INTRODUCTION

Video surveillance is a very common technology used in public transport, especially for security purposes. UITP, together with industry expert Axis Communications, conducted a survey among public transport organisations to get an understanding of video surveillance in public transport, particularly for security. The survey was conducted between April and September 2015. This report gives a full overview of the findings of the study and is divided into the following seven chapters covering 30 different topics:

- Introduction
- Equipment
- Usage
- Regulation
- Values
- Analytics
- Conclusions

A Statistics Brief was published in June 2015 with a summary of the main findings:
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 responders, 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.
  - All results are displayed with one decimal point throughout the report.
RESPONDERS – GEOGRAPHICAL COVERAGE

This full report contains input from 74 responders in 30 countries. Most responders come from Western Europe (56.8%), followed by Asia Pacific (13.5%), Central and Eastern Europe (10.8%), North America (10.8%), Latin America (6.8%) and other (1.4%). The majority of responders (83.8%) are from developed countries according to the OECD Market Classification.
The majority of responders are public transport operators (73.0%), with a number of public transport authorities also taking part (21.6%). A very small number of responders are infrastructure owner/managers or separate station owners (5.5%).

The largest group of responders operate in urban environments (63.5%). Together with the second largest group which bridges out urban areas to other zones, together they make up 87.8% of responders. The remainder operate in regional and/or national zones.
Responders cover 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 (71.6%), followed by only metro (39.2%), and other rail (16.2%). Definitions of each mode can be found in annex.

**Mode of Transport**

- Bus / Trolley bus: 60.8%
- Light rail / Tram: 48.6%
- Metro: 39.2%
- Commuter rail: 16.2%
- Ferries: 10.8%
- Main line rail: 5.4%
- Other: 2.7%

**Groups of Transport**

- Surface: 71.6%
- Metro: 39.2%
- Rail: 16.2%
51.3% of responders are from the security departments of their organisations.
40.5% of the responders had roles outside of security, such as operations.
8.1% of respondents work in IT or communications.
Equipment
Almost all responders have video surveillance installed today (97.3%). The number of cameras in the different transport networks varies widely. No correlation was noted between the size, mode or any other defining feature of a network and the number of cameras installed. However on average, the number of cameras is in the thousands for most operators. The highest reported number from one single network is 22,000.

Cameras can either be analogue or network/IP:
• Analogue: CCTV cameras with analogue signals
• Network/IP: digital, high quality image cameras, connected via IP networks

“Hybrid” surveillance systems contain a mix of these two types. About two thirds (67.3%) of respondents report that they have network/IP cameras as part of their surveillance systems today. Over half (52.9%) of the responders have a hybrid surveillance system. Another quarter (25.7%) of the responders are still using solely analogue cameras.
74.3% of responders have new surveillance system investment plans in the coming 12 months. 85.3% will consider network/IP cameras. 13.2% are uncertain but approximately half of this group do not have any investment plans in any case in the coming year.

This clearly shows 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.

Surveillance camera investment plans

- 74.3% New surveillance camera investment plans within 12 months
- 25.7% No new surveillance camera investment plans within 12 months

Will you consider network/IP cameras in the future?

- 85.3% No
- 13.2% Yes
- 1.5% Don't know
With 85.3% 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.
When acquiring new surveillance systems, the decision-making process is complex and different approaches exist in terms of which stakeholders are involved, with 2 or 3 often implicated.

Management buy-in and sign-off from top management and operational management is noticeably high and represent the top two groups of decision-makers. This confirms the extent to which video surveillance is of importance in public transport, both in terms of usage and in terms of the level of investment needed.

Unsurprisingly, security management and IT/Communication management were the next largest group of decision-makers, because security and IT ideally work together to create modern surveillance systems.
In practical terms, 39.7% of responders consider video surveillance a core asset and so have in-house competences to manage independently the acquisition of new systems. 27.9% of responders rely on system integrators, at least partially. 14.7% work directly with surveillance camera manufacturers for expertise. The use of consultants is noticeably less than the three other alternatives (10.3%).

**Investment approach**

- We act independently with the competence in-house
- We work with system integrators
- We approach surveillance camera manufacturers to help us
- We commission consultants to specify future surveillance systems
- We are looking for a public transport association to help us with recommendations
- Other
As for the barriers of investing in new technology, responders report “other priorities within their organisation” (30.4%) and “difficulty in getting funding” (20.3%) as the two largest categories of obstacles.

Approximately three quarters of responders that replied “No clear business case” have analogue cameras in their surveillance systems today.

Biggest obstacles

- Other priorities within the organization
- Difficulties around getting funding for public procurement
- No clear business case (never seen a TCO or ROI)
- Information technology department collaboration (IT-dept.)
- System integrator recommendations or scope of competence
- Do not understand the technology well enough to procure a modern system
- Other
Almost all responders do have surveillance cameras installed in their systems with only 2.7% of responders stating that they did not. Video surveillance is certainly one of the most widespread technologies used for security in public transport. Cameras are predominantly installed at stations (81.0%), onboard rolling stock (75.6%) and at depots and rail yards (70.2%).
Video footage can either be recorded, viewed in real-time, or both. Video in stations and on-board rolling stock and at depots and rail yards is very often recorded (72.6%, 71.6% and 56.7% respectively) and video data is stored for a determined period of time. The majority of recordings from stations will be from public areas such as public station areas and platforms, i.e. areas where large numbers of customers gather. Depots and rail yards do not typically have passenger presence, however recording here is popular due to the fact that it is where valuable assets are stored.
Cameras are often specifically targeted at areas with high passenger volumes such as public station areas (74.3%) and on platforms (63.5%).

They can also target key areas where it is useful to have video in case of problems (ticket gates, help points, escalators, each 47.3%, in elevators (39.2%).

Cameras can also be found, although to a lesser extent, in non-public areas (staff entrances 41.9%, tunnel entrances 31.1%).
Video recordings from cameras in stations generally mirror camera placement, with most recordings seen at public station areas (67.6%) and on platforms (56.8%).

However, escalators and elevators are more popular for recordings (47.3% and 37.8% respectively), whereas ticket gates and staff entrances are less popular (40.5% and 36.5% respectively).
Cameras can also be found, although to a lesser extent, in other non-public areas such along the infrastructure, mostly positioned at crossings (32.4%), along the infrastructure (24.3%), inside tunnels (18.9%) and at bridges (6.8%).

These figures are significantly lower than the figures in stations, however note that not all responders have tunnels or bridges as part of their assets.
VIDEO RECORDINGS - INFRASTRUCTURE

Fewer still are the video recordings made from cameras at the infrastructure. The three main areas with recordings are at crossings (23,0%), along the infrastructure (17,6%) and inside tunnels (14,9%).
CAMERA PLACEMENT IN THE COMING YEAR

In general more than half (52.7%) of responders reported that video surveillance would be installed onboard rolling stock in the coming 12 months which suggests that onboard cameras will become more common. Other parts of the system (stations, depots etc) will also see more cameras installed and only a quarter of responders do not plan any investments in video surveillance at all in the next 12 months.

Surveillance investment plans

NB the 25.7% with no new surveillance camera plans within 12 months is added to this graph for comparative reasons.
The wide placement and usage of cameras in the transport system as well as recordings of the video suggests that video surveillance systems are key to improving public transport security. The research confirms and shows a strong correlation between camera placements and video recordings.

<table>
<thead>
<tr>
<th></th>
<th>Cameras exist</th>
<th>Recordings are being made and stored</th>
</tr>
</thead>
<tbody>
<tr>
<td>At stations</td>
<td>81,0%</td>
<td>71,6%</td>
</tr>
<tr>
<td>Onboard rolling stock</td>
<td>75,6%</td>
<td>71,6%</td>
</tr>
<tr>
<td>At depots and rail yards</td>
<td>70,2%</td>
<td>56,7%</td>
</tr>
<tr>
<td>Along the infrastructure</td>
<td>50,0%</td>
<td>39,2%</td>
</tr>
<tr>
<td>At stops</td>
<td>32,4%</td>
<td>25,7%</td>
</tr>
</tbody>
</table>

The wide placement and usage of cameras in the transport system as well as recordings of the video suggests that video surveillance systems are key to improving public transport security. The research confirms and shows a strong correlation between camera placements and video recordings.
REAL-TIME USAGE TODAY AND TOMORROW

Real-time usage of video surveillance is 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.

Today, real-time usage of video footage is noticeably higher in static locations (stations (71.6%), depots and rail yards (60.8%)). Less common is real-time surveillance onboard rolling stock with 27% of responders using this.

In the future, about a quarter (26.1%) plan to increase the use of real-time usage and another quarter (24.6%) will not have real-time use at all.

15.9% of responders report using cameras in real-time everywhere.

Plans to act on incidents in real-time

Camera usage in real-time today

- Yes, same as today
- Yes, more than today
- Yes, everywhere
- No

- Around stations
- At depots or rail yards
- At stops
- Onboard rolling stock
- Along the infrastructure
- Nowhere
- Other area
It is also interesting to note the difference in usage between responders with analogue and responders 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. Terrorism did not rate highly as a potential use for video surveillance.

More details can be given in the “Values” section.
The incident lifecycle can be characterized in six distinct phases. Video surveillance can play a role in each one. The first four 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.

**Detection**

**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.

**Prioritization**

**During incident**

**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.

**Response**

**Main search and re-evaluation tool**  
As an incident evolves and changes, video is the key to scanning and re-evaluating the incident. For instance, if a suspect leaves the scene, live and recorded video can be viewed to aid in the search for people involved. Access to relevant video makes it possible to quickly re-prioritize actions and response while keeping everyone informed.

**Re-prioritization**

**Post-Incident**

**Investigation**

**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.

**Follow-up**

**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.
In terms of the life-cycle of an incident, using video footage for investigations into crime, injury, suicide, accidents and so on is considered useful. Indeed, the vast majority (86%) find this forensic element the most valuable concrete use. Detection in real-time of incidents also scored highly (72%), indicating this is an upcoming trend.
Most responders reported that video surveillance is firmly a cross-functional tool, used for safety and operational purposes on top of security. For both safety and security incidents, responders collaborate with a variety of external stakeholders such as police (particularly for security incidents), other authorities and other public transport operators.

CROSS-FUNCTIONAL TOOL

<table>
<thead>
<tr>
<th>Stakeholders &amp; safety incidents</th>
<th>Stakeholders &amp; security incidents</th>
<th>Stakeholders &amp; operational issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total 79,7%</td>
<td>Total 77,0%</td>
<td>Total 78,4%</td>
</tr>
<tr>
<td>36,5%</td>
<td>68,9%</td>
<td>14,9%</td>
</tr>
<tr>
<td>18,9%</td>
<td>18,9%</td>
<td>12,2%</td>
</tr>
<tr>
<td>10,8%</td>
<td>12,2%</td>
<td>10,8%</td>
</tr>
<tr>
<td>1,4%</td>
<td>4,1%</td>
<td>0,0%</td>
</tr>
<tr>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Sharing live video with other parties such as police or other authorities is very common. The sharing of live video is most frequent with operational control centres followed by central security centres and stations control centres. Police organisations are also a video sharing partner (37.8%). In some countries a specific transport police is present. If results are viewed looking at sharing with all police organisations, dedicated to transport or not, the consolidated data on video sharing is in parity with the previous group of control centres. The collaboration with police in is the one that will show the biggest increase in the coming years (up 4.1%).
Regulation
The legal situations regarding video surveillance vary widely from country to country. 38.2% of responders reported that surveillance monitoring is a legal requirement. For the 61.8% for whom it is not a legal requirement, it may still be further regulated when used in different ways.

For the regulated group, regulations tend to cover predominantly passenger areas: stations (96.2%), onboard vehicles (84.6%).

Where surveillance monitoring is a legal requirement (% of Yes responses)

- At stations: 96.2%
- On rolling stock: 84.6%
- Along the infrastructure: 65.4%
Public transport is a complex environment and the borders between the normal open (city) society and the public transport environment are many and often ambiguous. For more than a third, surveillance outside the property of the public transport system is not allowed, and a further third would need specific permits for this. For 20.8%, permits for surveillance outside of its property is included in their granted permissions.

**Surveillance outside of our property (% of all respondents)**

- Needs additional legal permits: 36.1%
- Is not allowed: 36.1%
- Is included in our granted permissions: 20.8%
In terms of the recording of video, 100% responders report that the recording of video footage is allowed, but almost all of those are subject to additional regulation: limited storage/retention time (ranging from 48h to 100 days) at 41,2%, certain areas only at 13,4%, for police usage only at 11,3% and other regulations (34,0%). Only 10,4% of responders have no legal limitations at all.
Using sound input with surveillance is an effective addition during incidents and can add additional evidence material. At the same time, it is sometimes considered more invasive of personal integrity. Sound input is permitted for 65.6% of responders, with no limitations for 12.5% of those. However, for the vast majority, there are legal regulations in terms of usage: storage and retention time (40.7%), certain areas only (17.5%) and police usage only (7.5%). For approximately a third (34.4%), sound input is not allowed at all.
When video surveillance is used as formal evidence in court, the quality of the material is important. For 66.7% of responders the quality of video to be valid evidence in court is regulated in some way, mainly either by law or by police directives. This gives assurance to the public transport organisation that video can be used as evidence. Different standards exist in different parts of the world in terms of the quality of images for court use. Local regulations on quality of image and/or sound for court use are widespread and very helpful in maximizing added-value of surveillance systems. Regulations are also in place to protect the privacy of citizens and staff and this is essential in many cultures for such systems to be accepted.
Values
There are four clear motives why surveillance systems are installed. Even more than the classical investigation motive, responders see the use of cameras as a means of deterrence and positively impacting the real and perceived security among passengers and staff.
POSITIVE EFFECTS FROM VIDEO SURVEILLANCE SYSTEM

Indeed, for the vast majority of responders, it is the increase of actual and perceived security, as well as minimising, deterring and managing various types of criminality, which are the biggest gains with all three categories scoring above 70%.

A third (32.4%) of responders mentioned helping investigations into crimes, injuries, suicides and accidents, including disproving false claims.

Reducing fare evasion was only relevant for a small minority (9.5%).
In terms of challenges, the most common problem of existing systems is the difficulty in monitoring the large number of cameras in the public transport system (43.2%). Afterwards came a wide variety of issues including poor image quality (27.0%), technical issues with the system (23.0%), resource intensive or requiring special competences (20.3%) and the fact that present system architecture does not allow for easy expansion of the system (18.9%). 18.9% reported no challenges negative effects at all.

In terms of image quality, it is interesting to note that 54.5% of responders with analogue systems reported poor image quality as a problem, compared to only 16.7% of responders with network/IP systems. However, this observation is not statistically sound due to too few responses from IP-only networks.
Staff is generally very positive towards the use of video surveillance with 78.3% indicating positive reactions from staff, especially when usage of the system is well communicated to staff. This goes up to 85.5% when including neutral reactions from staff. Not all responders measure the reaction of staff in this matter but of those that do, 0% of responders reported a negative reaction.

In terms of passenger attitudes, almost two thirds (64.7%) report positive reactions, with this figure going up to 75.0% when including neutral reactions. Of the 75% of responders who systematically measure passenger reactions in this area, 0% of responders reported negative attitudes from passengers.
When comparing staff and passenger reactions, it is interesting to point out that it is staff which is the most appreciative of surveillance systems, with 78.3% of staff positive compared to 64.7% of passengers. More than three quarters (76.8%) responded that passengers and staff would probably feel even more secure with surveillance systems used proactively to react in real-time to incidents.

Responders opinion on passengers and staff perception of proactive video use in real-time

- 76.8% Yes
- 18.8% Don't know
- 4.3% No
ANALYTICS - DEFINITIONS

The survey analyses awareness, present usage and future interest in video analytics to aid the responders’ 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:

**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.

**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.

**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.

**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.
ANALYTICS - DEFINITIONS

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

**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.

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

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

**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.

**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.

**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.
The awareness of analytics in general is very high between 35.5 – 79.1% of the responders. The different analytics can be put together in four distinct groups in terms of awareness:

- First group ~80%: intrusion, perimeter breach, face recognition
- Second group ~66%: rail track access, fire & smoke, left luggage, overcrowding
- Third group ~50+: graffiti behaviour, ticket gate jumping
- Fourth group <40%: aggression, tailgating, loitering
VIDEO ANALYTICS ALREADY IN USE TODAY

Five analytics stand out in terms of current usage, ranging from 6.8-25.0% of usage among responders: intrusion detection, perimeter breach detection, rail track access detection, fire & smoke detection and graffiti behaviour detection.

Analytics already in use

- Intrusion detection: 25.0%
- Perimeter breach detection: 20.0%
- Rail track access detection: 15.5%
- Fire & Smoke detection: 12.1%
- Graffiti behaviour detection: 6.8%
- Left luggage detection: 3.6%
- Loitering detection: 3.5%
- Aggression detection (through sound analysis): 3.4%
- Overcrowding detection: 1.7%
- Face recognition: 0.0%
- Tailgating detection (following someone through a ticket gate): 0.0%
- Ticket gate jumping: 0.0%
- Total: 100.0%
Future interest in video analytics amongst the responders is high: approximately half of the responders have answered that they are interested in using them moving forward.

Three groups of interest for future use can be noted:

First group: ~60%: graffiti behaviour, fire & smoke, left luggage, overcrowding
Second group: ~50%: perimeter breach, intrusion, face recognition, aggression, rail track access, loitering
Third group: ~30%: ticket gate jumping, tailgating
The number one challenge with existing surveillance systems today is the difficulty to monitor and overlook all cameras. Surveillance systems are made up of on average thousands of cameras in public transport networks.

One of the greatest values of video surveillance in the incident life cycle is regarding the detection phase, according to the research.

Today, public transport organisations are well aware of video analytics. 75% of the listed video analytics are known by over half of the responders.

To date they have mostly analytics in use which highlight and alert unwanted access into particular areas, like intrusion detection, perimeter breach detection and rail-track access detection.

From an analytics perspective these analytics are well defined and broadly used in many industry sectors.

Moving forward, to address the key challenge of monitoring and overlooking the large amount of cameras, and further adding value to the detection phase of incidents - approximately half of the public transport organisations say they will broaden the type of video analytics used, with as many as 7-10 different applications.

It is likely that this future trend will have a noticeable impact on the ability to detect more incidents in a timely fashion and be able to respond accordingly, minimizing their impact.
Conclusions
There is a clear tendency towards network/IP cameras in terms of future investment, in particular up-and-coming analytics applications for specific issues such as graffiti behaviour detection.

On the other hand, legacy analogue cameras will continue to have an important presence in public transport systems for the foreseeable future.

Real-time usage with analytics is also on the rise as public transport systems seek to react to security events as and when they happen, with alerts guiding the operators rather than the impossible task of coping with hundreds of live feeds.

With the reported investments foreseen in real-time, there will be more opportunity for live feeds to be shared with third parties than is reported today. Despite this drive towards real-time network/IP solutions, recorded footage for review purposes is still very helpful and will remain widely used in the foreseeable future.

**CONCLUSIONS**
In terms of regulation, local laws or rules for video to be valid in court is very helpful as it gives assurance that the evidence can be used. Other regulations in terms of usage, storage and so on vary widely from country to country depending on privacy and data protection laws. Laws certainly define the scope of how video surveillance is used in each place but rarely seems to be a barrier for public transport systems.

The survey clearly demonstrates that video surveillance is a widely used technology in public transport, for security but for other purposes too. The survey results point to more interesting conclusions other than those mentioned in this report, however the sample size was not large enough to merit statistically sound statements. A repeat of the survey in the future would enable the tracking of trends and digging deeper into these unsupported findings.

Video surveillance is a solution which is highly valued by staff as well as passengers. Public transport systems clearly intend to invest further in these technologies in the coming years, and the technology has huge potential to assist public transport organisations in real-time. Video surveillance will firmly remain a cornerstone technology in public transport.

UITP and Axis Communications would like to thank the responders 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.
ANNEX – TRANSPORT MODE DEFINITIONS

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
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 1,400 member companies giving access to 16,000 contacts from 96 countries. Our members are public transport authorities and operators, policy decision-makers, research institutes and the public transport supply and service industry.

www.uitp.org

Authors: Lindsey Mancini, Andrea Soehnchen, Phillip Soehnchen

Axis Communications
Axis offers intelligent security solutions that enable a smarter, safer world. As the global market leader in network video, Axis is driving the industry by continually launching innovative network products based on an open platform - delivering high value to customers through a global partner network.

Axis has long-term relationships with partners and provides them with knowledge and ground-breaking network products in existing and new markets.

Axis has more than 2,000 dedicated employees in more than 40 countries around the world, supported by a network of over 75,000 partners across 179 countries. Founded in 1984, Axis is a Sweden-based company listed on NASDAQ Stockholm under the ticker AXIS.

www.axis.com

Authors: Patrik Anderson, Johan Wallén