

The future of urban mobility with video and analytics

A digital-first approach to solving Asia Pacific's
urban mobility challenges

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1. Asia Pacific's urban mobility landscape

Cities are increasing in size across Asia, becoming home to seven of the world's largest ten megacities by 2025. Rapidly growing cities require more efficient transport systems and robust infrastructure to address new requirements that will inevitably arise from a growing urban population. With data-driven insights, rapidly developing cities can plan to place the right levels of investment and appropriate policies to support growth.

Bolstering existing mobility infrastructure is vital to support evolving needs and behaviours. Straining existing infrastructure can bring about a host of negative consequences, such as lowered productivity, congestion, rise in carbon emissions, and increased road traffic accidents, collectively undermining the benefits of urbanisation. Perennial issues such as congestion are estimated to cause the loss of approximately two to five percent of gross domestic product (GDP) in Asia Pacific annually, demonstrating the financial impact of ill-managed urbanisation.

Sustainable urban mobility plans can help rapidly growing cities to develop public transport infrastructure and processes to mitigate these risks effectively. Furthermore, collecting better traffic and infrastructure data can provide valuable insights for planning decisions supporting future growth.

From using real-time traffic insights to optimise traffic light cycles to accurately detecting traffic violations for prompt incident response, technologies such as video surveillance analytics and systems will be the cornerstone to boost safety and efficiency, as well as effective planning of urban road networks.

2. Tackling key urban mobility challenges

2.1 Accidents control and incident management

Traffic incidents happen every day in cities. In the APAC region alone, more than 2,000 people die on the road daily, with many others sustaining severe injuries. With speeding and distracted driving being two of the top causes of accidents – prompt detection and action by authorities can help reduce the chance of fatal accidents. But even with the best intentions, the sheer area of a city's entire road network and limited resources make it challenging to keep track of what's going on at every corner of a city's road network.

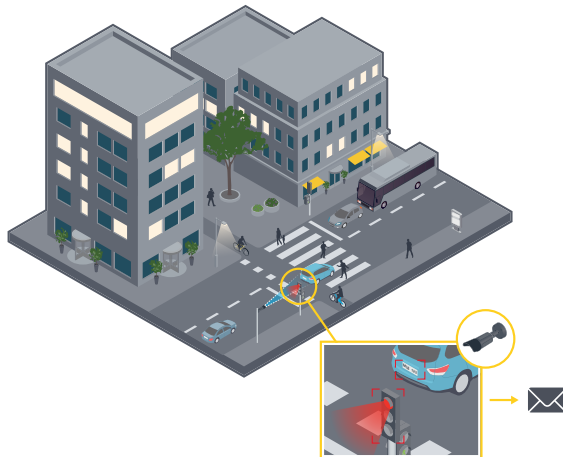
More efficient or accurate data collection and analysis are needed to ensure the ability of traffic operators or emergency services to offer assistance. Each second counts for first responders to comprehend a situation and determine the best next course of action, such as rerouting traffic; a delay in response could ultimately mean the difference between life and death.

Another challenge faced by traffic operators is capturing essential evidence for traffic offences. When a traffic offence is reported, the quality of evidence is crucial in meting out fines and sentences. With a plethora of traffic violations happening each moment on the roads, streets, sidewalks, and intersections across the city – the use of a smart surveillance system can vastly improve the ability of authorities to have complete visibility across a city's road network, and capture the evidence required for forensic investigations to prevent future incidents.

2.1.1 Solution: edge-based video analytics and preventive intelligence

Effectively managing traffic incidents is highly dependent on rapid and accurate information. In addition to providing real-time information about traffic congestion, network cameras can also serve as incident detectors, empowering authorities with actionable real-time data to support decision-making.

Axis offers a range of network cameras, such as fixed bullet and box cameras which could easily be combined with edge-based analytics to deliver reliable incident detection and significantly reduce false alarms. These cameras can be deployed across roads, highways, bridges or tunnels – and can identify traffic violations in a matter of seconds. When equipped with deep learning capabilities, notifications are automatically triggered based on abnormal data detected by cameras, enabling operators to quickly detect, verify, and respond to accidents. Besides being used as evidence in forensic investigations, the high-definition quality video footage from these cameras can also aid in identifying traffic offenders, requiring less staffing to be deployed on the ground for active monitoring. The implementation of a signed video will provide trust and assurance to Axis customers that the video has not been tampered with since leaving an Axis network camera. Axis has set a standard in the video industry with the signed video feature, increasing the viability and credibility of video as evidence and forensic matter.



The AXIS Q16 Box Camera Series includes models based on ARTPEC-8, the latest Axis system-on-chip (SoC). Built with a deep learning processing unit (DLPU), it allows for a faster and more scalable system without needing additional expensive servers. Integrated with AXIS Object Analytics, the camera can detect and classify humans, vehicles, and types of vehicles. Alternatively, the AXIS F Series cameras are a flexible, high-performance HDTV option that can be applied for discreet surveillance inside traffic lights to monitor traffic anomalies.

Integrating analytics into an existing surveillance network of Axis cameras is easy and effectively reduces the total cost of ownership. For instance, in Ho Chi Minh City, the City Council were able to enhance the system capabilities of their existing network of Axis PTZ cameras without the need to add additional hardware. Analytics could be run directly on the cameras to automatically detect traffic accidents and illegal parking, adding value to a previous investment and enabling authorities to manage city-wide incidents better.

2.2 Traffic flow and congestion control

Keeping traffic flowing safely and efficiently across the entire road network can be challenging, especially during rush hour. As urban populations grow, so does the strain on mobility infrastructure across cities, leading to many problems such as increased travel time, air and sound pollution, and more traffic incidents. Since road networks cannot be simply rebuilt quickly to tackle these challenges, optimising traffic flow in rapidly growing cities is a critical and complex issue. Collecting essential information for city planning and road works will also be crucial in the long run.

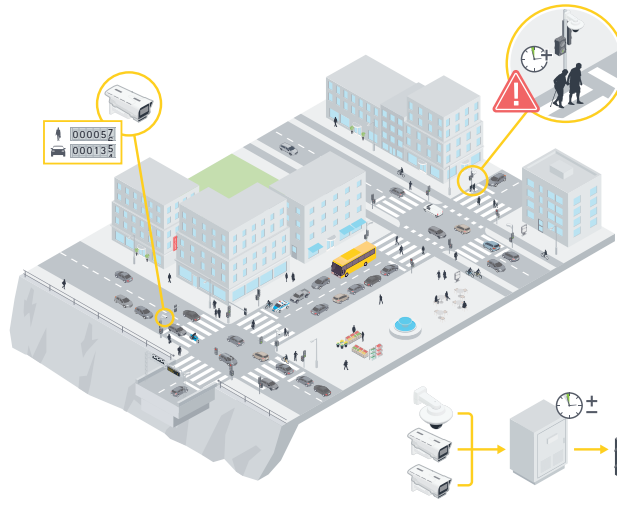
Intersection control is a concern for many modern cities. Designed to increase efficiency and safety at strategic locations in city traffic, poorly managed intersections can instead contribute to lengthy waiting times, traffic congestion, and a rise in fatal accidents. For optimal outcomes, authorities require flexibility to adjust traffic signal timing according to real-time or projected road conditions.

2.2.1 Solution: smart sensors and real-time situational analysis

Using network cameras with deep learning capabilities as smart sensors to collect and process reliable data can provide authorities with valuable insights into traffic flow at different locations and times of the day. Understanding traffic patterns and flows helps authorities identify high-risk areas, and additional safety precautions can be introduced to bolster pedestrians' and motorists' safety. For cameras to collect such information, they need to be able to operate round the clock, even under bad lighting or during inclement weather.

The AXIS Q63 PTZ Camera Series is an ideal option, with built-in advanced analytics and delivers clear images even in pitch darkness. Featuring up to 31x optical zoom, built-in laser, and quick-zoom functionality, the camera can easily capture fast-moving objects clearly under adverse conditions such as low-light environments.

Axis cameras, such as the AXIS FA Thermal Sensor Series, can integrate with partner analytics to work as smart sensors that provide real-time traffic data to manage intersection control better. With adaptive control, it analyses data from the video cameras of a pedestrian or vehicle at an intersection. The data collected can be used to adapt traffic light cycles, reducing waiting time or gridlock situations at intersections. For instance, upon identification of a prolonged queue of vehicles, adaptive control systems can automatically adjust traffic light signals to provide a longer duration of green traffic light signals. This can facilitate the clearance of more vehicles during each traffic light cycle, reducing overall delays in real-time before it changes to a 'red light'.



The data can also be used to inform advanced analytical models, such as digital twins, where planners can experiment with different scenarios (e.g. planned road works) on a virtual representation of the city, to make data-informed decisions. The data would be valuable for city planners, as they'll be able to more confidently plan for changes to mobility infrastructure, knowing that it will help improve safety and alleviate congestion while minimising disruption in the short run.

Atlanta's Smart Corridor is an example of the positive impact that video surveillance can deliver on urban mobility. With numerous key bicycle routes and 18 signalised intersections along the corridor, a robust surveillance system was vital to support the smooth flow of nearly 29,000 vehicles daily. Tapping existing video surveillance cameras, including Axis cameras, and integrating new capabilities to function as traffic sensors provided traffic statistics and data to operate and optimise the intersections, enabling real-time adjustments to traffic light timing that helped to create a smoother travelling experience.

2.3 Parking management

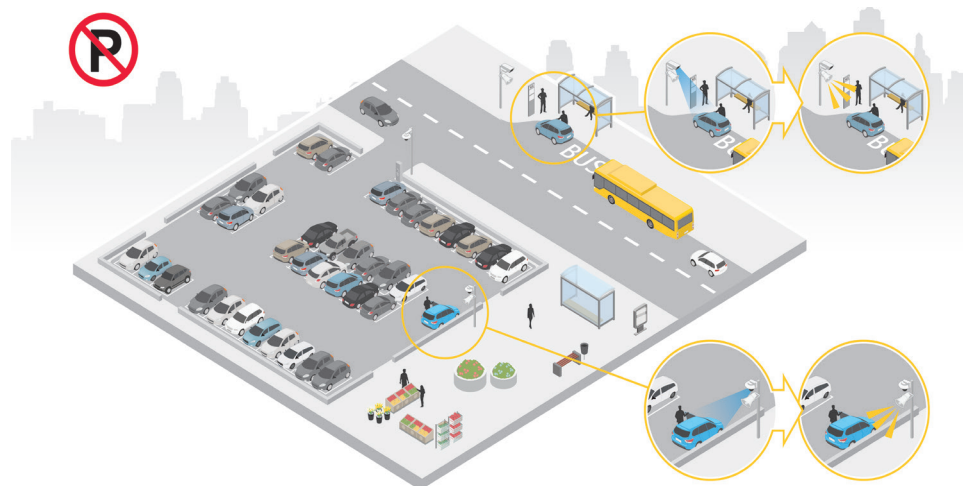
Poor parking management results in stress, inefficiencies, and a more significant impact on congestion as vehicles drive slowly through streets looking for vacant space. Many drivers end up resorting to parking illegally. Not only does this inconvenience other motorists, but it can also present a severe health and safety risk if emergency personnel or vehicles are blocked. In countries such as China, there is an estimated shortage of 80 million parking spots, a development that will inevitably increase the time required to park.

Poor parking management can also negatively impact the environment. From cars moving slowly through streets to drivers leaving engines running while illegally parked, all these ultimately lead to higher pollution and noise levels.

2.3.1 Solution: licence plate recognition and network surveillance cameras

When enhanced with specific analytics applications, network surveillance cameras can alert officers to parking violations or guide drivers to available spaces. Pre-defined detection zones can be demarcated to generate automatic alerts to relevant authorities if an unauthorised vehicle remains within the zone for a prolonged period. Analytics can also help to forecast specific areas or times when violations are most likely to occur, enabling staff to be where they are most needed timely, making it a highly cost-effective way to boost compliance.

The AXIS P32 Dome Camera Series and AXIS P14 Network Camera Series are high-performance, versatile parking management options with edge-based advanced analytics. When connected to the network, the Axis cameras can also pair with Axis Network Speakers, enabling sending of announcements remotely to deter parking violations.



A combination of surveillance cameras and analytics can identify available parking spaces and guide drivers through navigation apps or digital signages, saving time and significantly improving the driving experience. In addition, connected data and systems enable further possibilities, such as paying parking fees automatically, saving time and streamlining the entire process.

As cities' populations continue to grow rapidly, enhancing parking management doesn't necessarily require cities to invest considerable sums in new technology. Places like the Tržič Municipality of Slovenia did a complete overhaul of their ground parking sensors to switch to a smart parking solution. However, the newly-implemented Axis 180° multisensor cameras resulted in fewer installation points needed than the existing system, resulting in an overall lower cost of deployment.

3. Driving the future of urban mobility

3.1 Securing the future of mobility

Research indicates that city planners have made considerable progress in obtaining the data required to facilitate decision-making and efficient management of cities. This includes collecting, analysing, managing, integrating, and securing relevant and sufficient data. However, more headway will be required to effectively use collected data, such as enabling data to be shared across government departments for better decision-making. With the vast volume of data collected and processed by surveillance technology, data theft or misuse remains a central concern among citizens.

Effective cybersecurity and data management requires a continuous process of assessing risks and consequences and taking appropriate action. Designed with security in mind, Axis products have built-in cybersecurity features to decrease the risk of compromise from day one and in the long run. As experts in assessing risk and building processes for data protection into every level of our urban mobility solutions, Axis ensures compliance with current and future legislation, working closely with partners to mitigate risks and provide up-to-date insight into threats. Ultimately keeping citizens' data safe and secure.

Aside from the increase in susceptibility to data breaches and privacy violations, AI has proven to be immensely beneficial in helping systems differentiate objects and persons and the ability to analyse attributes such as car registration plates or face detection/recognition; on the other, it has brought about new concerns regarding ethics, bias, and privacy. One solution to privacy concerns in video surveillance today involves anonymising people or objects by obscuring specific footage areas, motion-based masking for all moving objects or using thermal video that captures only the shapes of people or objects.

3.2 Powering a greener tomorrow

Beyond keeping road users and pedestrians safe from traffic incidents, speeding cars, and accidents at crossings, authorities will need to take proactive steps to safeguard the environment, such as ensuring air quality remains healthy or keeping CO2 emissions at a minimum.

The future of urban mobility lies in cleaner, safer, more accessible, and more sustainable modes of transportation. To do this, cities must prioritise long-term sustainability objectives and implement the infrastructure needed to support them. Axis products are made with sustainability as an essential consideration. With many of our offerings achieving outstanding low light capabilities, this helps to cut down on power usage and light pollution significantly. Edge computing can also help to substantially lower the power consumption of server rooms – which are typically energy-intensive. Strategically using technology and the insights gleaned from the data collected will also ensure cities can keep pace with the evolving needs of citizens.

3.3 Unleashing new possibilities with technology

3.3.1 Increased computational power of deep learning and ai

With its ability to unlock a whole new range of capabilities to edge-based video analytics, AI-powered solutions are receiving increased attention. Governments worldwide are looking to harness machine learning abilities for more sophisticated surveillance and analytics capabilities.

Supporting AI and deep learning is the advent of video metadata – which makes the extraction, management, and sharing of search results for forensics investigations far more efficient. Metadata generated and analysed directly inside Axis cameras, such as the AXIS Q35 advanced dome series of cameras with deep learning capabilities that can perform a wide variety of search investigations, including object classification, object attributes, motion object tracking, duration on the scene, relative speed, date, time, and place – all without the need for additional analytics servers.

3.3.2 Radars

To achieve the best results, the most powerful security solutions employ a strategic mix of technologies. Every tool in the toolbox plays a significant role, and radar is increasingly vital. By adding a new – and more precise – dimension to data, radar can provide critical information about detected objects that many existing video cameras cannot, such as a vehicle's exact position, speed, and direction of movement.

Axis cameras, such as the AXIS Q1656-DLE Radar-Video Fusion Camera, incorporate radar into the visual camera to minimise false alarms and provide accurate data regarding the classification of an object – and its speed, velocity and angle, without visually defining it. Radar can also detect objects moving across the region in low- or no-light situations, reducing the amount of artificial lighting required at night.

Security radars such as the AXIS D2110-VE Security Radar can detect, classify, and track moving objects (e.g. vehicles) in large areas. Additionally, they serve as an additional layer of defence to support and fortify existing visual surveillance systems, resulting in a more precise and dependable security solution.

4. Conclusion

As urban populations increase, cities will continue to undergo rapid change, particularly in transportation management. Mobility around the city will also continue to evolve as residents and visitors embrace new ways to navigate the cityscape, with new types of vehicles to reduce environmental impact. If equipped with reliable information and insights, cities can quickly adapt to these evolving needs.

Leveraging the full potential of edge-based video surveillance analytics allows authorities and city planners to gather, analyse, and share data more efficiently than ever before – empowering them with the insights necessary to plan for future changes effectively. Together with Axis, explore an extensive range of highly robust, scalable video and analytics solutions for accident control, traffic flow, and parking to help improve citizens' quality of life through effective traffic management in today's city.

About Axis Communications

Axis enables a smarter and safer world by creating solutions for improving security and business performance. As a network technology company and industry leader, Axis offers solutions in video surveillance, access control, intercom, and audio systems. They are enhanced by intelligent analytics applications and supported by high-quality training.

Axis has around 4,000 dedicated employees in over 50 countries and collaborates with technology and system integration partners worldwide to deliver customer solutions. Axis was founded in 1984, and the headquarters are in Lund, Sweden.