



CLOSED-CIRCUIT TELEVISION — OPS

ITS Delivery Specification

18 OCTOBER 2022
0.8

Superseded

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More information

If you have further queries, contact the ITS S&S team via email: itsspec@nzta.govt.nz

More information about intelligent transport systems (ITS) is available on the Waka Kotahi website at <https://www.nzta.govt.nz/its>

This document is available on the Waka Kotahi website at <https://www.nzta.govt.nz/itsspecs>

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1 DOCUMENT CONTROL

1.1 Document information

| | |
|---|--|
| Document number | ITS-02-006-202211-SPEC-CCTV-OPS |
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1.2 Document owner

Role Head of Technology Engineering

Organisation Waka Kotahi

1.3 Document approvers

This table shows a record of the approvers for this document.

| Approval date | Approver | Role | Organisation |
|---------------|----------|------|--------------|
| DD/MM/YYYY | | | |
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1.4 Version history – major changes

Document version control is the process of tracking and managing different versions (or drafts) of a document to easily identify the current iteration of a file.

This table shows a record of all major (published) versions of this document (**for Waka Kotahi use only**). To record minor versions (author updates, amendments etc), go to section 9 Full version history.

| Version | Date | Author | Role and organisation | Reason |
|---------|------------|------------|-----------------------|---|
| 0.8 | 18/10/2022 | Gary Nates | Lead author, Beca Ltd | Draft updated for industry consultation |
| 1.0 | DD/MM/YYYY | | | |
| 2.0 | DD/MM/YYYY | | | |
| 3.0 | DD/MM/YYYY | | | |
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2 TERMINOLOGY USED IN THIS DOCUMENT

| Term | Definition |
|------------------|---|
| DRAFT | The document is being written and cannot be used outside of Waka Kotahi. |
| PENDING | The document has been finalised and is pending approval and ratification by Waka Kotahi. It can be used for procurement at this status. |
| RATIFIED | The document is an official Waka Kotahi document. Road controlling authorities are obliged to follow a document with this status. |
| RETIRED | The document is obsolete, and/or superseded. |
| AC | Alternating current |
| AS/NZS | Australian/New Zealand standard |
| CCTV | Closed-circuit television |
| dB | Decibels |
| DC | Direct current |
| DHCP | Dynamic Host Configuration Protocol |
| fps | Frames per second |
| IEC | International Electrotechnical Commission standard |
| IEEE | Institute of Electrical and Electronics Engineers standard |
| IP | Internet Protocol |
| ITS | Intelligent transport system |
| lux | Luminous intensity |
| Mb | Megabit |
| NIWA | National Institute of Water and Atmospheric Research |
| ONVIF | Open Network Video Interface Forum |
| PoE | Power over Ethernet |
| PTZ | Pan-tilt-zoom [camera] |
| SFP | Small form-factor pluggable |
| TCP | Transmission Control Protocol |
| TOC | Transport operations centre |
| USB | Universal serial bus |
| W | Watts |
| W/m ² | Watts per square metre |
| WDR | Wide dynamic range |

3 OVERVIEW AND OUTCOMES

This section defines the purpose of the equipment within the operational system.

3.1 Purpose

The purpose of this document is to specify the minimum requirements for the procurement of closed-circuit television (CCTV) cameras used for operational purposes by Waka Kotahi. These cameras are intended to be connected to the Waka Kotahi operations environment and network.

Delivery assurance is managed through a series of delivery specifications which support procurement and systems integration. The key risks that specifications address are ensuring the correct equipment is being procured, that it will integrate with operational systems, and will deliver the correct functionality and performance requirements.

3.2 Overview

3.2.1 Definition

CCTV cameras provide transport operation centres (TOCs) with operation visibility of key assets. The type of camera used depends on the functionality requirements:

- i. Pan-tilt-zoom (PTZ) cameras are large, high-quality, high-performance cameras for use on urban and high-volume roading environments.
- ii. Dome cameras are smaller, cost-effective cameras suited to areas where a full PTZ camera is not required. Dome cameras can be fixed or have PTZ functionality and are intended for shared-use paths or rural roading environments.
- iii. Fixed cameras are high-quality cameras but without PTZ ability.

3.2.2 Waka Kotahi ITS class

[Class definitions](#)

006 Cameras. Equipment used to view and capture footage of activity on the transport network.

3.3 Scope

This delivery specification sets out the requirements for the procurement of the following types of CCTV cameras:

- i. PTZ CCTV cameras
- ii. dome cameras
- iii. fixed CCTV cameras.

In general, the contractor shall supply CCTV cameras, camera mounting and appropriate housing as required, in line with this delivery specification.

This delivery specification does not cover web cameras or any other forms of cameras.

3.4 Outcomes

Typical outcomes for operational CCTV cameras are to:

- i. enable TOCs to have operational visibility of the road network and key assets
- ii. support incident assessment to allow decision support regarding network conditions
- iii. support demand management, especially around queuing and congestion decision support
- iv. support optimisation and the systems used to manage them (eg ramp meters, tidal flow systems etc).

3.4.1 Operational

The intended operational outcomes of this delivery specification are to:

- i. ensure the equipment is accessible for use (the reliability of the equipment will ensure that it is out of service for maintenance for very short periods)
- ii. provide the ability to view images in varying conditions that are of a high enough quality for situational awareness
- iii. ensure the camera is available and operational when required
- iv. ensure the camera is compatible with the operations systems used by the TOCs.

3.4.2 For users of the transport network

Operational cameras are intended to provide the TOCs with an operational and safety awareness that allows better decisions and faster visuals to be made that will reduce the impact of events on the transport network.

3.4.3 For road controlling authorities and transport operations centres

Operational awareness of the network through CCTV cameras allows management of safety, incidents and demand.

4 FUNCTIONAL REQUIREMENTS

This section outlines what the equipment and systems need to do (functional), and how they need to do it (non-functional).

4.1 Video image

All cameras must provide the functionality to provide high-quality video images from a range of lighting conditions that may change due to time of day or weather conditions. This may include open-air environments and enclosed tunnel environments.

4.1.1 Resolution

Cameras must provide a density of resolution to display the video image clearly and with an acceptable level of detail for operational requirements.

4.1.1.1 Minimum resolution

Cameras must provide a minimum resolution of 1080 pixels or higher.

4.1.2 Frame rate

Cameras must provide a frame rate that will display a smooth image and allow the tracking of moving vehicles.

4.1.2.1 Minimum frame rate

Cameras must provide a minimum frame rate of 24fps or higher.

4.1.3 Downscaling

Cameras must provide the ability to manually downscale the resolution and frame rate to maintain a sufficient latency and bandwidth.

4.1.3.1 Downscaling resolution range

The camera resolution must be able to be downscaled to 540 pixels or lower.

4.1.3.2 Downscaling frame rate range

The frame rate of the camera must be able to be downscaled to 15fps or lower.

4.1.4 Iris control

The lens must have iris control to maintain the light level as it changes throughout the day.

4.1.4.1 Automatic iris control

Cameras must have automatic iris control.

4.1.4.2 Manual iris control

Cameras must have the ability to remotely switch to manual iris control.

4.1.5 Wide dynamic range (WDR)

Cameras must display images clearly where the light levels within an image differ significantly.

4.1.5.1 True WDR

Cameras must provide true WDR. Digital WDR is not acceptable.

4.1.5.2 Minimum WDR

Cameras must provide a minimum WDR of 90dB.

4.1.6 Day/night functionality

Cameras must display images clearly in both day and night-time environments and easily switch between the two environments.

4.1.6.1 Automatic day/night functionality

Cameras must have the ability to switch automatically between day/night functionality.

4.1.6.2 Manual day/night functionality

Cameras must have the ability to switch remotely between day/night functionality.

4.1.7 Illumination

Cameras must display images clearly in low-light environments, including at night-time.

4.1.7.1 Minimum illumination

Cameras must produce a clear image where ambient light levels are at a minimum of 0.7 lux.

4.2 Zoom

4.2.1 Zoom operation

Cameras should provide zoom to enlarge objects beyond the lens focal point.

Fixed cameras do not need to provide zoom operations but must be selected with the correct focal lens to be suitable for its operational purpose.

4.2.1.1 Optical zoom

Cameras must provide a minimum optical zoom of 30x using physical lenses.

4.2.1.2 Digital zoom

In addition to the optical zoom, cameras must also provide a minimum of 12x digital zoom without distorting the image.

4.2.1.3 Zoom operation response

There shall be a maximum response time of 200 milliseconds from when the zoom operation is activated to when the camera begins to zoom.

4.3 Camera movement

Cameras must provide an angular movement in the horizontal plane (pan) and pitch in the vertical plane (tilt).

Fixed cameras do not need to provide camera movement functionality.

4.3.1 Pan operation

To view beyond the camera's angle of coverage in the horizontal plane, cameras must be able to swivel, known as panning. This functionality is actioned remotely.

4.3.1.1 Pan range

Cameras must provide a continuous and endless pan of 360° rotation.

4.3.1.2 Pan speed

Cameras must provide a minimum pan speed of 72° per second (2.5 seconds to pan 180°).

At the end of travel, the camera will come to a soft stop.

4.3.1.3 Pan response

There shall be a maximum response time of 200 milliseconds from when the pan operation is activated to when the camera begins to move.

4.3.2 Tilt operation

To view beyond the angle of coverage in the vertical plane, cameras must be able to pitch, known as tilting. This feature is actioned remotely.

4.3.2.1 Tilt range

PTZ cameras must provide +90° (above horizontal) to -90° (below horizontal) of tilt.

Dome cameras must provide +10° (above horizontal) to -90° (below horizontal) of tilt.

4.3.2.2 Tilt speed

Cameras must tilt at a minimum speed of 30° per second (three seconds to tilt 90°).

At the end of travel, the camera will come to a soft stop.

4.3.2.3 Tilt response

There shall be a maximum of 200 millisecond response time from when the tilt is activated to when the camera begins to move.

4.3.2.4 Automatic flip image

Cameras need to automatically flip images at the bottom of tilt travel (-90° below horizontal) to prevent the output of an inverted image.

4.3.3 Variable speed functionality

The camera must allow for speed variability depending on the input sensitivity from the operator's controller and also allow for proportional speed based on the level of zoom. This applies to both tilting and panning.

4.3.4 Camera position reporting

Cameras must be capable of displaying the direction the camera is orientated. This should be achieved without the need for calibrating or programming.

4.3.4.1 In-built camera position reporting

Cameras must be able to provide an in-built digital or absolute magnetic compass device to display the direction the camera is orientated. This display should be configurable and be able to be switched off.

4.3.5 Preset positions

A minimum of 15 remotely selectable position presets must be available (one preset entry defines a single XYZ orientation of the camera, including the level of zoom). These presets must be able to be adjusted remotely as required.

4.4 Privacy operations

All cameras must provide the functionality to blur or obscure private property or assets, such as neighbouring buildings.

4.4.1 Privacy zones

All cameras must provide programmable privacy zones which shall consist of an opaque polygon superimposed over the image to obscure parts of the field of view. The zones should move across the output image as appropriate to keep the desired zone covered as the camera moves and zooms.

4.4.1.1 Minimum number of privacy zones

Each camera must provide a minimum of 12 privacy zones.

4.5 Water removal from housing lens

PTZ cameras will need a feature to remove the build-up of condensation or rain from the exterior of the housing lens.

4.5.1 Wipers

Cameras must be supplied with integrated wipers as part of the camera housing that can be operated remotely by the TOC video management system.

Functionality such as speed dry or shake off is not an acceptable method of water removal.

Dome and fixed cameras do not need to provide wiper functionality.

4.5.2 Hydrophobic coating

Camera housing lenses may be coated with hydrophobic coating. This may be in addition to the requirements as detailed in section 4.5.1 Wipers.

4.6 Security functions

4.6.1 Username and passwords

All usernames and passwords need to be configurable, including defaults.

Cameras need to allow for the creation of new usernames.

4.6.1.1 Character type

Usernames and passwords need to allow for lower case, upper case and numbers and special characters.

4.6.1.2 Password length

The minimum password length must be 12 characters or more.

4.6.2 Logs

Cameras must provide a record of access logs (to identify each instance that any user has accessed the camera) and fault logs.

4.6.2.1 Timestamps

All logs must be timestamped.

4.6.2.2 Source IP address

All access logs must include the source IP address.

4.6.2.3 Authentication

All access logs must include if the authentication was successful or not.

4.6.2.4 Log retention

Logs should be stored for at least three months before being deleted.

4.6.3 Time synchronisation

Cameras must allow time synchronisation through NTP servers.

4.6.3.1 NTP servers

Cameras must allow to be configured with three NTP servers, as a minimum.

4.6.4 Firmware updates

Cameras must allow for firmware updates remotely and not rely on updates by physical means (eg the use of a USB flash drive or direct laptop connection).

4.6.4.1 Firmware rollback

Cameras must allow for roll back to the last previous version (n-1) as a minimum.

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5 PERFORMANCE REQUIREMENTS

This section outlines the reliability and availability requirements of equipment, which may require independent certification and/or declarations of conformity.

5.1 Operational life

Cameras shall be designed with a minimum operational life of not less than six years without degradation of performance quality.

5.2 External protection to dust and moisture

To prevent cameras from exposure to dust and water, camera housing shall provide a minimum IP66 ingress protection based on IEC 60529:1989+AMD1:1999+AMD2:2013 Degrees of protection provided by enclosures (IP code).

5.3 Resistance to the effects of external conditions

The operating environment of cameras can be relatively harsh. Equipment that is deemed fit for purpose is expected to continue to operate effectively exposed to the New Zealand environment as per the National Institute of Water and Atmospheric Research (NIWA). It is essential that materials and manufacturing processes take this into account.

Cameras shall be capable of continuous, normal operation (24 hours, seven days per week) and maintaining performance criteria in the conditions described below:

- i. installed and operated in direct sunlight
- ii. ambient temperature range between -25°C and $+55^{\circ}\text{C}$
- iii. maximum wind conditions likely to occur at the installation site as per AS/NZS 1170.2:2021 Structural design actions – Part 2: Wind actions
- iv. solar radiation with a value of up to $2000\text{W}/\text{m}^2$ at direct sunlight, incident at an angle of 30° from the vertical
- v. altitude up to 1000m
- vi. humidity between +10% and +95% non-condensing
- vii. conditions, both permanent and temporary, that may be unique to the specified location, eg instances of thick smoke and electromagnetic interference
- viii. vibrations expected in the installed location
- ix. marine environment.

6 TECHNICAL REQUIREMENTS

This section outlines specific technical and physical constraints for the equipment.

6.1 General

Cameras must be digital IP cameras.

6.2 Electrical requirements

6.2.1 Electrical supply

All cameras must be able to be powered by all of the following methods:

- i. AC
- ii. DC
- iii. Power over Ethernet (PoE).

6.2.1.1 PoE standards

PoE should meet one of the following standards, based on the power requirements of the camera:

- i. up to 15W (IEEE 802.3af-2003 Standard for Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications – Data Terminal Equipment (DTE) Power Via Media Dependent Interface (MDI))
- ii. up to 30W (IEEE 802.3at-2009 Standard for Information technology – Local and metropolitan area networks – Specific requirements – Part 3: CSMA/CD Access Method and Physical Layer Specifications Amendment 3: Data Terminal Equipment (DTE) Power via the Media Dependent Interface (MDI) Enhancements)
- iii. up to 90W (IEEE 802.3bt-2018 Standard for Ethernet Amendment 2: Physical Layer and Management Parameters for Power over Ethernet over 4 pairs).

6.3 System integration

6.3.1 Camera protocol support

Cameras must be listed as compliant under the ONVIF Profile S Specification v1.3 protocol conformance. Camera manufacturer must be a member of the ONVIF alliance.

6.3.2 Codecs

Cameras must provide video streaming codecs that meet ONVIF Profile S Specification v1.3 protocol.

6.3.3 TCP/IP protocols

Cameras must:

- i. be TCP/IP network capable
- ii. support DHCP for IP address assignment.

6.3.4 HTTPS and SSH protocols

Cameras must provide HTTPS and SSH protocols

6.3.5 SNMP

Cameras that use SNMP must provide SNMPv3.

6.3.6 Network connectivity

Cameras must have the ability to be connected using either:

- i. RJ45 100/1000Mb copper Ethernet (required for all cameras)
- ii. small form-factor pluggable (SFP) module (optional).

6.3.7 Unicast and multicast

All cameras must be able to provide full functionality in a unicast-only network environment.

Cameras may provide multicast, but this is not required.

6.4 Security requirements

If cameras are to be deployed outside of a secure Waka Kotahi network, then security requirements must be discussed with a Waka Kotahi representative.

6.4.1 New camera makes and models

Camera makes and models new to Waka Kotahi will need to be assessed by the Waka Kotahi Security team.

6.5 Documentation, software and licensing

6.5.1 Documentation

Camera vendors must supply original equipment manufacturer maintenance, service and operations guidelines and manuals which will include maintenance schedules and procedures, handling and storage, and spares list.

6.5.2 Software and licensing

Camera vendors must supply all software and licensing required to configure and manage the CCTV to Waka Kotahi or its agent(s).

Superseded

7 REFERENCES

This section lists all external and Waka Kotahi references included in this document.

7.1 Industry standards

| Standard number / name | Source | Licence type and conditions |
|---|--|-----------------------------|
| IEC 60529:1989+AMD1:1999+AMD2:2013 Degrees of protection by enclosures (IP code) | IEC webstore | Available for purchase |
| AS/NZS 1170.2:2021 Structural design actions, Part 2: Wind actions | Standards NZ website | Available for purchase |
| IEEE 802.3af-2003 Standard for Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications – Data Terminal Equipment (DTE) Power Via Media Dependent Interface (MDI) | IEEE Standards Association website | Available for purchase |
| IEEE 802.3at Standard for Information technology – Local and metropolitan area networks – Specific requirement – Part 3: CSMA/CD Access Method and Physical Layer Specifications Amendment 3: Data Terminal Equipment (DTE) Power via the Media Dependent Interface (MDI) Enhancements | IEEE Standards Association website | Available for purchase |
| IEEE 802.3bt-2018 Standard for Ethernet Amendment 2: Physical Layer and Management Parameters for Power over Ethernet over 4 pairs | IEEE Standards Association website | Available for purchase |
| ONVIF Profile S Specification v1.3 Nov 2019 | ONVIF website | Publicly available |

7.2 Waka Kotahi standards, specifications and resources

7.2.1 Standards and specifications

See the [Waka Kotahi website](#) for the latest versions of the ITS design standards, delivery specifications and core requirements listed below.

| Document name |
|---------------|
| |

7.2.2 Resources

| Document name / code | Waka Kotahi website link |
|----------------------|--------------------------|
| | |

7.3 ITS standard drawings

See the [Waka Kotahi website](#) for the latest versions of the ITS standard drawings listed below.

| Drawing number |
|----------------|
| |

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8 CONTENT TO BE REDIRECTED

This section records any circumstances where content from this document will be reclassified and moved into future documents. This table is then updated with a reference to the new location.

| Section reference | Section name | Future document | Class |
|-------------------|--------------|-----------------|-------|
| | | | |
| | | | |

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9 FULL VERSION HISTORY

This table shows the full history of changes made to this document, both minor and major, in chronological order, since the document was first authored.

Minor versions are numbered 0.1, 0.2 etc until such point as the document is approved and published, then it becomes 1.0 (major version). Subsequent edited versions become 1.1, 1.2 etc, or if it's a major update 2.0, and so on.

| Version | Date | Author | Role and organisation | Reason |
|---------|------------|------------|-----------------------|--|
| 0.1 | 09/11/2021 | Gary Nates | Lead author, Beca Ltd | Draft for Waka Kotahi Expert Panel |
| 0.2 | 07/12/2021 | Final Word | Editorial services | Proofread latest version |
| 0.3 | 16/03/2022 | Gary Nates | Lead author, Beca Ltd | Draft response to Expert Panel workshop |
| 0.4 | 05/04/2022 | Final Word | Editorial services | Proofread latest version |
| 0.5 | 12/04/2022 | Gary Nates | Lead author, Beca Ltd | Response to Final Word comments |
| 0.6 | 19/04/2022 | Final Word | Editorial services | Further queries for author and ITS Working Group |
| 0.7 | 06/05/2022 | Gary Nates | Lead author, Beca Ltd | Response to Final Word comments |
| 0.8 | 18/10/2022 | Gary Nates | Lead author, Beca Ltd | Response to RCA and Security comments |