

**PART R61****THE INSTALLATION AND INTEGRATION OF ITS EQUIPMENT****CONTENTS**

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**1. GENERAL**

- .1 This Part specifies the requirements for the installation and integration of Equipment for Intelligent Transport Systems (ITS). It shall be read in conjunction with the following Parts, as applicable to this Contract:
  - (a) Part R60: Supply of ITS Equipment
  - (b) Part R62: Mains Power
  - (c) Part R63: Telecommunications Network
  - (d) Part R64: Electrical Switchboards
  - (e) Part R65: ITS Enclosures
  - (f) Part R66: Variable and Changeable Message Signs;
  - (g) Part R67: Imaging Equipment;
  - (h) Part R68: Field Processors;
  - (i) Part R69: Vehicle Detection Systems;
  - (j) Part R70: Telecommunications Cabling; and
  - (k) Part R71: Help Telephones.
- .2 Documents referenced in this Part are listed below:
  - (a) AS 1100 Technical Drawing
  - (b) AS 1170.2 Wind Loads
  - (c) AS 1428 Design for Access and Mobility
  - (d) AS 1657 Fixed platforms, walkways, stairways and ladders — Design, construction and installation
  - (e) AS 174.2 Manual of Uniform Traffic Control Devices - Traffic Control Devices for General Use
  - (f) AS1742.15 Manual of Uniform Traffic Control Devices - Direction Signs, Information Signs and Route Numbering
  - (g) AS 2312 Guide to the Protection of Structural Steel against Corrosion by the use of Protective Coatings
  - (h) AS 2700 Colour Standards for General Purposes
  - (i) AS 3000 Electrical Installations
  - (j) AS 3008 Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV - Typical Australian installation conditions
  - (k) AS 5100 Bridge Design

## (l) AS 9001 Quality Management Systems – Requirements

.3 The following abbreviations may be used in this Contract:

- (a) BASS Blankable Advisory Speed Signs (advisory speed signs that have the display blanked out if the prevailing speed limit is lower than the advisory speed for a given location)
- (b) CMS Changeable Message Signs (signs which may display preselected messages)
- (c) VMS Variable Message Signs (signs which may display any message)
- (d) VSLS Variable Speed Limit Signs (regulatory signs capable of displaying a range of predetermined speed limits for a section of road)
- (e) FP Field Processor
- (f) TMSO Traffic Management System Outstation
- (g) DSL Digital Subscriber Line
- (h) TMC DPTI Traffic Management Centre
- (i) RF Radio Frequency
- (j) PSTN Public Switched Telephone Network
- (k) SIAT System Integration Acceptance Test
- (l) SAT Site Acceptance Test
- (m) FAT Factory Acceptance Test
- (n) ELV Extra-low voltage: Not exceeding 50 V a.c. or 120 V ripple-free d.c.\*
- (o) LV Low voltage: Exceeding extra-low voltage, but not exceeding 1,000 V a.c. or 1,500 V d.c.\*
- (p) HV High voltage: Exceeding low voltage.\*

\* From AS3000

.4 Refer to Part R60 for definitions.

## 2. QUALITY REQUIREMENTS

- .1 Where the Contractor is responsible for determining any location, layout or site selection for any of the Equipment, the Contractor shall provide to the Principal fully detailed location / layout documentation.
- .2 Where appropriate, the documentation shall show general layout, reduced levels, Equipment position, coordinates or offsets, speed zones, conduit and pit locations, mounting structure positions and any protective barriers.
- .3 If appropriate, details of Equipment brackets and support connections shall also be provided.
- .4 Any drawings provided pursuant to this clause shall be prepared in accordance with the Principal's drafting standards and guidelines, available from: <http://www.dpti.sa.gov.au/standards>.
- .5 If not submitted beforehand, the documentation required by this Clause shall be submitted at least 28 days prior to the commencement of site work.
- .6 Provision of this documentation shall constitute a **HOLD POINT**.

## 3. ELECTRICAL AND TELECOMMUNICATIONS REQUIREMENTS

### General

- .1 All installations shall be in accordance with Part R62 "Mains Power" and AS 3000.
- .2 Work on any part of the system shall only be carried out by a person who is suitably qualified and licensed. Prior to the commencement of this work, the Contractor shall provide evidence of the appropriate licence(s).
- .3 Provision of this evidence shall constitute a **HOLD POINT**.

**Cables, Conduits and Pits**

- .4 Conduits and Pits shall comply with Part R53 "Installation of Conduits and Pits". Electrical cables shall comply with AS 3008 and telecommunications cables shall comply with Part R70 "Telecommunications Cabling".
- .5 Unless specified otherwise, the Contractor shall install all conduits, pits and cables necessary for the provision of communications and power to the Equipment.
- .6 The location of conduits and pits shown on drawings (if any) may be approximate only.
- .7 Prior to installation, the Contractor clearly mark the proposed position of conduits and pits (including sizes and types) on the surface.
- .8 Following the marking out and prior to the commencement of excavation, a **HOLD POINT** shall apply.
- .9 A pit shall be installed adjacent to each item of Equipment. Outstations shall have separate power and communications pits. Single devices may share a common power and communications pit providing segregation requirements are met.
- .10 Subject to obtaining prior written approval, the Contractor may install conduits directly between adjacent Equipment sites if the Equipment sites are separated by less than the distance from the equipment to the backbone; for example, a CCTV camera located adjacent to an outstation.
- .11 All cables shall be continuous and without joints except at termination points or where the cable size is required to be reduced. Joints shall be accessible and not located within conduits. The Contractor shall:
  - (a) check conduits for damage and presence of foreign material;
  - (b) clean the conduits as required before drawing cables through them;
  - (c) not place excessive strain on any individual core, individual cable or cables during the drawing in process;
  - (d) replace any cable damaged during installation;
  - (e) label all cables and terminations with permanent markings, which shall not be hand written; and
  - (f) maintain adequate segregation between LV, ELV and data cables.
  - (g) Leave adequate spare cable in loops in pits, to enable cost efficient and timely repair in the event that the cable is damaged or severed.
- .12 The Contractor shall supply and install a submersible line fuse holder in an electrical service pit located between the service point and the outstation/distribution board.
- .13 The electrical service pit shall be located as near as practicable to the service point.
- .14 The Contractor shall provide an earth stake in a pit adjacent to each Outstation and distribution board. The earth stake shall protrude into the service pit by a minimum of 150 mm.
- .15 Where specified, earth stakes in pits shall also be provided adjacent to other Equipment. Copper clad, copper plated earth stakes or solid copper strips shall be used as a minimum.

**Fusing**

- .16 Where Equipment is powered sequentially, each Outstation/switchboard shall:
  - (a) be protected by a fuse/circuit breaker; and
  - (b) contain a sub main fuse/circuit breaker. Where possible, these fuses/circuit breakers shall be 'cascaded' in rating such that a fault in a submain will only result in the fusing/tripping of the sub main fuse/circuit breaker.
- .17 The design of the power reticulation to each device shall include a method of protection and/or isolation so that;
  - (a) in the event of a device being damaged or suffering an internal or cabling fault which activates (i.e. blows) a supply fuse, that the fuse blown only removes power to that device, and not others; and
  - (b) In the event that a device needs to be isolated, the supply for that device can be easily and safely isolated at the device, and also at the pit from which the device is powered

- .18 Acceptable methods of achieving the above are the installation of a fuse/circuit breaker at the device, and also installation of an inline submersible fuse installed in the pit from which the power supply for that device is derived.

### **Wireless Communications**

- .19 If wireless technology has been specified to avoid the need for conduits and pits, the wireless communications and communications Equipment shall comply with the applicable Australian and ACMA Standards.
- .20 Wireless communications to devices shall be from the closest TMSO. Communications interface Equipment and antennae shall be installed at the TMSO to facilitate communications between the TMSO processor and the device.
- .21 Wireless communications shall not be affected by normal maintenance activities.
- .22 Antennas shall not be co-located on see saw poles with other equipment.
- .23 Corresponding communications interface Equipment shall be installed at the device site. This Equipment shall be suitably interfaced to the device controller.

## **4. INTEGRATION**

- .1 This Clause only applies where STREAMS compatibility is specified.
- .2 The Contractor shall provide evidence of STREAMS compatibility, which may include having satisfactorily passed STREAMS acceptance testing (SAT). If the Contractor proposes to use Equipment not already defined as STREAMS compatible, the Contractor shall arrange for STREAMS compatibility to be proven.
- .3 Evidence of STREAMS compatibility shall constitute a **HOLD POINT**.
- .4 Each item of Equipment and/or associated system shall allow automatic operation via STREAMS and local manual operation independent of STREAMS. Unless otherwise specified, communication with STREAMS shall be by one of the following means (in the following order of preference):
  - (a) Direct Ethernet or serial connection to a Field Processor (FP);
  - (b) Remote Ethernet or serial (for example, using a serial/fibre media converter) connection to an FP located elsewhere and / or workstation on the Principal's Telecommunications Network.; or
  - (c) connection to the Principal's TMC.
- .5 Equipment that primarily provides data to STREAMS, for example vehicle detectors, shall provide event-driven messages to minimise or avoid polling between the Equipment and Field Processor/ STREAMS.
- .6 Equipment that requires frequent polling shall communicate at a sufficient data rate for all the available data to be exchanged within a 2 second interval.
- .7 Event-driven messages shall contain a time stamp marking the time the event occurred. Where communications from Equipment are mostly event-driven, a heartbeat (or status) message shall be emitted by the Equipment at least every minute.

## **5. INSTALLATION REQUIREMENTS**

### **General**

- .1 Prior to installation, the Contractor shall ensure that all records demonstrating compliance with Part R60 "Supply of ITS Equipment" and other relevant Parts for the supply of the Equipment have been provided.
- .2 Provision of this documentation shall constitute a **HOLD POINT**.

### **Location and Layout**

- .3 The general layout and installation of the Equipment shall:
  - (a) comply with the requirements of Clause 6 or 7 (as specified);
  - (b) be designed and installed to provide rapid, easy and safe access for maintenance purposes; and
  - (c) minimise, and wherever practicable eliminate, the need for traffic control during maintenance activities.

- .4 Where the Equipment has components located on opposite sides of the carriageway, any physical connection shall be immune to any future road widening envisaged in the Contract.
- .5 Unless otherwise specified, where Equipment is mounted above the carriageway, the vertical clearance from the bottom of the support structure and/or the Equipment enclosure to the road surface shall be a minimum 6.0 metres.

#### **Wiring Enclosures**

- .6 Each ITS device site shall be provided with conduit infrastructure necessary for the complete operation of the device.
- .7 Conduit infrastructure includes cable access from the backbone conduit network to the ITS field cabinet and/or field device.
- .8 Cable infrastructure shall be installed in accordance with Part R70 "Telecommunications Cabling".
- .9 After installation of cables, the associated conduits and/or glands shall be sealed to prevent vermin entry.
- .10 Cables for pole mounted devices shall connect to the device by entering the pole underground at its base, and exiting the pole either directly into the device enclosure (eg directly into a pole mounted equipment box), or exiting to the device at a height which prevents access to the conduit while standing at ground level.

#### **Equipment Enclosures**

- .11 Ground mounted Equipment enclosures shall be installed on a concrete plinth. The gap between the plinth and enclosure shall be vermin-proof and prevent corrosion of the enclosure or its fixings.
- .12 Enclosures shall be installed such that when all doors are fixed in the open position, visibility of the approaching traffic flow is maximised for maintenance personnel working in the enclosure.
- .13 The plinth shall be large enough to allow for service personnel to walk on the plinth around the device while all doors and access areas are open.
- .14 Equipment enclosures shall be positioned to minimise direct solar radiation and shall not be painted a dark colour.

#### **Vehicle Barriers**

- .15 Where road-side barrier treatments exist or are required adjacent to the Equipment site, the barriers shall be in accordance with AS3845.
- .16 Where vehicle barriers are to be provided on a road which is trafficked at the time of installation, the barriers (or temporary barriers) shall be installed prior to commencing civil works for the Equipment mounting foundations.

### **6. VEHICULAR SITE MAINTENANCE ACCESS**

- .1 This clause applies unless specified otherwise in the **Contract Specific Requirements**.
- .2 Permanent vehicle access points shall be provided within 50m of each Equipment site to allow maintenance vehicles to enter and exit the Equipment site from the carriageway safely. The design of access points shall:
  - (a) discourage unauthorised vehicles from accessing the site unless the site also contains a help phone or other public facility;
  - (b) allow a safe distance for indication and deceleration of a maintenance vehicle in order to safely enter the site, and a safe distance and adequate clear vision of the road to accelerate and merge onto the road when leaving the site;
  - (c) provide protection to the service vehicle and staff, e.g. via allowing the vehicle to park a safe distance from the road, or via a safety barrier;
  - (d) ensure maintenance vehicles can enter and park in the site without protruding into trafficable carriageway lanes (including emergency lanes); and
  - (e) not require traffic control during maintenance works.
- .3 The Contractor shall provide a suitable set-up area for the maintenance vehicle which:
  - (a) is close enough for safe operation of maintenance activities;
  - (b) allows the vehicle to be parked within 3m of the Equipment;

- (c) has the entrance / exit, access track and set-up area suitable for all-weather access for a maintenance vehicle pertinent to the maintenance activity, i.e. bitumen or concreted with adequate drainage;
- (d) is laid out so that the maintenance van has sufficient parking space so that it does not park over any pits in the set-up area when parked adjacent to the equipment; and
- (e) has any pits in the set-up area constructed to be trafficable (i.e. designed to be safely driven over by a maintenance vehicle without damage) and not installed in a manner which allows water to pool on or near the pit.

## **7. NON-VEHICULAR ACCESS**

- .1 This clause only applies if the **Contract Specific Requirements** specify that vehicular site maintenance access is not required
- .2 Permanent personnel access points from the carriageway to the Equipment site shall be provided within 5m of each item of Equipment. Access points shall:
  - (a) be arranged to prevent vehicles from entering the site;
  - (b) be secured to prevent unauthorised access; and
  - (c) avoid the need for traffic control during maintenance works.
- .3 A parking area suitable for maintenance vehicles shall be provided immediately adjacent to the access point. The parking area shall:
  - (a) allow personnel to alight from both sides of the vehicle concurrently and access the site without entering trafficable carriageway lanes (including emergency lanes); and
  - (b) provide a minimum sight-distance of upstream carriageway (from within the vehicle) equal to the distance required to allow the vehicle to accelerate to 80% of the carriageway's design speed.
  - (c) be laid out so that the maintenance van has sufficient parking space so that it does not park over any pits in the parking area
- .4 An access path shall be provided to each Equipment site for the safe movement of maintenance personnel between the carriageway access point and the Equipment. The access path and the area around the Equipment site shall:
  - (a) be evenly graded so as not to exceed 1:3 gradient;
  - (b) suitable for safe, all-weather access; and
  - (c) be fitted with safety barriers around the site if working on or near the site would be hazardous without the barriers.
- .5 Concrete steps may be provided to optimise path alignment. Where steps are provided, these shall be in accordance with the relevant standards and codes. A minimum 100mm thick, rectangular concrete pad shall be provided for a minimum 1200mm width around all Equipment enclosures and/or mounting plinths at the site. The access path and the area around the Equipment site shall be free of tripping and falling hazards.

## **8. TESTING & COMMISSIONING**

### **General**

- .1 The Contractor shall verify compliance with the requirements of the Contract by performing:
  - (a) factory acceptance testing of individual items of equipment and of system integration (FAT);
  - (b) site acceptance tests (SAT); and
  - (c) system integration acceptance tests (SIAT).
- .2 The Contractor shall identify and provide all Equipment, materials and other works necessary to perform the tests.
- .3 Any damage incurred as a result of undertaking tests shall be rectified by the Contractor.
- .4 Where the manufacturer of test Equipment indicates that the test Equipment requires calibration, the Contractor shall provide a current NATA certified certificate of calibration.

- .5 All test documentation shall indicate clearly the date the test was conducted and identify the responsible personnel. The test reports shall be submitted within 7 days of completion of the testing.

#### **Testing and Commissioning Plans**

- .6 At least 14 days prior to the commencement of testing, the Contractor shall provide FAT, SAT and SIAT plans which provide details of the necessary tests, record sheets and procedures for the Equipment.
- .7 Test plans and record sheets shall be suitable for recording compliance with the respective technical requirements of the Contract. The plans shall address as a minimum:
- (a) IP connectivity;
  - (b) electrical tests;
  - (c) required latency and bandwidth;
  - (d) test Equipment and/or system operation;
  - (e) compliance with the respective functional and operational requirements; and
  - (f) maintenance tests, if maintenance forms part of this Contract.
- .8 Provision of the plan(s) shall constitute a **HOLD POINT**.
- .9 Test plans shall take into consideration different traffic volumes and weather conditions where these may be reasonably expected to impact on the performance and/or accuracy of the device and/or system.

#### **Factory Acceptance Tests**

- .10 Prior to delivery to site, the Contractor shall verify and certify that the Equipment meets the requirements of the respective FAT. The FAT shall take place at the manufacturer's or Contractor's premises. The test setup shall be as close as possible to the operational system. A scaled down system may achieve this requirement.
- .11 The successful completion of the FAT shall constitute a **HOLD POINT**.

#### **Site Acceptance Tests**

- .12 Once installed on site, the Contractor shall verify and certify that the Equipment (or the related sub-system) operates correctly. The Equipment shall exhibit similar results in the intended operating environment as the results in the FAT. Sub-systems and/or distinct communication links shall be tested separately.
- .13 The successful completion of the SAT shall constitute a **HOLD POINT**.

#### **System Integration Acceptance Testing**

- .14 The SIAT shall verify that the Equipment is properly integrated into the ITS system. This shall include initialising performance parameters to suit the site specific function of operation.
- .15 The Equipment shall be tested by integrating the continuous operation, functionality, monitoring and control with other Equipment and/or systems including STREAMS under normal operating conditions.
- .16 The successful completion of the SIAT shall constitute a **HOLD POINT**.

### **9. DESIGN OF SUPPORT STRUCTURES**

#### **General**

- .1 Unless the Principal has specified details of the Equipment support structures, the Contractor is responsible for the design of suitable support structures in accordance with the requirements of this clause.
- .2 The mounting structures shall be easily and safely accessible for inspection and maintenance purposes. The access system shall prohibit access by unauthorised personnel.
- .3 The access system and platform shall provide for secure mounting points for effecting rescue of incapacitated personnel from the platform.
- .4 Unless specified otherwise, the support structures shall generally be of the same form and be aesthetically compatible with any other similar structures on the adjoining road network.
- .5 The design of the support structures and footings shall be undertaken by a Chartered Professional Engineer with qualifications admitting to Corporate Membership of the Institution of Engineers who is suitability

experienced in the design of such structures. The design shall be verified in accordance with AS9001: Clause 7.3.5 "Design and Development Verification".

### **Design Requirements**

- .6 Unless specified otherwise, all design and documentation shall be undertaken in accordance with the following documents:
  - (a) DPTI Design Standard – Structural, available from [http://www.dpti.sa.gov.au/documents/major\\_structures\\_documents](http://www.dpti.sa.gov.au/documents/major_structures_documents)
  - (b) DPTI Structural Drafting guidelines for Consultants, available from [http://www.dpti.sa.gov.au/documents/major\\_structures\\_documents](http://www.dpti.sa.gov.au/documents/major_structures_documents)
  - (c) AS 1100;
  - (d) AS 1170.2;
  - (e) AS 1657;
  - (f) AS 2312; and
  - (g) AS 5100.
- .7 Structures shall be designed for a minimum life of 100 years.

### **Design Documentation**

- .8 Prior to the commencement of fabrication or any work on site, the Contractor shall supply a copy of the calculations and an electronic copy of drawings in pdf, dwg and dwf format with a file name in accordance with the protocol supplied by the Principal.
- .9 Provision of the above calculations and drawings shall constitute a **HOLD POINT**.

## **10. FABRICATION AND INSTALLATION OF SUPPORT STRUCTURES**

### **General**

- .1 Support structures shall be fabricated and installed in accordance with Part S30 "Fabrication and Erection of Structural Steelwork".
- .2 A protective treatment in accordance with Part S35 "Protective Treatment of Structural Steelwork" shall be applied to the supports.
- .3 The minimum height above ground of the Equipment shall be such as to prevent unauthorised access.
- .4 Wherever practicable, any electronic processor which is sensitive to heat shall be positioned to minimise direct solar radiation and shall not be painted a dark colour.
- .5 If the Equipment is to be mounted on an existing structure, the Contractor shall verify the suitability of the structure and the mounting arrangement for support of the Equipment.
- .6 Unless specified to be galvanised, all visible surfaces of the support structure shall be painted Dark Green (Colour No. G61 to AS 2700).

### **Support Structures for Signs**

- .7 The mounting brackets for the signs shall be incorporated in the design to minimise the need to drill or weld to the enclosure.
- .8 The underside of signs shall be at least 2.5 m above ground level. Access for cables to the signs shall be included in the design.
- .9 The Contractor shall determine the tilt angle and orientation of the signs to ensure that the line of sight is set at its optimum. The design of the sign support shall allow adjustment of the tilt angle and orientation after installation of the sign. Sun shields and optical visors shall be part of the sign design to ensure visibility in full sun at all times of the year.
- .10 VSLs and BASS shall be installed on round poles unless otherwise specified. Exterior metal surfaces of Equipment shall be painted with a durable paint system that matches the support structure.

**Gantries and Major Support Structures**

- .11 Large signs supported on tubular single posts, tubular cantilever supports or gantries shall comply with AS 1742.2 and AS 1742.15. Unless specified otherwise, electronic signs mounted on major support structures shall have a service access platform.

**Records**

- .12 The Contractor shall supply to the Principal a detailed list of ITS devices and geographic locations in the format shown in Attachment R61A. The Principal will allocate Asset numbers to each device, and supply the Contractor with the Asset Numbers in the form of adhesive labels. The contractor shall then affix the labels to each device prior to, or immediately after, installation.

**11. HOLD POINTS**

- .1 The following is a summary of Hold Points referenced in this Part:

CLAUSE REF.	HOLD POINT	RESPONSE TIME
2.6	Layout / Design Documentation	5 working days
3.3	Provision of appropriate licence(s)	2 working days
3.8	Prior to excavation for conduits and pits	1 working day
4.3	Evidence of STREAMS compatibility	2 working days
5.2	Supply Conformance Documentation	5 working days
8.8	FAT, SAT and SIAT plans	2 working days
8.10	Factory Acceptance Test Results	2 working days
8.12	Site Acceptance Test Results	2 working days
8.16	System Integration Acceptance Test Results	2 working days
10.12	Design calculations, drawings and other Design Documents (only where design of the support forms part of this contract)	10 working days

**12. VERIFICATION REQUIREMENTS AND RECORDS**

- .1 The following is a summary of records (in addition to those supplied at Hold Points) to be supplied by the Contractor to demonstrate compliance with this Part:

CLAUSE REF	RECORD
9.4	List of ITS devices and geographic locations

- .2 Other requirements for verification and records will be included in the DPTI Master specification Parts listed in Clause 1 “General”.

**13. ATTACHMENT R61A ITS EQUIPMENT NUMBERING**

<u>Device / Asset Type</u>	<u>Asset / Label Number</u>	<u>Location</u> Road, direction of travel, at chainage or nearest side road
Variable Message Sign	VMS###	
Changeable Message Sign	CMS###	
Variable Speed Limit Sign	VSS###	
CCTV Camera	CAM###	
Fatality Free Day Sign	FFS###	
Weather Detector	WED###	
Outstation/ Field Processor	OUS###	
Power Distribution Board	PDB###	
Help Phone (formerly emergency phone)	HPH###	
Outback Road Condition Sign	RCS###	
En-Route Driver Information Signal (ERDIS)	ERS###	
Over Height Detector	OHD###	
Arrestor Bed Detector	ABD###	
Generator	GEN###	
Video. Incident. Detector	CAM###	
Emergency Signal	EMS###	
Advance Warning Sign	AWS###	
Switchboard	SWB###	
West Lakes Tidal Flushing System	WLT###	