# CLOSED-CIRCUIT TELEVISION – WEB CAMERAS

Intelligent Transport Systems (ITS) Delivery Specification

22 MAY 2023
VERSION 1.0

New Zealand Government

New Zealand Government

# Contents

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# 1 DOCUMENT CONTROL

## 1.1 Document information

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| Document number | ITS-SPEC-CCTV-WEB-202304 |
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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 |
|---|---|---|---|
| 9/03/2023 | Endorsed by Technical Standards Committee | Technical Standards Committee | Waka Kotahi |
| 23/03/2023 | Recommended by Ratification Group to endorse this document | Ratification Group | Waka Kotahi |
| 24/04/2023 | Approved by NMPAS | Delegated approver | Waka Kotahi |
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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 | Updated by | Role and organisation | Reason |
|---------|------|-----------|----------------------|--------|
| 0.8 | 18/10/2022 | Gary Nates | Lead author, Beca Ltd | Draft version updated for industry consultation |
| 1.0 | 24/04/2023 | Anandita Pujara | Document Manager, Waka Kotahi | Ratified and approved version released |
| | | | | |
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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. |
| FINAL DRAFT (Pending ratification) | The document has been finalised and is pending approval and ratification by Waka Kotahi. It can be used for procurement at this status. |
| APPROVED | The document is an official Waka Kotahi document. Waka Kotahi projects and other road controlling authorities connected to Waka Kotahi back-end systems must include this document in the contracts. The obligation to follow the requirements in this document would come from the inclusion of the S&S document in the contract. |
| RETIRED | The document is obsolete, and/or superseded. |
| AC | Alternating current |
| CCTV | Closed-circuit television |
| dB | Decibels |
| DC | Direct current |
| DHCP | Dynamic Host Configuration Protocol |
| fps | Frames per second |
| HTTPS | Hypertext Transfer Protocol Secure |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronics Engineers |
| IP | Internet Protocol |
| ITS | Intelligent transport system |
| JPEG | Joint Photographic Experts Group (standard image format for containing lossy and compressed image data) |
| lux | Luminous intensity |
| Mb | Megabit |
| NMPAS | National Manager, Programme and Standards |
| NTP | Network Time Protocol |
| ONVIF | Open Network Video Interface Forum |
| PoE | Power over Ethernet |
| PTZ | Pan-tilt-zoom (camera) |
| S&S | Standards and specifications |
| SCP | Secure Copy Protocol |
| SFP | Small form-factor pluggable |
| SFTP | Secure File Transfer Protocol |

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| Term | Definition |
| --- | --- |
| SNMP | Simple Network Management Protocol |
| SSH | Secure Shell (protocol) |
| TCP | Transmission Control Protocol |
| TLS | Transport Layer Security (protocol) |
| USB | Universal Serial Bus |
| W | Watts |
| W/m² | Watts per square metre |
| WDR | Wide dynamic range |

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# 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 requirements for the procurement of closed-circuit television (CCTV) web cameras used primarily by Waka Kotahi to show traffic conditions to the public. These cameras are intended to be connected to the Waka Kotahi network environment. The target application of this document is SM031 and SM032 – State highway construction and maintenance contract proforma manuals.

Delivery assurance is managed through a series of delivery specifications that support procurement and systems integration. The specifications are designed to ensure:

i. the correct equipment is being procured
ii. the equipment will integrate with operational systems
iii. the equipment will deliver the correct functionality and performance requirements.

## 3.2 Overview

### 3.2.1 Definition

Web cameras provide the public with the ability to check captured images of traffic conditions from various websites. These cameras can be either:

i. dome cameras with the ability to pan, tilt and zoom (PTZ), but which are kept in a fixed position
ii. fixed cameras 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. dome cameras
ii. fixed cameras.

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

This delivery specification does not cover operational cameras, thermal cameras, infra-red cameras or any other forms of cameras.

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## 3.4 Outcomes

The critical outcome for web cameras is for the public to be able to view low-quality images of the transport network in order to provide enough information for users to make decisions about their journeys.

### 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.

### 3.4.2 For users of the transport network

Web cameras allow transport network users to make informed journey choices.

### 3.4.3 For road controlling authorities and transport operations centres

Web cameras allow transport network users to make informed journey choices, thereby reducing demand on the network.

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# 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.

#### 4.1.1.1    Minimum resolution

Cameras must provide a minimum resolution of 720 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 20fps 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.

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#### 4.1.4.2 Manual iris control

Cameras shall 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.

### 4.1.8 JPEG snapshot

All web cameras must provide the Joint Photographic Experts Group (JPEG) snapshot feature.

## 4.2 Zoom

### 4.2.1 Zoom operation

Dome cameras should provide zoom to enlarge objects beyond the lens focal point. This functionality is actioned at setup and is not required during normal operations.

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.

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#### 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.

## 4.3 Camera movement

Dome cameras must provide an angular movement in the horizontal plane (pan) and pitch in the vertical plane (tilt). This functionality is actioned at setup and not required during normal operations.

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 pan of 360° rotation.

### 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

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

### 4.3.3 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.

#### 4.3.3.1 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.

### 4.3.4 Preset positions

A minimum of 10 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.

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## 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    Security functions

### 4.5.1    Usernames and passwords

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

Cameras need to allow for the creation of new usernames.

#### 4.5.1.1    Characters

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

#### 4.5.1.2    Password length

The minimum password length must be 12 characters or more.

### 4.5.2    Logs

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

#### 4.5.2.1    Timestamps

All logs must be timestamped.

#### 4.5.2.2    Source IP address

All access logs must include the source Internet Protocol (IP) address.

#### 4.5.2.3    Authentication

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

#### 4.5.2.4    Log retention

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

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### 4.5.3    Time synchronisation

Cameras must allow time synchronisation through Network Time Protocol (NTP) servers.

#### 4.5.3.1    NTP servers

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

### 4.5.4    Firmware updates

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

#### 4.5.4.1    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. It is essential that materials and manufacturing processes take this into account.

Cameras shall be capable of continuous, normal operation (24 hours a day, 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 −5°C and +55°C
iii.  solar radiation with a value of up to 2000W/m² at direct sunlight, incident at an angle of 30° from the vertical
iv.   altitude up to 1000m
v.    humidity between +10% and +95% non-condensing
vi.   conditions, both permanent and temporary, that may be unique to the specified location, eg instances of thick smoke and electromagnetic interference
vii.  vibrations expected in the installed location
viii. marine environment.

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# 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 either:

i.   alternating current (AC)
ii.  direct current (DC).

Cameras may be powered by Power over Ethernet (PoE). PoE should be in addition to either AC or DC.

#### 6.2.1.1 PoE standards

PoE should meet one of the standards listed below in Table 1, based on the power requirements of the camera.

| Power requirement | PoE standard |
|---|---|
| up to 15W | IEEE 802.3af-2003 IEEE 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) |
| up to 30W | IEEE 802.3at-2009 IEEE 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 |
| up to 90W | IEEE 802.3bt-2018 IEEE Standard for Ethernet Amendment 2: Physical Layer and Management Parameters for Power over Ethernet over 4 Pairs |

*Table 1. Power over Ethernet (PoE) standards*

## 6.3 System integration

### 6.3.1 Camera protocol support

Cameras must be listed as compliant under the Open Network Video Interface Forum (ONVIF) Profile S Specification v1.3 protocol conformance. The camera manufacturer must be a member of the ONVIF alliance.

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### 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 Transmission Control Protocol/Internet Protocol (TCP/IP) network capable
ii. support Dynamic Host Configuration Protocol (DHCP) for IP address assignment.

### 6.3.4 HTTPS and SSH protocols

Cameras must provide Hypertext Transfer Protocol Secure (HTTPS) and Secure Shell (SSH) protocol.

### 6.3.5 SNMP

Cameras that use Simple Network Management Protocol (SNMP) must provide SNMPv3.

### 6.3.6 Network connectivity

Cameras must be able to be connected using either:

i.  RJ45 copper Ethernet, with a minimum of 100Mb per second (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

In addition, cameras must meet the following security requirements:

i.   Secure protocols – Any CCTV camera or system to be used within Waka Kotahi must be capable of using secure protocols like SSH, HTTPS, SNMPv3, Transport Layer Security (TLS) v1.2, and 802.1x port security.
ii.  Access management – All CCTV cameras and systems must be capable of complying with Waka Kotahi password criteria (upper case, lower case, special characters, numbers, and long string passwords).
iii. Logging – All CCTV cameras and systems must have the ability to provide access and event logs for security visibility.
iv.  Vulnerability management – All CCTV cameras and systems must be supported with software updates for known vulnerabilities and bugs.
v.   Access control – All CCTV cameras and systems must have management access filtering based on source IP addresses.
vi.  Secure transfer – All CCTV cameras and systems must have the capability to do secure backup using secure protocols like Secure Copy Protocol (SCP), Secure File Transfer Protocol (SFTP), etc.

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## 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 instructions, and a 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).

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# 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 provided by enclosures (IP code) | IEC webstore | Available for purchase |
| IEEE 802.3af-2003 IEEE 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-2009 IEEE 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 | IEEE Standards Association website | Available for purchase |
| IEEE 802.3bt-2018 IEEE 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 November 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 |
|---|---|
| | |

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## 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 |
| 0.9 | 10/02/2023 | Gary Nates | Lead author, Beca Ltd | Response to Industry briefing |
| 0.10 | 15/02/2023 | Matthew Bauer | Editor, Clear Edit NZ | Copyedit |
| 0.11 | 17/02/2023 | Gary Nates | Lead author, Beca Ltd | Response to editorial service |
| 0.12 | 22/02/2023 | Matthew Bauer | Editor, Clear Edit NZ | Proofread |
| 0.13 | 09/03/2023 | Anandita Pujara | Document Manager, Waka Kotahi | Updates as per security and technical standard committee comments |
| 0.14 | 18/05/2023 | Matthew Bauer | Editor, Clear Edit NZ | Proofread |
| 1.0 | 22/05/2023 | Anandita Pujara | Document Manager, Waka Kotahi | Released final approved version 1.0 |

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