June 2019

International Trends in Video Surveillance
Public transport gets smarter

Full Report

CONTENT

Video surveillance is a very common technology used in public transport, especially for security purposes. Surveys were conducted in 2015 and 2017-18 by UITP, together with industry expert Axis Communications, to public transport organisations to get an understanding of video surveillance in public transport. This report coves the findings of these surveys including international trends in terms of current usage, equipment, regulations, positive effects as well as potential barriers in using the

technology. The comparison of the 2015 and 2017-18 results allow an analysis of the evolution of this technology and gives an indication of future trends.

Many of the expectations reported following the 2015 survey have been realised, and in some areas the growth in the intervening years is quite staggering.

This report gives a full overview of the findings of the study and is divided into the following chapters:

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Conclusions

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Introduction

REPORTING CONVENTIONS

The following reporting conventions are applied:

- Only complete answers are taken into account in the figures and diagrams. If a responder did not complete a question, the result is not shown.

- Percentages reported in the graphs are percentages of total respondents, unless otherwise stated.

- Several diagrams show results from multiple choice questions. This will make the summary of answers more than 100% as one respondent may have chosen more than one answer:

  - Multiple choice questions are displayed using bar-charts

  - Single choice questions are displayed using pie- or donut- charts

- All diagrams use the comma (,) sign as separator for decimals.

RESPONDENTS – GEOGRAPHICAL COVERAGE

This full report contains input from 61 respondents in 30 countries. Most respondents come from Western Europe (67%), followed by Latin America (10%), Asia Pacific (7%), Middle East and North Africa (5%), North America (3%) and Central and Eastern Europe + Israel (3%), with a further 5% from miscellaneous or unspecified locations.
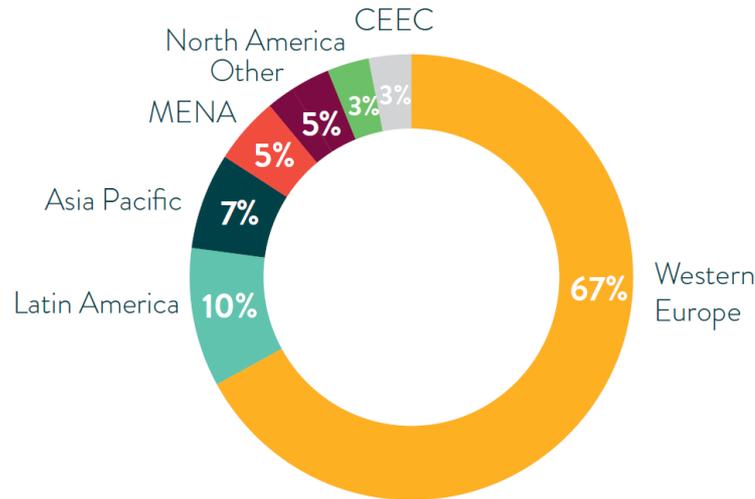
RESPONDENTS – PUBLIC TRANSPORT PROFILE

The majority of respondents are public transport operators (81%), with a number of public transport authorities also taking part (12%). A very small number of respondents are infrastructure owner/managers (7%).

Most respondents cover urban environments (93%), some of them exclusively, others also covering region, statewide or national areas too.

Respondent Profile

Legend: PTO, PTA, Infrastucture Managers

Zones

Legend: Exclusively urban, Exclusively non-urban
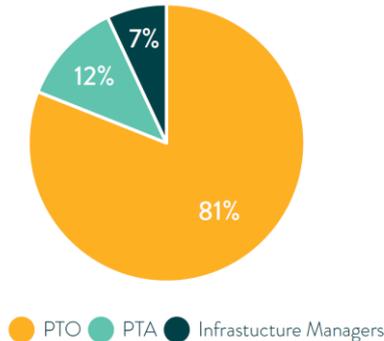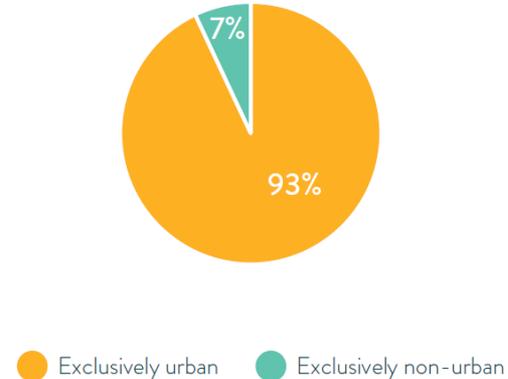
RESPONDENTS – TRANSPORT GROUPS AND MODES

Responders represent a variety of modes including bus/trolleybus, light rail/tram, metro, commuter rail, main line rail and ferry. Some were single mode operators however most operate two or more modes. The most common groups are a variety of surface operations (97,6%), followed by only metro (39,2%), and other rail-only (21,3%). Definitions of each mode can be found in annex.

Mode of Transport
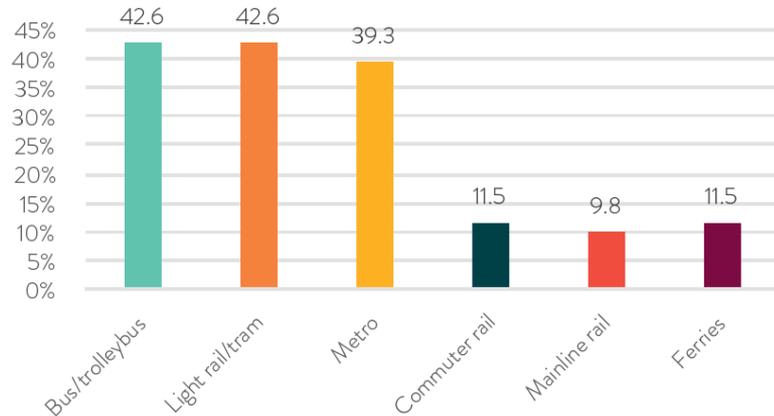
Mode aggregated
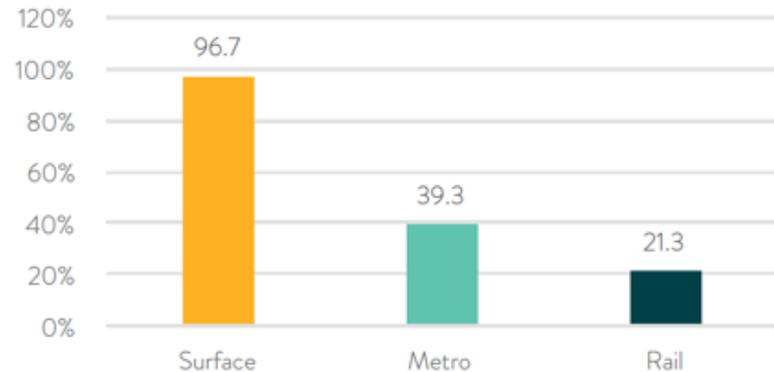
RESPONDENTS – JOB ROLES

Job roles

4%
7%
16%
12%
61%

- Security
- International relations
- IT/Communications
- Operations
- Other
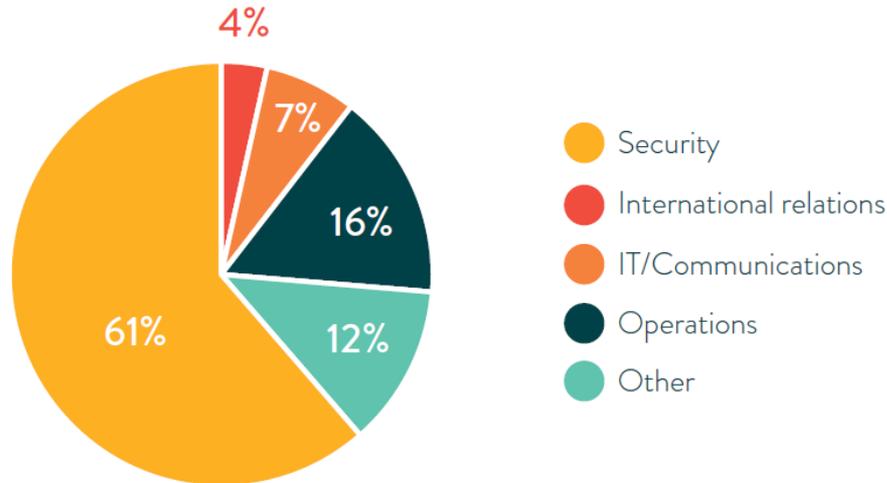
61% of respondents are from the security departments of their organisations.

The rest come from operations (16%), IT/Communications (7%), International relations (4%) and other (12%).

Equipment

MORE CAMERAS...

Number of cameras

Category	2015	2018
0-100	6.2	20.8
101-1,000	38.5	22.9
1,0001-5,000	38.5	31.3
5,0001-10,000	12.3	6.3
10,001+	4.5	18.7

● 2015   ● 2018
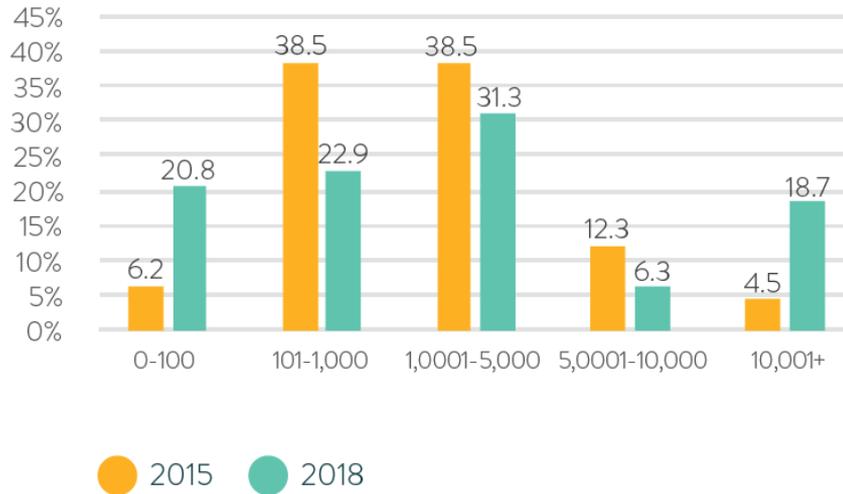
All respondents either have video surveillance installed today (95%) or plan to install it in the coming 12 months (5%). The number of cameras in the different transport networks varies widely. The largest total number of cameras reported by one respondent was 25,000. Indeed, the average number of cameras per network has increased almost 70%, from around 2,900 cameras to 4,900 cameras between 2015 and 2017-18. In the latest edition of the survey, 20% of respondents have reported to have 10,000 or more cameras, whereas only 5% of respondents did in the previous version, whilst the size of networks surveyed remains comparable.

" *Between 2015 and 2018, the average number of cameras per system surveyed has increased by almost 70%* "

ADVANCING PUBLIC TRANSPORT — UITP

AXIS COMMUNICATIONS

...IN MORE PLACES

The previous report pointed out that camera coverage concentrated on areas with passenger presence, as well as depots and rail yards. This continues to be true, however it seems that networks are covering a wider variety of locations. For example, the strongest growth can be seen at stops and along the infrastructure. Growth in installment on-board rolling stock, more technically challenging, is also notable, up to 90% from 76%.

Front-facing cameras (FFC) is a notable new trend (not featured in 2015 survey).


Category	2015	2018
Stations	81	86
On-board rolling stock	76	90
On-board rolling stock FFC[2]		65
Depots yards	70	85
Stops	32	77
Along infrastructure	50	78
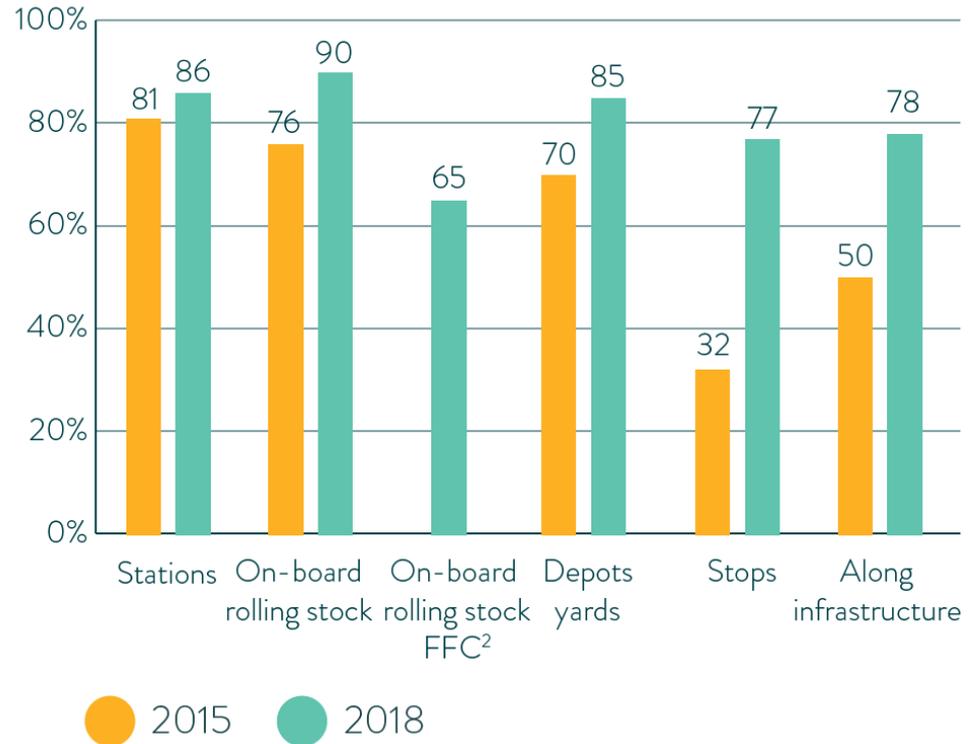
ORIGINAL PURPOSE

Purpose

Pie chart:
- 25% Security only
- 12% Operational only
- 63% Multipurpose
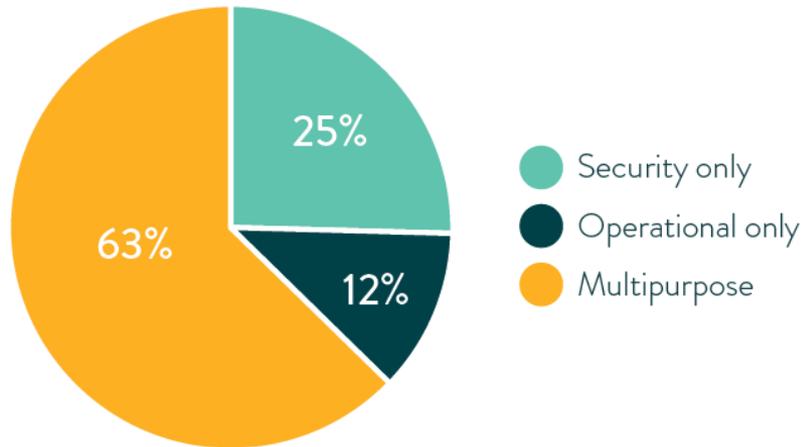
Surveillance systems in public transport are a key technology in terms of security. However, it is a multi-purpose tool. Indeed, nearly two thirds of respondents (63%) reveal that the original purpose of investing in the technology was for both security and other operational functions. 25% invested for security purposes alone compared to 12% for operational purposes alone.

Other operational functions mentioned include monitoring passenger flow, assisting personnel in monitoring boarding/alighting, general safety e.g. monitoring escalators, passenger counting and maintenance.

INVESTMENT PLANS

Most respondents (85%) have new surveillance system investment plans in the coming 12 months. Of those again, most (85%) will consider network/IP cameras. This is the same percentage reported in the 2015 survey.

This confirms a preference for network cameras for the future. However, it is important to note that legacy analogue cameras will clearly still have an important presence in public transport systems for the foreseeable future.

Installations are envisaged across the network and infrastructure but particularly within and/or around stations, at depots or yards and on-board rolling stock.

Fewer respondents have no investment plans compared to 2015.

Considering investing in IP

- Don't know
- No
- Yes

Investment plans

2015   2018
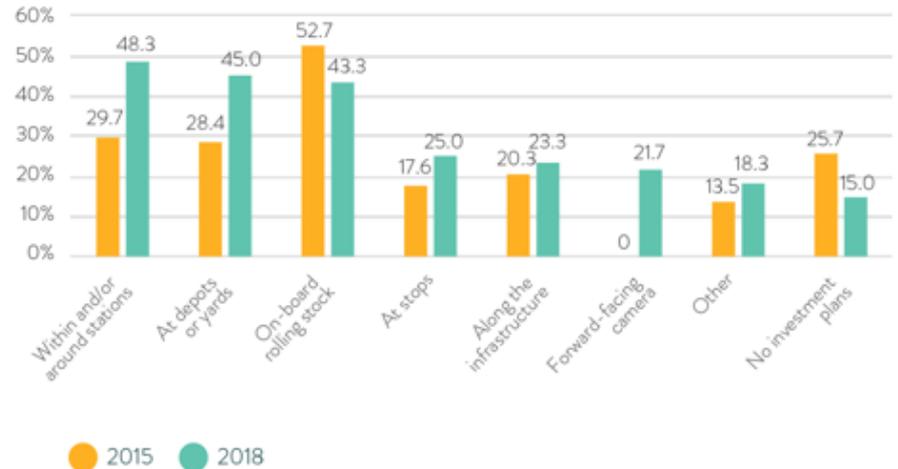
FUTURE INVESTMENT - TECHNOLOGY

With 85% of responders stating that they will consider network/IP cameras in the future, there is a clear migration trend from analogue cameras to hybrid systems to network/IP solutions. Even without installing network/IP cameras, analogue systems can be converted to network/IP systems by, for example, the use of video encoders.

Analogue → Hybrid → Network/IP

Migration path
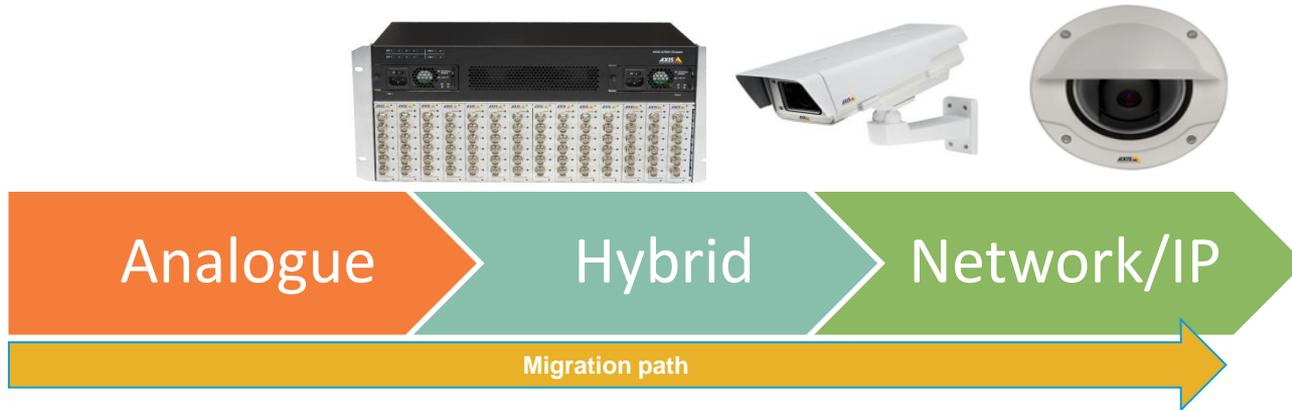
TYPE OF SURVEILLANCE CAMERA SYSTEM

Cameras can either be analogue or network/IP. Analogue cameras can also be adapted to the network using encoders. Compared to 2015, the number of public transport networks with only analogue cameras has decreased considerably (from 25% to 18%) as upgrades and new installations are increasingly digital. Those with purely digital systems has increased slightly (13% to 14%), and the biggest jump is in the share of hybrid systems, combining analogue cameras with IP or encoder-adapted cameras (55% to 68%).

The shift towards digital video surveillance systems is clear with 82% of respondents having a digital component to their systems.

Type of surveillance camera system

|	Analogue only	Hybrid	IP only
2015	25	55	13
2018	18	68	14

● 2015   ● 2018
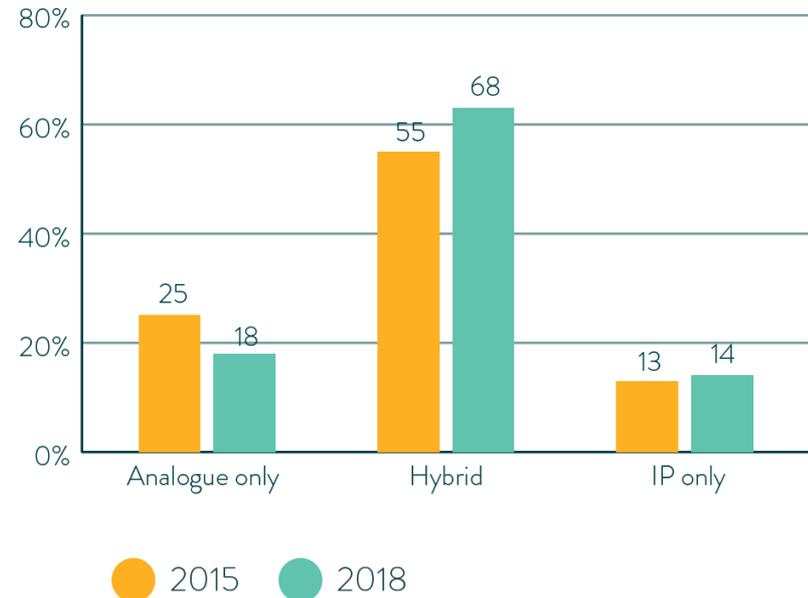
OBSTACLES

As for the obstacles of investing in new technology, almost a third (29,1%) of respondents report no obstacles at all, which was the most popular answer. A clear issue is the sheer size of systems, as the next popular answer with 27,3% was that system size means that the system can only be modernized in stages.

In the 2015 survey the questions were asked differently, meaning that a direct comparison is not possible. However, it is worth noting that the most popular answer in the previous version was that there were other investment priorities in the organisation (30,4%). This option only scored 18,2% in the new survey. This indicates that the added value of video surveillance is more accepted.

Another notable difference is "difficulties around getting funding" which scored 20,3% last time, double the 10,9% in today's survey.

- High costs compared to an analogue system
- No clear business case
- Other
- Conflicts with existing regulations or standardisation specifications
- Difficults getting funding
- Other investment priorities
- System size means modernise in stages
- No obstacles
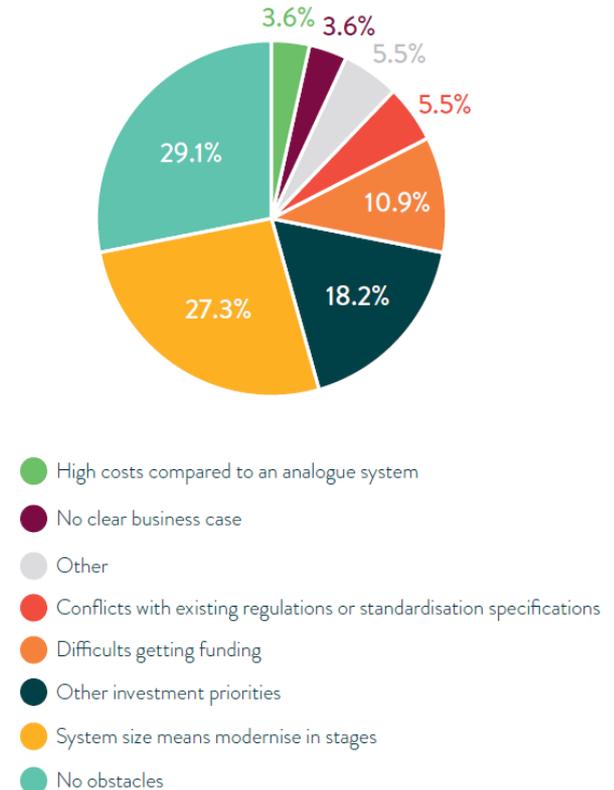
Usage

VIDEO RECORDINGS - LEGAL REQUIREMENTS

Minimum and maximum recording requirements
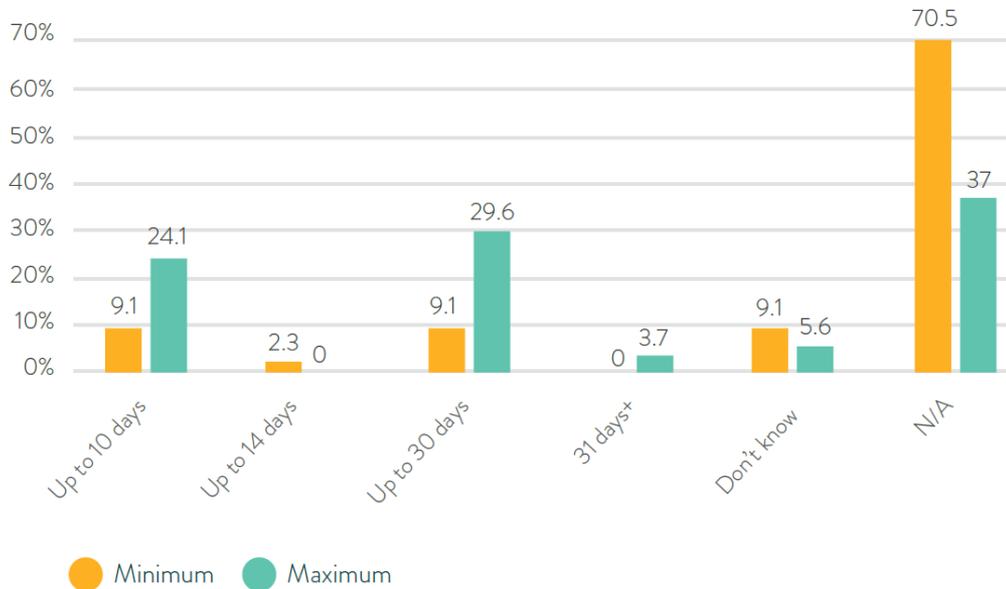
The recording of video is often regulated, either by imposing a minimum storage time of footage (29% of respondents have such a requirement), or by imposing a maximum storage time of footage (more common: up to 63% of respondents).

Among those with a maximum storage limit, 24,1% have a limit of up to 10 days and 29,6% have a limit of 30 days. It is rare to have a limit of over 30 days (4%).

It is interesting to look at the trends in terms of storing footage because it is a significant technical challenge.

VIDEO RECORDINGS – RECORDING PRACTICES

Recordings: fixed installations and onboard

Chart data:

Duration	Fixed installations	Onboard
Up to 2 days	14.3	29.4
Up to 7 days	24.5	41.2
Up to 14 days	16.3	5.9
Up to 30 days	34.7	21.6
30 days +	10.2	0

Legend: ● Fixed installations ● Onboard

Within the legal limitations described on the previous page, respondents reported differing recording practices for fixed installations compared to on-board camaras.

For fixed installations, the majority store recordings for 15-30 days (34,7%).

Unsurprisingly, recordings from on-board rolling stock tend to be shorter than recordings from fixed installations. The most popular answer onboard rolling stock was up to 7 days (41,2%).

REAL TIME USAGE

The term 'real-time' refers to viewing video live (monitoring) or using live video as a tool during an incident. Additionally video analytics can be added to support the detection of an incident. The usage of real-time surveillance is similar in stations, and on-board rolling stock. Big growth can been seen in depots and yards, at stops and along the infrastructure.

Looking at real-time planned in the coming 12 months, growth is expected in all locations but will be highest on-board rolling stock and forward-facing cameras (not shown on graph).

Real-time usage

	Stations	On-board rolling stock	On-board rolling stock FFC	Depots or yards	Stops	Along infrastructure
2015	76.6	27.0		60.8	32.4	25.7
2018	68.5	27.8	18.5	77.8	42.6	44.4
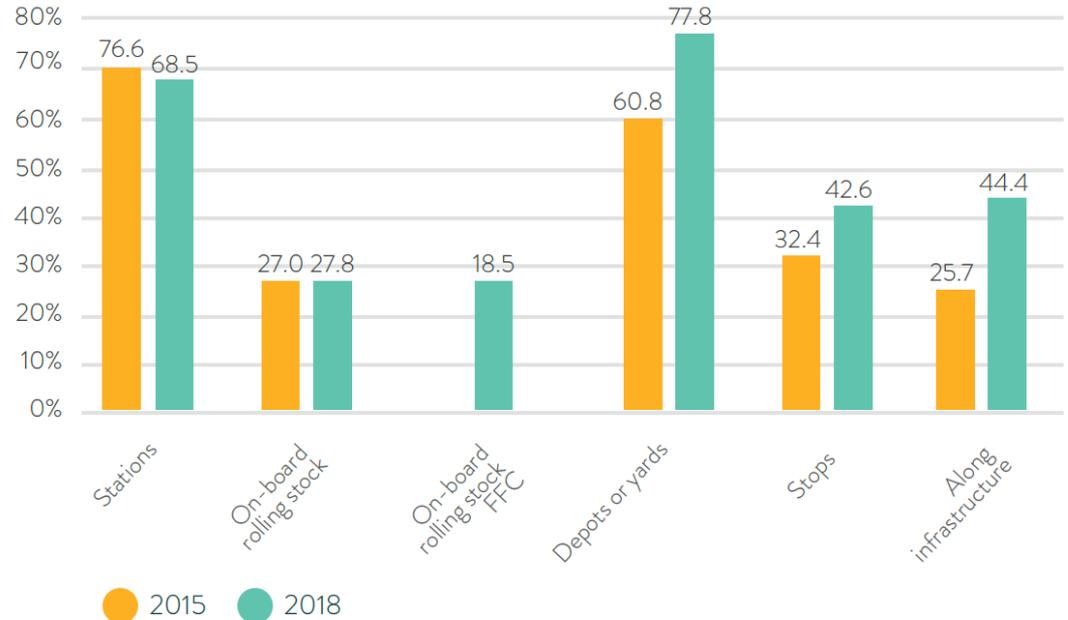
REAL-TIME USAGE – ANALOGUE VERSUS NETWORK/IP

It is also interesting to note the difference in usage between responders with analogue and respondents with network/IP systems.

For example, detection and response uses are more important for network/IP systems, whereas investigation and follow-up is more prevalent for analogue systems.

In terms of practical use, today video surveillance is considered most useful in increasing the **perception of security among passengers and staff**, as well as improving actual security levels by minimising, deterring and managing criminality such as theft, graffiti, vandalism, aggression, violence and so on.

Anti-terrorism did not rate highly as a potential use for video surveillance.

More details can be given in the "Values" section.

THE INCIDENT LIFECYCLE

The incident lifecycle can be characterised in five distinct phases. Video surveillance can play a role in each one. The first three take place in real-time during an incident. The latter two are forensic phases taking place post-incident.

Immediate detection

Traditionally, incidents are reported by passengers, staff or any of your security systems. Now, incidents can also be discovered automatically by an intelligent camera application.
This enables the cameras to send an automatic alert to the security center at the moment an incident occurs.

Common operating picture

The handover between security personnel and response personnel can be done by sending live video streams to mobile devices wirelessly. This gives everyone a common operating picture, where it's possible to continuously monitor how a situation potentially escalates or develops, and responders can prepare for arrival at the incident scene.

Incident playback and organizational learning

In the follow-up phase, video can be played back to review real incidents with staff. By discussing and studying recorded video, a learning organization is created where newer and experienced staff can benefit from shared thoughts from real incidents.

During incident　　　　　　*Post-Incident*

| Detection | Prioritization | Response | Investigation | Follow-up |

Visual assessment and identification

After detection, the incident needs to be prioritized against all other events happening at that time.
With clear video from every part of the transit system regardless of light and weather conditions, operators can make a visual assessment and decide on what action to take – in real-time.
Cameras deliver high-quality video to provide a clear view of the situation and valuable details of persons and objects.

Positive identification and valid evidence

Video evidence is key in investigating incidents and showing the actual scenario from many different angles.
It's vital for positively identifying people and avoiding any doubt of who did what.
In low-light stations or in very bright light, Cameras can adjust to still give high definition video.

# THE VALUE OF VIDEO SURVEILLANCE IN THE INCIDENT LIFECYCLE

There is a significant change comparing the 2015 and 2017-18 surveys in terms of the lifecycle.

Respondents were asked to rank the 5 phases with 1 being the least helpful and 5 being the most helpful.

In 2015, « investigation » was the most popular value. In 2017-8, the most popoular is « response ». Indeed, « investigation » is now the least popular usage.

This indicates the shift in the intervening years from a focus on *post-incident* use to a *real-time* use.

Lifecycle

	Detection	Prioritization	Response	Investigation	Follow-up
2015	2.5	1.6	1.3	3.0	1.5
2018	1.9	2.0	2.4	1.6	2.2

● 2015 ● 2018
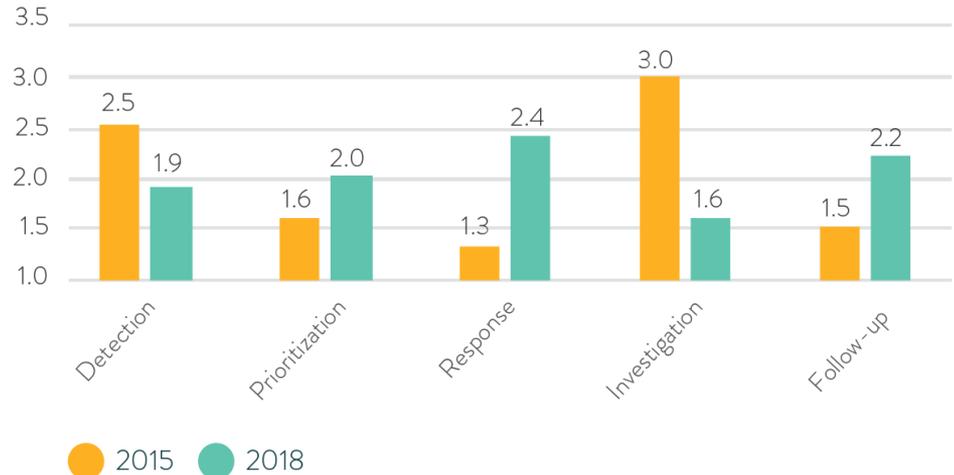
SHARING LIVE VIDEO

Sharing live video with other parties such as police or other authorities is very common. The sharing of live video is most frequent with central security centres, followed by operational control centres and police.

Massive growth can be seen in the sharing of video, both internally and externally, compared to 2015, particularly regarding "City surveillance centres" (10% to 22%), "Fire departments" (4% to 28%) and "Regional/national security centres" (5% to 12%). Additionally, it can be noted that more parties are being involved. In 2015, respondents shared video with an average of 3.04 parties. In 2017-18, the average is up to 3.4.

Chart data:

Category	2015	2018
Operational control centre(s)	58	77
Central security centre(s)	43	81
Station control centre(s)	41	61
Police organisations	42	70
City surveillance centre(s)	10	24
Region/national security	5	19
Fire department	7	33
Other	3	
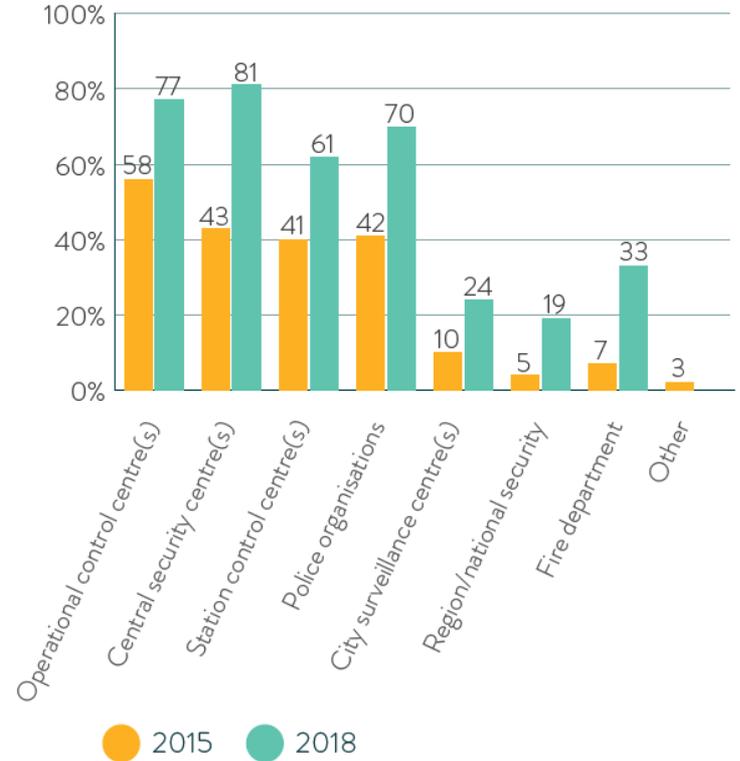
USE OF CAMERAS FOR OPERATIONAL PURPOSES - DEFINITIONS

Cameras can have a number of different uses other than simple surveillance:

Condition-based maintenance

Using cameras to inspect tunnel integrity (tracks, over-head lines, top cables etc).

Common situational picture

Joint evaluation of live camera pictures to coordinate actions between different stakeholders.

Driver assistance

Use of cameras with additional sensors (e.g. radar, lidar) for driver assistance e.g. automatic breaking.

Evidence search

Using camera snapshots to compare before/after situations.

Inspection/alarm verification

Remote visual inspection of a facility, including verification of alarms from sensors, locks etc.

Intervention planning

Sharing of live camera pictures with mobile devices to enable situational assessment for on-site teams.

Measurement and analysis

Intelligent cameras continuously measuring values, such as temperature, number of passengers etc.

USE OF CAMERAS FOR OPERATIONAL PURPOSES
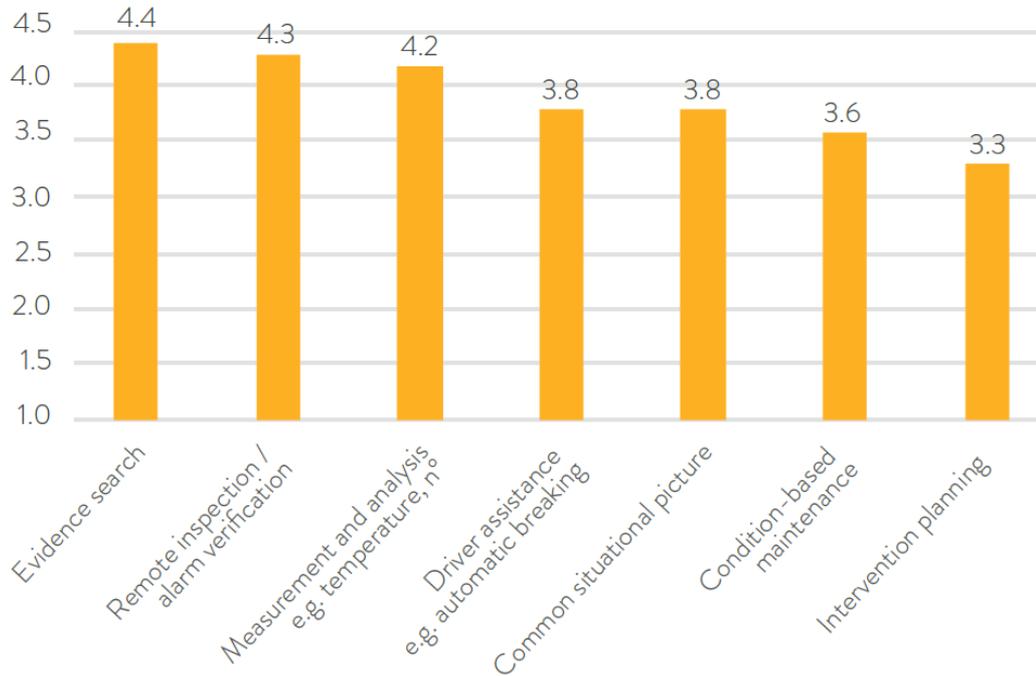
Respondents were asked to rate their interest in for each purpose with 1 being not at all interested and 6 being highly interested.

The most popular use is "evidence search", however all uses scored on average between 3,3 and 4,4, indicating a moderate level of interest in all uses.

ADDITIONAL CAMERA TECHNOLOGIES - DEFINITIONS

A number of other camera technologies are available:

Complex light
Identify details in complex lighting conditions with bright and dark areas at the same time.

Light extremes
Handle light extremes e.g. between strong sunlight during the day and very low-light needs during the night.

Low-light
Directly show life-like colours in very low-light situations without addition artificial light sources.

Tampering
Alert if the camera is tampered with, if camera position is moved or the lens covered.

Thermal heat
Use thermal heat radiation to "see" in any light, even complete darkness or through haze, dust rain, snow and smoke.

Vibrations
Mitigate image blurring from vibration and shaking, caused by wind or passing traffic.

ADDITIONAL CAMERA TECHNOLOGIES
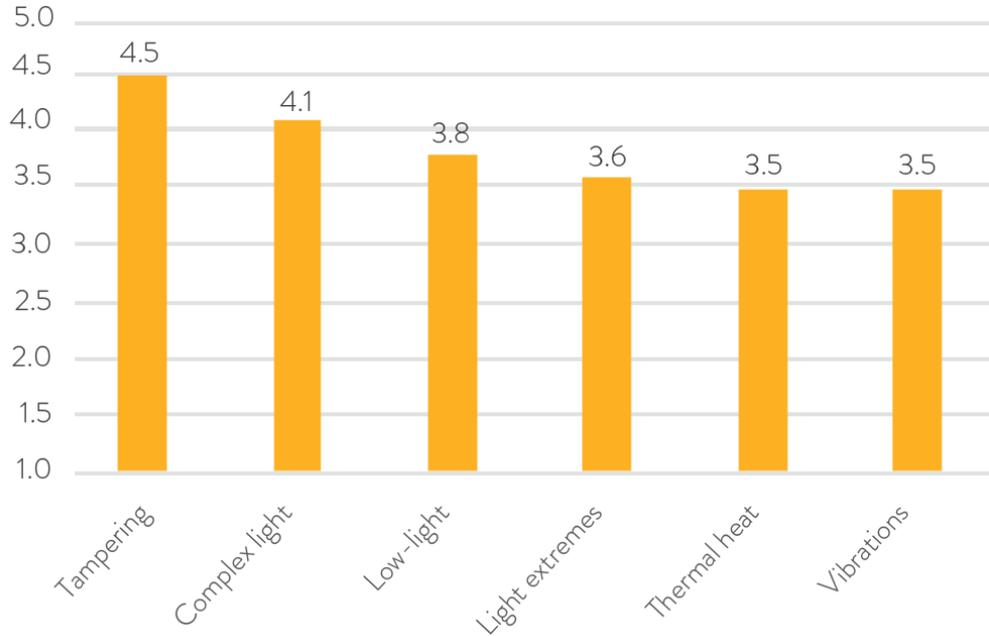
Respondents were asked to rate their interest in each camera technology with 1 being not at all interested and 6 being highly interested.

The most popular technology is "tampering", however all technologies scored on average between 3,5 and 4,5, indicating a moderate level of interest in all technologies.

Values

REASONS TO INSTALL SURVEILLANCE CAMERAS

Reasons to install surveillance cameras

Category	2015	2018
Increase actual security and safety	81.1	85.2
To minimize, deter and manage criminality	78.4	77.0
To help investigations of crime, injury, suicide, accidents	70.3	72.1
Increase perceived security and safety	68.9	67.2
To be prepared for possible terrorism	16.2	26.2
Meet legal requirements and policies	16.2	19.7
To reduce fare evasion	10.8	9.8
Other	1.4	4.9

● 2015   ● 2018
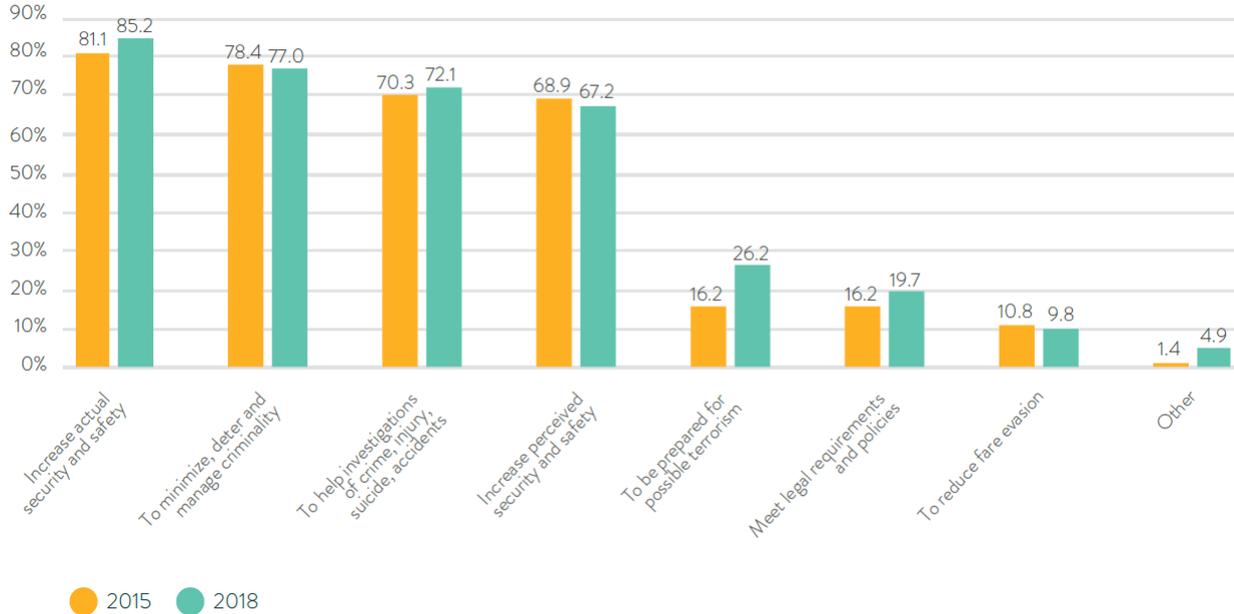
The first four clear motives to install video surveillance systems are stable between 2015 and 2017-18.

Even more than the classical investigation motive, respondents see the use of cameras as a means of deterrence and positively impacting the real and perceived security among passengers and staff.

To prepare for potential terrorism is the only category to see a significant increase, no doubt due to the number of terrorist acts which have unfortunately taken place over the last few years.

POSITIVE EFFECTS FROM VIDEO SURVEILLANCE SYSTEMS

There is a subtle but meaningful shift in the public perception of video surveillance between 2015 and 2017-18: Previously, the greatest positive effect of using video surveillance was the positive impact on the "perception" of security among passengers and staff, while now it is the improvement of actual security of passengers and staff itself. In other words, passengers and staff today not only feel safer when video surveillance is installed, they also benefit from higher levels of security in public transport thanks to video surveillance.

This implies a more active and proactive use of the technology to solve real problems in a way which is tangible for both staff and passengers, as opposed to a more passive role of the technology of the recent past.
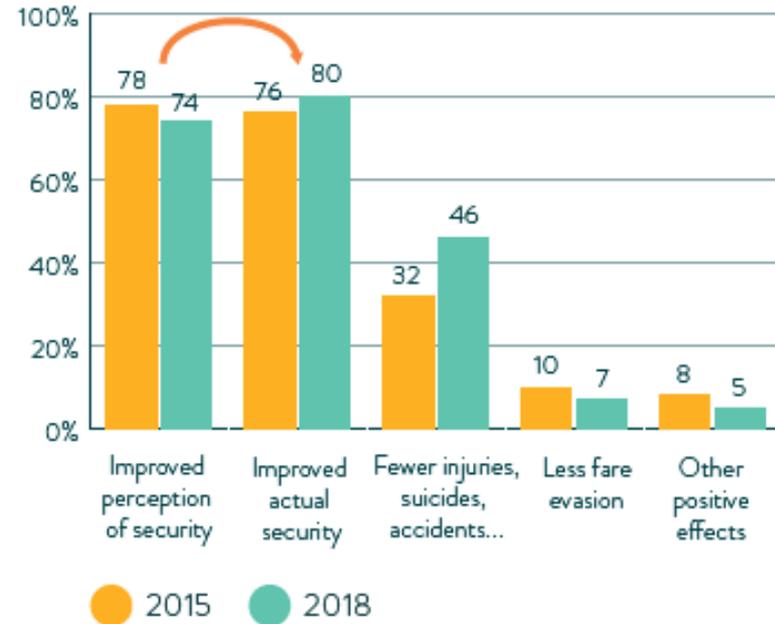
CHALLENGES

In terms of challenges, the most common problem in 2015 as well as 2017-18 is the difficulty in monitoring the large number of cameras in the public transport system (43%). This challenge out-shadows the others significantly.

Although not asked in the 2015 survey, large maintenance costs are also an issue.

Fear of surveillance systems interfering with the integrity of persons is less of an issue (3% down from 12%) whereas the frustration of the limited availability of real-time has grown, indicating the need for this capability.
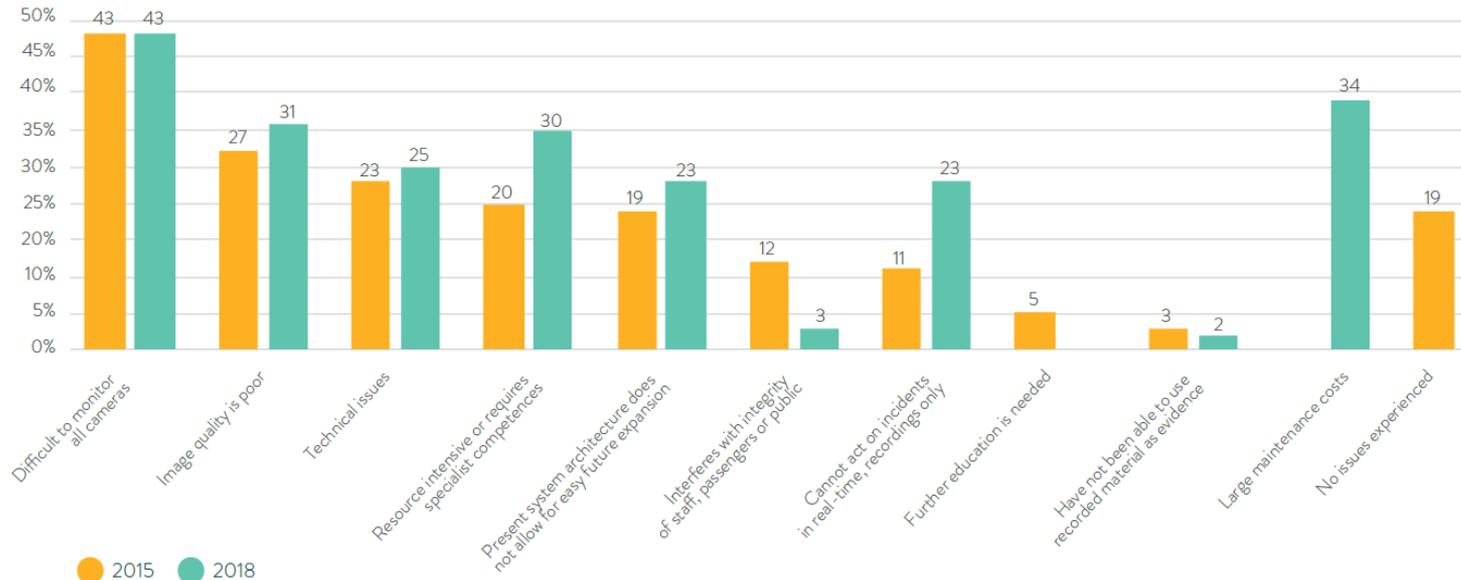
REACTION FROM PASSENGERS AND STAFF TO SURVEILLANCE SYSTEM

Passenger reactions
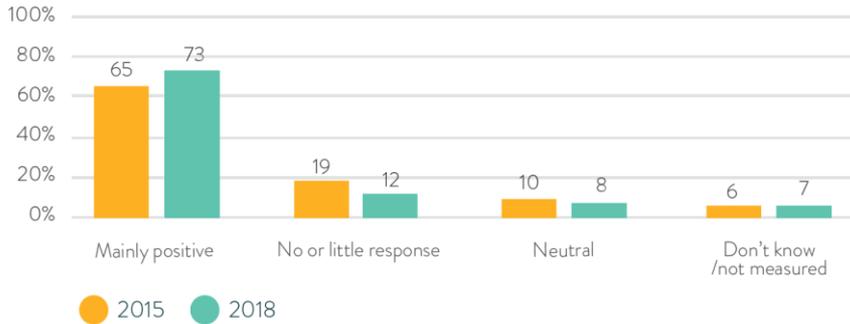
Passenger acceptance of video surveillance for security has always been rather high. Interestingly, public support for video surveillance has grown since 2015 (from 65% to 73%), whereas, by way of comparison, support from staff is stable on 78%. This may be due to the fact that investigation into some major high profile incidents involving public transport have been assisted thanks to footage from video surveillance in public transport systems. For example,

Staff reactions
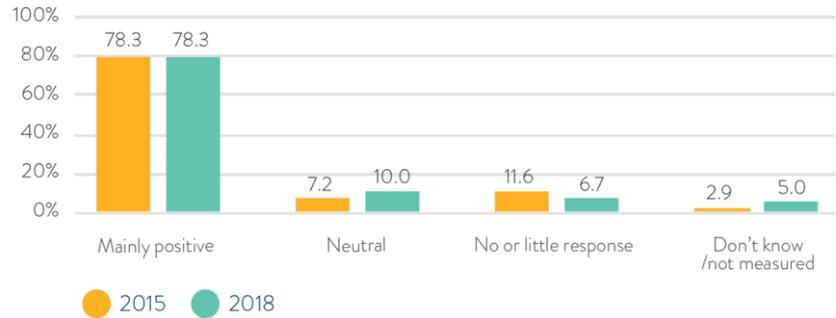
following the Brussels bombings of 22 March 2016, thanks to the video surveillance system, local operator STIB-MIVB quickly managed to identify the metro bomber as well as an accomplice, which gave valuable information to the police. Video surveillance systems were also instrumental for police interventions into the truck ramming in Berlin in December 2016 as well as the truck ramming in Stockholm in April 2017.

ANALYTICS - DEFINITIONS

The survey analyses awareness, present usage and future interest in video analytics to aid the respondents' video surveillance work. Video analytics is applications linked to or embedded in the surveillance system which send alerts when specific events are identified by the system. The applications included in this survey are defined as follows :

Aggression detection (through sound analysis): Sound analysis is made in the camera, by in real-time studying the pitch, tempo, echo effects and spectral shape of the sounds and thereby detecting possible verbal aggression which is notified to security operators. Sound analysis does not automatically mean that sound is recorded, should that be prohibited.

Automatic Number Plate Recognitions or License Plate Recognition (ANPR or LPR): uses optical character recognition technologies on images from primarily license plates, but also dangerous good (hazardous material) plates, container codes and UIC railway codes to automate the data processing of vehicles passing-by the camera.

Crowd panic behaviour detection: helps to identify mass panic situations during, for instance, urgent egress or emergencies.

Detect removal/stealing of goods: monitors objects in designated areas and triggers an alert when the object is removed.

Face recognition: can detect faces in real-time and compare them against as library of faces and if there is a match, send a notification to security operators. Also face recognition can be used in combination with access control to help determine that entrance is made by the person which the access credentials used, belongs to.

ANALYTICS – DEFINITIONS (2)

Fire & Smoke detection: smoke detection is an analytics which early identifies presence of smoke in the field of view of a camera and sends a notification to security operators. Cameras are often placed with a top→down view. Fire detection can be achieved by for instance thermal temperature alarm cameras that sends a notification to security operators when certain temperature values are met in the field of view of the camera. Video smoke detection and thermal temperature alarm cameras are complements to traditional fire & smoke detection systems for early warning.

Glass break detection (audio): Sound analysis is made in the camera by looking for predefined sound characteristics. Glass break detection warns for glass breakage during, for instance, vandalism, intrusion, break-ins or raids. Sound analysis does not automatically mean that sound is recorded, should that be prohibited.

Graffiti behavior detection: either detects a certain

human movement pattern (spraying) in the field of view of the camera, or audio analytics which triggers on the sound of spray cans in the nearby area of the camera and sends a notification to security operators.

Gunshot detection (audio): Sound analysis is made in the camera by matching with predefined sound characteristics. Gunshot detection recognises shots from a variety of firearms, including handguns, shotguns, rifles and automatic rifles. Sound analysis does not automatically mean that the sound is recorded, should that be prohibited.

Intrusion detection: detects if unwanted movement occurs within a designated area in the field of view of a camera. Can be used both indoor and outdoor to detect intrusion and send notification to security operators.

Left luggage detection: detects if an object is left in the field of view of the camera and sends a notification to security operators.

ANALYTICS – DEFINITIONS (3)

Loitering detection: determines if person(s) withholding themselves in the field of view of the camera during some time.

Perimeter breach detection: detects if a perimeter line is breached (for instance along a fence) and sends a notification to security operators. Often Thermal cameras are used, but also possible with "normal" cameras.

Rail track access detection: will determine if people are entering the rail tracks and send notification to security operators.

Sleeping driver detection: an automated in-vehicle analysis which helps prevent accidents caused by the driver getting drowsy due to fatigue.

Tailgating/Gate jumping: combination of analytics and integration to barrier gates and access control which can determine if a person is followed by another tailgating or if the ticketing gate is passed by without payment.

Overcrowding detection: evaluates the people occupancy level of certain areas in the field of a camera and sends a notification to security operators if a defined threshold value is achieved.

MASSIVE GROWTH IN CURRENT USE OF ANALYTICS

Analytics in use
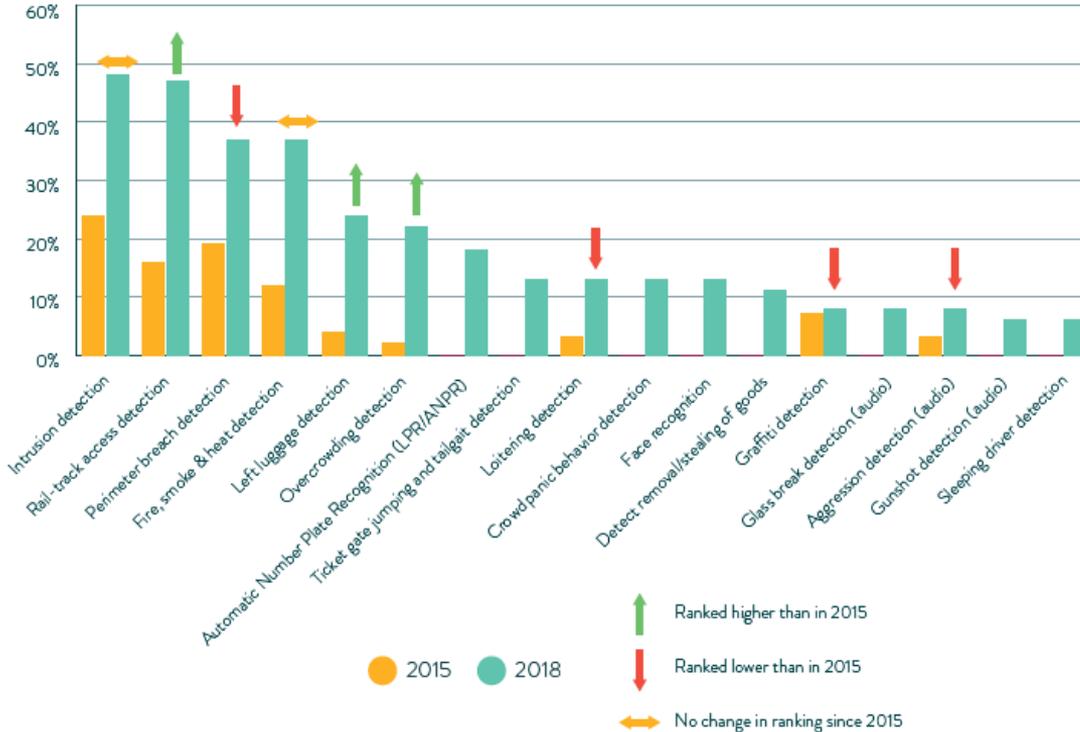
Among the most impressive areas of growth between the surveys concerns video and audio analytics and other advanced techniques currently in use. In 2015, a handful of such analytics were in use, and by a small number of respondents. By comparison, in 2017-18 all analytics mentioned in the survey are in use to a greater or lesser extent, with some of the most popular ones approaching 50% usage among respondents.

FUTURE INTEREST IN VIDEO ANALYTICS

In terms of future interest, it is worth noting which analytics score highest today compared to 2015. In the initial survey, "graffiti detection" topped the list, no doubt due to the prevalence of that particular issue at that time. Today, "intrusion detection", "fire, smoke and heat detection", "perimeter detection" and "overcrowding detection" are the front-runners. The arrows on the chart indicate the position of each analytic in terms of popularity between 2015 and 2017-8. So in the case of "face recognition" for instance, it has gone down from the 7th most popular analytic to the 14th most popular, even although 60% of respondents are now interested in the technology, compared to 50% in 2015. **The growth in this area is no doubt driven by the maturing of analytics, making them more usable and reliable.** Secondly, as sheer numbers of cameras are on the increase, it implies the necessity to invest in more intelligent management systems. Indeed, the greatest challenge mentioned by respondents is still the difficulty in overlooking and monitoring all cameras.

FUTURE INTEREST IN VIDEO ANALYTICS (2)

Analytics future interest

> " *Interest among respondents in analytics for the future use has grown in all instances.* "

Legend:
- 🟠 2015 🟢 2018
- ⬆ Ranked higher than in 2015
- ⬇ Ranked lower than in 2015
- ⬌ No change in ranking since 2015

Chart categories (left to right):
- Intrusion detection
- Fire, smoke & heat detection
- Perimeter breach detection
- Overcrowding detection
- Graffiti detection
- Crowd panic behavior detection
- Rail-track access detection
- Detect removal/stealing of goods
- Left luggage detection
- Aggression detection (audio)
- Loitering detection
- Gunshot detection (audio)
- Sleeping driver detection
- Face recognition
- Glass break detection (audio)
- Ticket gate jumping & tailgating detection
- Automatic Number Plate Recognition (LPR/ANPR)

UITP ADVANCING PUBLIC TRANSPORT

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CONCLUSIONS ON VIDEO ANALYTICS

The number one challenge with existing surveillance systems today remains the difficulty to monitor and overlook all cameras. Surveillance systems are made up of on average thousands of cameras in public transport networks.

Respondents are already shifting towards video surveillance being used in real-time to detect and solve incidents in real-time, rather than it simply being used as a post-event forensic tool.

The increasing maturity of analytics today is helping make this shift possible as the applications become more usable and reliable.

There has been massive growth in the update of analytics with usage at least doubling in most cases.

The most popular analytics (intrusion detection and rail-track access detection) are approaching 50% penetration rates among respondents.

Future interest in analytics is higher than ever and will no doubt continue to grow.

It is likely that this trend will have a noticeable impact on the ability to detect more incidents in a timely fashion and be able to respond accordingly, minimising their impact and further increasing the security of passengers, both real and perceived.

Conclusions

CONCLUSIONS

The findings of the 2015 report have been confirmed: a clear tendency towards the digitalisation of video surveillance networks, especially investment in real-time technology and analytics. This shift from post-incident to real-time is reflected strongly in the survey results.

The conclusion that legacy analogue cameras will continue to have an important presence for the foreseeable futures also remains valid.

The assumption that investment in real-time would allow greater opportunity for live feeds to be shared with third parties has certainly been proven. Indeed, the growth in sharing has surpassed all expectations.

The growth in sheer volume of cameras is quite remarkable, with the average number of cameras per respondent up 70%. Indeed, the main obstacles reported are related to this sheer volume, making it difficult and costly to manage such huge systems.

However, systems will continue to grow as more installations are planned.

This repeated survey clearly demonstrates that video surveillance is a widely used technology in public transport. It is a solution which is increasingly valued by staff as well as passengers.

These technologies are maturing rapidly. The potential to assist public transport organisations in real-time, as noted in 2015, is quickly becoming a reality.

Video surveillance will firmly remain a cornerstone technology in public transport and a positive example of how the digitalisation of the sector is bearing fruit.

UITP and Axis Communications would like to thank the respondents who took the time to complete the survey.

Annexes

ANNEX – TRANSPORT MODE DEFINITIONS

Bus/trolley bus

Bus: A rubber-tired vehicle normally designed and built to carry passengers on fixed routes on local urban, suburban and rural services. It is used in frequent stop service. A standard bus is 12 metres in length and has a low floor, but recently, 3 axles' 15 metre buses have been developed.

Trolleybus: A mode using bus type vehicles propelled by a motor drawing power from overhead wires via a connecting pole called a trolley from a central power source which is not on board the vehicle.

Light rail/tram: (Streetcar, tramway): permanently guided by at least one rail, operated in urban, suburban or regional environment with self-propelled vehicles and operated segregated or not segregated from general road traffic.

Metro: Metropolitan railway (metro, subway): A metro is an urban guided transport system, mostly on rails, running on an exclusive right-of-way without any interference from other traffic and mostly with some degree of drive automation and train protection. These design features allow high capacity trains to run with short headways and high commercial speed. Metros are therefore suitable for the carriage of high passenger flows. In different parts of the world metro systems are also known as the underground, subway or tube. Rail systems with specific construction issues operating on a segregated guideway (e.g. monorail, rack railways) are also treated as metros as long as they are designated to regular public passenger transport.

Commuter rail: (Regional rail, suburban rail): electric or diesel propelled railway for local short distance travel operating between a central city and adjacent suburbs. Intercity rail service is excluded.

Main line rail: Electric or diesel propelled railway for long distance, intercity or high speed rail services

Other, for example:

Cable car/funicular: An electric railway with individually controlled passenger cabins attached to an underneath moving cable and powered by engines or motors at a central location (not on board the vehicle). This type of transport is used for a line with a steep gradient.

Ferries: Ferryboat: A transport vehicle comprised of vessels carrying passengers and/or vehicles over water, and that are generally steam or diesel-powered. It may also be a hovercraft, hydrofoil or other highspeed vessel.
Water taxis: Small passenger-only ferries (about 15 metres or less) that may operate in both fixed route and on-demand service, depending on the time of day and patronage levels. They can load and unload very quickly and operate very frequently, sometimes to several different points.

Surface: bus/trolleybus + light rail/tram

Rail: commuter rail + main line rail

ABOUT THE AUTHORS

UITP

The International Association of Public Transport (UITP) is a passionate champion of sustainable urban mobility and is the only worldwide network to bring together all public transport stakeholders and all sustainable transport modes.

We have 1,600 member companies giving access to 18,000 contacts from 99 countries. Our members are public transport authorities and operators, policy decision-makers, research institutes and the public transport supply and service industry.

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Axis Communications

Axis enables a smarter and safer world by creating network solutions that provide insights for improving security and new ways of doing business.

As the industry leader in network video, Axis offers products and services for video surveillance and analytics, access control, and audio systems.

Axis has more than 3,000 dedicated employees in over 50 countries and collaborates with partners worldwide to deliver customer solutions.

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