

# TCS 067 - 2020

Specification

for the

Supply and Installation

of

## Digital Closed Circuit Television Camera (CCTV)

November 2020

Revision: A



Department  
of Transport

**TCS 067– 2020****Foreword**

This specification has been developed by Department of Transport (Roads) DoT (Roads). It is one of a number of technical specifications, and associated standard drawings, which set out the requirements for roadside ITS devices, traffic signal equipment and other electrical equipment and associated devices and control systems.

This specification is intended for use in all relevant works undertaken by or on behalf of DoT (Roads).

DoT (Roads) Standard Drawings, Specifications and Guidelines are available for downloading from the VicRoads website:

<https://www.vicroads.vic.gov.au/business-and-industry/technical-publications/electrical-and-intelligent-transport-systems>

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### Revision History

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2016	A	February 2016	SJS	Initial release
2019	A	April 2019	ITS	Revision and added installation requirements
2020	A	November 2020	ITS	Updated to DoT template, added security requirements, updated installation requirements, general revision

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## SECTION 1 SCOPE AND GENERAL

### 1.1 SCOPE

- 1.1.1 This document covers the requirements for the supply and installation of digital IP CCTV cameras for use by Department of Transport (DoT) throughout the State of Victoria.
- 1.1.2 This document covers, moving (PTZ) cameras for traffic monitoring, fixed cameras for web image provision and fixed cameras for VMS display verification.

### 1.2 GENERAL

- 1.2.1 DoT (Roads) operates a network of CCTV cameras throughout Victoria on the freeway and arterial road network.
- 1.2.2 These cameras are used to provide real time images of traffic conditions and assist in the management and verification of on-road incidents.
- 1.2.3 DoT (Roads) uses the video management system “Security Centre” developed by Genetec Inc. (Refer to [www.genetec.com](http://www.genetec.com)).
- 1.2.4 Any camera solution must be fully supported within the Genetec Inc. video management software packages:
  - a) Security Centre version 5.4 or later; and
  - b) Any third party software (such as STREAMS) that utilises Security Centre Software Development Kit (SDK) to monitor and control the cameras.
- 1.2.5 All cameras shall comply with the relevant requirements of this specification.
- 1.2.6 All cameras shall be fully compatible with DoT (Roads) existing devices and systems.
- 1.2.7 For PTZ cameras, only those that are listed in TCG 018, Register of ITS Approved products shall be used for DoT (Roads) projects.
- 1.2.8 A typical digital CCTV installation consists of the following:
  - a. Camera.
  - b. Weather proof housing.
  - c. Pole on which to mount the above items.
  - d. Control cabinet including, camera power supply, communication network equipment and electrical switchboard.

## SECTION 2 RELATED SPECIFICATIONS AND DRAWINGS

- 2.1 The manufacture and supply of the camera shall conform with all relevant Australian Standards.
- 2.2 Where no specific reference is made to an Australian Standard, the materials and processes used shall conform to the relevant Australian Standard or generally accepted practice.
- 2.3 All installation works shall conform to the relevant DoT (Roads) specifications and related specifications and standards as indicated throughout this document.

- 2.4 The following related Australian Standards are defined:

ASNZS 1170.2	Structural design actions – Wind actions
AS/NZS 3000	Electrical Installations – Wiring Rules
AS 4806.2	Closed Circuit Television (CCTV) Application Guidelines
AS 60068.2.6	Environmental testing – Tests – Test Fc: Vibration (sinusoidal)
AS 60529	Degrees of protection provided by enclosures for electrical equipment (IP code)

- 2.5 The following related international standards are defined:

EN 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK Code)
IEEE 802.3	IEEE Standard for Ethernet
ISO/IEC 14496 - 10	Information technology — Coding of audio-visual objects — Part 10: Advanced Video Coding

- 2.6 The following related DoT (Roads) specifications and standard drawings are defined:

TCG 018	Register of ITS Approved Products
Standard Section 730	Traffic signal installation
Standard Section 732	ITS Devices Installation
Standard Section 733	Conduits and pits for underground wiring and cabling
Standard Section 734	Electrical System and Equipment
Standard Section 735	Communications System and Equipment
TC-2011	Freeway camera site – typical layout
TC-2012	Camera column – 10m mid-hinge
TC-2013	Camera column – bored pile foundation – installation details
TC-2221	Gantry mounted CCTV Camera, AP and RP Pole – Typical Arrangement
TC-2222	CCTV Camera pole extension
TC-2260	Non-accessible LUMS gantry – general arrangement

## SECTION 3 ACRONYMS

### 3.1 ACRONYMS

The acronyms used in this document shall be interpreted as follows:

ACMA	Australian Communications and Media Authority
AS	Australian Standards
ARP	Address Resolution Protocol
BMP	Bitmap
B/W	Black and White
CBR	Constant Bit Rate
CCTV	Closed Circuit Television
CIF	Common Intermediate Format (352 x 240 pixels)
D1	Analogue TV image resolution
DHCP	Dynamic Host Configuration Protocol
DoT (Roads)	Department of Transport (Roads) (formerly VicRoads)
EMC	Electromagnetic Compatibility
FTP	File Transfer protocol
GIF	Graphics Interchange Format
GNSS	Global Navigation Satellite System
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
ICMP	Internet Control Message Protocol
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IGMP	Internet Group Management Protocol
IP	Internet Protocol
ISO	International Organisation for Standardisation
ITS	Intelligent Transport Systems
LUMS	Lane Use Management Sign
MJPEG	Motion Joint Photographics Expert Group
NTP	Network Time Protocol
NTSC	National Television System Committee
NZS	New Zealand Standard
QCIF	Quarter Common Intermediate Format (176 x 120 pixels)
ONVIF	Open Network Video Interface Forum
PAL	Phase Alternating Line
PoE	Power over Ethernet
PTZ	Pan – Tilt - Zoom
RTSP	Real Time Streaming Protocol
SNMPv2	Simple Network Management Protocol version 2
TCP	Transmission Control Protocol
VBR	Variable Bit Rate
VGA	Video Graphics Array
UDP	User Datagram Protocol
VMS	Variable Message Sign



## SECTION 4 CAMERA PERFORMANCE REQUIREMENTS

### 4.1 GENERAL

- 4.1.1 Cameras shall be digital IP cameras.
- 4.1.2 Cameras shall be designed with a minimum operational life of not less than 70,000 hours.
- 4.1.3 Cameras shall be supplied with a minimum 3-year manufacturer's warranty.

### 4.2 PTZ REQUIREMENTS

- 4.2.1 PTZ cameras shall be capable of the following control functions:
  - a) Continuous 360 degree panning.
  - b) Continuous tilting through at least 190 degrees and shall employ automatic image flip at the bottom of tilt travel to prevent the output of an inverted image.
  - c) Minimum vertical tilt of 15 degrees above horizontal.
- 4.2.2 The speed motion shall comply with the following:
  - a) A minimum range of 0.2 degrees per second to 80 degrees per second for manual panning operation.
  - b) A minimum range of 0.2 degrees per second to 40 degrees per second for manual tilting operation.
  - c) A minimum of 200 degrees per second for both pan and tilt directions during preset-recall operation.
- 4.2.3 Preset positions
  - a) Preset-positions shall store the pan, tilt and zoom position. The camera shall provide a minimum of 16 presets, all with the option for on screen labels.
- 4.2.4 All the PTZ pre-sets and labels shall be retained after power failure.
- 4.2.5 Compass and position feedback:
  - a) A built in digital and absolute magnetic compass device is the preferred arrangement.
  - b) Inferred and pulse encoder based compass devices shall only be used where the aforementioned is unavailable.
  - c) The camera shall provide an option to display a compass position indicating the current direction the camera is looking.
  - d) This reference shall be superimposed on the output image.
  - e) The camera shall also support digital position feedback through a Security Centre supported protocol.
- 4.2.6 The camera shall provide a minimum of 12x digital zoom without image distortion.

### **4.3 LENS**

4.3.1 The camera shall provide a horizontal angle of view between 55° and 65° at wide zoom.

4.3.2 The lens shall provide a minimum of 30x optical zoom.

4.3.3 The lens shall meet the following iris and focus requirements:

- a) The lens shall have auto iris and auto focus.
- b) Focus and iris control shall be set to automatic by default.
- c) The camera shall support manual override of focus and iris functions.

### **4.4 PROGRAMMABLE PRIVACY ZONES**

4.4.1 The camera shall provide a minimum of eight programmable privacy zones.

4.4.2 The privacy zones shall consist of an opaque polygon superimposed over the image to occlude parts of the field of view.

4.4.3 The privacy zones shall move across the output image as appropriate to keep the desired zone covered as the camera moves and zooms.

4.4.4 All the camera pre-set privacy zones shall be retained after power failure.

### **4.5 DAY/NIGHT OPERATION**

4.5.1 The camera shall provide a wide dynamic range colour image for daytime operation with the ability to automatically switch to a higher sensitivity mode when operating in low light.

4.5.2 The camera shall be able to operate in the following minimum illumination levels:

- a) Day (Colour) Mode: 0.5 lux.
- b) Night (Colour or B/W) Mode: 0.007 lux.
- c) The camera shall have the ability to show a colour image both during the day and the night.

4.5.3 The camera shall provide automatic white balance.

## SECTION 5 VIDEO, INTERFACE AND SECURITY REQUIREMENTS

### 5.1 GENERAL

Digital cameras shall include an internal video encoder to provide IP based video streams.

### 5.2 VIDEO

The video encoder shall comply with the video requirements as detailed in Table 5.1.

Item	Requirement
Compression algorithm	H.264, H265 (ISO/IEC 14496-10), MJPEG
Type of streaming	RTSP/UDP/IP (multicast and unicast)
Number of output streams	Minimum two streams configurable. Streams in H.264 or H.265 and one MJPEG concurrent and individual configurable streams with minimum resolution and frame rate on all streams.
Encoding latency	<130ms.
Resolution	Support the following as minimum: 800x450pixels, 480x270pixels and 320x180 pixels 800x600pixels, 480x360pixels and 320x 240 pixels
Frame rate	Minimum <b>25 fps</b> - fibre-optic cable connection Minimum <b>12 fps</b> – 3/4G modem connection
Output data rate	56 kb/s to 20 Mb/s (CBR or VBR selectable/ user profiles)
Video Settings	User profiles, contrast, brightness, colour saturation, hue, sharpness
Video Overlay	3x Text lines (configurable: position colour, border/outline colour, font size), 1x image in BMP, GIF, or JPEG format (configurable position, scaling)

**Table 5.1 – Video Requirements**

### 5.3 TRANSMISSION INTERFACE

The video encoder shall comply with the transmission interface requirements as detailed in Table 5.2.

Item	Requirement
Number of interfaces	1
Interface	10/100Base-TX Fast Ethernet Auto-negotiation, half-duplex/full-duplex.
Protocols	H.264, H.265, (M)JPEG, RTP, ICMP, RTSP, TCP, UDP, IP, DHCP, QOS, IGMPv2 and later, (S)NTP, HTTP, HTTPS, SNMPv3, FTP, ONVIF S.
Connector type	RJ-45

**Table 5.2 – Transmission Interface**

## 5.4 MANAGEMENT

The video encoder shall comply with the management requirements as detailed in Table 5.3.

Item	Requirement
Ethernet port indicators	<u>LED indicators:</u> LED: ON (Green in Colour) = Link Active, Flashes with activity; LED: ON (Red in Colour) = Link NOT Active; LED: Off (Means no Power);
Network management and Control	SNMP v3, HTTP, HTTPS, HTML (password protected)

**Table 5.3 - Management**

## 5.5 DATE AND TIME

The encoder shall provide an option to display the date and time on screen.

## 5.6 NETWORK INTERFACE AND COMMUNICATIONS PROTOCOLS

The camera encoder shall be capable of:

- a) Supporting static IP address setting.
- b) Retaining the IP address after the device has lost power.
- c) Supporting Unicast and Multicast transmission of digital video over IP.

## 5.7 WEB INTERFACE

5.7.1 The camera shall have the ability to be configured through a web page provided from a web server internal to the camera.

5.7.2 Through the web page interface the camera shall allow configuration of following as a minimum:

- a) Network interface settings, including:
  - Login user name and password;
  - TCP ports used for HTTP/HTTPS;
  - Manual IP and Manual DNS;
- b) RTSP, RTP, Unicast and Multicast settings.
- c) Image resolution settings.
- d) Video quality settings.

5.7.3 The web page interface shall also provide the ability to:

- a) View the video output.
- b) Pan, tilt and zoom the connected camera.
- c) Recall and store preset PTZ positions.
- d) User access log.

## **5.8 SECURITY REQUIREMENTS**

5.8.1 The camera shall meet all DoT (Roads) cyber security requirements, including but not limited to following:

- a) Access to device must be authenticated with at least username and password.
- b) Device must enforce DoT (Roads) password complexity standard.
- c) Factory default settings must result in all passwords being removed from the device.

## SECTION 6 MECHANICAL & PHYSICAL REQUIREMENTS

### 6.1 CONNECTIONS

- 6.1.1 All power and network cable connector shall be protected from the outside environment.
- 6.1.2 Connections for power and network shall provide the ability to be quickly connected and disconnected through the use of one or more miniature terminal strip connectors or similar.

### 6.2 CAMERA HOUSING

- 6.2.1 An environmental housing shall be supplied with the camera to provide a controlled atmosphere for the camera. The housing shall:
- Be tamper-proof.
  - Have an operational life of at least 70,000 hours in outdoor environmental conditions.
  - Use a clear optical grade thermoformed acrylic or equivalent grade viewing window to house the optical components.
  - Have a maximum weight (including environmental housing assembly but excluding the mounting bracket) of 10kg.
  - Have a minimum impact resistance of IK10 in accordance with EN 62262.
- 6.2.2 The housing lens should include a self-cleaning mechanism or a coating or film to minimise the build up of dirt and grime on the outside surface.

### 6.3 CAMERA HOUSING MOUNTING

- 6.3.1 Where CCTV camera housing is to be mounted on a DoT (Roads) approved mid-hinged pole, it shall be installed directly on top of the pole or on a 'J' bracket.
- 6.3.2 Where the camera housing is to be mounted on a DoT (Roads) joint use pole or gantry, it shall typically be attached using a mounting arm.
- 6.3.3 The mounting arm shall not extend more than 2.5 metres laterally from the pole.
- 6.3.4 The design of the outreach arm shall minimise the potential of the camera's field of view to be partially occluded by the arm itself.
- 6.3.5 Where the camera is mounted on various types of Mast Arms a dedicated camera brackets are to be designed and proof engineered.
- 6.3.6 The camera housing shall also be capable of being mounted under structures such as bridges.

- 6.3.7 The camera housing shall include appropriate vibration/sway damping to minimise camera movement.

## **6.4 CABLING**

- 6.4.1 All cables used in the camera installation shall have UV stabilised outer sheaths and be suitable for outdoor use.
- 6.4.2 A Cat6 Ethernet cable shall be used to connect the camera to the network switch installed inside the control cabinet. Where required, a dedicated fibre optic cable and media convertor can be used to connect the camera to the network switch.
- 6.4.3 The length of Cat6 Ethernet cable between the camera and the network switch shall not exceed 100m.
- 6.4.4 Conduit or flexible hose shall be used to provide protection to the above mentioned cables where they are exposed to the environment.
- 6.4.5 This conduit or flexible hose shall be UV stabilised and suitable to outdoor use.

## **6.5 CAMERA CONTROLLER CABINET**

- 6.5.1 Where required, a camera controller cabinet will be used to house some or all (as required) of the following equipment:
- a) Electrical switch board,
  - b) Socket outlets,
  - c) Network equipment (including switch, router, modem, etc),
  - d) Fibre-optic media converter,
  - e) Fibre-optic splicing tray (fibre-optic connections),
  - f) Power over Ethernet injectors.
- 6.5.2 The following cabinet types may be used for the camera controller cabinet:
- a) Small weather proof enclosure mounted on the pole. The cabinet shall be designed only to house the camera equipment.
  - b) Traffic Signal Controller ‘top-hat’.
  - c) ITS Field Cabinet.
  - d) ITS Post Mounted cabinet.

6.5.3 Typical applications of the cabinet types mentioned in 6.5.2 Clause are described Table 6.1 below.

Cabinet Type	Typical Application	Compliance
Small Weather Proof Enclosure	Used to house CCTV camera equipment and mounted on a pole of traffic signal site.	Clause 6.6 of this specification
Traffic Signal Controller 'top-hat'	Used to house CCTV circuit breaker on traffic signal installations.	TCS 016 Clause 2.10
ITS Field Cabinet	Used to house CCTV camera equipment in Freeway environments	TCS 061
ITS Post Mounted cabinet.	Used to house CCTV camera equipment in Freeway environments	TCS 061

**Table 6.1 – Typical Applications of CCTV Camera Cabinet Types**

## 6.6 CAMERA SMALL WEATHER PROOF ENCLOSURE

The pole mount enclosure shall comply with following:

- a) Be manufactured from a UV stabilised polycarbonate material, marine grade aluminium or stainless steel (mild steel shall not be used).
- b) Have a weather resistance of not less than IP65.
- c) Be as small as practicable while providing sufficient capacity to house all the required equipment.
- d) Be mounted on the pole not less than 2.4m above the ground.
- e) Ensure that all equipment housed within the enclosure is kept within the temperature limits in ambient temperatures as specified in Clause 8.1.



## SECTION 7 ELECTRICAL REQUIREMENTS

### 7.1 GENERAL

- 7.1.1 All electrical works shall comply with AS/NZS3000.
- 7.1.2 All cables and wires shall be insulated with a material with a degree of protection not less than that provided by V-90 grade PVC and shall be suitably labelled.
- 7.1.3 The combined electrical load of the camera, encoding equipment, and environmental housing shall not exceed 120 VA.
- 7.1.4 Any socket outlets installed as part of a CCTV installation shall include an integral RCD.
- 7.1.5 Stand-alone electrical systems installed specifically for CCTV shall incorporate the following facilities:
- a) A circuit-breaker board comprised of appropriately rated mains isolation switch and circuit breaker.
  - b) The ability to be isolated from mains supply at ground level using a suitable switch/breaker system.
- 7.1.6 It is preferred that cameras are powered by Power over Ethernet (PoE).
- 7.1.7 The camera manufacturer preferred PoE injector and equipment shall be used.
- 7.1.8 Where the cable length exceeds 100m, separate power source may be used in lieu of PoE.

### 7.2 OPERATING VOLTAGES

#### 7.2.1 Mains

The mains supply voltage shall be deemed to be 230 VAC +10%, -6% in accordance with AS 60038.

#### 7.2.2 Camera Voltage

The voltage for the camera and PTZ shall be-

- a) nominal 24Vac for separately powered cameras; and
- b) 44-57 volts DC for PoE in accordance with IEEE802.3

### **7.3 ELECTRICAL SUPPLY**

The camera installation shall include, within the camera control cabinet, a circuit-breaker board comprising appropriately rated mains isolation switch and an appropriately rated circuit breaker for each individual circuit.

### **7.4 INTERNAL PROTECTION**

All equipment including data lines shall be internally protected against damage resulting from:

- a) Lightning striking at or near the camera;
- b) Electrical transients on power cabling;
- c) Electrical transients on communications wiring;
- d) Radio frequency interference; and
- e) Static electrical discharge.

### **7.5 ELECTROMAGNETIC COMPATIBILITY (EMC)**

#### **7.5.1 General**

All equipment covered by this specification shall comply with all relevant requirements of the Australian Communications Media Authority (ACMA) for EMC and shall be labelled with a conforming 'RCM' mark.

#### **7.5.2 Immunity**

The camera shall comply with the relevant requirement of AS/NZS 61000.6.1.

#### **7.5.3 Electromagnetic Emission**

The camera shall comply with the relevant requirement of AS/NZS 61000.6.3.

## SECTION 8 COMMUNICATIONS REQUIREMENTS

- 8.1 The type of communications required shall be detailed individual contract documents.
- 8.2 The standard arrangements for communications for CCTV control and images is as detailed in Table 8.1 below.

Camera Type	Location	Modem	Network
PTZ	Managed Motorway or Freeway	DoT (Roads) Access Switch	Managed Motorway Fibre optic network
PTZ	Traffic Signal site or other arterial road	3/4/5G modem	TrafficNet via a dedicated Telstra mobile wireless service
<i>PTZ</i>	<i>Traffic Signal site or other arterial road</i>	<i>ADSL Traffic* Signal modem</i>	<i>TrafficNet via a dedicated Telstra ADSL service</i>
Fixed	Traffic Signal site or other arterial road	3/4/5G modem	TrafficNet via a dedicated Telstra mobile wireless service
VMS Verification	VM Sign	3/4/5G modem	TrafficNet via a dedicated Telstra mobile wireless service

**Table 8.1 – Accepted Communications Methods**

\* *For Possible for future use.*

## SECTION 9 ENVIRONMENTAL REQUIREMENTS

### 9.1 TEMPERATURE AND HUMIDITY

9.1.1 All cameras and associated equipment covered by this specification shall be designed to operate under the following conditions:

- a. Ambient air temperatures within the range  $-15^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$ ; and
- b. Insolation of up to  $1000\text{W}/\text{m}^2$ , incident at an angle of  $30^{\circ}$  from the vertical, applied to the maximum exposed surface of the equipment.

*Note: Where it is not practical to provide the required insolation during testing, it is acceptable to increase the upper ambient temperature limit by  $10^{\circ}\text{C}$  as substitute.*

9.1.2 Consideration shall be given to protection against the effects of high humidity, including condensation following a drop in ambient temperature.

9.1.3 The camera shall be able to operate continuously at an ambient temperature of  $-10^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$  with a relative humidity of 10% to 95%, non-condensing.

### 9.2 ENCLOSURE PROTECTION

All camera housings covered by this specification shall meet the requirements of AS 60529 for IP66.

### 9.3 VIBRATION

The complete camera and housing shall be subjected to vibration tests in accordance with the requirements of AS 60068.2.6 for sinusoidal vibration as detailed in Table 9.1.

Clause AS 60068.2.6	Detail	Parameters
	Test Camera	Powered and operating
	Test Type	Sinusoidal sweep
5.1	Frequency range	5 Hz to 55 Hz
5.2	Vibration amplitude	0.75mm
5.2	Cross-over frequency	Approximately 8.2 Hz
5.2	Acceleration amplitude	$2\text{ m/s}^2$ - 0.2gn

**Table 9.1 – Vibration Test Criteria**

### 9.4 WIND LOADING

9.4.1 The facilities provided for supporting and stabilizing the camera shall ensure that, when installed as in normal operation, the camera will maintain its intended orientation and position

when subjected to the wind-loading conditions applicable to the region in which the camera is intended to be used, in accordance with AS/NZS 1170.2.

- 9.4.2 The minimum wind-loading conditions applicable shall be those for Region A, Terrain Category 2 in accordance with AS/NZS 1170.2.

## SECTION 10 FIXED IP CAMERAS

### 10.1 GENERAL

- 10.1.1 DoT (Roads) uses fixed IP cameras on the road network to provide images of traffic conditions for viewing through DoT (Roads) web site.
- 10.1.2 Fixed IP cameras shall comply with the requirements detailed below.

### 10.2 WEB CAMERA REQUIREMENTS

- 10.2.1 Fixed IP cameras shall comply with the requirements detailed in Section in 4 of this specification except for section 4.2, 4.3 and 4.4.
- 10.2.2 Fixed IP camera shall provide a minimum horizontal Angle of View between 50° to 75°.
- 10.2.3 The horizontal Angle of View shall be user configurable remotely.
- 10.2.4 Minimum 4 independent programmable private zones are desirable.

### 10.3 VIDEO ENCODER REQUIREMENTS

- 10.3.1 The fixed IP camera video encoder shall comply with the relevant requirements detailed in Section 5 of this specification.
- 10.3.2 The fixed IP camera shall provide a function of uploading static picture to FTP server in a regular basis.
  - a) The picture file should be in JPG format.
  - b) The resolution of the picture file shall comply with the same resolution requirement defined in section 5.2.
  - c) The upload interval shall be user configurable between 30 seconds to 5 minutes.

### 10.4 MECHANICAL AND PHYSICAL REQUIREMENTS

The web camera shall comply with the relevant requirements detailed in Section 6 of this specification.

### 10.5 ELECTRICAL REQUIREMENTS

The web camera shall comply with the relevant requirements detailed in Section 7 of this specification.

## SECTION 11 VMS VERIFICATION CCTV

### 11.1 GENERAL

- 11.1.1 Variable Message Signs (VMS) shall be provided with a CCTV camera to enable verification of the displayed message.
- 11.1.2 On managed freeways, a CCTV camera should be located to provide clear vision of any nearby VMS.
- 11.1.3 Where a VMS is not visible from an existing camera, a new camera shall be installed. The camera installation shall be:
  - a) A PTZ camera on a mid-hinge pole that provides clear view of the VMS and also traffic vision (preferred option); or
  - b) A fixed position IP camera mounted on the VMS (typically rural or isolated locations).
- 11.1.4 VMS Verification cameras shall comply with the requirements detailed below.

### 11.2 FIXED POSITION IP CCTV CAMERA

- 11.2.1 The VMS verification camera shall comply with the requirements detailed in Section in 4 of this specification except for section 4.2 4.3 and 4.4.
- 11.2.2 The horizontal Angle of View shall be user configurable remotely.

### 11.3 VIDEO ENCODER REQUIREMENTS

The VMS verification camera video encoder shall comply with the relevant requirements detailed in Section 5 of this specification.

### 11.4 MECHANICAL AND PHYSICAL REQUIREMENTS

The VMS verification camera shall comply with the relevant requirements detailed in Section 6 of this specification.

### 11.5 ELECTRICAL REQUIREMENTS

- 11.5.1 The VMS verification camera shall be powered from the VMS via a separate circuit breaker.
- 11.5.2 The camera shall comply with the relevant requirements detailed in Section 7 of this specification.

## SECTION 12 INSTALLATION REQUIREMENTS

### 12.1 GENERAL

- 12.1.1 The camera and all associated communications and power wiring shall be installed in accordance with all the manufacturer's instructions.
- 12.1.2 All installation works associated with CCTV cameras and associated equipment shall comply with the relevant Clauses of:
- a) Standard Section 730 (for all works associated with traffic signal sites).
  - b) Standard Section 732.
  - c) Standard Section 733 for all conduit and pit works.
  - d) Standard Section 736 for testing and integration.
  - e) The requirements of individual contract documents.
- 12.1.3 All video, communication and power cables shall be labelled at both ends. All cables should be neatly trained and organised.
- 12.1.4 CCTV camera controller cabinets shall be installed as near as practicable to the associated camera.
- 12.1.5 Unless otherwise specified in individual contract documents, or approved by the Superintendent on a case-by-case basis, cameras shall be installed on a standard 10m mid-hinged pole in accordance with DoT (Roads) standard drawings TC-2011, TC-2012 and TC-2013.
- 12.1.6 If the CCTV camera is installed on existing pole/gantry the contractor needs to ensure that the structure can support the additional weight.
- 12.1.7 CCTV camera shall communicate using DoT owned Fibre network, where it is available.
- 12.1.8 If the CCTV camera is installed close to locations where there is potential for large crowd gatherings (eg. stadiums) the CCTV camera shall communicate using hardwire connection such as Fibre or ADSL, where this is possible.
- 12.1.9 DoT (Roads) ITS Group shall allocate a camera site number when requested.

### 12.2 CCTV INSTALLED ON MANAGED MOTORWAY OR FREEWAY

#### 12.2.1 General

- 12.2.1.1 Cameras installed on managed motorways or freeways shall be installed in accordance with Table 12.1 below.



Installation Method	Details	Associated Standard Drawings
Mid-hinge CCTV pole	<p>This is the default method.</p> <p>This is the preferred method as it provides easy access for maintenance activities.</p>	TC-2011, TC-2012 and TC-2013
LUMS Gantry	<p>This method may be approved where the installation of a mid-hinge pole is not possible due to site constraints.</p> <p>Where installed on a gantry, the camera shall be on an outside leg to enable access for maintenance activities.</p>	TC-2221 and TC-2260
Ramp metering gantries	<p>This method may be approved where the installation of a mid-hinge pole is not possible due to site constraints.</p> <p>Where installed on a gantry, the camera shall be on an outside leg to enable access for maintenance activities.</p>	TC-2250, TC-2251 & TC-2252
Other Structure	Where approved by the Superintendent.	N/A

**Table 12.1 – Installation Methods**

12.2.1.2 Where additional height for the CCTV camera is required a pole extension in accordance with standard drawing TC-2222 shall be used.

### 12.2.2 Location

12.2.2.1 CCTV installed on a Managed Motorway or freeway shall be located as far as is practicable to provide:

- a) Clear and unimpeded view of all areas of the carriageway and surrounding areas.
- b) Clear view of signs (e.g. LUMS) and other roadside infrastructure.
- c) Easy access for maintenance works.
- d) Minimal impact to traffic during maintenance activities.

12.2.2.2 Acceptable locations for installing a CCTV camera are:

- a) On a mid-hinge pole located behind guard rail or other suitable barrier, with vehicle access for maintenance activities (preferred arrangement).
- b) On the outside extremities of a LUMS gantry, provided the column supports are on the outside of the freeway lanes.

### 12.2.2.3 CCTV cameras, and any associated CCTV cabinet, shall not be located:

- a) On any pole or other support structure located on or within a median barrier separating running lanes (e.g. Main line and collector/distributor lanes) that would require multiple lane closures for maintenance access.
- b) On any portal gantry that does not extend to the very outside lanes of the freeway.
- c) On any cantilever gantry, the column of which is located on or within a median barrier separating running lanes (e.g. Main line and collector/distributor lanes) that would require multiple lane closures for maintenance access.
- d) On a street lighting pole.
- e) In any other location that prevents access for maintenance activities.

12.2.2.4 Where a single CCTV camera cannot be installed in a location that enables acceptable coverage of the entire freeway, the Superintendent may approve to use of two appropriately positioned cameras to achieve the minimum viewing requirements.

### 12.2.3 CCTV Controller Cabinet

The preferred arrangement for the CCTV controller cabinet is shown in Table 12.2 below.

Installation Arrangement	Cabinet Details
Mid-hinge CCTV pole	A pole mounted cabinet attached to the pole (the cabinet must not interfere with the pole function)  or  A standalone pole mounted cabinet located within 5m of the pole.
LUMS Gantry	A pole mounted cabinet attached to the leg of the gantry.
Other Structure	One of the above options as approved by the Superintendent.

**Table 12.2 – Controller Cabinet Installation Methods**

### 12.2.4 Power

Power shall be provided and installed in accordance with Standard Section 734 and as specified in individual contract documents.

### 12.2.5 Communications

Communications shall be provided and installed in accordance with Standard Section 735 and as specified in individual contract documents.

## 12.3 CCTV INSTALLED ON TRAFFIC SIGNAL POLE

### 12.3.1 General

12.3.1.1 CCTV cameras installed at signalised intersections shall be located as far as is practicable to provide:

- a) Clear and unimpeded view of all approaches to the intersection.
- b) Easy access for maintenance works.
- c) Minimal impact to traffic during maintenance activities.

12.3.1.2 In some locations, in order to meet the requirements of 11.3.1.1 above, two cameras may be required.

### 12.3.2 Camera Mounting Location

12.3.2.1 Cameras shall be located to ensure easy access for maintenance activities. The preferred mounting arrangement for cameras in order of preference is:

- a) On a mid-hinge camera pole.
- b) On a JUP, JUMA or MA (attached to the vertical column of the pole).
- c) On a 2B pedestal (attached via a raiser bracket to provide additional height)

12.3.2.2 CCTV cameras **shall not** be located in the following locations as this creates access issues for maintenance activities:

- a) The outreach of a MA or JUMA.
- b) A street lighting outreach bracket.
- c) Any third party, non-DoT (Roads) owned pole.
- d) Close to high voltage tram overhead cables.
- e) Any other location that would require multiple lane closures for access.

### 12.3.3 Control and Communications Equipment

12.3.3.1 The camera control and communications equipment shall be installed separate to traffic signal equipment as much as practicable.

12.3.3.2 The preferred method of installing and housing CCTV camera equipment is in a Small Weather Proof Enclosure mounted on traffic signal pole, compliant to Clause 6.6 of this specification and designed only to house CCTV camera equipment. The enclosure will typically house the following equipment:

- a) PoE injector.
- b) The 3/4G modem.
- c) Antenna for 3/4G modem.

#### 12.3.4 Power

12.3.4.1 Cameras installed on a traffic signal site shall be powered from a separate circuit breaker in the controller's switchboard to ensure it uses the same point of supply as the traffic signal site.

**NOTE: Power MUST come from the controller switchboard to ensure that when the controllers main switch is turned off, ALL electrical devices attached to any traffic signal pole have been de-energised.**

12.3.4.2 Where a top-hat is used, a second sub-board with a smaller circuit breaker (to provide electrical discrimination) shall be installed in the top-hat.

12.3.4.3 Where a spare unreserved core is available in the traffic signal cable (ie. core 33-38), this shall be used to provide power to the CCTV camera equipment.

12.3.4.4 Where a spare core is not available, a separate power cable shall be run from the CCTV circuit breaker (see Clause 12.3.3.1 and 12.3.3.2 above) to the camera pole.

12.3.4.5 Socket outlet shall not be used to provide power for the PoE Injector and the modem where housed in a pole mounted enclosure.

#### 12.3.5 Power over Ethernet Connection

12.3.5.1 The camera shall be connected to the PoE injector for power and control.

12.3.5.2 A CAT-5E or CAT-6 Ethernet cable shall be used to connect the camera to the PoE injector. The insulation rating of the ethernet cable shall not be less than low voltage (i.e. 240Vac).

#### 12.3.6 Communications

12.3.6.1 Communications shall typically be via an approved 3/4G/5G modem.

12.3.6.2 The modem shall be housed within the Small Weather Proof Enclosure compliant as detailed in Clause 6.6 above.

12.3.6.3 Where specified in individual contract documents, communications will be via the traffic signal controllers ADSL modem.

*Note: At the time of this specification, the ADSL option is not available.*

## 12.4 FIXED IP CAMERAS

12.4.1 Fixed IP cameras shall be installed as far as it is practicable to provide:

- a) Clear and unimpeded view of all approaches.
- b) Easy access for maintenance works.

12.4.2 Fixed IP Camera installations shall comply with the relevant requirements of this specification including the requirement as detailed in Table 12.1, below.

Location	Compliance
Managed Motorway/Freeway	12.1 and 12.2 Clauses of this specification
Traffic Signal Site	12.1 and 12.3 Clause of this specification

**Table 12.1 - Fixed IP Camera Installations Requirement**

## 12.5 VMS VERIFICATION CAMERA

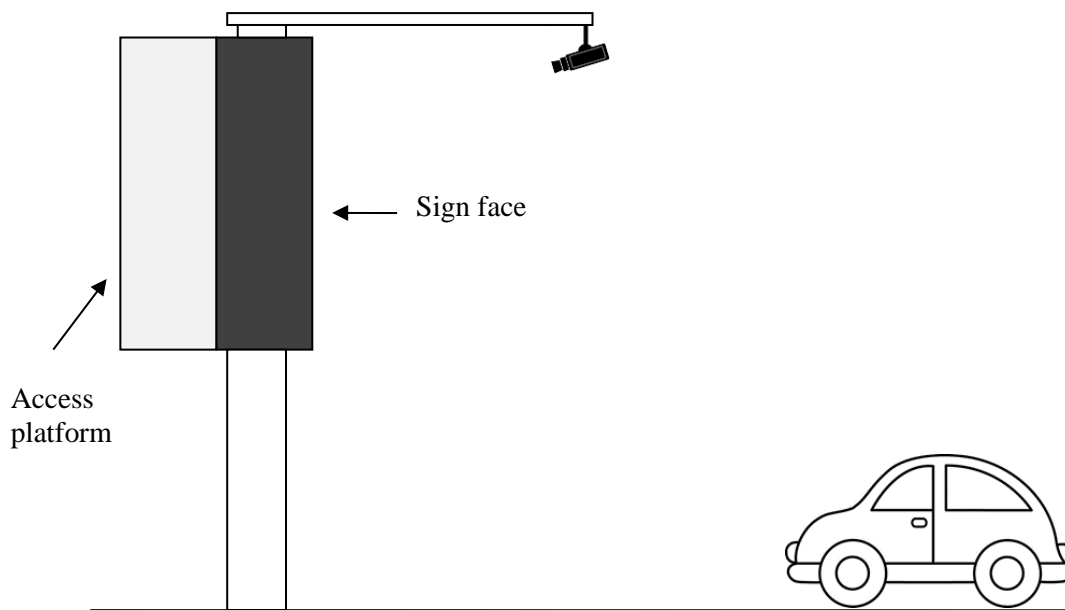
### 12.5.1 General

12.5.1.1 Installation of VMS verification cameras shall comply with the relevant requirements of this specification and the requirements of individual contract documents.

12.5.1.2 The camera shall be mounted on a suitable support that places the camera forward of the sign face in a position that provides clear view of the entire sign.

12.5.1.3 The position of the camera shall not impede the view of any message for approaching motorists. A typical arrangement would be a support pole mounted on the top of the VMS, placing the camera forward and above the sign face. An example arrangement is shown in Figure 12.1.

12.5.1.4 The camera shall be capable of being removed and replaced from the VMS access platform without the need for an elevated platform vehicle.



**Figure 12.1: Example arrangement for VMS Verification Camera Installation**

### 12.5.2 Power

12.5.2.1 Power for the camera shall be from a separate circuit breaker located in the VMS.

12.5.2.2 The PoE power supply shall be housed within the VMS.

### 12.5.3 Communications

12.5.3.1 Communications shall typically be via an approved 3/4G/5 modem.

12.5.3.2 The modem and antenna shall be housed within the VMS.

## 12.6 CONFIGURATION

12.6.1 The Contractor shall configure all network parameters including the IP address into each applicable device.

12.6.2 All parameters including IP addresses shall be obtained from DoT (Roads).

12.6.3 The Contractor shall provide a summary of the proposed settings for the camera for review by DoT (Roads) prior final configuration of these devices.

12.6.4 The Contractor shall configure the agreed parameters into the camera during installation.

## 12.7 HAND OVER DOCUMENTS AND INSTALLATION RECORDS

### 12.7.1 Hand over documents

12.7.1.1 Following successful commissioning of the system, the following documentation shall be provided:

- a) CCTV Datasheet;
- b) CCTV Configuration sheet;
- c) CES for installation works;
- d) As built drawings;
- e) CCTV wiring diagram;

### 12.7.2 Installation Records

12.7.2.1 All CCTV installations shall have the following information recorded and provided as specified below.

12.7.2.2 All CCTV assets shall have their location identified and recorded using GNSS co-ordinates. The co-ordinates shall be captured using the World Geodetic System WGS84 in decimal degrees to 6 decimal places.

12.7.2.3 The following site information shall be provided.

- a) Site number
- b) Site address
- c) Camera type
- d) Communications type (i.e. fibre-optic or 3/4G/5G)
- e) IP address
- f) SIM card details
- g) Phone number
- h) Modem type
- i) Pole type
- j) Pole location
- k) Municipality
- l) DoT (Roads) Region
- m) Camera GNSS co-ordinates
- n) Cabinet GNSS co-ordinates
- o) Point of supply

## APPENDIX A REQUIREMENTS FOR ACCEPTANCE

(Normative)

### A1 GENERAL

To enable assessment for the purpose of granting acceptance for use for DoT (Roads) projects, the supplier is to submit a formal request for acceptance accompanied by the following:

- a. Documentation to demonstrate that the camera complies with the requirements of this specification
- b. An outline drawing showing the general presentation and overall dimensions of the camera.
- c. Details of the installation requirements for the camera (eg. Top mount, lower mount etc.).

### A2 REQUIRED NATA ACCREDITED TESTING

The supplier shall provide evidence of compliance with the requirements of Section 8 of this specification. Such evidence shall be as detailed in Table A1.1 below.

Clause	Requirements	Evidence
6.2.1	IK 10 Impact resistance	Test Report or other acceptable evidence
7.5	EMC Compliance	Test Report or evidence of RCM mark
8.1	Temperature and humidity	Test Report or other acceptable evidence
8.2	Enclosure protection	Test Report or statement of compliance
8.3	Vibration	Test Report or statement of compliance
8.4	Wind loading	Test Report or statement of compliance

### A3 OTHER REQUIRED TESTING

- a. A benchtop test will be carried out by DoT (Roads) to ensure correct operation on DoT (Roads) system.
- b. Following a successful benchtop test, a field trial will be required in order to fully test the camera in DoT (Roads) CCTV system.
- c. DoT (Roads) may require additional information or testing to be carried out as part of its evaluation.