid damage to items during dismantling operations and transport.

Refer to the **Salvaged Items** clause in PRELIMINARIES.

Deliver the salvaged materials to a storage shed to be nominated by the Superintendent. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Excavate and remove from the site all traces of abandoned concrete footings, hold down bolts and cabling.

### **20.10.2 Temporary Lighting - Hold Point**

Provide temporary lighting in accordance with Power and Water Corporation standards at intersections during periods of construction if existing street lighting is removed before new street lighting is installed.

Provide temporary lighting to Category V3 of AS/NZS 1158.1.1 and AS/NZS 1158.1.2.

**Hold point** – Submit plans of the proposed temporary street lighting to the Superintendent for approval prior to removal of existing street lights.

## **20.11 TESTING AND COMMISSIONING**

**TESTING:** Measure and record in Megohms the insulation resistance between each conductor and earth.

Check continuity of each cable installed.

Check correct phasings of all active cables of the low voltage distribution system.

Check polarity at each street lighting column to ensure that neutral and active cables are not inadvertently interchanged. Incorrect polarity at a street lighting column would result in a live column.

**COMMISSIONING:** After all the above test results are found satisfactory, arrange for Power and Water Corporation to carry out the commissioning work to energise the newly installed low voltage distribution system.

## **20.12 REINSTATEMENT**

Reinstate any damage to roads, footpaths, verges, drainage structures and vehicle driveways to their original condition.

## **20.13 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 21 DIRECTIONAL BORING

### 21.1 GENERAL

This section specifies the underground boring of passages for the installation of piping, piped services, or cabled services, beneath trafficked surfaces, buildings or other nominated areas without trenching, disruption to traffic, or subsidence.

### 21.2 CROSS REFERENCES

DRAINAGE WORKS

LANDSCAPE

DUCTING AND CONDUITS

TRAFFIC CONTROL SIGNALS AND INTELLIGENT TRANSPORT SYSTEMS

TRAFFIC COUNTING STATIONS

STREET LIGHTING

### 21.3 STANDARDS AND AUTHORITIES

Conform to the following Standards unless specified otherwise:

AS 1579 Arc welded steel pipes and fittings for water and waste water.

AS/NZS 3000 Electrical installations (Australian/New Zealand Wiring Rules)

AS/NZS 3500 (set) Plumbing and drainage

AS/NZS 4645 Gas distribution networks

Conform to the requirements of the following Authorities if their services are to be installed in the bored passages:

- Telstra
- NBN Corporation
- Power and Water Corporation
- Jacana Energy
- Territory Generation
- Any gas supply agency or authority
- Any data service provider
- Any other Agency or Authority

### 21.4 PROPOSED METHOD – HOLD POINT

**Hold point** – Submit details of the proposed method of directional boring not less than 14 days prior to commencement of construction using that method. Include details of proposed filling of cavities. No disruption or excavation of the surface is to take place over the length nominated. Co-ordinate boring works with the Authorities with jurisdiction over the services to be installed in the bored passages.

#### 21.4.1 Directional Boring With Pipe Casing – Witness Point

Keep dimensions of jacking pits to the minimum necessary.

Use pipe jacking equipment inspected and approved and certified as fit for use by a competent person. The certification of fitness for use must have been issued not more than one year prior to the date of the scheduled completion of the works plus one calendar month. A competent person is defined in the NT Work Safe Bulletin 09.01.16 Competent Persons for Inspection and Maintenance of Plant.

Comply with the guidance provided in the Safe Work Australia Code of Practice Managing Risks of Plant in the Workplace.

**Witness Point** – Provide documentary evidence of the certification that the pipe jacking equipment is fit for use issued by a competent person. Provide documentary evidence of that person's skills and qualifications which indicate their competence as defined in the NT Work Safe Bulletin cited above. This evidence is to be provided within 2 weeks of the award of the contract.

Use a welded mild steel pipe casing manufactured in accordance with AS 1579 and of sufficient strength to withstand the forces generated irrespective of the nature of sub-surface material encountered.

Ensure the inside diameter of the casing is 50 mm greater than the maximum outside diameter of the pipe joints, skids, cradle runners or other protrusions related to pipe insertion.

#### **21.4.2 Directional Boring Without Pipe Casing – Hold Point**

**Hold Point** – Obtain written permission from the Superintendent to use directional boring without pipe casing.

Bore the hole cleanly without projections to a diameter at least 50 mm greater than the maximum outside diameter of the pipe joints, skids or other protrusions related to pipe insertion.

Use plastic skids extending the whole length of the pipe apart from joints to ensure the pipe is at least 10 mm clear of the hole perimeter. Insert the pipe so that the joints are neither stressed nor pulled apart.

### **21.5 TESTING OF SERVICES**

Co-ordinate testing of services with the authority with jurisdiction over the installed service to be tested.

For plumbing installations testing is to be to the **Testing and commissioning** section of the applicable Part of AS 3500.

For electrical installations testing is to be to the requirements of Power and Water Corporation and/or to the requirements of AS 3000.

For telephone and data, including NBN, installations, testing is to be to the requirements of Telstra, NBN Corporation, or other authority with jurisdiction regarding the installation.

For installations related to Traffic Control, Traffic Count, and Street Lighting, refer to the applicable worksection for tests required.

For installations related to gas supply, refer to AS/NZS 4645, and to the applicable authority, for tests required.

Other tests may be specified in other work sections.

The Superintendent may specify other tests.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

If any installation is tested, and fails that test, the Contractor is to rectify the installation and test the installation again, at no cost to the Principal.

### **21.6 FILLING OF CAVITIES**

This sub-clause is in respect to piping installed in passages bored without pipe casings.

#### **Pressure Service Pipes**

Carry out grouting around the service pipe in the cavity with pumped cementitious grout (Class 10 MPa) containing an appropriate plasticising agent. Any water service pipe is to be full of water under a pressure equal to normal expected operating pressure.

#### **Non-pressure Service Pipes**

Fill cavities around the service pipes with Type 1 bedding material thoroughly watered in.

Type 1 bedding: Granular material free of clay, dust, fines, salt or organic matter complying with either of the following gradings:

**Table – Granular Bedding Material Gradings**

Sieve Size	Percentage Passing By Weight	
	Type 1A	Type 1B
9.5 mm	100	-
6.75 mm	100	90 – 100
2.36 mm	100	75 – 100
1.18 mm	95 – 100	45 – 95
600 um	80 – 100	20 – 80
300 um	40 – 80	5 – 40
150 um	0 – 6	0 – 6
75 um	0 – 6	0 - 6

Linear shrinkage of materials passing a 425 um sieve to be less than 2.5%.

### **21.7 END CAPS**

Fit end caps to a bored passage if services will not be installed in the passage on the day it is bored.

Fit end caps to pipe casing if services will not be installed in the pipe casing on the day it is bored/installed.

Plug ends of bored passages around the installed services after installation, testing, and commissioning of the services is complete. Use an appropriate plugging material which is compatible with the materials of the installed services with which the plugging material will come into contact.

### **21.8 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 22 PROTECTIVE COATINGS

### 22.1 STANDARDS, LEGISLATION AND CODES

All materials and work shall comply with the latest issue of the relevant codes and standards. Some standards and codes are listed below.

When conflict arises between the requirements in the manufacturer's data sheets or recommendations and the specification, the highest standard shall be adopted as directed by the Superintendent.

#### 22.1.1 Standards

AS 1580 Paints and related materials - Methods of test.

AS/NZS 1580.108.1 - Determination of dry film thickness on metallic substrates - Non-destructive methods.

AS 1627 Metal finishing - Preparation and pretreatment of surfaces. (Code of Practice for Preparation and Pretreatment of Metal Surfaces prior to Protective Coating).

AS 1627.1 - Removal of oil, grease and related contamination.

AS 1627.2 - Power tool cleaning.

AS 1627.4 - Abrasive blast cleaning of steel.

AS 1627.9 - Pictorial surface preparation standards for painting steel surfaces.

AS 1678 Emergency Procedures Guide – Transport.

AS 1678.3A1 - Group Text EPGs for Class 3 substances – Flammable Liquids.

AS 1940 The Storage and Handling of Flammable and Combustible Liquids.

AS/NZS 2311 Guide to the Painting of Buildings.

AS 2312 Guide to the Protection of Structural Steel against atmospheric corrosion by the use of protective coatings.

AS 2312.1 - Paint coatings.

AS 2700 Colours for General Purposes.

AS 2865 Confined Spaces.

AS 3894 Site Testing of Protective Coatings.

AS 3894.3 - Determination of dry film thickness.

AS 3894.5 - Determination of surface profile.

AS 3894.10 - Inspection Report – Daily surface and ambient conditions.

AS 3894.11 - Equipment Report.

AS 3894.12 - Inspection Report – Coating.

AS 3894.13 - Inspection Report – Daily blast and paint.

AS 3894.14 - Inspection Report – Daily painting

AS/NZS ISO 9000 Quality management systems - Fundamentals and vocabulary.

#### 22.1.2 APAS

APAS Specification 2908 Inorganic zinc coating for protection of steel

APAS Specification 2971 Epoxy two-pack durable primer for protection of steel in atmosphere

#### 22.1.3 ASTM

ASTM D5064 Standard Practice for Conducting a Patch Test to Assess Coating Compatibility.

#### **22.1.4 Legislation**

*Work Health and Safety (NUL) Act 2011.*

Work Health and Safety (NUL) Regulations 2011.

#### **22.1.5 Codes**

Code of Practice, Abrasive Blasting, Safe Work Australia.

Code of Practice, Managing the Risk of Falls at Workplaces, NT WorkSafe.

### **22.2 ABBREVIATIONS**

**ACA** Australasian Corrosion Association

**DFT** Dry Film Thickness

**EPA** Environment Protection Authority

**EPG** Emergency Procedure Guide to AS 1678

**ICorr** Institute of Corrosion, UK

**ITPs** Inspection and Testing Plans

**JSA** Job Safety Analysis

**NACE** National Association of Corrosion Engineers, USA

**NCR** Non-Conformance Report

**NTCZ** See NORTHERN TERRITORY CLIMATE ZONES TABLE

**PCCP** Painting Contractors Certification Program

**ppm** Parts per million

**QA** Quality Assurance

**SDS** Safety Data Sheets – formerly known as Material Safety Data Sheets

**SWMS** Safe Work Method Statement

**TDS** Total Dissolved Solids

### **22.3 PROTECTIVE COATINGS - HOLD POINT**

**Hold Point:** Surface Preparation: To AS 1627. Provide a copy of the proposed specification for surface preparation as detailed in AS 1627.0 before commencing surface preparation works.

Remove loose millscale, rust, oil, grease, dirt, globules of weld metal, weld slag and other foreign matter.

Priming: Apply the primer coat to the structural steel before delivery to the site and protect from damage during handling and transport.

**Hold Point:** Complete and submit Site testing of protective coatings: To AS 3894.10 and AS 3894.11 and AS 3894.12.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

#### **22.3.1 Single pack zinc phosphate**

Thoroughly wire brush steelwork to AS 1627.2 and prime with one coat of single pack zinc phosphate to APAS specification 0162 with a dry film thickness of 40 microns.

#### **22.3.2 Epoxy zinc phosphate**

Blast clean to the recommendations of AS 1627.4 to grade Sa of AS 1627.9 and prime with one coat of epoxy zinc phosphate to APAS specification 2971 with a dry film thickness of 45 microns.

### **22.3.3 Inorganic zinc silicate**

Blast clean to recommendations of AS 1627.4 to grade Sa of AS 1627.9 and prime with one coat of inorganic zinc silicate to APAS specification 2908 with a dry film thickness of 75 microns.

Site work: After erection, repair any damage to the shop coating and apply the coating, if any, omitted at site connections.

Time delay: Prime the steel surface as soon as possible after surface preparation and prior to any deterioration of the surface. If the surface is contaminated or rust bloomed, repeat the surface preparation before applying the primer.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## **22.4 PROTECTIVE COATING SPECIFICATIONS - SYSTEMS AND APPROVED PRODUCTS**

Refer to Clause **Tables – Protective Coating Specifications – Systems And Approved Products** in this worksection.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## **22.5 CONTRACTOR'S RESPONSIBILITIES – WITNESS POINT**

Applicators must be PCCP accredited in the category appropriate to the works.

**Witness point:** Provide documentary evidence of PCCP accreditation before commencing protective coatings work.

Provide all protective coating materials, abrasives, labour, supervision, equipment and materials required to complete all work as specified.

Submit:

- Written details of plant and equipment to be used for the work,
- Written details of experience in similar projects,
- ITPs (Inspection & Test Plans) detailing all procedures and test plans to be undertaken to complete the project.
- Details of Environmental Policy. Contractor must present details of procedures to protect the environment.
- Details of warranties outlining the responsibilities of the Coating Manufacturer and the Contractors period of warranty.

### **22.5.1 Pre Job Meeting**

Attend a pre job meeting with the Superintendent and the coating applicator, to review this specification and the coating contractors ITPs. Any variation proposed shall be discussed at this meeting. No variation shall be allowed unless agreed at this meeting and formally signed off.

### **22.5.2 Standard Of Workmanship**

Follow the protective coating manufacturer's instructions pertaining to mixing, application, drying time etc. Produce a satisfactory end result acceptable to the superintendent.

Compliance with the protective coating manufacturer's instructions shall not absolve the Contractor of responsibility to rectify unacceptable work. Perform all work in a safe and workmanlike manner.

All phases of the work shall be available for observation by a representative of the coatings manufacturer as well as by the Superintendent or their appointed Inspector.

Use personnel experienced in their particular field to carry out all work on surface preparation, protective coatings application and inspection.

The Superintendent may require the Contractor to produce proof of the tradesmen's qualifications.

## **22.6 SAFETY**

Comply with *Work Health and Safety (NUL) Act 2011*, Regulations, Codes of Practice, Policies and Procedures applicable to the works at all times during the execution of the works.

Abrasive blasting and protective coatings application must include safety precautions necessitated by the presence of air-hydrocarbon mixtures or other flammable materials.

### **22.6.1 Thinners, Solvents And Coating Material Safety**

All thinners, solvents, primers and coating materials shall be regarded as hazardous materials and their use and storage shall comply with AS 1940, the coating manufacturer's recommendations and Dangerous Goods Regulations. All caution notices on the product containers and material labels shall be strictly observed.

The SDS for all chemicals, including paints and solvents, used and stored on site must be registered with the site manager prior to the product arriving on site.

A copy of the SDS and the applicable Emergency Procedure Guide (EPG) as per AS 1678 must accompany all chemicals during transport.

Keep SDS for all paints as reference.

## **22.7 TRAFFIC MANAGEMENT**

Comply with the Traffic Management requirements in PROVISION FOR TRAFFIC.

Obtain a Permit to Work in a Road Reserve and comply with any conditions imposed in the Permit.

Provide a Traffic Management Plan that caters for vehicular traffic. Include provisions in the Traffic Management Plan for pedestrians, cyclists and water transport if pedestrians, cyclists or water craft might be affected by the works.

## **22.8 BARRIERS**

Install barriers and warning signs for fire hazards, dust, abrasive blasting operations, dangerous fumes and the like, during blasting and coating activities.

Protect adjacent areas and equipment from abrasive blasting grit, water, and detritus and overspray by the erection of screens, hoardings, or drop sheets.

Remove all materials used to mask areas requiring protection during blasting and painting operations upon completion.

## **22.9 EQUIPMENT**

Use equipment including, but not necessarily limited to, ladders, scaffold, compressors and electrical and pneumatic equipment conforming to the requirements in force by the appropriate statutory Acts, Regulations and By-laws. Maintain and use this equipment in strict accordance with any safety regulations or requirements pertaining to them.

Do not use ladders as work platforms.

All equipment including dust collectors, air compressors, lifting devices etc. shall conform to the relevant Standards for safety and performance.

Use air supply hoses and couplings of the anti-static type which are safety wired.

Note: Compliance to site safety instructions will be in addition to regulatory requirements.

### **22.9.1 Personal Air Supply**

Where personal breathing equipment is used, the operator's hood or headgear shall be ventilated by clean, cool, oil free air served through a regulator filter. Air supply must be of respiratory quality.

### **22.9.2 Equipment – Witness Point**

Use compressors used for blasting, cleaning and spray painting which have oil and moisture separators with properly maintained filters in the airlines. Perform oil carry-over tests prior to the start of blasting and coating application and on a weekly basis thereafter. Record the results.

**Witness Point** – Give notice so that the oil carry-over tests may be witnessed by the Superintendent or their nominated representative.

## **22.10 ENVIRONMENTAL CONDITIONS**

Comply with coating manufacturers' specifications, particularly with reference to ambient environmental conditions, such as temperature, relative humidity and substrate temperature, prevailing at the location where surface preparation and coating system application is to take place.

Provide copies of Environmental Test Reports to AS 3894, Parts 10, 11, and 12.

In addition provide Reports to AS 3894 Parts 13 and 14 for structural steel.

## **22.11 WORK IN OR NEAR BODIES OF WATER**

Consider the movements of the tide for work to be conducted on components located in tidal waters.

Consider variations to water depth for all work in or near bodies of water.

Refer to **Diving Work** and **Work Near Waters Where Crocodiles May Be Present** clauses in MISCELLANEOUS PROVISIONS.

## **22.12 SURFACE PREPARATION**

Remove all substrate surface defects including weld spatter, slag, burrs, fins, sharp edges and corrosion product.

Remove all surface contaminants such as oil, grease and dirt in accordance with AS 1627.1 using a suitable solvent, oil emulsifier, alkaline degreaser or other approved product.

Assess compatibility and substrate and inter-coat adhesion between the original and new coating systems during maintenance activities by coating a test patch and assessing compatibility and adhesion by ASTM D5064.

Plan and execute all works so as to minimize the possibility of pollution of the Site and adjoining areas from chemicals, dangerous goods and potential contaminants such as dust from abrasive blasting.

### **22.12.1 Preparation Of Surfaces Prior To Blast Cleaning**

Permanent welds shall be smooth and shall merge evenly with joining surfaces.

All edges, including drilled or punched holes shall be de-burred and rounded where practical to a minimum of 2mm radius.

### **22.12.2 Abrasive Blasting – Hold Point**

Abrasives shall conform to AS 1627.4 and shall be free from oil, grease, and moisture. The abrasive shall contain no more than 50 ppm soluble salts (TDS) and free from greater than 100 ppm lead.

Do not use silica sand and other potentially silica containing materials. Do not use zinc or copper slag.

Abrasive shall be capable of providing the specified profile.

Do not carry out abrasive blasting if:

- The relative humidity is above 85%.
- The metal temperature is less than 3°C above the dew point.

Blow down blasted surfaces with clean, dry compressed air, or vacuum, or wipe free of dust and spent abrasive media, before any coatings are applied.

**Hold Point** - At the completion of the final blast and prior to coating application, the surface profile of each item shall be measured according to Method A, Profile Replicating Tape, of AS 3894.5. Provide documentary confirmation that the surface is suitable for the application of the specified coatings. This shall be identified as a Hold Point in the contractor's ITP.

### **22.12.3 Spot And Whip Abrasive Blasting**

Use spot blasting of localised corrosion or coating breakdown to provide a profile suitable for the coating system being applied during maintenance coating activities.

Feather the perimeter of the spot blasted area over a 50mm width from where the original coating system is sound.

Whip blast the generally sound coating surface after spot blasting to provide an adequate key for the coating system being applied.

Where whip blasting is not possible, gloss on sound coating may be removed by power tool or hand sanding.

### **22.12.4 Alternate Surface Preparation – Hold Point**

**Hold Point** - Do not use forms of surface preparation other than abrasive blasting, such as bristle blaster, needle guns, power tool cleaning and hand tool cleaning, without written permission from the Superintendent. Alternate methods of surface preparation must be included in the Contractor's ITP.

### **22.12.5 Water Washing and Jetting**

#### **Low pressure water washing**

Low pressure water washing operates at pressures up to 35 MPa (up to 5000 psi).

Used to remove loose millscale, rust, paint chalking and soluble salts.

#### **High pressure water washing**

For effective high pressure water washing 35 MPa to 70 MPa (5000 to 10,000 psi).

Used to remove light to moderate rust scale, concrete splashes, severe marine fouling and loose coatings.

#### **High pressure water jetting**

High pressure water jetting operates at 70 MPa to 210 MPa (10 000 to 30 000 psi).

Used to remove some rust, intact paints and contaminants.

#### **Ultra high pressure water jetting**

Ultra high pressure water jetting equipment needs to operate above 210 MPa (30 000 psi).

Used to remove rust and coatings and to prepare steel to a cleanliness level close to near white metal.

#### **Alternate methods**

Alternate methods of surface preparation must be included in the Contractor's ITP.

#### **Final rinse**

To avoid flash rusting use only demineralised water for the final rinse.

## **22.13 APPLICATION OF PROTECTIVE COATINGS**

### **22.13.1 Atmospheric Conditions**

The atmospheric conditions which prevail during the application of coatings shall be such that the surface being coated is completely free of moisture.

Do not apply coatings if:

- The ambient temperature is below 5°C, unless otherwise permitted by the material supplier's data sheet or
- The relative humidity is above 85% or
- The metal temperature is less than 3°C above the dew point or
- The ambient temperature is above 35°C, unless otherwise permitted by the material supplier's data sheet or
- Any combination of the above.

Record the ambient conditions both before and at the completion of each day's coating and at three hourly intervals during coating. Submit this information with other daily records specified. Refer to Contractor Records in Inspection And Testing.

### **22.13.2 Coating – Witness Point – Hold Point**

**Witness Point** – Provide copies of specifications for application of protective coatings from the manufacturers of the products used. Provide copies of manufacturers' product technical data sheets for all products used.

Have all coating materials delivered to the factory, workshop or site in the manufacturers' original containers with the labels intact and seals unbroken.

All materials which have been stored for longer than the specified shelf life or exposed to conditions outside the permissible storage conditions shall be discarded and replaced.

Stored, mix, thin, apply and use all paints strictly in accordance with the coating manufacturers' recommendations.

**Hold Point** - Provide coating manufacturers' written approval for use before using any other additives (eg promoters, accelerators etc).

Do not mix or use coating materials which have livered, gelled or otherwise deteriorated.

Do not exceed the pot life of catalysed materials corresponding to the working temperature.

When the pot life limit is reached, the spray pot shall be emptied, remaining material discarded, the equipment cleaned, material line shall be emptied and flushed out with nominated solvent/cleaner, and new material mixed and catalysed.

### **22.13.3 Thinners**

Use only thinners and dilutents from the same manufacturer as the specified coating for that coating. Use these only at the rate recommended by the coating manufacturer for the specific application.

### **22.13.4 Stripe Coating**

Stripe coat all metal with edges (100mm either side of the weld or edge), where practical, prior to applying the remainder of the protective coating.

Apply the stripe coating by brush or spray. Use the specified coating materials. Ensure the correct DFT for each coat is achieved.

### **22.13.5 Multiple Coats**

Where multiple coats of paint of the same type are specified, each successive coat of paint shall show, where possible, a distinguishable difference in colour to the one over which it is applied.

Comply with coating manufacturer's recommended recoating times for the ambient conditions and temperatures prevailing at the time of coating. If this cannot be achieved and the recoat period is exceeded submit a Non Conformance Report and Corrective Action Report.

#### **22.13.6 Alternate Coating – Hold Point**

**Hold Point** - Do not use coating materials other than specified, without written permission from the Superintendent. Alternate coating materials must be included in the Contractor's ITP.

#### **22.13.7 Coating Defects – Hold Point – Witness Point**

Adhesion of coatings shall be sound throughout. All coatings shall be free of sagging, pinholes, dry overspray and other defects.

**Hold Point** – Provide details of repairs required and procedures and processes proposed for making the repairs to the Superintendent prior to making any repairs. Any requirements for the repair of protective coatings shall be identified as a Hold Point in the contractor's ITP.

Marking of defective areas shall be made using a marker compatible with the coating over which it is applied. Crayons and paint pens shall not be used.

**Witness Point** - This compatibility between marker and coating is to be confirmed by the coating manufacturer. Provide written evidence of this compatibility if requested by the Superintendent.

Sand, or whip blast, and recoat surfaces contaminated by embedded dust to the specified DFT using the full system selected. If the defects cannot be rectified through the above means, then the Contractor is required to submit a Non Conformance Report and a Corrective Action Report.

#### **22.13.8 Transit And Erection Damage And Field Weld Margins**

Spot abrasive blast all coating damaged during transit and erection, including field weld margins, such that it is thoroughly cleaned. Restore the area according to the coating manufacturer's recommendations with a material compatible with, and providing at least the same performance as, the parent coating.

#### **22.13.9 Surfaces Not To Be Coated**

Do not blast or coat the following surfaces and materials unless specifically directed by the Superintendent:

- Stainless Steel
- Other surfaces nominated by the Superintendent.

#### **22.13.10 Inspection And Testing**

All work performed may be subject to inspection by the Superintendent or a nominated representative.

Ensure all necessary inspections are carried out.

### **22.14 QUALITY ASSURANCE AND TRACEABILITY**

The Superintendent will give preference to Protective Coating System manufacturers and applicators certified to AS/NZS ISO 9000 Series or equivalent, or holding approval from the Paint Contractors' Certification Program (Class 4).

### **22.15 ITP, JSA AND SWMS – HOLD POINT**

**Hold Point** – Provide ITPs, JSAs, a SWMS and other quality control procedures and documents to be used during protective coating systems application. These must be approved prior to commencement of work.

## 22.16 CONTRACTOR RECORDS – WITNESS POINT – HOLD POINT

Maintain written records of the work so that complete traceability of all work and materials provided under this Specification is maintained. Use the relevant sections of AS 3894.10, AS 3894.11 & AS 3894.12 QA report forms as a basis of this record keeping format for all protective coating work under this contract. Use AS 3894.13 and AS 3894.14, in addition to the preceding Australian Standards, for structural steel work coated under this contract.

**Witness Point** - Maintain these reports on a daily basis. Submit them to the Superintendent when requested, or, if not specifically requested, at least weekly.

**Hold Point** - Provide copies of all NCRs (Non Conformance Reports) immediately they are completed or received. The NCRs must detail the non-conformance and be accompanied by a Corrective Action Report (CAR) which is to detail the action proposed to be undertaken to rectify the non-conformance.

### 22.16.1 Film Thickness – Hold Point – Witness Point

The film thickness is the minimum average dry film thickness, with an exception criteria as defined in AS 3894.3, including primer coats specified in the painting system.

**Hold Point** - Final acceptance of each increment of work will not be made until the dry film thickness meets or exceeds the specified thickness. Regardless of the number of coats specified, additional coats shall be applied as may be necessary to achieve the specified thickness, at the contractor's expense.

**Witness Point** - Provide and operate wet film and dry film thickness gauges of approved types to ensure the correct thickness of each coat and the full system is achieved. Provide details of the gauges proposed for use.

Use an electronic thickness gauge to determine the total dry film thickness on metallic substrates.

Calibrate the gauges in accordance with AS 3894.3 (dry film thickness) or AS/NZS 1580.108.1 (wet film thickness).

### 22.16.2 Inspector – Hold Point

Appoint an inspector of coatings, qualified or certified under ACA, NACE, or ICorr, for inspection and testing of substrate preparation and protective coating systems applied under this contract.

**Hold Point** – Provide the name and qualifications of the inspector prior to commencement of work.

All work may be subject to inspection by the Superintendent. This shall not relieve the Contractor of their own Quality Assurance/Quality Control responsibilities.

## 22.17 HANDLING OF FINISH COATED ITEMS

Handle with care all metalwork that has been coated to preserve the coating in the best practicable condition.

Do not handle coated metalwork until the coating has dried hard.

Use web slings or slings covered with a rubber hose or similar soft material for the handling of finish coated items.

Protect finish coated items with soft material such as cloth, carpet or rubber sheeting on areas of contact (eg. wooden supports and holding down chains or slings) during transport and storage.

Repair and make good any damage to finish coated items.

Items with any damage caused by insufficient care are to have the entire coating removed and be recoated in accordance with this specification at the Contractor's expense.

**22.18 NOTES**

Coating systems are to be compatible with level of surface preparation available or proposed. Refer to NT CLIMATE ZONES TABLE.

**22.19 TABLES – PROTECTIVE COATING SPECIFICATIONS – SYSTEMS AND APPROVED PRODUCTS**

<b>Table - Corrosivity Categories of Areas of the NT</b>	
ARID REGIONS: Corrosivity Category C2 Low	Areas south of, and including, Tennant Creek. (NTCZ01)
INLAND REGIONS: Corrosivity Category C3 Medium	Areas north of Tennant Creek and south of, and including, Katherine and areas more than 50 km from the coast or tidal estuaries. (NTCZ02)
COASTAL / TROPICAL: Corrosivity Category C5-M Very High and T (Inland Tropical)	Areas north of Katherine and areas up to 50 km from the coast or tidal estuaries. (NTCZ03 & NTCZ04)

PROTECTIVE COATINGS

<b>Table - Protective Coating Specification # PS1</b>							
<b>General</b>							
Coating Specification for Steel – Arid Regions Corrosivity Category C2 Low							
<b>Areas</b>							
Coating system for Steel where Abrasive Blasting cannot be undertaken. Typical Exposure: Atmospheric exposure for arid regions including areas of Alice Springs, Tennant Creek and all central Australian locations. Areas south of, and including, Tennant Creek. (NTCZ01)							
<b>Surface Preparation</b>							
Surfaces to be clean, free of oil and grease and all contaminants and salts. All loose and flaking coating to be removed. All edges to be feathered back to a sound tightly adhered surface. All corrosion to be removed by power or hand tool cleaning to AS 1627.2 and AS 1627.9 Class St 3 standard.							
<b>Protective Coating System as per AS 2312</b>							
	DFT in $\mu\text{m}$	Int'l Paints	Dulux	Jotun	PPG Industries	Hempel	Wattyl
<b>1<sup>st</sup> Coat</b>							
Epoxy Mastic	100-150	Interplus 1180	Durebild STE	Jotamastic 90	Amerlock 400	Hempadur Quattro 17634	Epinamel DTM 985
<b>Optional 2<sup>nd</sup> Coat</b>							
Finish Coat Polyurethane	75	Interthane 990	Weathermax HBR	Hardtop Flexi	Amershield	Hempathane HS 55610	Poly U750
<b>Total DFT in <math>\mu\text{m}</math></b>	175-225						
Notes: Apply all coatings in strict accordance with the manufacturers' technical data sheets. Provide coatings manufacturers' recommendations prior to commencing work. The coating systems in these tables form part of, and should be read in conjunction with, the other clauses in this work section.							

PROTECTIVE COATINGS

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<b>Table - Protective Coating Specification # PS2</b>							
<b>General</b>							
Coating Specification for Steel – Arid Regions Corrosivity Category C2 Low							
<b>Areas</b>							
Coating system for Steel where Abrasive Blasting can be undertaken. Typical Exposure: Atmospheric exposure for arid regions including areas of Alice Springs, Tennant Creek and all central Australian locations. Areas south of, and including, Tennant Creek. (NTCZ01)							
<b>Surface Preparation</b>							
Surfaces to be clean, free of oil and grease and all contaminants and salts Abrasive blast to AS 1627.4 & AS 1627.9 Sa 2½ , near white metal with angular surface profile 40 – 75 microns.							
<b>Protective Coating System as per AS 2312</b>							
	<b>DFT in µm</b>	<b>Int'l Paints</b>	<b>Dulux</b>	<b>Jotun</b>	<b>PPG Industries</b>	<b>Hempel</b>	<b>Wattyl</b>
<b>1<sup>st</sup> Coat</b>							
Zinc Rich Epoxy Primer	75	Interzinc 52	Zincanode 402	Barrier Plus	Sigmazinc 471	Hempadur Zinc 17360	Galvit EP100
<b>2<sup>nd</sup> Coat</b>							
Finish Coat Polyurethane	75	Interthane 990	Weathermax HBR	Hardtop Flexi	Amershield	Hempathane HS 55610	Poly U750
<b>Total DFT in µm</b>	150						
Notes: Apply all coatings in strict accordance with the manufacturers' technical data sheets. Provide coatings manufacturers' recommendations prior to commencing work. The coating systems in these tables form part of, and should be read in conjunction with, the other clauses in this work section.							

PROTECTIVE COATINGS

<b>Table - Protective Coating Specification # PS3</b>							
<b>General</b>							
Coating Specification for Steel – Inland Regions Corrosivity Category C3 Medium							
<b>Areas</b>							
Coating system for Steel where Abrasive Blasting cannot be undertaken. Typical Exposure: Atmospheric exposure for inland regions including Katherine and other inland regions. Areas north of Tennant Creek and south of, and including, Katherine and areas more than 50 km from the coast or tidal estuaries. (NTCZ02)							
<b>Surface Preparation</b>							
Surfaces to be clean, free of oil and grease and all contaminants and salts. All loose and flaking coating to be removed. All edges to be feathered back to a sound tightly adhered surface. All corrosion to be removed by power or hand tool cleaning to AS 1627.2 and AS 1627.9 Class St 3 standard.							
<b>Protective Coating System as per AS 2312</b>							
	<b>DFT in <math>\mu\text{m}</math></b>	<b>Int'l Paints</b>	<b>Dulux</b>	<b>Jotun</b>	<b>PPG Industries</b>	<b>Hempel</b>	<b>Wattyl</b>
<b>1<sup>st</sup> Coat</b>							
Epoxy Mastic	75-100	Interplus 356	Durebild STE	Jotamastic 90	Amerlock 400	Hempadur Quattro 17364	Epinamel DTS 680
<b>2<sup>nd</sup> Coat</b>							
Intermediate Epoxy Mastic	75-100	Interplus 356	Durebild STE	Jotamastic 90	Amerlock 400	Hempadur Quattro 17364	Epinamel DTS 680
<b>Optional Top Coat</b>							
Finish Coat Polyurethane	75	Interthane 990	Weathermax HBR	Hardtop Flexi	Amershield	Hempathane HS 55610	Poly U 750
<b>Total DFT in <math>\mu\text{m}</math></b>	<b>225-275</b>						
Notes: Apply all coatings in strict accordance with the manufacturers' technical data sheets. Provide coatings manufacturers' recommendations prior to commencing work. The coating systems in these tables form part of, and should be read in conjunction with, the other clauses in this work section.							

PROTECTIVE COATINGS

<b>Table - Protective Coating Specification # PS4</b>							
<b>General</b>							
Coating Specification for Steel – Inland Regions Corrosivity Category C3 Medium							
<b>Areas</b>							
Coating system for Steel where Abrasive Blasting can be undertaken. Typical Exposure: Atmospheric exposure for inland regions including Katherine and other inland regions. Areas north of Tennant Creek and south of, and including, Katherine and areas more than 50 km from the coast or tidal estuaries. (NTCZ02)							
<b>Surface Preparation</b>							
Surfaces to be clean, free of oil and grease and all contaminants and salts. Abrasive blast to AS 1627.4 & AS 1627.9 Sa 2½ , near white metal with angular surface profile 40 – 75 microns.							
<b>Protective Coating System as per AS 2312</b>							
	DFT in µm	Int'l Paints	Dulux	Jotun	PPG Industries	Hempel	Wattyl
<b>1<sup>st</sup> Coat</b>							
PRIMER Zinc Rich Epoxy	50-75	Interzinc 52	Zincanode 402	Barrier Plus	Sigmazinc 471	Hempadur Zinc 17360	Epinamel PR360ZPS
<b>2<sup>nd</sup> Coat</b>							
Intermediate High Build Epoxy	100-150	Interplus 1180	Duremax GPE	Jotacote Universal	Amerlock 400	Hempadur Quattro 17364	Epinamel DTM 985
<b>Optional Top Coat</b>							
Finish Coat Polyurethane	75	Interthane 990	Weathermax HBR	Hardtop Flexi	Amershield	Hempathane HS 55610	Poly U750
<b>Total DFT in µm</b>	225-300						
Notes: Apply all coatings in strict accordance with the manufacturers' technical data sheets. Provide coatings manufacturers' recommendations prior to commencing work. The coating systems in these tables form part of, and should be read in conjunction with, the other clauses in this work section.							

PROTECTIVE COATINGS

<b>Table - Protective Coating Specification # PS5</b>							
<b>General</b>							
Coating Specification for Steel – Coastal Regions Corrosivity Category C5M Very High and T (Inland Tropical)							
<b>Areas</b>							
Coating system for Steel where Abrasive Blasting cannot be undertaken. Typical Exposure: Atmospheric exposure for coastal regions including Darwin and other coastal establishments. Areas north of Katherine and areas up to 50 km from the coast or tidal estuaries. (NTCZ03 & NTCZ04)							
<b>Surface Preparation</b>							
Surfaces to be clean, free of oil and grease and all contaminants and salts. All loose and flaking coating to be removed. All edges to be feathered back to a sound tightly adhered surface. All corrosion to be removed by power or hand tool cleaning to AS 1627.2 and AS 1627.9 Class St 3 standard.							
<b>Protective Coating System as per AS 2312</b>							
	DFT in $\mu\text{m}$	Int'l Paints	Dulux	Jotun	PPG Industries	Hempel	Wattyl
<b>1<sup>st</sup> Coat</b>							
Epoxy Mastic MIO	125-150	Interplus 356	Durebild STE MIO	Jotacote 605 MIO	Amerlock 400 MIO	Hempadur Mastic 45881	Epiname! DTM 985 MIO
<b>2<sup>nd</sup> Coat</b>							
Intermediate High Build Epoxy	100-150	Interplus 1180	Duremax GPE	Jotacote Universal	Amerlock 400	Hempadur Quattro 17364	Epiname! DTM 985
<b>Optional Top Coat</b>							
Finish Coat Polyurethane	75	Interthane 990	Weathermax HBR	Hardtop Flexi	Amershield	Hempathane HS 55610	Poly U750
<b>Total DFT in <math>\mu\text{m}</math></b>	325-375						
Notes: Apply all coatings in strict accordance with the manufacturers' technical data sheets. Provide coatings manufacturers' recommendations prior to commencing work. The coating systems in these tables form part of, and should be read in conjunction with, the other clauses in this work section.							

PROTECTIVE COATINGS

<b>Table - Protective Coating Specification # PS6</b>							
<b>General</b>							
Coating Specification for Steel – Coastal Regions Corrosivity Category C5M Very High and T (Inland Tropical)							
<b>Areas</b>							
Coating system for Steel where Abrasive Blasting can be undertaken. Typical Exposure: Atmospheric exposure for coastal regions including Darwin and other coastal establishments. Areas north of Katherine and areas up to 50 km from the coast or tidal estuaries. (NTCZ03 & NTCZ04)							
<b>Surface Preparation</b>							
Surfaces to be clean, free of oil and grease and all contaminants and salts. Abrasive blast to AS 1627.4 & AS 1627.9 Sa 2½ , near white metal with angular surface profile 40 – 75 microns.							
<b>Protective Coating System as per AS 2312</b>							
	DFT in µm	Int'l Paints	Dulux	Jotun	PPG Industries	Hempel	Wattyl
<b>1<sup>st</sup> Coat</b>							
PRIMER Zinc Rich Epoxy	50-75	Interzinc 52	Zincanode 402	Barrier Plus	Sigmazinc 471	Hempadur Zinc 17360	Galvit EP100
<b>2<sup>nd</sup> Coat</b>							
Intermediate High Build MIO Epoxy	150-200	Interplus 1180	Duremax GPE MIO	Penguard Express MIO	Amerlock 400 MIO	Hempadur Mastic 45881	Epiname DTM 985 MIO
<b>Optional Top Coat</b>							
Finish Coat Polyurethane	75	Interthane 990	Weathermax HBR	Hardtop Flexi	Amershield	Hempathane HS 55610	Poly U 750
<b>Total DFT in µm</b>	275-350						
Notes: Apply all coatings in strict accordance with the manufacturers' technical data sheets. Provide coatings manufacturers' recommendations prior to commencing work. The coating systems in these tables form part of, and should be read in conjunction with, the other clauses in this work section.							

PROTECTIVE COATINGS

<b>Table - Protective Coating Specification # PS7</b>							
<b>General</b>							
Existing Hot Dipped Galvanised Steel Subject to Severe - Atmospheric Exposure – New and Maintenance							
<b>Areas</b>							
Coating system for galvanized steel.							
<b>Surface Preparation</b>							
Surfaces to be clean, free of oil and grease, salts and all other contaminants. Abrasive Sweep (brush) blast to AS 1627.4 Appendix 'D' to achieve an angular surface profile using garnet to 25-40 microns. Rust affected areas to be spot blasted to AS 1627.4 & AS 1627.9 Sa 2½ with an angular surface profile of 40-75 microns.							
<b>Protective Coating System as per AS 2312</b>							
	DFT in µm	Int'l Paints	Dulux	Jotun	PPG Industries	Hempel	Wattyl
<b>1<sup>st</sup> Coat</b>							
Primer Zinc Phosphate Epoxy Primer	50 - 75	Intergard 251	Durepon P14	Pengard Special Grey	Sigmacover 280LT	Hempadur 15590	Epiname PR 250
<b>2<sup>nd</sup> Coat</b>							
Finish Coat High Build Epoxy	300 - 350	Interzone 505GF	Durebild STE GF	Jotamastic 87 GF	Sigmashield 825 LT (Amerlock 2K Glass Flake)	Hempadur Multi-Strength 45540	Epiname DTM 985
<b>Total DFT In µm</b>	350 - 475						
Allowance should be made for the galvanizing approximately 85 microns.							
Notes: Apply all coatings in strict accordance with the manufacturers' technical data sheets. Provide coatings manufacturers' recommendations prior to commencing work. The coating systems in these tables form part of, and should be read in conjunction with, the other clauses in this work section.							

PROTECTIVE COATINGS

<b>Table - Protective Coating Specification # PS8</b>							
<b>General</b>							
Repair specification for wharf structures, steel piling, ship loading facilities, oil spill clean up equipment and plant piping operating at <40°C.							
<b>Areas</b>							
Marine environment : onshore and offshore							
<b>Surface Preparation</b>							
Abrasive blast clean to remove all previous coatings and corrosion products. Bevel all edges. Surface shall be high pressure water blasted at a minimum pressure of 3,000 psi then tested to ensure free from soluble salts (see Clause 6). Abrasive blast clean to AS 1627.4 Class 2½ Surface profile 30-60µm							
<b>Protective Coating System as per AS 2312</b>							
<b>Protective Coating – PS8.1 Steel with light to minimal pitting</b>							
	DFT in µ	Int'l Paints	Dulux	Jotun	PPG	Hempel	Wattyl
<b>1st Coat</b>							
High build epoxy	200-250	Interzone 954	Durebild STE Glass Flake	Marathon 500	Sigmashield 880	Hempadur Quattro 17634	EpinameI DTM 985
<b>2nd Coat</b>							
High build epoxy	200-250	Interzone 954	Durebild STE Glass Flake	Marathon 500	Sigmashield 880	Hempadur Quattro 17634	EpinameI DTM 985
<b>Total DFT</b>	400-500						
<b>Protective Coating System as per AS 2312</b>							
<b>Protective Coating – PS8.2 Heavily pitted steel</b>							
	DFT in µ	Int'l Paints	Dulux	Jotun	PPG	Hempel	Wattyl
<b>1st Coat</b>							
High build epoxy	450-500	Interzone 954	Durebild STE Glass Flake	Marathon 500	Sigmashield 880	Hempadur Quattro 17634	EpinameI DTM 985
<b>2nd Coat</b>							
High build epoxy	450-5000	Interzone 954	Durebild STE Glass Flake	Marathon 500	Sigmashield 880	Hempadur Quattro 17634	EpinameI DTM 985
<b>Total DFT</b>	900-1000						
Notes: Apply all coatings in strict accordance with the manufacturers' technical data sheets. Provide coatings manufacturers' recommendations prior to commencing work. The coating systems in these tables form part of, and should be read in conjunction with, the other clauses in this work section.							

PROTECTIVE COATINGS

<b>Table - Protective Coating Specification # PS9</b>							
<b>General</b>							
Ultra high build epoxy for coating new piles, and other surfaces in underwater or splash zone environment.							
<b>Areas</b>							
Underwater & splash zone							
<b>Surface Preparation</b>							
Abrasive blast clean to remove all corrosion products and/or previous coatings. Bevel all edges. Surface shall be high pressure water blasted at a minimum pressure of 3,000 psi then tested to ensure free from soluble salts (see Clause 6). Abrasive blast clean to AS 1627.4 Class 2½ 75-100µm (angular profile)							
<b>Protective Coating System as per AS 2312</b>							
	DFT in µ	Int'l Paints	Dulux	Jotun	PPG	Hempel	Wattyl
<b>1st Coat</b>							
Primer Holding Primer (if required)	30-50	Interline 982	Luxepoxy 66	N/A	Sigmacover 280LT	Hempadur 15590	Epiname PR 250 (thinned)
<b>2nd Coat</b>							
Ultra High Build Epoxy	1000-1500	Interzone 485	Luxepoxy UHB	Jotacote UHB	Sigmashield 880	Hempadur Multi Strength 45540 (2 coats of 500 um)	Epiname UHB 1000
<b>Total DFT</b>	1030 - 1550						
Notes: Apply all coatings in strict accordance with the manufacturers' technical data sheets. Provide coatings manufacturers' recommendations prior to commencing work. The coating systems in these tables form part of, and should be read in conjunction with, the other clauses in this work section.							

PROTECTIVE COATINGS

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<b>Table - Protective Coating Specification # PS10</b>	
<b>General</b>	
Repair coating for cylindrical piling using petrolatum tape system, for use in very exposed sites and harsh environments.	
<b>Areas</b>	
Very exposed sites and harsh environments.	
<b>Surface Preparation</b>	
Remove all loose rust, original coating, marine growth etc, by scraping, chipping, water blast cleaning or ship's hull scrubber. Close examination, after preparation, to ensure thoroughly clean surface without growth, sharp or protruding edges.	
<b>System</b>	
Primer	Denso Seashield Primer (or equal approved)
Tape	Denso Seashield Tape (or equal approved) Overlap of 55%
Outer Cover	Denso Seashield 2000 FD Outer Cover (or equal approved) Fixed with 316 stainless bolts
<b>Note:</b> Inspection points as per Denso Seashield published instructions.	
Notes: Apply all coatings in strict accordance with the manufacturers' technical data sheets. Provide coatings manufacturers' recommendations prior to commencing work. The coating systems in these tables form part of, and should be read in conjunction with, the other clauses in this work section.	

## 22.20 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## **23 MEASUREMENT AND PAYMENT**

The following Measurement and Payment clauses refer to the specification sections of the same name, however, the clause numbers do not match the section numbers of the same title.

The selection of specific items or materials for the works being carried out are those items listed in the Schedule of Rates in the Response Schedules for the particular Contract and any items specified in the PROJECT SPECIFIC REQUIREMENTS section of the Request for Tender document. Any additional work or any changes to the reference specification will be specified in the PROJECT SPECIFIC REQUIREMENTS section.

Only the Measurement and Payment clauses applicable to the project apply.

### **23.1 MISCELLANEOUS PROVISIONS**

#### **23.1.1 Environmental Management Generally**

Not measured separately

Include the cost of environmental management in the rates for the applicable items.

#### **23.1.2 Environmental Management Plan**

Measured as an item.

#### **23.1.3 Cleaning of Vehicles and Plant**

Measured as an item (irrespective of the number cleaned).

Vehicles and plant items are priced separately.

#### **23.1.4 Establishment**

The sum for establishment not to exceed 30 per cent of the Tender Sum.

Mobilisation: Measured as an item. Not to exceed 10 per cent of the Tender Sum.  
Payment when the Contractor established on site.

Demobilisation: Measured as an item.  
Payment when demobilisation complete.

Ongoing costs: Measured as an item.  
Payment progressively during the contract in proportion to the value of complying work.

#### **23.1.5 Project Notice Boards**

Measured by number erected.

#### **23.1.6 As Constructed Information**

Provide as constructed information as detailed in MISCELLANEOUS PROVISIONS.

Include the cost for as constructed information in the costs for the related elements of the works.

Provide as constructed information related to variations in the scope of the works. Include the cost of the as-varied scope constructed information in the negotiated costs for the variations to the works.

#### **23.1.7 Level Checking**

Measured in kilometres for the layer under consideration.

#### **23.1.8 Control Station Check Survey**

Measured as an item.

#### **23.1.9 Cycle and pedestrian shared paths**

Not measured separately.

Include in MISCELLANEOUS CONCRETE.

## **23.2 PROVISION FOR TRAFFIC**

### **23.2.1 Traffic Management Plan**

Include in Provision for Traffic. Include Traffic Guidance Schemes (TGSs) including, but not limited to, plans, drawings, sketches, and/or diagrams.

### **23.2.2 Provision for Traffic**

Measured as an item.

Includes TMP and TGSs and all activities required to implement them.

Includes detours, temporary connections access to adjacent properties, traffic guidance, traffic control devices, temporary bridging, warning devices, maintenance and restoration.

Includes variable message boards irrespective of number.

Payment will be made progressively in proportion to the value of work carried out.

### **23.2.3 Graveling of Detours**

Measured in square metres for the specified gravel thickness and width.

Make allowance for supply, delivery, and compaction of material.

### **23.2.4 Sealing of Detours**

Measured in square metres for the specified width.

Make allowance for the removal and disposal of seal and restoration work.

## **23.3 CLEARING GRUBBING AND REHABILITATION**

Measured as an item.

Includes removing vegetation stripping and stockpiling, top soil respreading, removal of un-recoverable fencing, drainage structures, old road surfaces and other obstacles.

Make allowance for stripping, stockpiling and respreading of the top layer.

Make allowance for replacement of stripped layer.

### **23.3.1 Treatment of Existing Sealed Surface**

Not measured separately.

### **23.3.2 Scarifying of Existing Roads**

Measured in linear metres.

### **23.3.3 Mulching**

Measured as an item.

Make allowance for mulching demolished vegetation, burying stumps, roots and grasses, stockpiling mulched material, spreading mulch and removing excess mulched material.

## **23.4 EARTHWORKS**

Measurements are based on natural surface levels prior to stripping.

### **23.4.1 Earthworks in Cut**

Measured in in-situ cubic metres.

Volume includes Table Drains.

Allow for trimming and compaction of exposed surfaces.

### **23.4.2 Rock in Subgrade**

Measured in in-situ cubic metres.

Payment only for works directed by the Superintendent.

Payment for excavation will be at a rate to be agreed.

Payment for filling is at the rate for Select Fill (compacted volume).

### **23.4.3 Unsuitable Material Below Subgrade Surface Other Than Rock**

Measured in in-situ cubic metres.

Payment only for works directed by the Superintendent.

Payment for excavation is at the rate for Earthworks in Cut.

Payment for filling is at the rate for Earthworks in Fill (compacted volume).

### **23.4.4 Earthworks in Fill**

Measured in compacted cubic metres.

Make allowance for volumes affected by Clearing and Grubbing.

Make allowance for preparation prior to filling and benching.

Allow for trimming.

### **23.4.5 Unsuitable Material Beneath Fill**

Measured in in-situ cubic metres.

Payment only for works directed by the Superintendent.

Payment for excavation is at the rate for Earthworks in Cut. Payment for filling is at the rate for Earthworks in Fill (compacted volume).

### **23.4.6 Select Fill**

Measured in compacted cubic metres.

Payment at a rate to be agreed.

Refer to clause **SSRW Clause 4.6.3 Select Fill** in PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ and refer to the Schedule of Rates.

### **23.4.7 Sand Clay Fill**

Measured in compacted cubic metres.

### **23.4.8 Preparation and Maintenance of Subgrade Surface**

Measured in square metres.

### **23.4.9 Stream Diversions**

Measured in in-situ cubic metres for cut and compacted cubic metres for fill.

Temporary work is not measured.

### **23.4.10 Levees**

Measured in compacted cubic metres.

Temporary work is not measured.

**23.4.11 Table Drain Offlets**

Measured by number.

**23.4.12 Table Drain Blocks**

Measured by number.

**23.4.13 Catch Drains**

Measured in linear metres.

**23.4.14 Widening of Existing Formation**

Measured in linear metres.

**23.4.15 Trim and Compact Unpaved Areas**

Measured in square metres.

Excludes trimming and compacting areas exposed in cut.

Excludes trimming and compacting in fill.

**23.4.16 Surface Formation**

Measured in linear metres.

Allow for imported material.

**23.4.17 Batter Protection by Grassing**

Measured in square metres.

**23.4.18 Bridge Foundation Excavation**

Measured in in-situ cubic metres.

The quantity measured shall be determined by multiplying the dimensioned area of the structure footing by the distance from natural surface to foundation level.

Make allowance for coffer-dams, shoring and sheeting, pumping.

Make allowance for excavation beyond measured limits for formwork, shoring and sheeting, pumping, etc.

**23.4.19 Bridge Foundation Blinding**

Measured in square metres.

**23.4.20 Bridge Foundation Backfilling**

Measured in compacted cubic metres.

Make allowance for backfill beyond measured limits.

**23.4.21 Fill Adjacent to Bridge Structures**

Measured in compacted cubic metres.

**23.5 CONFORMANCE TESTING**

**23.5.1 Conformance Testing**

The Superintendent will pay for all conformance testing directly to the Panel Period Contractor selected to perform the conformance tests required under this contract and nominated as the Superintendent's responsibility.

If the tests fail the cost of the failed tests will be a negative variation to the contract.

When testing has been ordered and the site is not ready for testing at the time specified by the Contractor, the Contractor will bear the cost of time and travel incurred by the Panel Period Contractor and the Superintendent, where applicable.

Where bituminous products are Non-Conforming: refer to the Superintendent for requirements if samples are non-conforming.

### **23.5.2 Process Testing**

The Contractor is responsible for the ordering up and payment for all process tests carried out. This is not measured separately.

Include the cost of process testing under the relevant items in the Schedule of Rates.

## **23.6 PAVEMENTS AND SHOULDERS**

### **23.6.1 Construction of Pavement Layers**

Measured in square metres for each specified layer, thickness, and material.

Make allowance for pavement or shoulder materials outside the carriageway width not included in measurement.

### **23.6.2 Reconstruction and Rehabilitation of Existing Pavements**

Refer to **Strengthening By Granular Overlay** sub-clauses **SSRW Clause 6.5.2** and **SSRW Clause 6.5.3** in PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Measured in linear metres, includes both sides for widening.

Measured in square metres for overlay and reworking.

Make allowance for variation in pavement thickness and deformation of existing pavement.

### **23.6.3 Supply to Stockpile**

Measured in cubic metres in the stockpile.

### **23.6.4 Pavement Acceptance**

Measured as an item for activities undertaken to achieve pavement and shoulder acceptance.

## **23.7 STABILISATION AND MODIFICATION**

### **23.7.1 Supply of Materials to be Stabilised**

Measured in square metres, compacted, for each specified thickness, for each layer type (sub-base, base, shoulders).

### **23.7.2 Supply and Spread Binder**

Measured in tonnes for cement and lime. Measured in litres for bitumen.

Determined by multiplying the application rate by the area to be treated.

Make allowance for tolerances.

### **23.7.3 Granular Modification**

Measured in compacted cubic metres.

### **23.7.4 Mixing, Trimming and Curing**

Measured in square metres for each specified thickness.

### **23.7.5 Plant-Mix**

Measured in cubic metres.

Determined by multiplying the specified area by the specified compacted depth.

Make allowance for all materials to be stabilised.

Make allowance for curing.

## **23.8 SPRAY SEALING**

### **23.8.1 Calculation Accuracy**

All calculations regarding payment to be to an accuracy of the nearest whole number.

### **23.8.2 Preparation of Pavement**

Measured in square metres of the prepared area.

### **23.8.3 Prime, Primer Seals, and Enrichment Coats**

Refer to **SSRW Section 8** in PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Measured in litres at 15°C. Adjust volumes using the **Table - Bitumen Equivalent Volumes in Calculation of Equivalent Volumes for Spray Rates** clause in SPRAY SEALING.

Payment calculated for each spray run. Quantity sprayed is determined by dipping the sprayer tank for each spray run.

Allow for the temperature of the mixture in determining the actual application rate.

The designated volume is determined from the area sprayed and the rate of application indicated in the procedure for such area at 15°C. Multipliers for reducing the volume of hot bitumen to the equivalent volume at 15°C are contained in the **Table - Bitumen Equivalent Volumes in Calculation of Equivalent Volumes for Spray Rates** clause in SPRAY SEALING.

For primers, enrichment coats, primer seals, polymer modified binder or emulsion seals the rate of application refers to the whole of the mixture.

Allow for adhesion agent in the rate for polymer modified binder.

Tapers are exempt from adjustment tables.

#### **Adjustment To Payment For The Sprayed Volume When The Spray Application Rates Equal Or Exceed 1.0 L/m<sup>2</sup>:**

(i) Application 90% to 95% of the designated volume:

Payment for the sprayed volume less one-half the difference between the sprayed volume and 95% of the designated volume.

(Example: Application = 92% of designated volume.

Pay for  $(92\% - 0.5 \times (95\% - 92\%)) = 90.5\%$  of designated volume.)

(ii) Application 95% to 105% of the designated volume:

Payment for the sprayed volume.

(iii) Application 105% to 115% of the designated volume:

Payment for 105% of the designated volume.

The Contractor must rectify bleeding or flushing seals during the defined defects period where binder application rates were applied at > than 105% of the designated volume.

(iv) Application less than 90% or more than 115% of the designated volume will be rejected. Rectify by methods approved by the Superintendent, at the Contractor's expense.

#### **Adjustment To Payment For The Sprayed Volume When Spray Application Rates Below 1.0L/m<sup>2</sup>:**

(v) Application plus 0.1L/m<sup>2</sup> and minus 0.1L/m<sup>2</sup> of the designated spray rate:

Payment for the sprayed volume.

(vi) Application rates varying more than 0.1L/m<sup>2</sup> of the designated spray rate will result in work being rejected. Rectification will be at the Contractor's expense by respraying or by other methods approved by the Superintendent.

Payment will be made for the designated volume upon satisfactory rectification of the rejected

area at no extra expense to the Principal.

Adjustment to payment for seal coat items (binder, additive, precoat, aggregate) is in accordance with the **Table - Payment Adjustments**.

**23.8.4 Table - Payment Adjustments**

<b>Table - Payment Adjustments</b>	
<b>Viscosity (at 60°C Pa.s) of AS 2008 Class 320 Bitumen Component of The Binder</b>	<b>Reduction in Payment for Seal Coat Items</b>
Under 260	10% reduction for each 10 Pa.s (or part thereof) below 260.
260 – 380	Nil.
Over 380	10% reduction for each 10 Pa.s (or part thereof) over 380.
<b>Where Samples Not Collected</b>	10% reduction to rate per litre
<b>Polymer Modified Binders</b>	<b>Reduction in Payment for Seal Coat Items</b>
Torsional Recovery 1 – 3% less than specified	2% reduction to rate per litre
Torsional Recovery 4 – 6% less than specified	10% reduction to rate per litre
Torsional Recovery over 6% less than specified	20% reduction to rate per litre
Softening Point 0 – 2 deg. C less than specified	5% Reduction to rate per litre
Softening Point 2.1 – 5 deg. C less than specified	15% Reduction to rate per litre
Softening Point 5.1 – 10 deg. C less than specified	20% Reduction to rate per litre
Softening Point 10.1 or more deg. C less than specified	*Rejected (see note below)
<u>Note:</u> * Rejected - Reseal with materials and methods approved by the Superintendent. Costs incurred from reseal work will be at the Contractor's expense.	
<u>Note:</u> Adjustments are only applied to materials represented by the test sample.	

**23.8.5 Payment Adjustment Applied to Sub-Contractors**

Where:

- a. a payment adjustment is applied against the Contractor under the Contract; and
- b. the Contractor then applies that adjustment to the sub-contractor that carried out the Works the subject of the payment adjustment,

the Contractor will provide the sub-contractor with a copy of the document/s from the Principal that evidence the payment adjustment applied to the Contractor.

**23.8.6 Additives**

Measured in litres at 15°C.

Polymer additives in polymer modified binders not measured separately.

Make allowance in the rates for seal coats.

**23.8.7 Precoat Applied to Aggregate**

Measured in litres.

Make allowance for adhesion agent.

**23.8.8 Stockpile Sites**

Make allowance for stockpile sites in the relevant rates for sealing aggregate.

**23.8.9 Sealing Aggregate**

Supply and delivery.

Measured in square metres.

**23.8.10 Application of Geofabric**

Measured in square metres of fabric, installed, with tack coat.

**23.8.11 Application of Aggregate**

Measured in square metres of finished aggregate work for each size of aggregate.

**23.9 DENSE GRADED ASPHALT**

**23.9.1 New Pavements**

Measured in square metres for each specified thickness.

Payments will be determined as per **Rate of Payment Adjustments** sub-clause and tables.

**23.9.2 Correction Course Layer**

Measured in tonnes placed as evidenced by weighbridge docketts.

Correction courses are exempt from adjustments for voids.

**23.9.3 Resurfacing Work**

Measured in tonnes placed as evidenced by weigh bridge docketts.

Payments will be determined as per **Rate of Payment Adjustments** sub-clause and tables.

**23.9.4 Rate of Payment Adjustments**

Rates will be adjusted as follows:

<b>Table - Rate of Payment Adjustments</b>	
<b>Reduction Level</b>	<b>Payment Reduction</b>
Level 1	5%
Level 2	10%
Level 3	20%
Note: Adjustments are for materials specified at 30mm and greater thickness.	

<b>Table - Payment Adjustments - Bitumen Conformance - Class 320 Bitumen</b>	
<b>Viscosity (At 60°C Pa.s) of AS 2008 Class 320 Bitumen Component Of The Binder</b>	<b>Payment Reduction</b>
Under 260 (Pa.s)	5% reduction for each 10 Pa.s (or part thereof) less than 260
260 – 380 (Pa.s)	Nil.
Over 380 (Pa.s)	5% reduction for each 10 Pa.s (or part thereof) over 380.

<b>Polymer Modified Binders A15E</b>	<b>Payment Reduction* to m<sup>2</sup> rate (\$) of lot</b>
Consistency (60°C Pas) 4500 - 4999	5%
Consistency (60°C Pas) 4000 - 4449	10%
Consistency (60°C Pas) 4000 - 3000	20%
Consistency (60°C Pas) less than - 3000	Remove and Replace
Torsional Recovery (25°C,30s,%) 1% – 5% less than specified	5%
Torsional Recovery (25°C,30s,%) 6% – 10% less than specified	10%
Torsional Recovery (25°C,30s,%) over 10% less than specified	20%
Softening Point 0 – 5 °C less than specified	5%
Softening Point 5.1 – 10 °C less than specified	10%
Softening Point 10.1 – 15 °C less than specified	20%
Softening Point more than 15.1 – 20.0 °C less than specified	30%
Softening Point more than 20.1 °C less than specified	Remove and Replace
* Payment reduction shall only apply to the test property providing highest level of non-conformance	

### 23.9.5 Surface Roughness

Adjustments related to Surface Roughness (per lot)

<b>Increase in specified maximum IRI (per lot)</b>	<b>%Adjustment to the m<sup>2</sup> rate of lot</b>
0.01 – 0.10	2%
0.11 – 0.20	4%
0.21 – 0.30	6%
0.31 – 0.40	8%
0.41 – 0.50	10%
0.51 – 0.60	12%
0.61 – 0.70	14%
0.71 – 0.80	16%
>0.80	Remove and Replace / Rectify
<b>Note:</b> Lots may be subdivided where individual IRI exceeds 2.5.	

### 23.9.6 Progress Claims

Contractor may claim up to three-quarters of the contract rate when works are physically completed on site with balance of payment following conformance test results.

### 23.9.7 Payment Adjustment Applied to Sub-Contractors

Where:

- a. a payment adjustment is applied against the Contractor under the Contract; and
- b. the Contractor then applies that adjustment to the sub-contractor that carried out the Works the subject of the payment adjustment,

the Contractor will provide the sub-contractor with a copy of the document/s from the Principal as evidence that the payment adjustment applied to the Contractor.

## **23.10 SLURRY SURFACING**

Payment will be made at the tendered rates for the actual quantity of accepted slurry surfacing mix spread.

Measurement;

- Slurry surfacing laid per m<sup>2</sup> at an average 9 mm thickness, including surface preparation and supply and laying of slurry surfacing mix.
- Slurry correction volume per m<sup>3</sup>.

## **23.11 MISCELLANEOUS CONCRETE**

Make allowance for excavation, bedding and backfilling for the following items.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ for additional items, if any.

### **23.11.1 Footpaths**

Includes cycle and pedestrian shared paths. (Refer to MISCELLANEOUS PROVISIONS)

Measured in linear metres for each type.

Make allowance for reinforcement.

### **23.11.2 Vehicle Crossings and Access Strips**

Measured as an item for each type.

Make allowance for reinforcement.

### **23.11.3 Kerbs and Gutters**

Measured in linear metres for each type (any drainage structures/crossings excluded from measured lengths.)

### **23.11.4 Inverts**

Measured in linear metres.

### **23.11.5 Wheelchair Crossings**

Measured by number.

### **23.11.6 Traffic Island and Median Infill**

Measured in square metres.

## **23.12 DRAINAGE WORKS**

### **23.12.1 Excavation in Trenching**

Measured in in-situ cubic metres for the specified range of depths to invert.

The length of the trench shall be measured between the outside face of headwalls or between the centre of pits.

The width of the trench shall be the outside width of the culvert plus margins on each side as shown on drawing CS-3101.

The depth of the trench is the average of the depths to invert measured at the structure at each end of the section.

The depth to invert is the lesser of the depth below natural surface and the depth below finished surface level. In the case of kerbside structures, the finished surface level is measured at the top of kerb.

Make allowance for shoring, bedding, inlet structures, outlet structures, irregularities in the natural surface, and for the depth of RC floor slabs for precast box culverts, where applicable.

### **23.12.2 Supply, Load, Transport, Bed, Lay and Backfill Culverts**

Measured in linear metres along the invert of the culvert as the distance between the outside face of headwalls or other structures for the type and size scheduled.

Multiple barrel culverts are measured as the single distance between the outside face of headwalls or other structures.

Make allowance for RC floor slabs for precast box culverts.

Excavation is measured separately.

### **23.12.3 Concrete Headwalls, Headwalls with Wing Walls, Pits, and Other Structures**

Measured by number.

Head walls with wing walls are measured separately from headwalls without wing walls.

Other structures include, but are not limited to:

- Gully / Side Entry / Letter Box inlet pits,
- Alterations to existing structures and/or devices,
- Connections to existing structures and/or devices,
- Inspection pits,
- Junction pits.

### **23.12.4 Collar Joints, Bandage Joints, Anchor Blocks and End Caps**

Measured by number.

Make allowance for splay ends.

### **23.12.5 Inlet and Outlet Channels**

Measured in in-situ cubic metres.

Not measured separately for culvert waterways less than 2 square metres in cross-sectional area and channels less than 50 metres long.

### **23.12.6 Open Unlined Drains**

Measured in in situ cubic metres.

### **23.12.7 Subsoil Drains**

Measured in linear metres.

Make allowance for blocks, headwalls, filter material, geotextiles, and connection to existing drainage system.

### **23.12.8 Demolish and Remove Existing Drainage Structures**

Measured as an item.

Make allowance for backfilling.

## **23.13 PROTECTION WORKS**

### **23.13.1 Geotextile Fabric**

Measured in square metres of completed area.

Make allowance for supply and placement.

Make allowance for laps and folds.

### **23.13.2 Stone Pitching**

Measured in square metres of the face area.

**23.13.3 Grouted Stone Pitching**

Measured in square metres of the face area.  
Make allowance for weep holes.

**23.13.4 Dumped Rock Protection**

Measured in cubic metres.

**23.13.5 Rubble**

Measured in cubic metres.

**23.13.6 Gabions**

Measured in cubic metres.  
Includes the excavation, steel wire mesh box and the stone filling.

**23.13.7 Reno Mattresses**

Measured in square metres.  
Includes the excavation, steel wire mesh box and the stone filling.

**23.13.8 Revetment Mattresses**

Measured in square metres.

**23.13.9 Embankment Protection - Concrete**

Measured in square metres of the face area.  
Make allowance for weep holes.  
Make allowance for toes (nib walls) and reinforcement.

**23.13.10 Margins**

Measured in linear metres.  
Make allowance for reinforcement.

**23.14 ROAD FURNITURE AND TRAFFIC CONTROL DEVICES**

**23.14.1 Tactile Ground Surface Indicators**

Measured in square metres installed.  
Make allowance for all required preparatory work for installation, and for all fixings, fasteners, adhesives, and other necessary items.

**23.14.2 Fencing**

Measured in linear metres by type. Refer to PROJECT SPECIFIC REQUIREMENTS.  
Make allowance for gates which are not measured separately.  
Make allowance for clearing of fence lines which is not measured separately.  
Bollards measured by number. Make allowance for installation including footings.  
Vehicle movement barriers measured by number for each type (stock length, half stock length, "banana bars" restriction/terminal devices).  
Vehicle movement barriers measured by number for each type (stock length, half stock length, "banana bars" restriction/terminal devices).

**23.14.3 Cyclist Holding Rails**

Measured by number.  
Make allowance for installation including footings.

**23.14.4 Recycled Plastic Bollards**

Measured by number.

Make allowance for installation including footings.

**23.14.5 Culvert Crossing Guardrails**

Measured by number by type.

Make allowance for installation including footings.

**23.14.6 Guide Posts**

Measured by number.

Make allowance for delineators.

**23.14.7 Road Signs, Supply and Install**

Measured by number of each sign type or classification.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

Make allowance for anti-spear fixings where these are required.

**23.14.8 Reinstate/Relocate Existing Road Signs**

Measured by number.

**23.14.9 Flood Gauge Posts**

Measured by number.

Make allowance for gauge.

**23.14.10 Cattle Grids**

Measured by number per type. (10 m or 12.4 m and with or without concrete approach)

Make allowance for gate in adjacent fence.

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

**23.14.11 Road Safety Barriers - Steel Rail**

Measured from centre to centre of end posts in linear metres, for type as specified

Make allowance for posts, footings, spacers, fasteners, delineators and all necessary fittings.

**23.14.12 Road Safety Barriers - Steel Rail Terminals**

Measured by number for type installed.

**23.14.13 Road Safety Barriers - Wire Rope**

Measured from centre to centre of end posts in linear metres, for type as specified

Make allowance for posts, footings, tensioning devices and equipment, spacers, fasteners, delineators and all necessary fittings.

**23.14.14 Road Safety Barriers - Wire Rope Terminals**

Measured by number for type installed.

Make allowance for footings.

**23.15 PAVEMENT MARKING**

**23.15.1 Establishment – Period Contracts for Maintenance  
Urban Areas**

Mobilisation - not measured separately

Demobilisation - not measured separately

Include the cost in the rates for the applicable items

### **Rural Areas**

Mobilisation - The Contractor will be paid for all vehicles, plant, men, materials, and equipment, inclusive of all traffic control requirements, as a single item for each work request, one way for each kilometre travelled beyond the Stuart Highway (PRP20/0.00km) and the Arnhem Highway (PRP1/ 0.00km) Intersection

Demobilisation - not measured separately

### **Aerodromes**

Not measured separately for access by road, apply rural mobilisation

Measured by negotiated rates for access by sea.

Make allowance for mobilisation, demobilisation and all associated ongoing cost

Provide details substantiating the amounts shown in the negotiated rate.

### **23.15.2 Co-ordination and Setting Out**

Payment for the co-ordination and setting out for new works only will be at an additional 15% of the scheduled rates for the items ordered total amount for the work site.

This is inclusive of the attendance, and recording of the extent of the works, and submission of a report detailing these to the Superintendent.

This is inclusive of the removal of all temporary markers and the removal and delivery of temporary traffic control signage, including temporary signage left on site by resealing Contractors or others to the designated delivery point.

### **Co-ordination of Pavement Marking Work for Resurfacing Works**

Measured as an Item for each site of works

Make allowance for attendance and recording of the extent of works and submission of a report detailing these to the Superintendent.

### **Removal of resealing works temporary signage at completion of linemarking.**

Included in other items.

### **23.15.3 Pavement Marking**

Refer to the **Table – Application Rates – All Longitudinal and Transverse Pavement Markings** in the **Pavement Marking Conformance Tolerances** clause in PAVEMENT MARKING.

Lengths of line being painted are based on the total length for the work item. For example, 2,500m of broken line will be paid as a single rate item within the ordered lengths 'Broken Line'.

### **Glass Beads**

Make allowance for the supply and application of specified glass beads with all markings.

Payment for Type B-HR beads for initial new works application shall be made at the tendered Schedule of Rates for all pavement marking.

Payment for Type B-HR beads for subsequent remark and all remarking works shall be made at the tendered Schedule of Rates for all rural pavement marking.

Payment for Type D-HR beads for subsequent remark and all remarking works shall be made at the tendered Schedule of Rates for all urban pavement markings.

### **Line markings**

The following are measured in linear metres for type of painted line, inclusive of unpainted gaps:

- Continuity line - (single broken).
- Continuity line special (single broken).
- Unbroken lane line - (single continuous).

- Broken lane line or separation line - (single).
- Barrier lines both directions - (double continuous longitudinal lines).
- Barrier lines one direction - (double longitudinal lines broken on one side, continuous on the other).
- Edge line - (single continuous).
- Single Yellow Line - (yellow single continuous).
- Outline (around medians)
- Stop Lines (single continuous)
- Hold Lines (single continuous)
- Turn Lines (single broken)
- Special Purpose Broken Lane Line (Alberta Line)
- Signalized Pedestrian Crossings (single broken)
- Car / Bus / Truck Parking Bays

The following are measured by number:

- Arrow Heads (single, double, triple, merge)
- Numbers and Letters
- Disabled Symbols

Chevrons and Speed Humps are measured by square meter (painted area only)

Pavement markings at intersections are measured as an item and include chevrons, outlines, turn lines, hold, stop and pedestrian lines, and unbroken lane lines.

Removal of existing pavement markings and disposal of the waste is measured as an item.

Provision of audio tactile line marking is measured in lineal metres including unpainted gaps.

Other lines are measured in lineal metres.

Other large areas are measured in square metres of painted areas only.

The following are measured as nominated for Aerodrome Marking:

- Runway centreline measured in linear metres inclusive of unpainted gaps (white 0.300m wide) (MoS 8.3.3)
- Runway designation markings. measured by number of digits (white 9.0 m length) (MoS 8.3.4)
- Runway end markings measured in linear metres of painted line (white 1.2 m wide) (MoS 8.3.5)
- Runway Threshold Markings measured by number (white 30 m x 1.5 m wide) (MoS 8.3.8)
- Taxi Guideline Markings. measured in linear metres of painted line (yellow 0.150m wide) (MoS 8.4.2)
- Runway holding positions Pattern "A" measured in linear metres include all painted lines required to meet detail in MoS 8.4.3 (yellow 0.150m wide).
- Taxiway edge markings and Apron markings (measured in linear metres of double painted line (yellow 0.150m wide spaced 0.150m apart) (MoS 8.4.5 and 8.5.3)
- Lead Out Line measured in linear metres of painted line (yellow 0.150m wide) (MoS 8.5.22)
- Alignment Line measured by number for a 17.0 m length of painted line (yellow 0.150m wide) (MoS 8.15.18)
- Parking Clearance Line measured in linear metres of painted line to detail in MoS 8.4.5 (yellow and red lines)

**23.15.4 Raised Reflective Pavement Markers.**

Supply and install, and/or removal and disposal. Includes preparation of pavement. Measured by number of each type as nominated in the schedule of rates.

**23.15.5 Compliance with the requirements for Project Control and Procedures, Calls and Payments**

Not measured separately.

Include all costs associated with the **Project Control**, and **Procedures Calls and Payments** clauses, in the rates for the applicable items.

**23.15.6 Distance Measuring Equipment and Communication Equipment**

Not measured separately.

Include the cost of Distance measuring Equipment and Communication Equipment in the rates for applicable items

**23.15.7 Payment Generally.**

Payment for Scheduled Work shall be made at the tendered Schedule of Rates.

Payment for Priority Work shall be made at the tendered Schedule of Rates and an additional payment for Priority attendance.

Payment for Urgent Works shall be made at the tendered Schedule of Rates, and an additional payment for urgent attendance.

**23.15.8 Pavement Marking - Resealing Contracts**

The Superintendent will pay for all pavement marking work directly to the Panel Contractor selected to perform the pavement marking work under this contract.

Measurement of completed pavement marking will be done jointly with the reseal contractor, the panel contract linemarker and the Superintendent.

Recording of localities and extent of pavement marking work, including set out prior to line marking activities are measured as an item. Include recording existing pavement marking in works area.

Include all activities required to co-ordinate the pavement marking work.

**23.16 LANDSCAPE**

**23.16.1 Site Preparation**

Measured as an item.

Make allowance for any filling and levelling required.

**23.16.2 Topsoil**

Measured in square metres.

Make allowance for any supply required, and spreading.

**23.16.3 Trees, Shrubs and Ground Covers**

Measured by number of each type of genus and species.

Make allowance for supply of plants, mulch, fertilisers, excavation of planting holes, and planting.

**23.16.4 Irrigation**

Measured as an item.

Make allowance for any design requirements, cost of approvals and connection to the water

supply, cost of testing, and provision of as constructed drawings.

**23.16.5 Grassing**

Measured in square metres.

Make allowance for reseeding.

**23.16.6 Watering**

Measured as an item.

Note that cost of water will be borne by the Superintendent.

**23.17 DUCTING AND CONDUITS**

**23.17.1 Electrical Ducting**

Measured in linear metres.

Make allowance for excavation and backfilling trenches, marker tapes, draw wires and kerb markers.

**23.17.2 Water Ducting**

Measured in linear metres.

Make allowance for excavation and backfilling trenches, marker tapes, draw wires and kerb markers.

**23.17.3 Conduit Markers**

Measured by number.

**23.18 TRAFFIC CONTROL SIGNALS AND INTELLIGENT TRANSPORT SYSTEMS**

**23.18.1 Supply and Install Pedestals and Footings**

Measured by number.

**23.18.2 Supply and Install High Mast Pedestals and Footings**

Measured by number.

**23.18.3 Supply and Install Non-standard Pedestals and Footings**

Measured by number.

**23.18.4 Supply and Install Vehicle and Pedestrian Signal Lanterns**

Measured by number.

Make allowance for terminal assembly, target boards, cowls and louvres, and all ancillary items.

**23.18.5 Install and Commission Controller**

Measured as an item.

Make allowance for all ancillary items such as surge reduction filter and earth stake.

**23.18.6 Supply, Install and Test Multicore Connecting Cable**

Measured in linear metres.

**23.18.7 Supply, Install and Test Detector Feeder Cables**

Measured in linear metres.

**23.18.8 Supply and Install Detector Loops**

Measured by number.

**23.18.9 Provision of Power Connection**

Measured as an item.

**23.18.10 Supply and Install Conduits**

Measured in linear metres.

Make allowance for draw wires, end caps, and ancillary items.

**23.18.11 Supply and Install Conduit Junction Pits**

Measured by number.

**23.18.12 Supply and Install Detector Pits**

Measured by number.

**23.18.13 Supply and Install Pedestrian Push Button and Audio-tactile Assemblies**

Measured by number.

**23.18.14 Supply and Install Communications Isolation Pillar**

Measured as an item.

**23.18.15 Documents and Plans**

Measured as an item.

**23.18.16 Provision Of Communication Line**

Measured as an item.

**23.19 TRAFFIC COUNTING STATIONS**

**23.19.1 Install Cabinet**

Measured as an item.

Make allowance for supply and installation of terminal blocks and switchboard.

Make allowance for drawing of labelled loop layout and terminal blocks.

**23.19.2 Construction of Pole Foundation**

Measured as an item.

Make allowance for excavation, reinforcement and rag bolts.

**23.19.3 Supply and Install Vehicle Loop Detectors**

Measured by number.

Make allowance for cutting, install cable, junction boxes and detector feeder cables.

**23.19.4 Install Piezo Axle Sensors**

Measured by number.

Make allowance for supply and installation of feeder cables.

**23.19.5 Install Pole Assembly**

Measured as an item.

Make allowance for installation of solar power supply.

**23.19.6 Supply and Install Conduits**

Measured by length in lineal metres.

Make allowance for excavation, ducting, reinstatement and connections.

## **23.20 STREET LIGHTING**

### **23.20.1 Supply and Install Light Columns**

Measured by number.

Make allowance for supply and installation of street lighting columns including the following:

- Determining the locations of other services, above, on, and below ground;
- trenching and supply and installation of cables including marker tape and backfilling;
- supply and installation of footings and hold down bolts;
- supply and installation of distribution pillars and control equipment;
- luminaires and lamps;
- connections; and
- testing and commissioning.

### **23.20.2 Supply and Install Conduits**

Measured in metres.

Make allowance for draw wires, end caps and ancillary items.

Cable installation is paid for in the "Install Light Columns" item.

### **23.20.3 Removal of Existing Street Lighting**

Measured by number.

Make allowance for removal of existing footings and the delivery of the salvaged materials to the specified location.

### **23.20.4 Provision of Temporary Lighting**

Measured as an item.

Make allowance for temporary lighting and additional work required by Power and Water Corporation.

### **23.20.5 Connection of Power**

Measured as an item.

Make allowance for fees and charges and additional work required by Power and Water Corporation.

## **23.21 DIRECTIONAL BORING**

### **23.21.1 Directional Boring With Pipe Casing**

Measured in linear metres.

Includes supply of pipe casing and filling of cavities.

### **23.21.2 Directional Boring Without Pipe Casing**

Measured in linear metres.

Includes filling of cavities.

## **23.22 PROTECTIVE COATINGS**

Measured as an item for each coating system required. Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ.

## 24 REFERENCED AUSTRALIAN STANDARDS

<b>Referenced Australian Standards</b>		
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Dates entered like this (R2013) indicate that a Standard was reviewed and re-issued unaltered in the year cited in the parentheses.		
AS 1012 (set)	-	Methods of testing concrete
AS 1074	1989	Steel tubes and tubulars for ordinary services
AS 1111 (set)	-	ISO metric hexagon commercial bolts and screws - Product Grade C
AS 1112 (set)	-	ISO metric hexagon nuts
AS 1141(set)	-	Methods for sampling and testing aggregates
AS 1141.0	1999	- List of Methods
AS 1141.1	2015	- Definitions
AS 1141.2	2015	- Basic testing equipment
AS 1141.3.1	2012	- Sampling - Aggregates
AS 1141.5	2000 (R2016)	- Particle density and water absorption of fine aggregate
AS 1141.6.1	2000 (R2016)	- Particle density and water absorption of coarse aggregate - Weighing-in-water method
AS 1141.11.1	2009	- Particle size distribution – Sieving method
AS 1141.14	2007 (R2018)	- Particle shape, by proportional calliper
AS 1141.15	1999 (R2018)	- Flakiness index
AS 1141.18	1996	- Crushed particles in coarse aggregate derived from gravel
AS 1141.20.1	2000 (R2013)	- Average least dimension - Direct measurement (nominal size 10 mm and greater)
AS 1141.20.2	2000 (R2013)	- Average least dimension – Direct measurement (nominal size 7 mm and 5mm)
AS 1141.20.3	2000 (R2013)	- Average least dimension – Calculation (nomograph).
AS 1141.22	2008	- Aggregate soundness – Evaluation by exposure to sodium sulphate solution
AS 1141.23	2009	- Los Angeles value
AS 1141.24	2013	- Aggregate soundness – Evaluation by exposure to sodium sulphate solution
AS 1141.25.1	2003 (R2013)	- Degradation factor – Source rock
AS 1141.26	2008	- Secondary minerals content in igneous rocks
AS 1141.29	2014	- Accelerated soundness index by reflux
AS 1141.40	2017	- Polished aggregate friction value - Vertical road-wheel machine
AS 1141.41	2017	- Polished aggregate friction value – Horizontal bed machine
AS 1141.42	2017	- Pendulum friction test

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AS 1141.50	1998 (R2016)	– Resistance to stripping of cover aggregates from binders
AS/NZS 1158 (set)	-	Lighting for roads and public spaces
AS/NZS 1158.1.1	2005	– Vehicular traffic (Category V) lighting – Performance and design requirements
AS/NZS 1158.1.2	2010	– Vehicular traffic (Category V) lighting – Guide to design, installation, operation and maintenance
AS 1160	1996	Bitumen emulsions for construction and maintenance of pavements
AS/NZS 1163	2016	Cold-formed structural steel hollow sections
AS 1231	2000 (R2017)	Aluminium and aluminium alloys - Anodic oxidation coatings
AS/NZS 1252 (set)	-	High strength steel fastener assemblies for structural engineering - Bolts, nuts and washers for structural engineering
AS/NZS 1252.1	2016	– Technical requirements
AS/NZS 1252.2	2016	– Verification testing for bolt assemblies
AS 1273	1991 (R2018)	Unplasticised PVC (UPVC) downpipe and fittings for rainwater
AS 1289 (set)	-	Methods of testing soils for engineering purposes
AS 1289.0	2014	– Definitions and general requirements
AS1289.1.1	2001	– Soil classification tests - Sampling and preparation of soils – Disturbed soil samples
AS1289.2.1.1	2005 (R2016)	– Soil classification tests - Moisture content – Oven drying method (standard method)
AS 1289.3.1.1	2009 (R2017)	– Soil classification tests - Determination of the liquid limit of a soil – Four point Casagrande method
AS 1289.3.2.1	2009	– Soil classification tests - Determination of the plastic limit of a soil – Standard method
AS 1289.3.3.1	2009	– Soil classification tests - Calculation of the plasticity index of a soil
AS 1289.3.4.1	2008 (R2016)	– Soil classification tests - Determination of the linear shrinkage of a soil – Standard method
AS 1289.3.6.1	2009	– Soil classification tests - Determination of the particle size distribution of a soil – Standard method of analysis by sieving
AS 1289.3.7.1	2002 (R2013)	– Soil classification tests - Determination of the sand equivalent of a soil using a power-operated shaker
AS 1289.5.1.1	2017	– Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using standard compactive effort

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Dates entered like this (R2013) indicate that a Standard was reviewed and re-issued unaltered in the year cited in the parentheses.		
AS 1289.5.2.1	2017	– Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using modified compactive effort
AS 1289.5.4.1	2007 (R2016)	– Soil compaction and density tests – Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.8.1	2007	– Determination of field density and field moisture content of a soil using a nuclear surface moisture density gauge – Direct transmission mode
AS 1289.6.1.1	2014	– Soil strength and consolidation tests - Determination of the California Bearing Ratio of a soil – Standard laboratory methods for a remoulded specimen
AS/NZS 1336	2014	Eye and face protection - Guidelines
AS/NZS 1337 (set)	-	Personal eye protection and Eye and face protection
AS/NZS 1338 (set)	-	Filters for eye protectors
AS 1345	1995	Identification of the contents of pipes, conduits and ducts
AS 1348	2002	Glossary of terms - Road and traffic engineering
AS 1379	2007 (R2017)	Specification and supply of concrete
AS 1397	2011	Continuous hot-dip metallic coated steel sheet and strip - Coatings of zinc and zinc alloyed with aluminium and magnesium
AS 1428.4.1	2009	Design for access and mobility – Means to assist the orientation of people with vision impairment - Tactile ground surface indicators
AS/NZS 1477	2017	PVC pipes and fittings for pressure applications
AS 1478.1	2000	Chemical admixtures for concrete, mortar and grout – Admixtures for concrete
AS/NZS 1554 (set)	-	Structural steel welding
AS 1579	2001	Arc-welded steel pipes and fittings for water and waste-water
AS/NZS 1580 (set)	-	Paints and related materials – Methods of test
AS/NZS 1580.108.1	1994 (R2013)	– Determination of dry film thickness on metallic substrates - Non- destructive methods
AS/NZS 1580.205.4	1998 (R2013)	– Application properties – Airless spraying
AS/NZS 1594	2002 (R2016)	Hot rolled steel flat products
AS 1597.1	2010	Precast reinforced concrete box culverts – Small culverts (not exceeding 1200 mm span and 1200 mm height)
AS 1597.2	2013	Precast reinforced concrete box culverts – Large culverts (exceeding 1200 mm span or 1200 mm height and up to and including 4200 mm span and 4200 mm height)
AS 1604.1	2012	Specification for preservative treatment – Sawn and round timber

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Dates entered like this (R2013) indicate that a Standard was reviewed and re-issued unaltered in the year cited in the parentheses.		
AS 1627 (set)	-	Metal finishing - Preparation and pretreatment of surfaces. (Code of Practice for Preparation and Pretreatment of Metal Surfaces prior to Protective Coating).
AS 1627.0	1997 (R2017)	- Method selection guide
AS 1627.1	2003 (R2017)	- Removal of oil, grease and related contamination.
AS 1627.2	2002 (R2017)	- Power tool cleaning.
AS 1627.4	2005 (R2017)	- Abrasive blast cleaning of steel.
AS 1627.9	2002 (R2017)	- Pictorial surface preparation standards for painting steel surfaces
AS 1672.1	1997 (R2016)	Limes and limestones – Limes for building
AS 1678 (set)	-	Emergency procedure guide – Transport
AS 1678.3A1	2004 (R2016)	- Group text EPGs for Class 3 substances – Flammable liquids
AS 1722	1992 (R2017)	Pipe threads of Whitworth form - Fastening pipe threads
AS 1725 (set)	-	Chain link fabric fencing
AS/NZS 1734	1997	Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate
AS 1742 (set)	-	Manual of uniform traffic control devices
AS 1742.3	2009	- Traffic control for works on roads
AS 1742.6	2014	- Tourist and services signs
AS 1742.9	2000	- Bicycle facilities
AS 1742.10	2009	- Pedestrian control and protection
AS 1743	2018	Road signs – Specifications
AS 1744	2015	Standard alphabets for road signs
AS/NZS 1800	1998	Occupational protective helmets - Selection, care and use
AS/NZS 1801	1997	Occupational protective helmets
AS 1906 (set)	-	Retroreflective materials and devices for road traffic control purposes
AS/NZS 1906.1	2017	- Retroreflective sheeting
AS/NZS 1906.2	2007	- Retroreflective devices (non pavement application)
AS/NZS 1906.3	2017	- Raised pavement markers (retroreflective and non-retroreflective)
AS/NZS 1906.4	2010	- High-visibility materials for safety garments
AS 1940	2017	The storage and handling of flammable and combustible liquids
AS 2001 (set)	-	Methods of test for textiles - Physical tests
AS 2001.2.3.2	2001 (R2016)	- Determination of maximum force using the grab method (ISO 13934-2:1999, MOD)

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Dates entered like this (R2013) indicate that a Standard was reviewed and re-issued unaltered in the year cited in the parentheses.		
AS 2008	2013	Bitumen for pavements
AS/NZS 2009	2006 (R2016)	Glass beads for pavement-marking materials
AS/NZS 2053 (set)	-	Conduits and fittings for electrical Installations
AS/NZS 2053.1	2001 (R2016)	– General requirements
AS 2106.2	2005 (R2016)	Methods for the determination of the flash point of flammable liquids (closed cup) - Determination of flash point - Pensky-Martens closed cup method
AS 2144	2014	Traffic signal lanterns
AS 2150	2005	Hot mix asphalt – A guide to good practice
AS 2157	1997	Cutback bitumen
AS 2187.1	1998	Explosives - Storage, transport and use - Storage
AS 2187.2	2006	Explosives - Storage, transport and use - Use of explosives
AS/NZS 2210 (set)	-	Safety, protective and occupational footwear
AS/NZS 2276 (set)	-	Cables for traffic signal installations
AS/NZS 2276.1	2004 (R2017)	– Multicore power cables
AS/NZS 2276.2	1998 (R2017)	– Feeder cable for vehicle detectors
AS/NZS 2276.3	2002 (R2017)	– Loop cables for vehicle detectors
AS/NZS 2299 (set)	-	Occupational diving operations
AS/NZS 2299.1	2015	– Standard operational practice
AS/NZS 2299.2	2002	– Scientific diving
AS/NZS 2299.3	2003	– Recreational industry diving and snorkelling operations
AS/NZS 2299.4	2005	– Film and photographic diving
AS 2303	2018	Tree stock for landscape use
AS/NZS 2310	2002 (R2016)	Glossary of paint and painting terms
AS/NZS 2311	2017	Guide to the painting of buildings
AS 2312 (set)	-	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS 2312.1	2014	– Paint coatings
AS/NZS 2312.2	2014	– Hot dip galvanizing
AS 2339	2017	Traffic signal posts, mast arms and attachments (Replaces AS 2979)
AS 2341 (set)	-	Methods of testing bitumen and related roadmaking products
AS/NZS 2341.2	2015	– Determination of dynamic viscosity by vacuum capillary viscometer
AS 2341.3	1993	– Determination of kinematic viscosity by flow through a capillary tube

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Dates entered like this (R2013) indicate that a Standard was reviewed and re-issued unaltered in the year cited in the parentheses.		
AS/NZS 2341.4	2015	– Determination of dynamic viscosity by rotational viscometer
AS 2341.6	1992	– Determination of density using a hydrometer
AS 2341.9	1992	– Determination of water content (Dean and Stark)
AS 2341.12	1993	– Determination of penetration (available obsolescent - approximately equivalent to ASTM D5)
AS/NZS 2341.13	1997 (R2013)	– Long-term exposure to heat and air
AS 2341.18	1992	– Determination of softening point (ring and ball method)
AS/NZS 2350.0	1999 (R2016)	Methods of testing portland and blended cements - General introduction and list of methods
AS/NZS 2350.1	2006 (R2016)	Methods of testing portland, blended and masonry cements – Sampling
AS 2353	2018	Pedestrian push button assemblies
AS 2423	2002	Coated steel wire fencing products for terrestrial, aquatic and general use
AS/NZS 2433	1994	Plastics - Method for exposure to ultraviolet lamps
AS 2439.1	2007	Perforated plastics drainage and effluent pipe and fittings - Perforated drainage pipe and associated fittings
AS 2698.2	2000 (R2017)	Plastics pipes and fittings for irrigation and rural applications - Polyethylene rural pipe
AS 2698.3	1990 (R2017)	Plastics pipes and fittings for irrigation and rural applications - Mechanical joint fittings for use with polyethylene micro-irrigation pipes
AS 2700(set)	-	Colour Standards for general purposes
AS 2700S(B21)	2011	– Ultramarine
AS 2700S(G13)(	2011	– Emerald
AS 2700S(N14)	2011	– White
AS 2700S(N61)	2011	– Black
AS 2700S(R13)	2011	– Signal red
AS 2700S(R62)	2011	– Venetian red
AS 2700S(Y14)	2011	– Golden yellow
AS 2700S(Y35)	2011	– Off-white
AS 2703	2008	Vehicle loop detector sensors
AS 2758 (set)	-	Aggregates and rock for engineering purposes
AS 2758.1	2014	– Concrete aggregates
AS 2758.2	2009	– Aggregate for sprayed bituminous surfacing
AS 2758.5	2009	– Coarse asphalt aggregates

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Dates entered like this (R2013) indicate that a Standard was reviewed and re-issued unaltered in the year cited in the parentheses.		
AS 2809.5	2001	Road tank vehicles for dangerous goods - Tankers for bitumen based products
AS 2815 (set)	-	Training and certification of occupational divers
AS 2815.1	2008	- Occupational SCUBA diver - Standard
AS/NZS 2815.2	2013	- Surface supplied diving to 30 m
AS 2815.3	1992	- Air diving to 50 m
AS 2815.4	1992	- Bell diving
AS/NZS 2815.5	2013	- Dive supervisor
AS 2865	2009	Confined Spaces
AS 2876	2000	Concrete kerbs and channels (gutters) - Manually or machine placed
AS 2890(set)	-	Parking facilities
AS 2890.1	2004	- Off-street car parking
AS 2890.2	2002	- Off-street commercial vehicles facilities
AS 2890.3	2015	- Bicycle parking
AS 2890.5	1993	- On-street parking
AS/NZS 2890.6	2009	- Off-street parking for people with disabilities
AS 2891 (set)	-	Methods of sampling and testing asphalt
AS/NZS 2891.1.1	2013	- Sampling – Loose asphalt
AS 2891.1.2	2008	- Sampling – Coring method
AS 2891.1.3	2008	- Sampling – Asphalt from slabs
AS/NZS 2891.3.1	2013	- Binder content and aggregate grading – Reflux method
AS/NZS 2891.3.2	2013	- Binder content and aggregate grading – Centrifugal extraction method
AS/NZS 2891.3.3	2013	- Binder content and aggregate grading – Pressure filter method
AS/NZS 2891.5	2015	- Compaction of asphalt by Marshall method and determination of stability and flow – Marshall procedure
AS/NZS 2891.7.1	2015	- Determination of maximum density of asphalt – Water displacement method
AS/NZS 2891.7.3	2014	- Determination of maximum density of asphalt – Methylated spirits displacement
AS/NZS 2891.8	2014	- Voids and volumetric properties of compacted asphalt mixes
AS/NZS 2891.9.1	2014	- Determination of bulk density of compacted asphalt – Waxing procedure

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<b>Referenced Australian Standards</b>		
Use Standards, and their amendments, and their supplements, current 3 months before the date for the close of tenders, except where different editions, and amendments, and supplements, are required by statutory authorities, including, but not limited to, NATA and the National Construction Code including the Building Code of Australia.		
Dates entered like this (R2013) indicate that a Standard was reviewed and re-issued unaltered in the year cited in the parentheses.		
AS/NZS 2891.9.2	2014	– Determination of bulk density of compacted asphalt – Presaturation method
AS/NZS 2891.9.3	2014	– Determination of bulk density of compacted asphalt – Mensuration method
AS 2979	-	(Superseded by AS 2339)
AS/NZS 3000	2018	Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3100	2017	Approval and test specification - General requirements for electrical equipment
AS/NZS 3191	2008	Electric flexible cords
AS/NZS 3500.1	2018	Plumbing and drainage – Water service
AS 3568	1999	Oils for reducing the viscosity of residual bitumen for pavements
AS 3600	2018	Concrete structures
AS 3610.1	2018	Formwork for concrete – Specifications
AS/NZS 3661.1	-	(Superseded by AS/NZS 4586 and AS/NZS 4663)
AS/NZS 3661.2	1994	Slip resistance of pedestrian surfaces – Guide to the reduction of slip hazards
AS/NZS 3678	2016	Structural steel - Hot rolled plates, floorplates and slabs
AS/NZS 3679.1	2016	Structural steel - Hot rolled bars and sections
AS 3706 (set)	-	Geotextiles – Methods of test
AS 3706.1	2012	– General requirements, sampling, conditioning, basic physical properties and statistical analysis
AS 3706.2	2012	– Determination of tensile properties – Wide strip and grab method
AS 3706.3	2012	– Determination of tearing strength – Trapezoidal method
AS 3706.4	2012	– Determination of bursting strength – California bearing ratio (CBR) – Plunger method
AS 3706.9	2012	– Determination of permittivity, permeability and flow rate
AS 3706.11	2012	– Determination of durability - Resistance to degradation by light, heat and moisture
AS/NZS 3725	2007	Design for installation of buried concrete pipes
AS 3730.14	2006 (R2016)	Guide to properties of paints for buildings - Undercoat - Solvent borne - Interior/exterior
AS/NZS 3750.9	2009	Paints for steel structures – Organic zinc-rich primer
AS/NZS 3750.22	2008	Paints for steel structures – Full gloss enamel – Solvent-borne
AS/NZS 3845.1	2015	Road safety barrier systems and devices - Road safety barrier systems
AS/NZS 3845.2	2017	Road safety barrier systems and devices - Road safety devices

REFERENCED AUSTRALIAN STANDARDS

<b>Referenced Australian Standards</b>		
Use Standards, and their amendments, and their supplements, current 3 months before the date for the close of tenders, except where different editions, and amendments, and supplements, are required by statutory authorities, including, but not limited to, NATA and the National Construction Code including the Building Code of Australia.		
Dates entered like this (R2013) indicate that a Standard was reviewed and re-issued unaltered in the year cited in the parentheses.		
AS 3894(set)	-	Site Testing of Protective Coatings
AS 3894.3	2002 (R2013)	– Determination of dry film thickness
AS 3894.5	2002 (R2013)	– Determination of surface profile
AS 3894.10	2002	– Inspection Report – Daily surface and ambient conditions
AS 3894.11	2002	– Equipment Report
AS 3894.12	2002	– Inspection Report – Coating
AS 3894.13	2002	– Daily blast and paint
AS 3894.14	2002	– Inspection Report – Daily painting
AS 3972	2010	General purpose and blended cements
AS 4049 (set)	-	Paints and related materials - Pavement marking materials
AS 4049.1	2005 (R2016)	– Solvent borne paint - For use with surface applied glass beads
AS 4049.2	2005 (R2016)	– Thermoplastic pavement marking materials - For use with surface applied glass beads
AS 4049.3	2005 (R2016)	– Waterborne paint - For use with surface applied glass beads
AS 4049.4	2006 (R2016)	– High performance pavement marking systems
AS 4049.5	2007	– Performance assessment of pavement markings
AS/NZS 4058	2007	Precast concrete pipes (pressure and non-pressure)
AS 4133 (set)	-	Methods of testing rocks for engineering purposes
AS 4191	2015	Portable traffic signal systems
AS 4373	2007	Pruning of amenity trees
AS/NZS 4399	2017	Sun protective clothing – Evaluation and classification
AS 4419	2003	Soils for landscaping and garden use
AS 4454	2012	Composts, soil conditioners and mulches
AS/NZS 4501.1	2008	Occupational protective clothing - Guidelines on the selection, use, care and maintenance of protective clothing
AS/NZS 4501.2	2006	Occupational protective clothing - General requirements
AS/NZS 4586	1999	Slip resistance classification of new pedestrian surface materials (Partially supersedes AS/NZS 3661.1)
AS/NZS 4602.1	2011	High visibility safety garments - Garments for high risk applications
AS/NZS 4645(set)	-	Gas distribution networks
AS/NZS 4663	2002	Slip resistance measurement of existing pedestrian surfaces (Partially supersedes AS/NZS 3661.1)
AS/NZS 4671	2001	Steel reinforcing materials
AS/NZS 4680	2006 (R2017)	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

<b>Referenced Australian Standards</b>		
Use Standards, and their amendments, and their supplements, current 3 months before the date for the close of tenders, except where different editions, and amendments, and supplements, are required by statutory authorities, including, but not limited to, NATA and the National Construction Code including the Building Code of Australia.		
Dates entered like this (R2013) indicate that a Standard was reviewed and re-issued unaltered in the year cited in the parentheses.		
AS 4687	2007	Temporary fencing and hoardings
AS 4742	2003	Earth-moving machinery - Machine-mounted forward and reverse audible warning alarm - Sound test method
AS 4852.1	2009	Variable message signs - Fixed signs
AS 4852.2	2009	Variable message signs - Portable signs
AS/NZS 5000.1	2005 (R2017)	Electric cables – Polymetric insulated – For working voltages up to and including 0.6/1 (1.2) kV
AS 5100.5	2017	Bridge design - Concrete
AS/NZS ISO 9000	2016	Quality management systems - Fundamentals and vocabulary
AS/NZS ISO 31000	2009	Risk Management – Principles and guidelines
AS/NZS 61558 (set)	-	Safety of power transformers, power supplies, reactors and similar products
AS/NZS 61558.1	2008	– General requirements and tests (IEC 61558-1 Ed 2, MOD)
AS/NZS 61558.2.4	2009	– For supply voltages up to 1 100 V - Particular requirements and tests for isolating transformers for isolating transformers and power supply units incorporating transformers (IEC 61558-2-4:Ed 2, IDT)
AS/NZS 61558.2.6	2009	– For supply voltages up to 1 100 V - Particular requirements for safety isolating transformers and power supply units incorporating safety isolating transformers (IEC 61558-2-6:Ed 2, MOD)

## 24.1 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ

## 25 OTHER REFERENCED AUTHORITIES AND DOCUMENTS

Other Referenced Authorities and Documents	
AAPA	Australian Asphalt Pavement Association
APAS	Australian Paint Approval Scheme
AP-S0041/2	Pavement marking paint, solvent-borne
AP-S0041/3	Pavement marking materials – cold applied plastic
AP-S0041/4	Pavement marking paint, thermoplastic
AP-S0041/5	Pavement marking paint, water borne
AP-S0041/6	Airport runway markings
AP-S0042	Glass beads for use in pavement marking paints
AP-S0162	Zinc phosphate metal primer
AP-S1441/1	Permanent graffiti barrier, clear, exterior
AP-S1442/1	Temporary graffiti barrier, clear, exterior
AP-S1443	Graffiti Remover
AP-S2908	Inorganic zinc coating for protection of steel
AP-S2916	Organic zinc rich coating for protection of steel
AP-S2971	Epoxy two-pack durable primer for protection of steel in atmosphere
APVMA	Australian Pesticides and Veterinary Medicines Authority
AGBT	Austroads Guide to Bridge Technology
AGPT	Austroads Guide to Pavement Technology
AGPT04B-14	- Part 4B Asphalt
AGPT04H-08	- Part 4H: Test Methods
AGPT04K-09	- Part 4K: Seals
AGPT-T	Austroads Guide to Pavement Technology - Test methods
AGPT-T103-06	- Pre-treatment and Loss on Heating of Bitumen Multigrade and polymer Binders (rolling thin film oven [RTFO] test)
AGPT-T108-06	- Segregation of Polymer Modified Binders
AGPT-T109-06	- Ease of Remixing of Polymer Modified Binders
AGPT-T111-06	- Handling Viscosity of Polymer Modified Binders (Brookfield Thermosel)
AGPT-T112-06	- Flash Point of Polymer Modified Binders
AGPT-T121-14	- Shear Properties of Polymer Modified Binders (ARRB Elastometer)
AGPT-T122-06	- Torsional Recovery of Polymer Modified Binders
AGPT-T124-16	- Force Ratio of Polymer Modified Binders (ARRB Extensometer)
AGPT-T131-06	- Softening Point of Polymer Modified Binders
AGPT-T132-06	- Compressive Limit of Polymer Modified Binders
AGPT-T142-06	- Rubber content of digested crumb rubber binders - Trichlor bath method
AGPT-T190-14	- Specification Framework for Polymer Modified Binders and Multigrade Bitumens
AGPT-T231-06	- Deformation Resistance of Asphalt Mixtures by the Wheel Tracking Test
AGPT-T272-05	- Determination of Abrasion Loss of Bitumen Slurry (Wet track abrasion test)
AGRD	Austroads Guide to Road Design
AP-C87-15	Austroads Glossary of Terms
AP-G41-15	Bituminous Materials Safety Guide

## OTHER REFERENCED AUTHORITIES AND DOCUMENTS

AP-T68-06	Update of Austroads Sprayed Seal Design Method
AP-T235-13	Guide to the Selection and Use of Polymer Modified Binders and Multigrade Bitumens
AP-T236-13	Update of Double/Double Design for Austroads Sprayed Seal Design Methods
ASTM	American Society for Testing and Materials
ASTM D86	- Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure
ASTM D445	- Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
ASTM D1298	- Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
BS 381C-637	Medium sea grey
CASA	Civil Aviation Safety Authority
EN 1317	Road restraint systems
ISO 9533:2010	Earth-moving machinery - Machine-mounted audible travel alarms and forward horns - Test methods and performance criteria
ISSA	International Slurry Surfacing Association
NATA	National Association of Testing Authorities
NCHRP 350	Recommended procedures for the safety performance evaluation of highway features
NTCP	Northern Territory Code of Practice (in NTMTM)
NTMTM	Northern Territory Materials Testing Manual (includes NTCPs and NTTMs)
NTTM	Northern Territory Testing Methods (in NTMTM)
TB 114	ISSA Test method for wet stripping of cured/bitumen slurry (wet track abrasion method)
WA 730.1	Main Roads Western Australia, Bitumen Content and Particle Size Distribution of Asphalt and Stabilised Soil: Centrifuge Method
NRETAS Fact Sheet "Guidelines for Water Extraction as they relate to Road Construction and Maintenance.	
SPECIFICATIONS	
Electronically available: <a href="https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/technical-specifications">https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/technical-specifications</a>	
Standard Specification for Environmental Management	
Standard Specification for Small Building Works	
Standard Specification for Civil (Road) Maintenance	

### 25.1 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ

## 26 ACTS, REGULATIONS, CODES, AND AUTHORITIES

Acts, Regulations, and Codes applicable to the works, and authorities with jurisdiction over the works include, but are not limited to the following. A reference to an Act includes a reference to its Regulations.

### 26.1 ACTS AND REGULATIONS

*Aboriginal Land Rights (NT) Act 1976 (Cth)*

*Building Act 1993 and Regulations 1993*

*Bushfires Management Act 2016*

*Control of Roads Act 1953 and Control of Roads (Infringement Notice) Regulations 2011*

*Dangerous Goods Act 1998 and Regulations 1985*

*Energy Pipelines Act 1991*

*Environmental Offences and Penalties Act 1996*

*Environment Protection Act 2019*

*Environment Protection and Biodiversity Conservation Act 1999 (Cth)*

*Fair Work Act 2009 (Cth)*

*Fire and Emergency Act 1996*

*Food Act 2004*

*Heritage Act 2011*

*Medicines, Poisons and Therapeutic Goods Act 2012 and Regulations 2014*

*Mineral Titles Act 2010*

*Mining Management Act 2001*

*Northern Territory Aboriginal Sacred Sites Act 1989*

*Planning Act 1999 and Regulations 2000*

*Public and Environmental Health Act 2011 and Regulations 2014*

*Rail Safety (National Uniform Legislation) Act 2012*

*Soil Conservation and Land Utilisation Act 1969*

*Territory Parks and Wildlife Conservation Act 1976*

*Traffic Act 1987 and Regulations 1999 and Traffic Regulations, Schedule 3 – Australian Road Rules 1999*

*Volatile Substance Abuse Prevention Act 2005*

*Waste Management and Pollution Control Act 1998*

*Water Act 1992*

*Weeds Management Act 2001*

*Work Health and Safety (National Uniform Legislation) Act 2011 and Regulations 2011*

## **26.2 CODES AND GUIDELINES**

Building Code of Australia (BCA)

CASA Directives

CASA Manual of Standards

National Construction Code (NCC)

NT Code of Practice for Small On-site Sewage and Sullage Treatment Systems and the Disposal or Re-use of Sewage Effluent.

NT Deemed to Comply Manual

NT Health and Safety Guidelines for Commercial Kitchens

## **26.3 AUTHORITIES**

Aboriginal Areas Protection Authority (AAPA)

Development Consent Authority of the NT (DCA)

NT Department of Health

NT Department of the Environment and Natural Resources (DENR)

NT Fire and Rescue Service (NTFRS)

NT WorkSafe

Power and Water Corporation of the NT (PWC)

The engaged Building Certifier

Local Municipal Councils

Local Shire Councils

Aboriginal Land Councils

Aboriginal Community Councils

## **26.4 OTHER REQUIREMENTS**

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ

## 27 CIVIL STANDARD DRAWINGS FOR ROADWORKS

<b>Civil Standard Drawings for Roadworks</b>	
Use Civil Standard Drawings current at the time the works are executed.	
Civil Standard Drawings are accessible via <a href="https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/standard-drawings">https://dipl.nt.gov.au/industry/technical-standards-guidelines-and-specifications/standard-drawings</a>	
The CS Drawings listed here are those cited in the Roadworks Master Specification and the Standard Specification for Roadworks as at July 2020. Additional CS drawings may be cited in RFTs or RFQs or in PSRs.	
CS Drawings numbered under the OLD numbering system	
CS 1501	Signal Details - Pole Foundation
CS 1502	Signal Details - Mast Arm Foundation
CS 1503	Signal Details - Controller Foundation
CS 1504	Signal Details - Communication Isolation Pillar
CS 1505	Signal Detail Lantern Mounting Details
CS 1506	Pedestrian Push Button
CS 1507	Signal Detail Detector Installation
CS 1550	Standard Traffic Counting Station Post Mounted Detector Loop and Pit Details
CS 1551	Standard Traffic Counting Station Post Mounted Detector Loop Layout
CS 1552	Standard Traffic Counting Station Post Mounted Piezo Tube Layout
CS 1553	Standard Traffic Counting Station Post Mounted Foundation Details
CS 1554	Standard Traffic Control Station Post Mounted Cabinet Wiring Details
CS 1555	Standard Traffic Counting Station Post Mounted Post Assembly
CS Drawings numbered under the NEW numbering system	
CS 3101	Installation, Bedding And Filling/Backfilling Against/Over Culverts
CS 3200	Steel Beam Guard Rail
CS 3302	Pram Ramps, With and Without Tactile Ground Surface Indicator (TGSI)
CS 3305	Vehicle Barrier Fencing, Wheelchair Crossing for Medians, and Intersection Hold Rail Details
CS 3306	Cycle/Shared Path Culvert Crossing Fence Details
CS 3307	Pedestrian Fence
CS 3308	Standard Security Fence
CS 3310	Stock Fence Design and Details
CS 3312	Standard Stock Fence Swinging Floodgate for Stream Crossings
CS 3313	Standard Cattle Grid Plan and Sections with Approach Sla
CS 3314	Standard Cattle Grid Plan and Sections without Approach Slab
CS 3315	Standard Cattle Grid Details
CS 3317	Irrigation – Telemetry Control Station Detail
CS 3400	Line marking
CS 3401	Pavement Markings -Chevrans and RRPM's – Sheet 1
CS 3402	Pavement Markings -Chevrans and RRPM's – Sheet 2
CS 3403	Edge Line and Audio Tactile Ribs
CS 3500	Flexible Guide Posts
CS 3501	Flood Gauge Posts
CS 3516	Hazard Marker Installation Details For Rehabilitation Of Existing Sign
CS 3517	Hazard Marker Installation Details For New Installation
CS 3518	Hazard Marker Connection Details

### 27.1 OTHER REQUIREMENTS

Refer to PROJECT SPECIFIC REQUIREMENTS in the RFT/RFQ

## 28 NORTHERN TERRITORY CLIMATE ZONES TABLE

NORTHERN TERRITORY CLIMATE ZONES TABLE – Updated 12June2020						
The categorisations below do not take in to account aggressive environments. Special design considerations need to be put in place for aggressive environments.						
ACC – Atmospheric Corrosivity Classification						
		NTCZ 01 Areas south of, and including, Tennant Creek	NTCZ 02 Areas north of Tennant Creek and south of and including Katherine, and areas more than 50 km from the coast or tidal estuaries	NTCZ 03 Areas north of Katherine and areas between 10 km and 50 km from the coast or tidal estuaries	NTCZ 04 Areas less than 10 km from the coast or tidal estuaries	NTCZ 05 Areas inside buildings
AS 1170	Wind Region	A4	B	B & C	C	n/a
AS 1192	Service Condition Category	2	3	4	5	n/a
	Corrosion Category	B	C & F	D	E	C
AS 1231	Thickness Grade	AA15	AA25	AA25	AA25	AA10 Low airborne moisture
						AA15 High airborne moisture
AS/NZS 2312	ACC	C3	C4	C5, CX & CT	C5, CX & CT	C2
AS 2423	Climatic Category	B	C & F	D	E	A
AS 2699	Durability Classification	R1 (Green mark)	R2 (Yellow mark)	R3 (Red mark)	R4 (White or blue mk)	R1 (Green mark)
AS 3566.2	Corrosion Resistance Class	3	4	4	4	2
AS 3600	Exposure Classification	A	A	B1	B2 or C	A
AS 3715	Service Condition Category	3	4	5	5	n/a
	ACC	3	4	5	5	n/a
AS 4145	Corrosion Resistance Category	C6	C6	C7	C7	C6
AS 4312	ACC	C3	C4	C5	C5	C2
AS/NZS 4534	ACC	C (=C3)	D (=C4)	E (=C5)	E or F (=C5orCT)	B (=C2)
BCA Vol.2 Table 3.5.1.1	Environment category	Low	Low	Medium	High - Very High	n/a

## 29 HOLD POINTS AND WITNESS POINTS SCHEDULES

### 29.1 SCHEDULE 1 - HOLD POINTS

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>01 MISCELLANEOUS PROVISIONS</b>				
<b>VOLATILE SUBSTANCES MANAGEMENT</b> Provide details of the volatile substances proposed to be brought in to the area(s) subject to Volatile Substance Abuse Management Plan(s) and provide details of the proposed methods for complying with the requirements of any applicable Volatile Substance Abuse Management Plan(s).	1.7	10 & 11		
<b>PERMITS TO ACCESS LAND FOR WORKS ON ROADS</b> The Contractor must provide documentary evidence of having been granted the required permission(s) to; <ul style="list-style-type: none"> <li>– enter the land which is the site(s) of the works, and</li> <li>– to enter any other lands for ancillary activities related to the works, and</li> <li>– carry out the works and works related activities.</li> </ul> Do not enter the land until this evidence has been received by the Superintendent	1.8	11		
<b>PERMITS TO ACCESS LAND FOR WORKS ON ROADS</b> Provide documented advice on sites to which surplus materials will be taken. Provide documentary evidence of permits, from the entity/entities with jurisdiction over those sites, for the dumping of surplus materials at those sites.	1.8	11		
<b>CAMP SITE/COMPOUND/WORKSHOP</b> Provide a copy of written permission from the owner or lessee of the land permitting establishment and operation of a camp site, compound and/or workshop, before commencing works.	1.9	12		
<b>FOOD PREPARATION FACILITIES</b> Provide a copy of proof of registration with DoH of any camp food preparation area in accordance with the <i>Food Act 2004</i> .	1.9.1	12		
<b>EFFLUENT</b> Provide a copy of written approval from Department of Health (DoH) for any proposed on-site effluent disposal system, before commencing works.	1.9.3	12		
<b>EFFLUENT</b> Where the use of septic tanks or portable toilets is not reasonable or practical, pit toilets may be used, but this requires the prior written approval of the Superintendent.	1.9.3	12		
<b>REHABILITATION</b> Obtain approval from the Superintendent for the completed rehabilitation of the camp site/compound/workshop before final demobilisation.	1.9.4	12		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>OPERATION OF EXTRACTION AREAS LIMIT OF EXCAVATION</b> Obtain Superintendent approval to exceed 1ha pit size.	1.11.5	13 & 14		
<b>EXPLOSIVES</b> Obtain approval from Superintendent before commencing blasting operations.	1.12	15		
<b>WORK HEALTH AND SAFETY MANAGEMENT PLAN</b> If the Act requires it, provide a Work Health and Safety Management Plan within 14 calendar days of award of the contract. Do not commence works until the Superintendent has advised that the Work Health and Safety Management Plan may be used.	1.14.2	16		
<b>WORK ON RAILWAY SITES</b> Do not commence work until the work plan has been approved by the owner and operator of the rail system.	1.16	17 & 18		
<b>WORK NEAR TRAFFIC COUNTING STATIONS</b> Prior to commencing any excavation, boring of holes, blasting, rock breaking, soil compaction or similar activity in the vicinity of traffic counter station detector loops, obtain the location of the cables from the Department, Transport Planning Division, Data Contracts Officer and pay all fees.	1.17	18		
<b>AS CONSTRUCTED INFORMATION</b> Provision of As Constructed information is a condition precedent to Practical Completion.	1.23	19		
<b>CONTRACTOR'S SUBMISSIONS</b> Provide copies of permits, and approvals, for works, and associated activities, proposed to be carried out in areas not in the road reserve before commencing any proposed works, and activities.	1.27	23		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>02 PROVISION FOR TRAFFIC</b>				
<p><b>SUBMISSION OF TRAFFIC MANAGEMENT PLAN</b>                      Submit the Traffic Management Plan (TMP), with the Traffic Guidance Schemes.                      For contracts where audits of traffic control measures are required:</p> <ul style="list-style-type: none"> <li>- Do not commence implementing traffic control measures until the TMP has been audited by a Panel Period Audit Consultant and found to be suitable.</li> <li>- Do not commence the works until the TMP has been audited by a Panel Period Audit Consultant and found to be suitable.</li> </ul> <p>For contracts where audits of traffic control measures are not required:</p> <ul style="list-style-type: none"> <li>- Do not commence implementing traffic control measures until the TMP has been appraised by DIPL Road Operations and found to be suitable for use.</li> <li>- Do not commence the works until the TMP has been appraised by DIPL Road Operations and found to be suitable for use.</li> </ul>	2.6.2	29		
<p><b>TRAFFIC MANAGEMENT AUDIT REQUIREMENTS – SUITABILITY AUDIT REQUIREMENTS</b>                      The Traffic Management Plan must not be implemented before it is audited for suitability and found to be suitable.</p>	2.8.2	33 & 34		
<p><b>TRAFFIC MANAGEMENT AUDIT REQUIREMENTS – SUITABILITY AUDIT REQUIREMENTS</b>                      Works must not commence before the Traffic Management Plan is audited for suitability and found to be suitable.</p>	2.8.2	33 & 34		
<p><b>TRAFFIC MANAGEMENT AUDIT REQUIREMENTS – NOTICE OF IMPLEMENTATION</b>                      Provide the Superintendent with a copies of all audit reports confirming conformance, or indicating non-conformance, with specifications, Standards, and requirements for each implemented TGS within 24 hours of implementation.</p>	2.8.6	35		
<p><b>TRAFFIC MANAGEMENT AUDIT REQUIREMENTS – NOTICE OF IMPLEMENTATION</b>                      Provide the Superintendent with a copies of all audit reports confirming conformance, or non-conformance, with specifications, Standards, and requirements for each significant change within 24 hours of implementation.</p>	2.8.6	35		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>TRAFFIC MANAGEMENT AUDIT REQUIREMENTS – NOTICE OF IMPLEMENTATION</b> The Contractor shall rectify the significant/urgent non-conformance in the time instructed by the Superintendent. If the Contractor fails to rectify the non-conformance the Superintendent may engage others to rectify the non-conformance, and the associated costs shall become a debt due and payable to the Principal.	2.8.6	35		
<b>TRAFFIC MANAGEMENT AUDIT REQUIREMENTS – NOTICE OF INDEPENDENT THIRD PARTY AUDITS</b> Notify Superintendent and submit revised TGSs & TMPs to DIPL Road Operations for appraisal.	2.8.7	35		
<b>AMENDMENTS TO TRAFFIC MANAGEMENT PLANS</b> Modified TMPs must be audited for suitability by a Panel Period Audit Consultant, or appraised by DIPL Road Operations if Traffic Management audits are not required under the contract, before implementation of the modified TMP.	2.10	38		
<b>AMENDMENTS TO TRAFFIC MANAGEMENT PLANS</b> Modified traffic management control measures must be audited for compliance by a Panel Period Audit Consultant, or appraised by DIPL Road Operations if Traffic Management audits are not required under the contract, before works resume.	2.10	38		
<b>WORK IN RURAL AREAS</b> Undertake work during daylight hours only unless approval is given by the Superintendent. Approval will only be granted in exceptional circumstances.	2.11	38		
<b>WORK IN BUILT UP AREAS – WORKING TIMES</b> Obtain Superintendent approval if proposing to work inside the restricted work hours.	2.12.1	38		
<b>TRAFFIC LANES</b> Obtain prior written approval from the relevant Local Government or Council if traffic is to be detoured onto their road network or the proposed works affects their network/assets accordingly. Provide a copy of all relevant approvals with the Traffic Management Plan.	2.12.2	39		
<b>LANE CLOSURES</b> Do not use bullnose or V type barriers unless no other option is available. Obtain permission from the Superintendent to use bullnose or V type barriers before placing them on site.	2.12.3	39		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>NIGHT ILLUMINATION</b> Sections of the roadway, including detours and side tracks, affected by Work Zone Traffic Management, must be illuminated at night to AS 1742.3, if night works are in progress, and/or if signage left on site overnight is not illuminated by the headlights of vehicles approaching the signs. Illumination to be 10 lux minimum at ground level.	2.13	39		
<b>NON-STANDARD SIGNS</b> Obtain specific approval from the Superintendent before using signs not included in AS 1742.3.	2.15.4	41		
<b>VARIABLE MESSAGE SIGNS (VMS)</b> Provide details of the messages to be displayed and the locations of the variable message signs. Provide wording for advance warning message(s) and wording for message(s) to be displayed during the works. Do not use any VMS until the messages to be displayed have been approved. Do not use any VMS until the proposed location and orientation of the VMS has been approved. Provide this information not less than 5 working days before the VMSs are to be put in to service for the project.	2.15.5	41 & 42		
<b>TEMPORARY SPEED LIMITS</b> Submit temporary speed limit authorisation applications to alter speed limits to the Superintendent, 5 working days prior to the implementation of temporary speed limits, for approval under the Control of Roads Act.	2.15.7	43		
<b>ROAD SAFETY BARRIERS</b> Provide a statement, signed by your engineer, and signed by the author of the Traffic Management Plan, which states that the Road Safety Barriers proposal complies with AS 1742.3, and with AS/NZS 3845.1, and with AS/NZS 3845.2, and with the specifications and installation manuals from the manufacturers of the components proposed to be used in the Road Safety Barriers system. Provide the Traffic Management Plan with this statement.	2.15.8	43 & 44		
<b>DETOURS, SIDE TRACKS, AND CROSSOVERS</b> Obtain written approval from the Superintendent before commencing any works.	2.18	45		
<b>TEMPORARY BRIDGING</b> Obtain written approval from the Regional Manager, Road Projects prior to commencement of any such works.	2.21	47		
<b>TEMPORARY BRIDGING</b> Provide copies of approvals obtained by Contractor to the Superintendent prior to the commencement of the works	2.21	47		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>CONTRACTOR'S PLANT AND EQUIPMENT</b> On roads carrying significant traffic, floodlight the road and area within 50 m of the site when working at night, if approved by the Superintendent, to a ground level luminance of 10 lux minimum.	2.22	48		
<b>TRAFFIC SIGNALS</b> Obtain clearances from the Department's Traffic Section, ph. 8999 4402, prior to commencement of the works. Co-ordinate your works activities with the Department's Traffic Section for the duration of the works.	2.24.1	49		
<b>REQUIREMENTS FOR WORKS CARRIED OUT DURING WORKING HOURS</b> Provide copies of the endorsed TGSs, and contact the Traffic Section, by phone on 8999 4402, not less than one working day prior to the commencement of work.	2.24.1.1	49		
<b>REQUIREMENTS FOR WORKS CARRIED OUT DURING WORKING HOURS</b> If the traffic signals need to be re-mapped, advise the Traffic Section not less than one working day prior to the commencement of work. Contact should be made by email to <a href="mailto:traffic.NTG@nt.gov.au">traffic.NTG@nt.gov.au</a> or by phone.	2.24.1.1	49		
<b>REQUIREMENTS FOR WORKS CARRIED OUT DURING WORKING HOURS</b> Contact the Traffic Section by phone immediately before installing traffic control on the day the works are to be carried out to advise the Traffic Section about the planned lane closures. Contact the Traffic Section immediately if unacceptable traffic congestion occurs during the works so that the Traffic Section can assist by adjusting traffic signal timings. If traffic congestion cannot be relieved by adjusting traffic signal timings it may be necessary to remove lane closures.	2.24.1.1	49 & 50		
<b>REQUIREMENTS FOR WORKS CARRIED OUT DURING WORKING HOURS</b> Advise the Traffic Section immediately before traffic control is removed	2.24.1.1	49 & 50		
<b>REQUIREMENTS FOR WORKS CARRIED OUT OUTSIDE WORKING HOURS</b> Provide copies of the endorsed TGSs, and contact the Traffic Section, not less than one working day prior to the commencement of work.	2.24.1.2	50		
<b>REQUIREMENTS FOR WORKS CARRIED OUT OUTSIDE WORKING HOURS</b> If the traffic signals need to be re-mapped, advise the Traffic Section not less than one working day prior to the commencement of work.	2.24.1.2	50		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>REQUIREMENTS FOR WORKS CARRIED OUT OUTSIDE WORKING HOURS</b> Advise the Traffic Section after-hours contact officer about the planned lane closures, using the after-hours phone number provided, immediately before installing traffic control, on the day the works are to be carried out.	2.24.1.2	50		
<b>REQUIREMENTS FOR WORKS CARRIED OUT OUTSIDE WORKING HOURS</b> Advise the Traffic Section after-hours contact officer, on the after-hours phone number provided, immediately before traffic control is removed.	2.24.1.2	50		
<b>VARIABLE SPEED LIMIT ZONES</b> Obtain clearances from the Department's Traffic Section, ph. 8999 4402, not less than five working days prior to commencing works.	2.24.2	50		
<b>TRAFFIC COUNT STATIONS</b> Prior to the commencement of work within the trafficked lanes and within 50 m of traffic signals or within 20 m, in any direction, of any component of the traffic count equipment, whether located in or on the trafficked lanes, shoulders, nature strips, and/or medians, or located in another type of area, obtain a clearance to commence the works from Department's Traffic Section for the region in which the works are located, and with either the Superintendent or with the Maintenance Manager (phone 8999 4660). Co-ordinate works activities, with the Department's Traffic Section for the region in which the works are located, for the duration of the works.	2.24.3	50 & 51		
<b>PORTABLE TRAFFIC SIGNALS</b> Complete and provide the Portable Traffic Signal Authorisation (PTSA) form, included in the application for a Permit to Work in the Road Reserve document, to seek formal approval from the Superintendent to use the proposed portable traffic signals and the proposed time settings, not less than 5 working days prior to the intended use of the portable traffic signals. Do not use any PTSs on site until an authorised Departmental Officer has signed off the PTSA form.	2.25	51		
<b>TEMPORARY SPEED LIMITS</b> Work zone speed limits require approval from the Superintendent prior to implementation.	2.25.1	52		
<b>04 EARTHWORKS</b>				
<b>EXCESS MATERIAL</b> Obtain approval from Superintendent prior to hauling, dumping and spreading excess material.	4.4.2	57		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>ROCK IN SUBGRADE</b> Obtain agreement from the Superintendent to the extent of the excavation.	4.4.3	57		
<b>UNSUITABLE MATERIAL BELOW SUBGRADE SURFACE OTHER THAN ROCK</b> Obtain directions from the Superintendent before works commence.	4.4.4	57		
<b>PREPARATION PRIOR TO FILLING</b> Once moisture conditioned and compacted, subject each lot to a proof roll, with the Superintendent in attendance, as specified in the Proof Rolling sub-clause of the Conformance clause in this work section	4.5.2	58		
<b>UNSUITABLE MATERIAL BENEATH FILL</b> Obtain directions from the Superintendent before works commence.	4.5.4	58		
<b>EXCAVATION - PREPARATION</b> Obtain Superintendent's agreement with inspection record of current conditions.	4.13.2.2	64		
<b>EXCAVATION - PREPARATION</b> Obtain the Superintendent's approval for the foundation surface before placing the blinding concrete.	4.13.2.2	64		
<b>PROOF ROLLING</b> Submit a proof rolling procedure to the Superintendent for approval including the proposed method of preparing the areas, the extent of proof rolling, and details of the plant and / or equipment proposed to be used.	4.16.3	66		
<b>CONFORMANCE TESTING</b> Obtain the Superintendent's approval of subgrade conformance prior to placing further material.	4.16.4	66		
<b>05 CONFORMANCE TESTING</b>				
<b>ITP SUBMISSION</b> Submit: ITPs, detailing all procedures and test plans to be undertaken to complete the project, before commencing work.	5.4	69		
<b>06 PAVEMENTS AND SHOULDERS</b>				
<b>PROCESS CONTROL TESTING</b> Provide the Superintendent with a program and procedure for process control testing for the project within 14 days of the awarding of the contract and before work is commenced on site. Base the process control testing on lots and comply with the clause Conformance of Compaction of Soils in CONFORMANCE TESTING.	6.4.1	86		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>PAVEMENT ACCEPTANCE REQUIREMENTS</b> Obtain the Superintendent's approval for pavement and shoulders acceptance prior to any surfacing work, including satisfying all requirements for: <ul style="list-style-type: none"> <li>– Final Pavement Layer Integrity</li> <li>– Dry back</li> <li>– Proof Rolling</li> <li>– Conformance testing</li> <li>– Surface Roughness</li> <li>– Other Tolerances</li> </ul> For unsealed pavements, obtain the Superintendent's approval for pavement conformance at conclusion of pavement works.	6.7.1	88		
<b>07 STABILISATION AND MODIFICATION</b>				
<b>BINDER FIELD APPLICATION RATES</b> Determine field application rate for spreading based on laboratory testing of materials. Obtain the Superintendent's approval of the field application rate for each source material for the project.	7.4.4.1	93		
<b>GRANULAR MODIFICATION</b> Determine blending ratios based on laboratory testing of materials. Obtain the Superintendent's approval.	7.4.6	94		
<b>PLANT MIX STABILIZATION - BINDER CONTENT</b> Assess the cement content based upon test results of materials to be stabilised. Obtain the Superintendent's approval for the cement content.	7.5.1	95		
<b>CONFORMANCE TESTING</b> Superintendent to approve conformance of stabilised layer prior to commencing surfacing work.	7.6.2	97		
<b>08 SPRAY SEALING</b>				
<b>APPLICATION SPRAY RATES</b> Do not commence spraying until the spray rates are advised by the Superintendent.	8.13.3	113		
<b>APPLICATION OF GEOFABRIC</b> Submit details of proposed machinery and method of application.	8.14	114		
<b>APPLICATION OF AGGREGATE</b> Obtain approval from the Superintendent for use of the proposed aggregate loader before commencing loading operations.	8.15	114		
<b>SELF-PROPELLED MULTI RUBBER TYRED VIBRATING ROLLERS</b> Obtain Superintendent's approval for the use of self-propelled multi rubber tyred vibrating rollers before using them.	8.15.4	116		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>WASTE MATERIAL</b> Obtain written approval from the Superintendent for use of rotary type brooms to windrow the loose aggregate in the urban area. Suction type brooms are still to be used to remove the waste aggregate.	8.17	116 & 117		
<b>09 DENSE GRADED ASPHALT</b>				
<b>DESIGN MIX REQUIREMENTS</b> No asphalt shall be supplied until the mix has been registered and the Superintendent has approved the mix for use	9.6.2	123		
<b>DESIGN MIX REQUIREMENTS</b> Where it is proposed to change the source grading or nature of the components or binders, new mix designs must be carried out in accordance with the Department's Code of Practice for Registration of Asphalt Mix Designs.	9.6.2	123		
<b>TEMPORARY WORKS</b> This work must be approved by the Superintendent before the section is opened to traffic.	9.7.5	125		
<b>LONGITUDINAL JOINTS</b> Provide a plan showing all proposed longitudinal joints. The plan must be approved by the Superintendent prior to works depicted commencing.	9.10.7	127		
<b>10 SLURRY SURFACING</b>				
<b>BINDER</b> Additives to improve the workability of the mix, or to accelerate or retard setting of the mix may be used with the approval of the Superintendent.	10.5.1	132		
<b>MIX DESIGN – PROCESS TESTING AND ENDORSEMENT</b> At least 14 days before commencing work, forward the details of the mix design, and copies of test reports to the Superintendent. Testing is to be carried out in a NATA accredited laboratory and at is to be carried out at no cost to the Principal. Once the mix design is endorsed by the Superintendent it becomes the specified job mix.	10.7.2	134		
<b>SWEEPING PAVEMENT</b> Do not commence spreading of the slurry surfacing mix until the prepared pavement has been endorsed by the Superintendent.	10.8.1	135		
<b>11 MISCELLANEOUS CONCRETE WORKS</b>				
<b>CHEMICAL ADMIXTURES</b> Do not use admixtures without obtaining prior written approval from the Superintendent.	11.3.5	138		
<b>REINFORCEMENT</b> Do not place concrete until the reinforcement has been inspected by the Superintendent.	11.3.6	139		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>PLACING OF CONCRETE</b> Provide verification that all constituent materials, formwork, falsework, reinforcement, and environmental conditions comply with all requirements. Do not cast any concrete without that verification.	11.6.3	140		
<b>EXISTING SERVICES</b> Obtain the Superintendent's approval before altering the line or level of existing services.	11.8	142		
<b>12 DRAINAGE WORKS</b>				
<b>PRECAST REINFORCED CONCRETE BOX CULVERTS</b> Provide drawings showing complete reinforcement and dimensions with tolerances and obtain the Superintendent's approval prior to fabricating any units. Provide manufacturer's certification that the provided culverts comply with the applicable sections of AS 5100.5 and with AS 1597. Certify that the design is reflected accurately by the shop drawings and that the design is adequate to resist all specified loads and the soil loads pertaining to the site. Provide a table of construction axle loads versus minimum required cover for each box culvert size.	12.5.3	146		
<b>CONSTRUCTION OF CULVERTS AND STRUCTURES - SETTING OUT</b> Obtain the Superintendent's approval for the setting out before construction.	12.6.1	147		
<b>CONSTRUCTION OF CULVERTS AND STRUCTURES - BACKFILL</b> Do not place backfill against any in-situ concrete structure until the concrete has attained 80% characteristic strength and approval has been given.	12.6.10	149		
<b>INLET AND OUTLET STRUCTURES AND MAINTENANCE HOLES - LAYING AND BACKFILLING</b> Obtain Superintendent's approval of the pipe installation before backfilling.	12.11.5	150		
<b>13 PROTECTION WORKS</b>				
<b>GROUTED STONE PITCHING</b> Obtain Superintendent's approval before grouting.	13.5.2	155		
<b>14 ROAD FURNITURE AND TRAFFIC CONTROL DEVICES</b>				
<b>FLEXIBLE GUIDE POSTS - SAMPLES</b> Provide a sample flexible guide post from each batch purchased for this contract for inspection and approval before installing any posts.	14.6.4	164		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>FLEXIBLE GUIDE POST - TESTS</b> Submit test results to the Superintendent in respect to the following characteristics before ordering the guide posts: - Heat resistance. - Cold resistance. - Rigidity - Vehicle impact.	14.6.7	165 & 166		
<b>ROAD SIGNS - MATERIALS</b> Obtain Superintendent's approval for the use of anti-graffiti film or coating products. Apply anti-graffiti products only to the new road signs specified by the Superintendent.	14.7.3	167 & 168		
<b>ROAD SAFETY BARRIERS – WIRE ROPE SYSTEMS</b> Obtain Superintendent's approval for any proposed Steel Wire Rope Road Safety Barrier System before ordering any components.	14.11	173		
<b>15 PAVEMENT MARKING</b>				
<b>PAVEMENT MARKING PAINT</b> Submit Certificates of Compliance, issued by an accredited testing authority, stating that all paints being used comply with, the relevant Australian Standards and/or APAS specifications.	15.5	176		
<b>GLASS BEADS</b> Submit Certificates of Compliance, issued by an accredited testing authority, stating that the glass beads being used comply with, the relevant Australian Standards and APAS specifications.	15.6	177		
<b>PAVEMENT MARKING CONFORMANCE TOLERANCES</b> Provide evidence that the pavement marking complies with the requirements of this specification.	15.9	178		
<b>THERMOPLASTIC MATERIALS</b> Approval from Director of Engineering and Environment Services is required before thermoplastic materials are used.	15.11	180		
<b>COLD APPLIED PLASTIC MATERIALS</b> Approval from Director of Engineering and Environment Services is required before cold applied plastic materials are used.	15.12	181		
<b>AUDIO TACTILE LINE MARKING</b> Approval from Director of Engineering and Environment Services is required before audio tactile line marking materials are used.	15.13	181		
<b>RAISED RETROREFLECTIVE PAVEMENT MARKERS</b> Submit details in relation the manufacturer's warranties, performance, durability and maintenance of the raised retroreflective pavement markers	15.14.1	182		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>REMOVAL OF PAVEMENT MARKINGS</b> Obtain approval from the Superintendent on the method used for pavement marking removal before commencing removal operations.	15.15	183		
<b>PAINT BLACKOUT</b> Obtain Superintendent's approval before using this methodology.	15.15.4	183		
<b>REPORTING</b> Submit to the Superintendent the following information, in Microsoft Excel spreadsheet format, every quarter, for all works carried out under this contract: <ul style="list-style-type: none"> <li>– CSR number (for panel contract works)</li> <li>– Contract number (for new works)</li> <li>– Date</li> <li>– Road number</li> <li>– Chainages – start point and finish point of each section of works</li> <li>– PRP numbers - start point and finish point of each section of works</li> <li>– GPS coordinates in Decimal Degrees - start point and finish point of each section of works</li> <li>– Type of carriageway – inbound outbound (for dual carriageways) and full width (for two way carriageway) and</li> <li>– Bead size used and Paint application rate.</li> </ul>	15.17	185		
<b>16 LANDSCAPE</b>				
<b>IMPORTED SOILS</b> Advise the name of the proposed supplier. Do not order soils without Superintendent's approval of the supplier.	16.3.4	188		
<b>MULCH</b> Advise the name of the proposed supplier. Do not order mulch without Superintendent's approval of the supplier.	16.3.6	188		
<b>SETTING OUT OF HOLES</b> Obtain approval of the set out from the Superintendent before commencing any planting.	16.5.1	190		
<b>IRRIGATION SYSTEM</b> Backfill trenches only after inspection and approval of wiring.	16.8.1	200 & 201		
<b>DESIGN PLANS</b> Submit drawings to Superintendent for approval indicating design proposals showing all pipework, sprinklers, valves and control systems.	16.8.2	201		
<b>TESTING</b> Obtain Superintendent's approval to proceed with backfilling other than spot filling to retain pipework from movement during pressure testing.	16.8.7	203		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>18 TRAFFIC CONTROL SIGNALS AND INTELLIGENT TRANSPORT SYSTEMS</b>				
TRAFFIC SIGNAL CABLING Submit documentation of proposed cable layout for approval prior to commencing installation of cabling.	18.5	210		
CONNECTION TO TELSTRA PIT FROM COMMUNICATIONS ISOLATION PILLAR Provide documentary evidence that the installation is approved by Telstra.	18.8.3	212		
DOCUMENTS AND PLANS Submit to the Superintendent one complete set of As Constructed Drawings and completed Cable Layout and Connection Chart before the issue of the Certificate of Practical Completion.	18.9	212		
<b>20 STREET LIGHTING</b>				
TEMPORARY LIGHTING Submit plans of the proposed temporary street lighting to the Superintendent for approval prior to removal of existing street lights.	20.10.2	221		
<b>21 DIRECTIONAL BORING</b>				
PROPOSED METHOD Submit details of the proposed method of directional boring not less than 14 days prior to commencement of construction using that method. Include details of proposed filling of cavities. No disruption or excavation of the surface is to take place over the length nominated.	21.4	222		
DIRECTIONAL BORING WITHOUT PIPE CASING Obtain written permission from the Superintendent to use directional boring without pipe casing.	21.4.2	223		
<b>22 PROTECTIVE COATINGS</b>				
PROTECTIVE COATINGS Surface Preparation: To AS 1627.	22.3	226		
PROTECTIVE COATINGS Complete and submit Site testing of protective coatings: To AS 3894.10 and AS 3894.11 and AS 3894.12.	22.3	226		
ABRASIVE BLASTING At the completion of the final blast and prior to coating application, the surface profile of each item shall be measured according to Method A, Profile Replicating Tape, of AS 3894.5. Provide documentary confirmation that the surface is suitable for the application of the specified coatings. This shall be identified as a Hold Point in the contractor's ITP.	22.12.2	229 & 230		

<b>SCHEDULE 1 – HOLD POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>ALTERNATE SURFACE PREPARATION</b> Do not use forms of surface preparation other than abrasive blasting, such as bristle blaster, needle guns, power tool cleaning and hand tool cleaning, without written permission from the Superintendent. Alternate methods of surface preparation must be included in the Contractor's ITP.	22.12.4	230		
<b>COATING</b> Provide coating manufacturers' written approval for use before using any other additives (eg promoters, accelerators etc).	22.13.2	231		
<b>ALTERNATE COATING</b> Do not use coating materials other than specified, without written permission from the Superintendent. Alternate coating materials must be included in the Contractor's ITP.	22.13.6	232		
<b>COATING DEFECTS</b> Provide details of repairs required and procedures and processes proposed for making the repairs to the Superintendent prior to making any repairs. Any requirements for the repair of protective coatings shall be identified as a Hold Point in the contractor's ITP.	22.13.7	232		
<b>ITP, JSA AND SWMS</b> Provide ITPs, JSAs, a SWMS and other quality control procedures and documents to be used during protective coating systems application. These must be approved prior to commencement of work.	22.15	232		
<b>CONTRACTOR RECORDS</b> Provide copies of all NCRs (Non Conformance Reports) immediately they are completed or received. The NCRs must detail the non-conformance and be accompanied by a Corrective Action Report (CAR) which is to detail the action proposed to be undertaken to rectify the non-conformance.	22.16	233		
<b>FILM THICKNESS</b> Final acceptance of each increment of work will not be made until the dry film thickness meets or exceeds the specified thickness. Regardless of the number of coats specified, additional coats shall be applied as may be necessary to achieve the specified thickness, at the contractor's expense.	22.16.1	233		
<b>INSPECTOR</b> Provide the name and qualifications of the inspector prior to commencement of work.	22.16.2	233		

**29.2 SCHEDULE 2 - WITNESS POINTS**

<b>SCHEDULE 2 – WITNESS POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>01 MISCELLANEOUS PROVISIONS</b>				
<b>CRUSHING OR SCREENING</b> Provide documentary evidence of the certification that the plant is fit for use issued by a competent person. Provide documentary evidence of that person’s skills and qualifications which indicate their competence as defined in the NT Work Safe Bulletin cited above. This evidence is to be provided within 2 weeks of the award of the contract.	1.11.3	13		
<b>SAFETY OFFICER</b> Appoint a Safety Officer and notify the Superintendent of the Safety Officer’s name, and contact details, including an after-hours contact phone number. Ensure the Safety Officer is capable and available at all times as required.	1.14.1	16		
<b>CONTROL STATION CHECK SURVEY</b> Where results exceed the quoted tolerance notify the Superintendent and obtain directions.	1.21	19		
<b>AS CONSTRUCTED INFORMATION</b> Provide As Constructed drawings for all of the works. <ul style="list-style-type: none"> <li>– Show co-ordinate dimensions where applicable.</li> <li>– Show design levels and as constructed levels on the as constructed drawings. Clearly identify on the as constructed drawings which levels are design levels and which levels are as constructed levels.</li> <li>– Clearly show set-out on the as constructed drawings. Show both design set-out and as constructed set-out. Show clearly which is design and which is as constructed.</li> <li>– Refer to the specific deliverables in the NTG Technical Drawings Part 1 - Requirements for Technical Records Management document, which is accessible via <a href="https://dipl.nt.gov.au/infrastructure/technical-standards-guidelines-and-specifications/technical-records">https://dipl.nt.gov.au/infrastructure/technical-standards-guidelines-and-specifications/technical-records</a> .</li> </ul> Drawings without changes shall be described as "As Constructed - No Changes" in the amendment description column.	1.23	19 & 20		
<b>AS CONSTRUCTED INFORMATION</b> Before the work commences provide a proposed procedure for recording and submitting the amended drawings.	1.23	19 & 20		

<b>SCHEDULE 2 – WITNESS POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>02 PROVISION FOR TRAFFIC</b>				
TRAFFIC MANAGEMENT AUDIT REQUIREMENTS – NOTICE OF INDEPENDENT THIRD PARTY AUDITS Notify the Superintendent prior to rework arising due to failed audits.	2.8.7	35		
DETOURS, SIDETRACKS, AND CROSSOVERS - CONSTRUCTION Obtain advice from the Superintendent that all requirements for the construction of the detours, side tracks, and/or crossovers have been met on completion	2.18.1	45		
DETOURS, SIDETRACKS, AND CROSSOVERS - CONSTRUCTION Provide not less than 5 days notice before opening any side track, detour, or crossover, to traffic.	2.18.1	45		
<b>04 EARTHWORKS</b>				
EXISTING SURFACE LEVELS Obtain inspections of any disputed existing surface levels with the Superintendent prior to any stripping or earthworks operations.	4.16.1	65		
PROOF ROLLING Give the Superintendent not less than 24 hours notice of the location and commencement time for the proof rolling.	4.16.3	66		
<b>05 CONFORMANCE TESTING</b>				
NOTICE OF TESTING Provide the Superintendent with a copy of the order for testing simultaneously with the order being sent to the Panel Period Contractor.	5.8	70		
NOTICE OF TESTING Notify the Superintendent prior to any rework of failed lots.	5.8	70		
<b>06 PAVEMENTS AND SHOULDERS</b>				
PAVEMENT ACCEPTANCE – PROOF ROLLING REQUIREMENT Give the Superintendent not less than 24 hours notice of the location and commencement time for the proof rolling. Give 48hrs notice for remote work (greater than 5hrs travel one way from regional centre).	6.7.2	88		
PAVEMENT ACCEPTANCE - FINAL PAVEMENT LAYER INTEGRITY REQUIREMENT Give the Superintendent not less than 24 hours notice of the location and commencement time for the inspection of the prepared layer. Give 48hrs notice for remote work (greater than 5hrs travel one way from regional centre).	6.7.5	89		

<b>SCHEDULE 2 – WITNESS POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>08 SPRAY SEALING</b>				
<b>SAMPLING OF BINDER - COLLECTION OF SAMPLES</b> Take samples from the point of delivery on transfer from the bulker to the sprayer or as directed. Where transfer is for works in the urban area or for small works ensure that conformance testing is ordered and samples are taken at the point of transfer from bulker to sprayer.	8.9.5	110		
<b>SPRAYING</b> Give the Superintendent 48 hours notice of intention to spray bitumen.	8.13	112		
<b>PREPARATION FOR SPRAYER RUN</b> Record the volume and temperature of the sprayer contents before each run, while sprayer is on level ground. Dip Sprayer Tank before and after each sprayer run. Record the dip readings, and the temperature of the sprayer contents at the time the dip was done. Provide copies of records of Sprayer Tank dips and temperatures of tank contents within one day of the completion of a day's work.	8.13.4	113		
<b>PREPARATION FOR SPRAYER RUN</b> Allow visual inspection when requested.	8.13.4	113		
<b>PREPARATION FOR SPRAYER RUN</b> Check that the spray bar is at the correct height before spraying begins.	8.13.4	113		
<b>SPRAYSHEETS</b> Supply spraysheets (paper or electronic formats are acceptable) to the Superintendent at the end of each day's production.	8.18.1	117		
<b>09 DENSE GRADED ASPHALT</b>				
<b>BITUMINOUS BINDER</b> Demonstrate that the binder used for asphalt manufacture has been handled according to these requirements.	9.5.4	122		
<b>SURFACE PREPARATION - NEW CONSTRUCTION</b> Give the Superintendent not less than 24 hours notice of the location and scheduled commencement time of surface preparation works.	9.7.1	124		
<b>SPREADING - GENERAL</b> Give at least 24 hours notice before commencement of asphalt material spreading.	9.10.1	126		
<b>LAYING PATTERN</b> Provide a construction program and paving plan at least 7 working days prior to commencement of works. Paving plans must be confirmed prior to the commencement of each shift.	9.10.4	127		
<b>COMPACTION TEMPERATURES</b> The Contractor must advise the Superintendent of temperature limits relating to compaction.	9.11.2	128		

<b>SCHEDULE 2 – WITNESS POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>10 SLURRY SURFACING</b>				
<b>COMMENCEMENT OF WORK</b> Give the Superintendent at least 7 days notice of the date and time of the commencement of work.	10.3	132		
<b>RECORDS</b> Forward a copy of the slurry surfacing Daily Record Sheet to the Superintendent daily.	10.13	137		
<b>11 MISCELLANEOUS CONCRETE WORKS</b>				
<b>FORMWORK</b> Do not place concrete until the formwork has been inspected by the Superintendent.	11.6.2	140		
<b>PLACING OF CONCRETE</b> Give the Superintendent sufficient notice so that inspection may be made before and during pouring concrete.	11.6.3	140		
<b>12 DRAINAGE WORKS</b>				
<b>PRECAST REINFORCED CONCRETE BOX CULVERTS</b> Give the Superintendent notice prior to casting concrete.	12.5.3	146		
<b>EXCAVATION</b> Excavate unsuitable material below specified level if directed by the Superintendent.	12.6.2	147		
<b>CONNECTION TO EXISTING SYSTEMS</b> Advise the Superintendent within 2 days when cleaning out is completed.	12.6.9	148		
<b>BACKFILL</b> Notify the Superintendent before backfilling where holes or fissures occur in rock trenches.	12.6.10	149		
<b>INLET AND OUTLET CHANNELS</b> Advise the Superintendent within 2 days when cleaning out is completed.	12.8	149		
<b>END WALLS</b> Advise the Superintendent within 2 days of when cleaning out is completed.	12.11.6	150		
<b>14 ROAD FURNITURE AND TRAFFIC CONTROL DEVICES</b>				
<b>TACTILE GROUND SURFACE INDICATORS</b> Provide a 5 year warranty for the materials used, and for the devices installed as tactile ground surface indicators. Provide a 5 year warranty for the workmanship for the installation of the tactile ground surface indicators. Both warranties to be in the name of the Principal.	14.4	161		

<b>SCHEDULE 2 – WITNESS POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>FLEXIBLE GUIDE POSTS – PRODUCT DATA</b> Submit details of the proposed flexible guide post including the following: <ul style="list-style-type: none"> <li>- Manufacturer’s details on the materials, and the properties of the materials, used in the manufacture of the guide posts.</li> <li>- Manufacturer’s recommended installation procedures.</li> <li>- Technical specifications.</li> <li>- Test results per the test sub-clauses</li> </ul>	14.6.2	163		
<b>FLEXIBLE GUIDE POSTS – WARRANTIES</b> Submit the manufacturer’s published product warranties in the name of the Principal.	14.6.3	164		
<b>15 PAVEMENT MARKING</b>				
<b>PAVEMENT MARKING APPLICATION</b> Obtain approval from the Superintendent for the type of equipment to be used for applying pavement marking materials.	15.8	177		
<b>PAVEMENT MARKING APPLICATION</b> Produce documented evidence to show that the spraying equipment has been calibrated in accordance with PCCP requirements and is certified by PCCP as being suitable for the works to be carried out under this contract.	15.8	177		
<b>PAVEMENT MARKING APPLICATION</b> Obtain Superintendent’s approval for variation to the any of the above requirements.	15.8	177		
<b>COLD APPLIED PLASTIC MATERIALS</b> Provide evidence that all proprietary products such as epoxy or plastic products have demonstrated satisfactory field performance for a period of at least three years.	15.12	181		
<b>16 LANDSCAPE</b>				
<b>IMPORTED SOILS</b> Provide a 5 kg sample of topsoil proposed for the works. Do not order soils without Superintendent’s approval of the sample. Provide copies of delivery dockets for the topsoil delivered to site for the works.	16.3.4	188		
<b>MULCH</b> Provide a 5 kg sample of mulch proposed for the works. Do not order mulch without Superintendent’s approval of the sample. Provide copies of delivery dockets for the mulch delivered to site for the works.	16.3.6	188		

<b>SCHEDULE 2 – WITNESS POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
BATTER PROTECTION BY HYDROSEEDING - CONTRACTOR SUBMISSIONS Product Data: Submit manufacturer’s product data and installation instructions. Include required substrate preparation, list of materials and application rates	16.7.2	195		
BATTER PROTECTION BY HYDROSEEDING – SOIL TESTING Obtain Superintendent’s approval before using additives not listed above in Composition sub-clause. Approved additives are to be applied with the hydroseeding slurry at Manufacturer recommended rates based on soil test results.	16.7.7	197		
<b>18 TRAFFIC CONTROL SIGNALS AND INTELLIGENT TRAFFIC SYSTEMS</b>				
INSPECTIONS Give 24 hours notice to the Superintendent for inspection of excavations for pedestals, bases and conduits.	18.5.8	211		
CHECKING AND TESTING Give 24 hours notice for checking and testing signal controller, cabling and lanterns.	18.10	212		
<b>19 TRAFFIC COUNTING STATIONS</b>				
DETECTOR LOOP Provide 24 hours notice to the Superintendent prior to installation of vehicle detector loops.	19.8.1	215 & 216		
TESTING AND INSPECTION - GENERAL Test the installation in the presence of the Superintendent.	19.10.1	217		
TESTING AND INSPECTION - INSPECTION Provide 24 hours notice to the Superintendent for inspection of excavations for foundations and conduits.	19.10.3	217		
<b>20 STREET LIGHTING</b>				
EXCAVATION - TRENCHES Notify the Superintendent when trench excavation is complete and before backfilling has commenced.	20.5.2	219		
<b>21 DIRECTIONAL BORING</b>				
DIRECTIONAL BORING WITH PIPE CASING Provide documentary evidence of the certification that the pipe jacking equipment is fit for use issued by a competent person. Provide documentary evidence of that person’s skills and qualifications which indicate their competence as defined in the NT Work Safe Bulletin cited above. This evidence is to be provided within 2 weeks of the award of the contract.	21.4.1	222 & 223		
<b>22 PROTECTIVE COATINGS</b>				
CONTRACTOR’S RESPONSIBILITIES Provide documentary evidence of PCCP accreditation before commencing protective coatings work.	22.5	227		

<b>SCHEDULE 2 – WITNESS POINTS</b>				
<b>CLAUSE TITLE</b>	<b>SECTION</b>	<b>PAGE</b>	<b>INITIALS</b>	<b>DATE</b>
<b>EQUIPMENT</b> Give notice so that the oil carry-over tests may be witnessed by the Superintendent or their nominated representative.	22.9.2	229		
<b>COATING</b> Provide copies of specifications for application of protective coatings from the manufacturers of the products used. Provide copies of manufacturers' product technical data sheets for all products used.	22.13.2	231		
<b>COATING DEFECTS</b> This compatibility between marker and coating is to be confirmed by the coating manufacturer. Provide written evidence of this compatibility if requested by the Superintendent.	22.13.7	232		
<b>CONTRACTOR RECORDS</b> Maintain written records of the work so that complete traceability of all work and materials provided under this Specification is maintained. Use the relevant sections of AS 3894.10, AS 3894.11 & AS 3894.12 QA report forms as a basis of this record keeping format for all protective coating work under this contract. Use AS 3894.13 and AS 3894.14, in addition to the preceding Australian Standards, for structural steel work coated under this contract. Maintain these reports on a daily basis. Submit them to the Superintendent when requested, or, if not specifically requested, at least weekly.	22.16	233		
<b>FILM THICKNESS</b> Provide and operate wet film and dry film thickness gauges of approved types to ensure the correct thickness of each coat and the full system is achieved. Provide details of the gauges proposed for use.	22.16.1	233		

## 30 UPDATES OVERVIEW

<b>Table – Overview of Updates to Roadworks Specifications - July 2020</b>		
<b>CLAUSE</b>		<b>CHANGE</b>
Web page URLs updated. Legislation references updated.		
<b>01 MISCELLANEOUS PROVISIONS</b>		
1.14	Safety	Interstate construction induction cards now accepted.
<b>04 EARTHWORKS</b>		
		Trim and compact requirements made explicit
<b>07 STABILISATION AND MODIFICATION</b>		
7.4.4.2	In-situ stabilisation and modification – Binder spreading – Spread rates for tender purposes	Minimum layer thickness changed to 200mm
<b>14 ROAD FURNITURE AND TRAFFIC CONTROL DEVICES</b>		
14.2	Standards and Publications	New entries added to lists.
14.5.12	Culvert crossing fences	Terminology changed from “guard rail(s)” to “fence(s)”.
14.6	Flexible guide posts	New title. Content has been significantly updated.
14.7.2	Anti-spear fixings for hazard markers	Requirements made explicit – additional information provided. References to Queensland documents deleted.
14.10	Road safety barriers – Steel beam guard rail system	Content significantly updated. MASH testing added. References to Department’s Safety Barrier Technical Conditions of Use information added.
14.11	Road safety barriers – Steel wire rope system	Content significantly updated. MASH testing added. References to Department’s Safety Barrier Technical Conditions of Use information added.
<b>23 MEASUREMENT AND PAYMENT</b>		
23.1.3	Cleaning of vehicles and plant	Measured as an item irrespective of numbers cleaned
23.1.6	As constructed information	Requirements clarified.
23.2.2	Provision for traffic	VMBs included in Provision for Traffic item irrespective of number of VMBs required
23.4	Earthworks	Trim and compact requirements clarified
<b>24 REFERENCED AUSTRALIAN STANDARDS</b>		
		Updated
<b>26 ACTS, REGULATIONS, CODES, AND AUTHORITIES</b>		
26.1	Acts and Regulations	Updated
<b>27 CIVIL STANDARD DRAWINGS FOR ROADWORKS</b>		
		CS 3101, CS 3516, CS 3517, & CS 3518 added
<b>28 NORTHERN TERRITORY CLIMATE ZONES TABLE</b>		
		Updated
<b>29 HOLD POINTS AND WITNESS POINTS SCHEDULES</b>		
		Updated
<b>30 UPDATES OVERVIEW</b>		
		New updates overview

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