



**BOSCH**

Invented for life

## Intelligent transportation systems

### Delivering safety alerts and data to maximize mobility

Bosch empowers you to build a smarter, safer and more sustainable transportation ecosystem with analytics-driven video solutions.





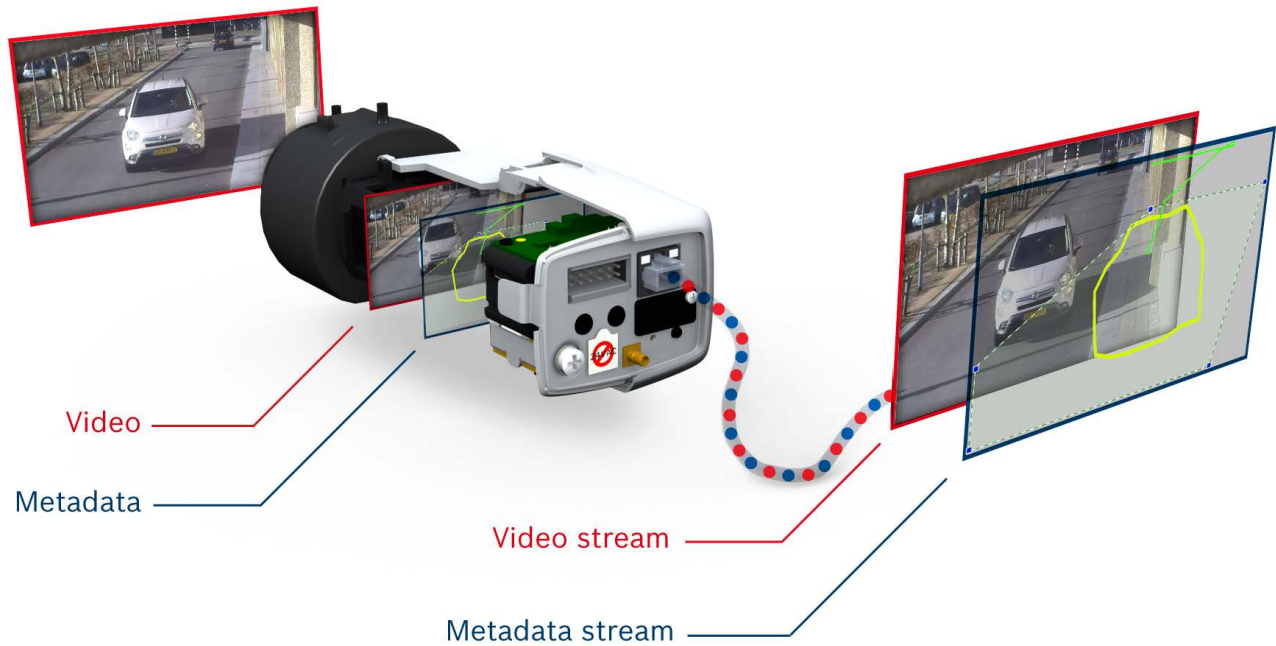


As city streets and sidewalks become progressively more congested, city planners are facing new safety challenges. At the same time, connected and automated vehicles that can communicate with each other and with roadside infrastructure are on the rise in cities and on highways. The challenge for senior traffic engineers and planners is complex. How do you choose the right technology and partner to improve mobility, safety, and efficient use of roadways now and into the future?

Bosch IP cameras acting as video sensors are a key component to intelligent transportation systems that help to keep roadways flowing safely and efficiently. Working with strategic partners, Bosch IP cameras enable detection and monitoring solutions that instantly alert the right people to safety risks while constantly gathering information on roadway usage to provide better insights and information for data-driven decision-making. As a result, city planners and senior traffic engineers can create a smarter, safer and more sustainable transportation ecosystem.

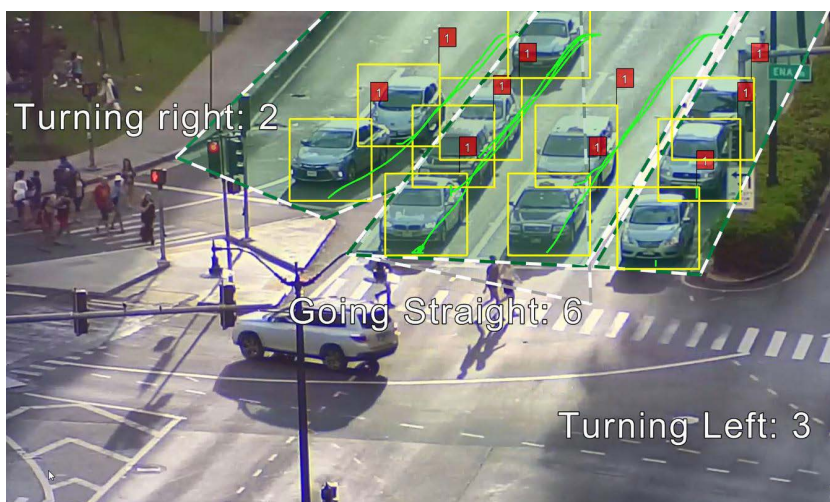


# Reliable data and detection



For decades, Bosch has developed Video Analytics technology used in vehicles for driver assistance, semi-autonomous and autonomous driving, and intelligent safety systems. This same foundational analytics technology is inside Bosch IP cameras. Video Analytics built-in to Bosch IP cameras enables intelligent devices that can alert to safety risks and deliver valuable data for highway and urban infrastructure planning.

With Bosch IP cameras, analytics processing is at the edge – in the camera itself – with no central server required. This enables a distributed network of cameras acting as intelligent processing nodes with no single point of failure, delivering cost-effective and reliable video as a sensor solutions. A single video device provides superior video images, intelligent event detection and real-time alerts, and data collection and aggregation.



## Video Analytics with machine learning

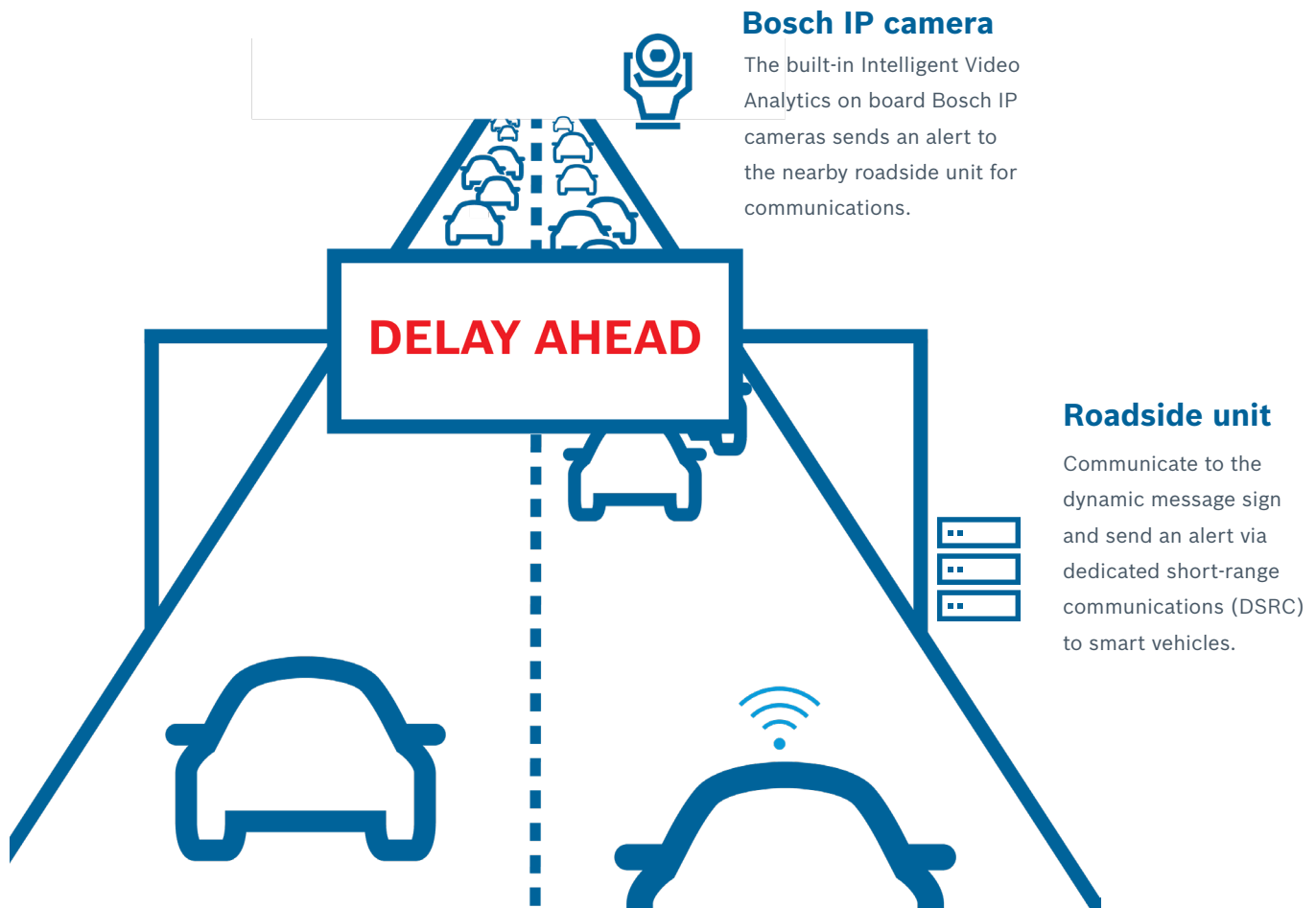
Our most recent advancement, Camera Trainer technology based on machine learning, enables the cameras to be taught to recognize up to 16 user-defined object classifiers. These 16 custom classifiers are in addition to four standard classifiers for pedestrian, bicycle, car, and truck. Use Camera Trainer to separate vehicles clustered in front of traffic lights or in dense traffic, determine parking durations, and much more. This technology improves detection accuracy for precise vehicle counts.

# Enhance safety with Video Analytics

Improve safety by alerting to risks on the road. Intelligent IP cameras deliver automatic incident detection and verification for slow or stopped vehicles, queues of vehicles at exit ramps, vehicles traveling the wrong way, objects in the road – such as lost cargo – and other traffic events.

Through partnerships with highway information solution providers, Bosch cameras can trigger third-party systems to notify drivers on the road, improving situational awareness and enabling them to take action earlier. This enables:

- ▶ Automated triggers to dynamic message signs, flashing beacons, and dedicated short-range communication (DSRC) broadcast messages for smart vehicles to ensure drivers are alerted to safety issues or congestion
- ▶ Early incident detection and mitigation by enabling traffic operations centers to implement workflows to resolve road irregularities faster, help first responders to intervene more quickly, and avoid secondary accidents



For the I-670 SmartLane project, Ohio Department of Transportation (ODOT) has deployed 30 Bosch cameras with Video Analytics along nine miles of highway. The cameras detect anomalies on the road, such as stopped or slow vehicles, and help ODOT monitor the hard shoulder for debris that would prohibit them from opening the SmartLane.



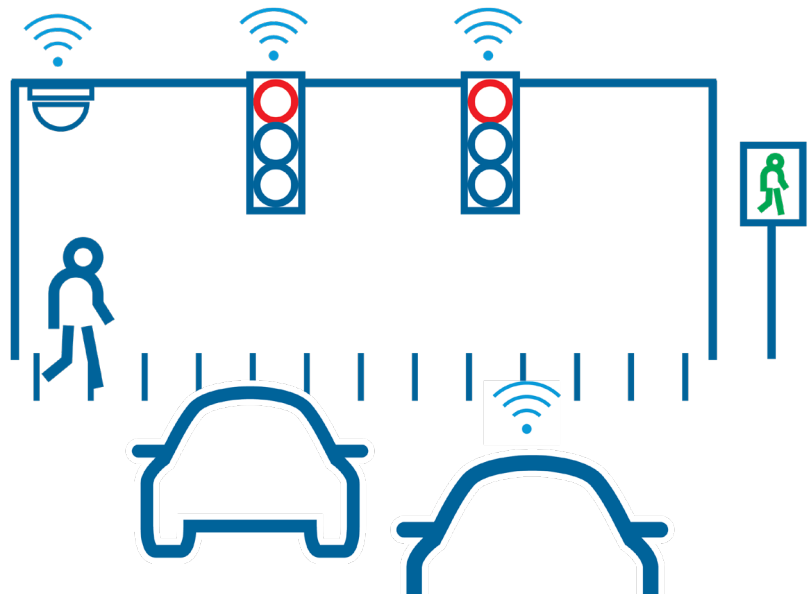
Ohio's first SmartLane is a nine-mile stretch of I-670 between downtown Columbus and the John Glenn Columbus International Airport. Thirty Bosch IP cameras, including DINION IP 7000 fixed cameras and ruggedized MIC IP pan-tilt-zoom cameras with built-in Intelligent Video Analytics, detect anomalies on the road, such as stopped or slow vehicles. During peak congestion, traffic monitors can open a SmartLane -- the eastbound shoulder -- after performing a visual check using the MIC IP cameras to ensure it is free from debris or other hazards. Dynamic message signs communicate to drivers when the SmartLane is open and closed, display the reduced speed limit of 45 miles per hour when the lane is open, and update drivers about road conditions. The cost to develop the SmartLane is significantly less than the cost of building an additional lane to alleviate traffic congestion.

## Intelligent intersections

With distracted pedestrians, more bicyclists, and an increase in public transportation in urban environments, it is essential to implement strategies for improved safety. Make people more visible to motorists to enhance the safety of intersections and pedestrian crossings.

### With Video Analytics:

- ▶ Detection of pedestrians in a crosswalk can alert the traffic controller to preempt traffic signals to increase safety, enabling smart intersection control
- ▶ Increase visibility of pedestrians at night by using Video Analytics to trigger the camera's onboard white light illuminator, highlighting pedestrian presence to approaching traffic
- ▶ Integration with third-party technology can broadcast messages to smart vehicles alerting them to the presence of pedestrians

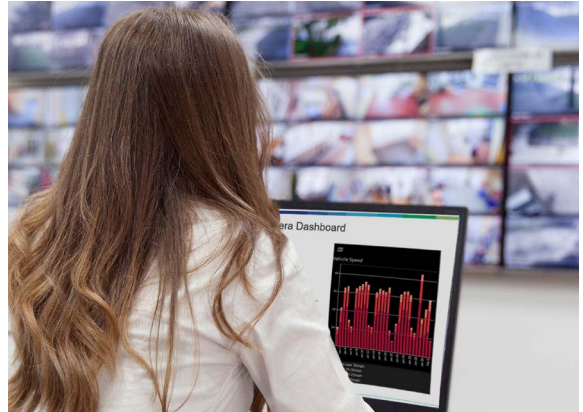




# Analyze data to extend beyond safety

With Video Analytics, the IP camera becomes an intelligent sensor that can classify objects as cars, trucks, bicycles, and pedestrians, and detect speed and trajectory. Using video as a sensor, city traffic planning directors and senior traffic engineers can continuously collect real-time data to analyze flow patterns on networks of roadways for implementing new policies that result in safer and more efficient intersections.

Providing a complete solution, Bosch makes it easy to collect and filter data from multiple cameras and translate it into a consumable format that can feed data to dashboards. Dashboards deliver actionable information for business intelligence purposes – helping you understand traffic patterns, congestion points, and more. Data examples include:



- ▶ Pedestrian, bicycle, and vehicle counts
- ▶ Classification of vehicles, such as cars versus trucks
- ▶ Average speed and direction
- ▶ Road occupancy

When only data is needed, low bandwidth connections can stream it from the camera sensor into the data warehouse, reducing the impact on the network.

## Intelligent parking

In busy cities, Video Analytics can also help monitor parking lot occupancy, curbside parking, and enforce no-parking zones. In lots, cameras can count the number of open spaces, specialized spots – such as those for handicap or electric vehicles – or track ingress and egress, and relay this data to the video and parking management systems. Sharing this information and alternative parking locations on a dynamic message sign can help drivers find open parking faster to get off the road and reduce traffic congestion and emissions.

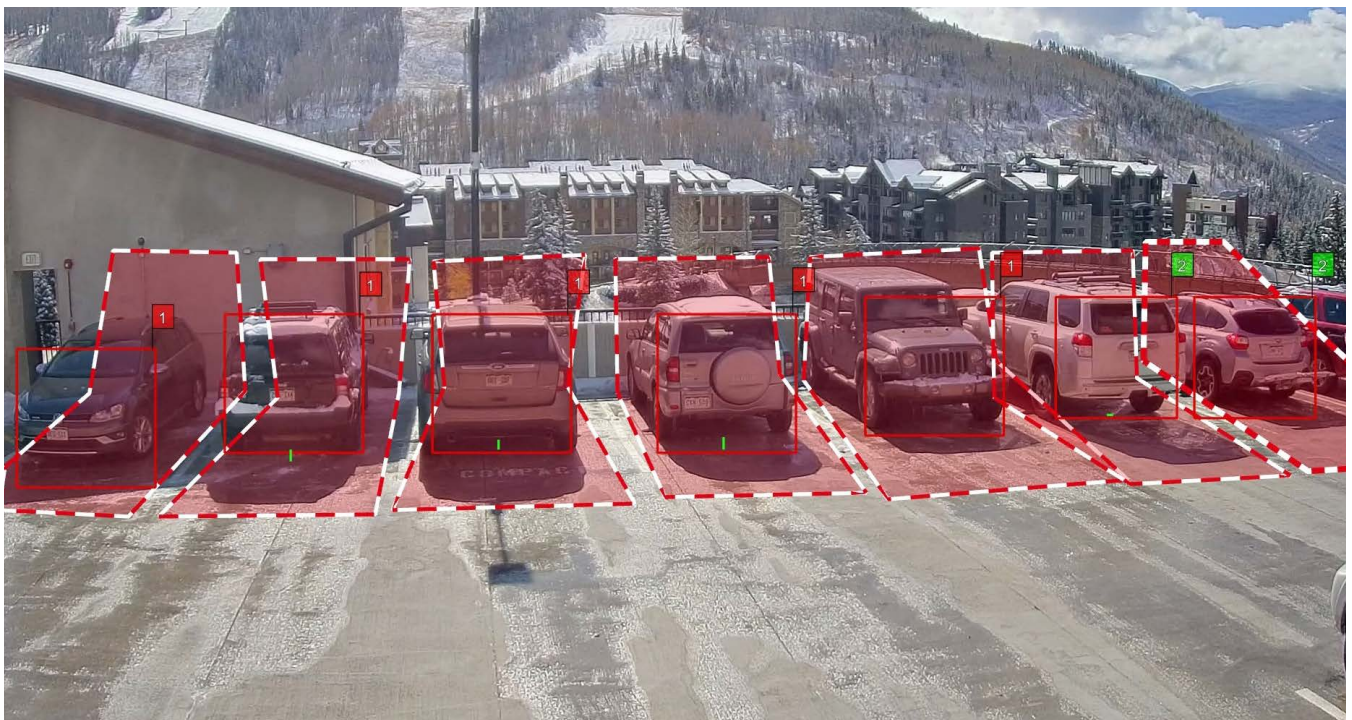


Image captured from a Bosch FLEXIDOME IP starlight 7000 VR camera installed at Vail Ski Resort.

# Bosch solutions for ITS

Bosch offers a complete camera portfolio for intelligent transportation systems. NEMA TS 2 certification confirms they meet environmental requirements for traffic applications, while NTCIP compliance ensures communication with traffic management systems. Bosch IP cameras offer best-in-class light sensitivity, excellent high dynamic range, and front and backlight compensation for clear images even in difficult conditions. Plus, all Bosch IP 7000-9000 series cameras feature built-in Intelligent Video Analytics as standard.

## MIC IP cameras

One of the most robust cameras for intelligent transportation systems, the MIC IP family of extremely rugged cameras withstand severe weather and environmental conditions, such as vibration on bridges and high impacts from debris. The cameras offer IP68-rated protection against water ingress without requiring a pressurized housing to reduce maintenance and your total cost of ownership.



### AUTODOME IP 7000i

Capture highly detailed color images of fast moving objects with this high-speed pan-tilt-zoom camera. Intelligent Tracking keeps important objects in the field of view.



### FLEXIDOME IP starlight 8000i

Available in HD 1080p, 6 MP, or 4K Ultra HD, these fixed dome cameras offer wireless and remote commissioning to eliminate lane closures for adjustment.



### DINION IP thermal 8000

This fixed camera offers excellent thermal performance for early detection in tunnels, on bridges, and in fog.



### AVIOTEC IP starlight 8000

This video-based fire detection solution enables early and reliable smoke and flame detection in tunnels before traditional sensors trigger an alarm.



### PRAESIDEO Digital Paging and Mass Notification Systems

Get your message across. This public address and emergency sound solution delivers superb quality for announcements. Bosch outdoor loudspeakers complement the solution.



### Bosch Video Management System

BVMS is a scalable solution that offers maximum reliability, keeping your operations up and running even in the event of a server failure.

To learn more about how Bosch solutions for intelligent transportation systems enhance safety, contact [intelligent.transportation@us.bosch.com](mailto:intelligent.transportation@us.bosch.com).

## Bosch Security and Safety Systems

Protecting lives, buildings and assets is our aim. Our product portfolio includes video security, intrusion detection, fire detection and voice evacuation systems as well as access control and management systems. Professional audio and conference systems for communications of voice, sound and music complete the range.

Bosch Security and Safety Systems  
To learn more about our product offering,  
please visit [www.boschsecurity.com](http://www.boschsecurity.com)

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