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Orchestrated Connected Corridors:

the key to improved road safety and advanced traffic management

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Orchestrated Connected Corridors are based on a single platform suite that enables digital transformation for highway and urban environments. They provide a basis for cohesive, consolidated and modular services for increased safety, mobility and sustainability, with the option to expand capabilities in the future as authorities' needs continue to evolve. In this Kapsch TrafficCom guide, we take a tour of OCCs, and discuss what they are, how they work, and how they help authorities advance their goal of 'zero accident' roadways, while also supporting a range of new, value-added services for drivers.

For highway and city authorities around the world, managing traffic congestion and keeping road users safe are major and constantly growing challenges.

In the USA, for example, the National Highway Traffic Safety Administration estimates that nearly 43,000 people died in road traffic accidents in 2021, with 19,800 deaths reported across EU countries, and intersection incidents involving vulnerable road users (VRUs) have also risen in recent years and account for more than 50% of the over 1.3 million fatalities due to Road Traffic injuries globally. The cost and environmental impact of traffic congestion is also a pressing concern in cities around the world, with major initiatives underway in all regions to reduce emissions from 'stop-start' traffic.

To make roadways safer and greener, and to improve traffic flow, many authorities around the world are beginning to test and implement Orchestrated Connected Corridor (OCC) solutions. Using Connected Vehicles combined with advanced data collection and processing platforms at the network edge, and in the cloud, OCCs provide real-time traffic management capabilities and insights that support a range of innovative safety and traffic mobility use cases.

For example, OCCs make it possible to improve safety on both urban and interurban routes by supporting real-time safety applications such as Co-operative Automated Vehicles (CAV), and by communicating key safety information and warnings to drivers in their vehicles. It is also possible to use real-time traffic data from OCCs to support cross-domain traffic, tolling, and demand management applications that reduce congestion and emissions from 'stop-start' traffic.

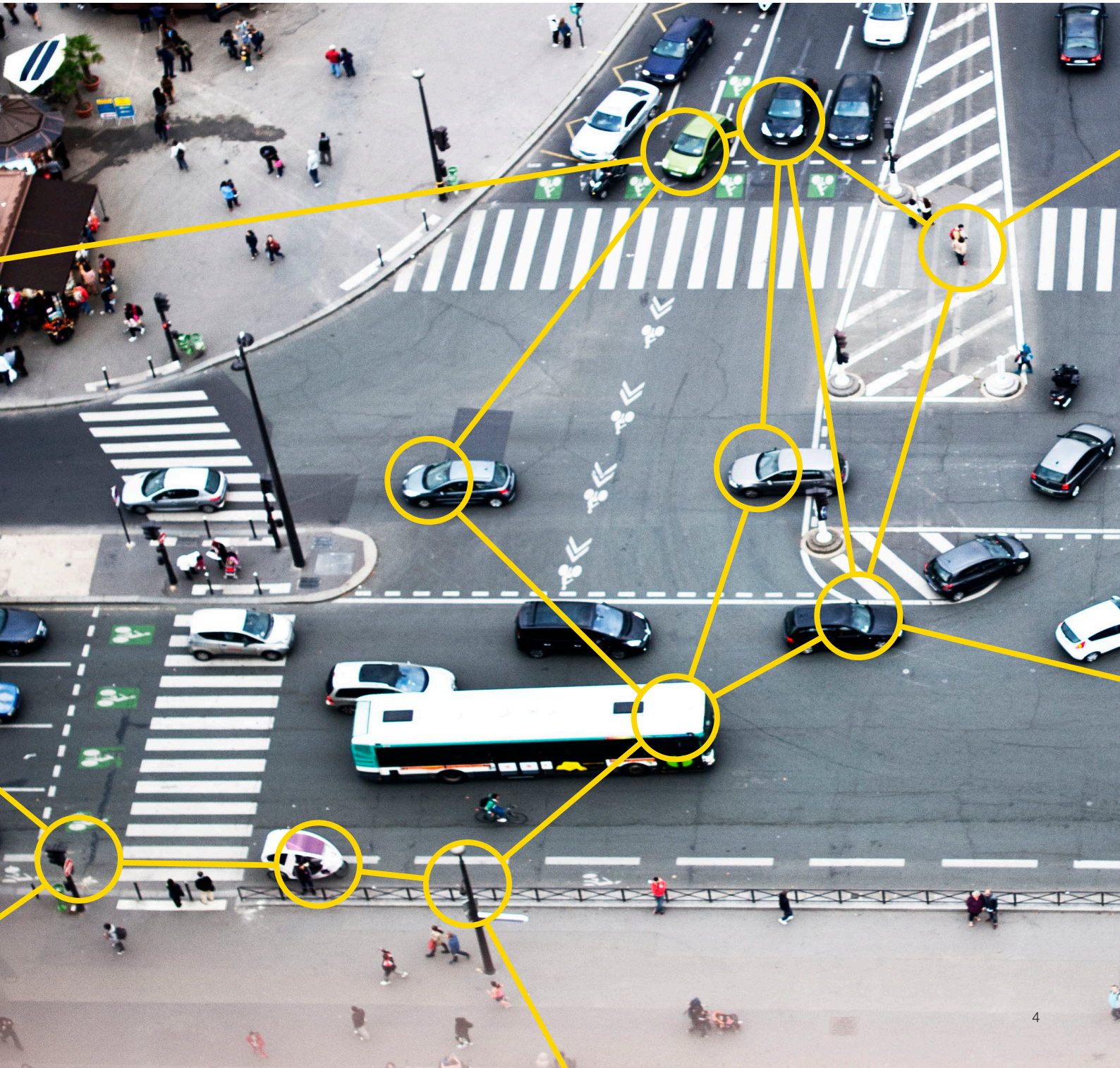
In this short guide, we look at how OCCs can help authorities improve road safety, traffic management, and meet their emissions targets, while also delivering major improvements in road-user experiences.

The top OCC benefits

At the highest level, OCC helps to reduce congestion, while improving mobility and safety for motorists and VRUs. By deploying OCCs, authorities can start planning for 'zero accident' roadways with support for CAV features and advanced warning of potential hazards on the road that may otherwise cause accidents.

In particular, OCCs address major challenges such as driver distraction, inattentiveness or a lack of awareness of dangers on the road – which account for 3,142 vehicular accident fatalities according to NHTSA. The main way OCCs improve safety is by identifying hazardous scenarios and communicating with all stakeholders in the transportation ecosystem in real time to reduce accident risks.

The following sections consider some of the key use cases and benefits of OCCs for authorities and drivers.



1. Hazard warnings for improved road safety

This key safety application gives drivers advanced warning of potential hazards in the road ahead – either using roadside signage, or in-vehicle messaging to the dashboard systems. Alerts that can be passed to drivers include notifications of accident zones or traffic jams ahead, as well as road and lane closures and the presence of work teams on the roadway (Road Works Warnings).

Based on information delivered to in-vehicle systems, drivers can also be warned about a range of other conditions and factors that could be potentially hazardous. These include adverse weather conditions, slippery road surfaces, or an animal, person, or emergency vehicle on the road.

In urban settings, such as intersections, image processing capabilities can be used to identify pedestrians crossing, or cyclists straying into a traffic lane, for example. These hazards can be communicated directly to the vehicle, helping drivers to minimize the risk of accidents and protecting other road users. Conversely, network based solutions enable the delivery of similar awareness information to the same vulnerable road users directly improving their safety.

Based on the breadth of hazard warnings that can be detected and communicated to drivers as part of an OCC solution, authorities can dramatically increase road safety and further their goal for 'zero accident' corridors.

OCC Highway use case examples

Mobility

- Digital signage & vDMS
- EV Charging
- Infrastructured Controlled Vehicles
- Load Balancing
- Multi Modal Coordination
- Route Guidance
- Travel Times

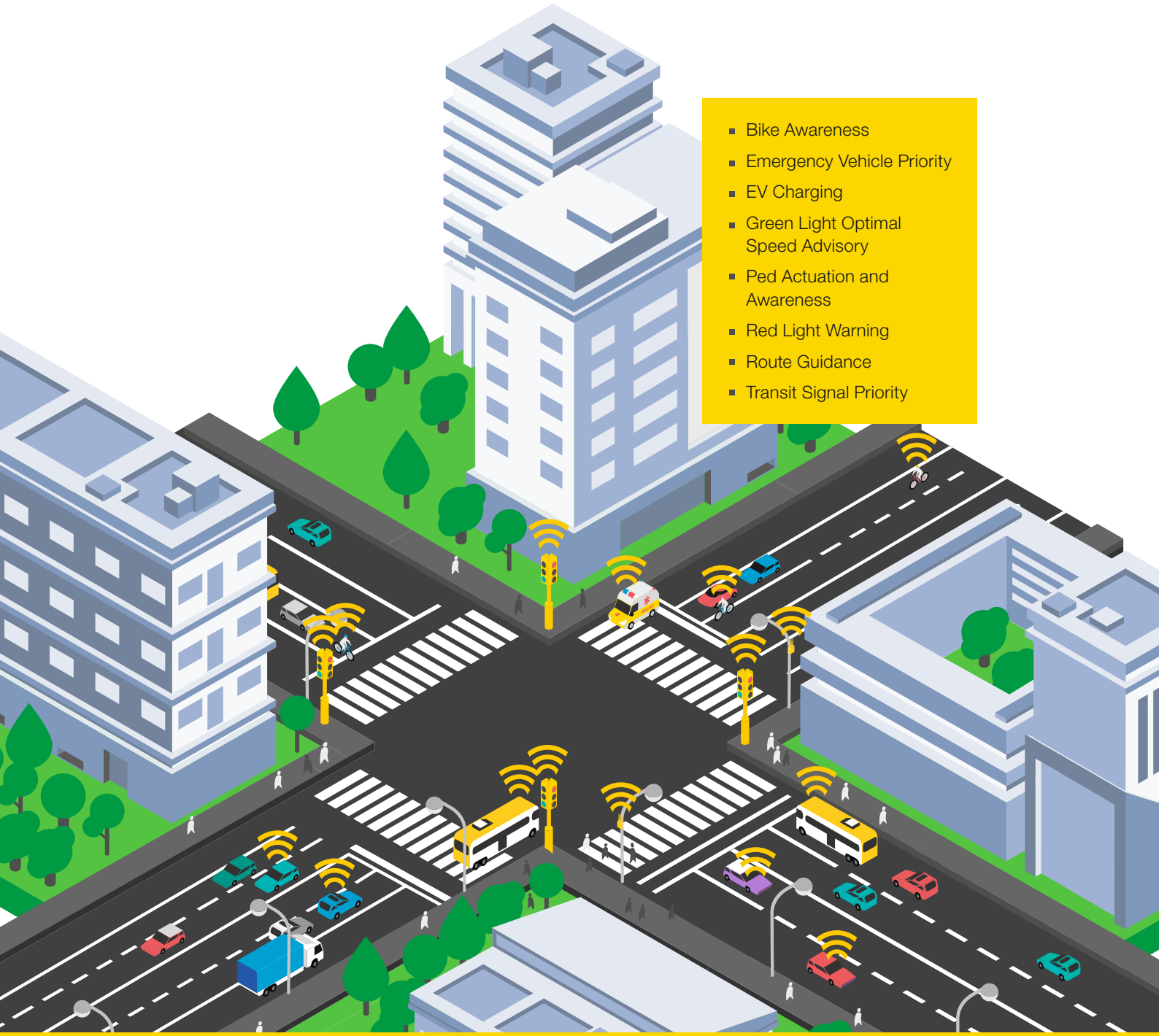
Tolling

- Consolidated Tolling Services incl. RUC
- Managed Lanes

Safety

- Curve Speed warning
- End of queuing warning
- Object warning
- Lane Closure
- Speed advisory
- Stopped vehicle
- Wrong Way driver

OCC Urban use case examples



2. Vulnerable Road User (VRU) Safety

A growing area of concern within the mobility ecosystem is Vulnerable Road Users (VRUs). VRUs are loosely defined as the group containing pedestrians, bicyclists, mopeds, scooters, etc. Emerging technology not only allows the identification of such roadway users but also communication with such users. OCC services specifically address VRUs through sophisticated sensor platforms increasing the awareness of drivers and the safety of VRUs.

3. Driver in-vehicle signage and alerts for increased mobility

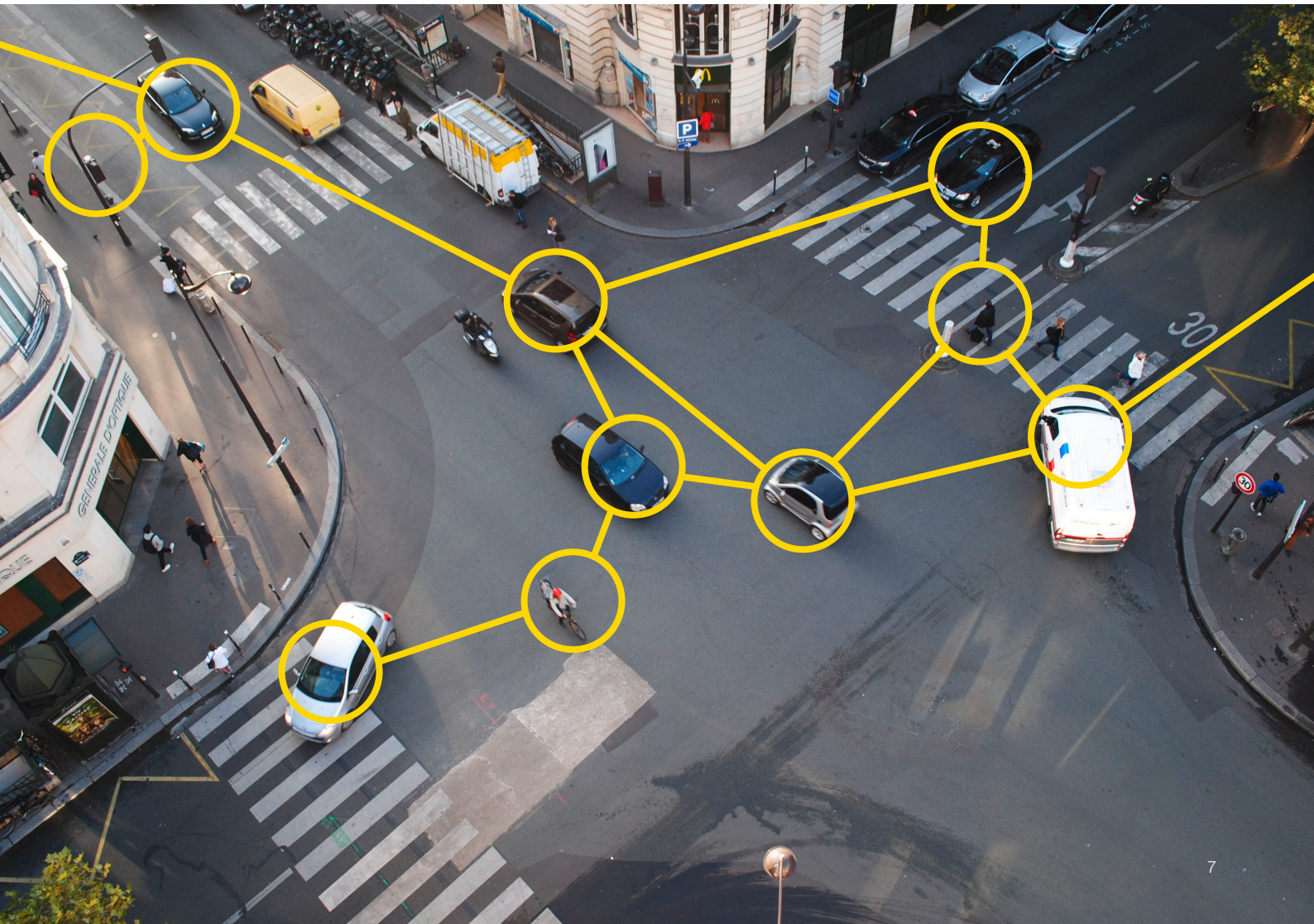
Information from OCC systems – communicated to drivers in their vehicles – help to reduce travel delays. This is particularly the case where roadway and traffic conditions change quickly, or where planned or unplanned traffic events occur frequently, or where authorities implement dynamic speed limits depending on the traffic load.

In such cases, drivers can receive alerts relating to where congestion is slowing traffic and see notifications of the speed limit where they are traveling. Drivers can also be alerted to any potential hazards on the road ahead to improve safety and reduce accident risks.

Another key application for in-vehicle signage is speed advice for 'green wave' driving, particularly on urban corridors. The integration of signaling systems, real-time traffic perception and vehicle-to-roadway communications allow information to be sent to drivers in their vehicles, showing them the ideal speed to drive to avoid red lights and to maximize the flow of traffic in busy lanes.

For operational services, such as transit and emergency responses, priority and pre-emption of the signaling systems increases not only mobility but also increases efficiency and improves safety for both first responders and people at intersections. In the case of emergency response, reducing response time even by 1 second can be the difference between life and death. Transit mobility improvements improve schedule efficiency and reliability of the transit system as a whole thereby influencing increased usage.

Finally, but equally importantly, in-vehicle signage can be used to advise motorists where authorities are using Dynamic Lane Management to ease traffic flow, which usually means changing the direction of traffic flow on certain lanes during busy times. Advanced warning of these kinds of changes in vehicle help drivers to understand current traffic flows, significantly reducing the risk of accidents.



4. Improved Traffic Management and planning

One of the key use cases for OCCs is improved traffic management and demand management. To achieve this, the leading OCC solutions offer seamless integration with systems for improved traffic management, including dynamic traffic rerouting in the event of congestion or road incidents, traffic light timing adjustments for 'green wave' driving, dynamic charging during peak and off-peak times, and much more.

The availability of accurate, real-time traffic data across the OCC also empowers authorities to proactively respond with actionable information more quickly in the event of a traffic incident or accident, and to ensure that all possible measures are taken to ensure public safety and ease traffic flow for an overall improvement in road-user experience.

Critically, data insights from OCCs allow authorities to optimize existing transport corridors and to launch new services that support mixed-mode mobility and automated vehicles. By analyzing traffic data and trends, authorities can also implement initiatives and solutions for smart routing, speed optimization and road resources and capacity optimization.

5. Support for congestion charging and low-emissions zones

Because OCCs use machine-learning-driven image processing to provide granular data on vehicles and their locations, they can support a wide range of congestion and emissions reduction initiatives. This is often a key driver for deployment, especially in cities looking to reduce congestion and emissions from stop-start traffic on their roadways.

6. New commercial opportunities for traffic authorities

The ability to understand real-time traffic conditions supports a range of new commercial opportunities based around creating, and billing for, value-added services for drivers. In particular, these kinds of solutions can support dynamic charging based on congestion levels or charging for specific lanes at specific times of day, or during peak times.

Some examples of value-added services that enable new commercial opportunities in North America include the ability to support High Occupancy Vehicle (HOV) or High Occupancy Toll (HOT) lanes with associated charging.

The technology building blocks needed for OCCs

OCCs are built on a range of hardware and software technologies that provide end-to-end traffic solutions, including data collection, transmission, and processing. The leading OCC solutions provide modular concepts that allow authorities to evolve their existing roadside infrastructure and technology stack in a seamless, efficient, and low-risk way.

OCCs must also be able to generate, process, and activate a wide range of data relating to vehicles (and their locations), traffic conditions, road conditions and more. This data is generated by a range of devices and sensors, from in-car systems and OBUs, to roadside cameras with advanced machine learning and image processing capabilities.

Key components required for high-functioning OCC deployments include:

1 Data sources for real-time traffic insights

These typically include vehicle onboard units (OBUs), which communicate with roadside infrastructure sensors and infra-structure, such as cameras with AI capabilities for vehicle and VRU detection. Additional data sources for OCCs may include tolling data, floating car data, C-ITS data from paired traffic management systems, and mobile data from drivers' phones or other devices.

2 Fast, reliable connectivity between C-ITS systems (vehicles and roadside infrastructure)

This is based on V2X technology (such as ITS-G5 or C-V2X) which supports latency-sensitive applications such as in-vehicle driver communications and warnings relating to road works, lane closures and so on.

3 Roadside infrastructure and sensors

OCC solutions should provide a roadmap that enables authorities to update and optimize their existing estates of roadside infra-structure and devices. The leading roadside infrastructure solutions are now 'intelligent', using machine learning to distinguish between different types of vehicles, cyclists, pedestrians, and other objects in the roadway to support key safety applications and to enable the deployment of low-emissions zones, congestion charging schemes, and more.

4 Advanced data platforms

To enable OCCs to function, data generated by vehicle OBUs and roadside sensors (such as cameras, radar and LiDAR) needs to be stored and processed by an advanced data platform. The leading solutions of this type support real-time pro-cessing and analytics for critical safety use cases based on descriptive, diagnostic and predictive traffic data analytics. Advanced data platforms offer a wide range of insights, including detailed analysis of traffic on the OCC, travel time calculations, detection of incidents or anomalies, traffic predictions, and more.

5 Open integration with traffic management platforms

Data from OCC data platforms can be integrated seamlessly into traffic management systems, allowing authorities to immediately see the status of roadside units, dynamic message signs, AI cameras and all other connected devices, and the data generated by them. Traffic management platforms support a real-time view of traffic across the OCC, with a decision support system to enable faster responses to safety incidents or to initiate actions such as traffic re-routing or 'green wave' applications when needed to speed up traffic flow.

6 End-to-end consultancy and integration services

To successfully plan and deploy OCC solutions, consultancy and integration support from a trusted technology partner is paramount.

Real-world OCCs success stories

Around the world, Kapsch TrafficCom is supporting authorities as they deploy OCC solutions to improve road safety, enhance driver experiences, and reduce congestion and emissions. The following project write ups outline the benefits for authorities and road users.

Austria highways nationwide rollout, and city solutions based on C-ITS, are enabling truly connected corridors.

The project: Austria's C-ROADS C-ITS initiative: nationwide and city-based Connected Vehicle deployments for improved road safety

ASFINAG, the organization that builds and maintains Austria's highways, is implementing a nationwide project to improve road safety with C-ITS Connected Vehicle technologies. The project, which also includes connected intersection deployments in Austrian cities – including Salzburg and Vienna – is using C-ROADS specifications to ensure compatibility and interoperability for all equipment.

Kapsch TrafficCom's contribution to the nationwide highways project

Kapsch TrafficCom has been cooperating with ASFINAG for over ten years around Eco-AT creating specifications, pilot operations and living lab studies, besides others, to establish the foundation of C-ITS infrastructure in Europe.

Now in the operational deployment phase for the national highways project, Kapsch TrafficCom is providing in-vehicle Onboard Units (OBUs) for service vehicles to facilitate real-time data exchange with ASFINAG's C-ITS roadside infrastructure. Data from Kapsch's onboard units is used to deliver safety information to drivers' dashboards in real time – reducing the risk of accidents.

The results: Improved road safety and driver experiences

The decision to deploy a nationwide C-ROADS C-ITS solution across all highways in Austria promises to significantly improve road safety, helping to minimize accidents across the network and pave the way for connected automated driving (CAD) for the next decade. With timely warnings of roadworks, obstacles, congestion, and other factors that jeopardize driver safety, authorities will be able to further their goal towards 'zero accident' roadways. As an additional benefit, data from Kapsch TrafficCom OBUs and the national C-ROADS C-ITS deployment is being used to improve planning and to support initiatives to make road travel safer and faster across the country.

These benefits are also being mirrored in several Austrian cities, which have also chosen to develop and deploy Connected Vehicle and connected intersection solutions based on C-ROADS specifications for the greatest possible harmonization and interoperability.

Smart Columbus Connected Corridor project, Ohio, USA

The project: Creating a full-featured Connected Vehicle Environment for the 'Smart Columbus' program

The Connected Vehicle Environment (CVE) project, which started in 2016, aims to increase transportation mobility, safety, and efficiency for local residents in the city of Columbus, Ohio. The CVE integrates connected vehicles into the city's transportation environment by installing in-vehicle and roadside technology, and by deploying CV applications that will facilitate enhanced safety and mobility features.

Delivery and integration of the multiple components of the CVE

Kapsch TrafficCom and our partners led the implementation and integration of CV technologies in Columbus. A total of 100 roadside units were supplied by Kapsch TrafficCom, and other vendor solutions were deployed to enable data collection at intersections along the key corridors in the city.

The Kapsch Connected Mobility Control Center (CMCC) software platform, which is interoperable with Kapsch TrafficCom and other vendor devices, has been deployed to configure, monitor, and gather live data from the CVE. This data is integrated into the Smart Columbus network with the ultimate goal of improving mobility for local residents, while improving the safety and efficiency of the transportation network.

The benefits: Improved road safety and reduced congestion and delays

By providing information such as traffic signal status, speed limits, and other alerts to drivers in their vehicles, Columbus' CVE is improving safety for road users. Increased driver awareness of potential hazards and speed limits outside schools is also reducing accident risks. Finally, the CVE is improving traffic flow and corridor mobility by optimizing signaling and reducing start-stop traffic.

AIMES Connected Corridor and Intelligent Intersection solutions, Melbourne, Australia

The project: A Kapsch TrafficCom Connected Corridor solution within the Australian Integrated Multimodal EcoSystem (AIMES) zone in Melbourne, Australia

Kapsch TrafficCom Australia has established a local Connected Corridor and Intelligent Intersection pilot within the Australian Integrated Multimodal EcoSystem (AIMES), a 6km2 area of Melbourne, which is situated near Melbourne CBD and includes the University of Melbourne campus.

The solution: An end-to-end Connected Corridor and Intelligent Intersection solution from Kapsch TrafficCom

Working with the University of Melbourne, Kapsch TrafficCom has deployed the AIMES Connected Corridor end-to-end solution, including maintenance and support services. The project is funded by the University and by the Victoria Department of Transport and Planning.

The solution incorporates a number of key Kapsch TrafficCom technologies, including C-ITS Roadside Units (RSUs) and the Kapsch Connected Mobility Control Center (CMCC) and EcoTrafix software platforms. The Kapsch Deep Learning Versatile Platform system provides a real-time view of traffic, including the number of vehicles on the roadway or passing through an intersection, the types of vehicles, the speed of each vehicle, and more.

The benefits: Traffic awareness and enforcement for increased road safety and reduced congestion

The AIMES solution is helping the city of Melbourne to increase the safety of drivers, cyclists and pedestrians based on increased awareness of safety risks in the area. The ability to spot and sanction traffic violations also promises to change and improve driving on the city's streets, further helping to reduce accident risks and, potentially, providing a new revenue stream for the city.

The future of OCCs

In the future, the industry anticipates an era where less heavy roadside infrastructure, and more AI-powered sensors and data analytics platforms and tools, will be needed to support OCCs. As well as Connected Vehicles, we will see other kinds of data sources feeding into OCC solutions, including in-vehicle sensor and communication clusters as part of ADAS (advanced driver assistance system), onboard computers, dash cams, drivers' mobile devices, and others. With evolving short-range communications technologies, and expanding coverage of 5G cellular networks, we will also potentially see a greater scope to deploy OCC applications and use cases over broader sections of local and national road networks.

Why innovating responsibly is the key to success

The transition to digital infrastructure-based OCCs is coming, but it must be undertaken responsibly. This is to say that all applications and use cases should be subjected to rigorous testing, at all stages of development and deployment.

It also stands to reason that non-latency-sensitive Connected Vehicle applications, such as vehicle rerouting, or green wave driving, will soon be run on cellular networks and cloud-based platforms.

How Kapsch TrafficCom is driving OCC innovation

Kapsch TrafficCom is at the forefront of the current model for OCC deployment. However, we are also collaborating with partners and customers to usher in the new era of infrastructure-light and infra-structure-less projects. From collaborating on standards for new short-range communications, to exploring the viability of Connected Vehicle use cases using LTE (4G) and 5G cellular networks, we are always looking to the future for the benefit of authorities and road users.

The last word: why Kapsch TrafficCom for OCCs?

Kapsch TrafficCom offers unique roadside infrastructure and traffic management experience and capabilities, combined with an end-to-end portfolio of traffic and tolling services that leverage cloud, edge, and light infrastructure sensors and communication devices that ensure success for complex OCC projects. Based on our unique industry knowledge and experience and technical capabilities, we have been chosen to deliver and manage large-scale Connected Vehicle projects in North America, Europe, the Middle East, Asia-Pacific and Australia.

Kapsch TrafficCom's clear differentiation in the Connected Vehicle market is based on:

Unique road traffic management knowledge and experience

For decades, Kapsch TrafficCom has been delivering solutions for roadside infrastructure, traffic management, tolling, and related projects. This multi-domain experience and expertise allows us to work with our customers and prospects to understand the unique traffic safety and management challenges of their particular roadways, and to propose OCC solutions that deliver the best outcomes for both authorities and road users.

For each project, we assess specific project challenges and objectives from the outset. We then propose the most suitable combination of OCC technologies and capabilities, whether the roadway in question is a high-density urban route, an intersection, an inter-urban highway or a different type of environment, such as an enclosed logistics park. As a result of our deep understanding of these different types of transport corridors, we can design and deliver solutions that maximize safety and optimize traffic management in every case.

End-to-end Connected Vehicle technology portfolio and delivery capabilities

As a single point of contact and access for Connected Vehicle infrastructure, data and analytics platforms and services, Kapsch TrafficCom can help authorities to minimize deployment time and cost risks and accelerate time to benefit their complex projects.

For greenfield rollouts, we can help authorities select, deploy and integrate the most appropriate OCC solutions from the outset based on defined objectives. In the case of brownfield deployments, we can help to maximize the lifecycle and ROI of existing roadside infrastructure, including cameras and sensor fleets, by integrating them seamlessly into Kapsch's data analytics and traffic management platforms and extending with connectivity to vehicles.

Support for the development of new Connected Vehicle technologies and standards

The Connected Vehicle market is characterized by rapid progress in terms of technology, communication protocols, and standards – and Kapsch TrafficCom can help authorities to navigate all current and future changes.

Currently, the market is transitioning from solely focusing on Dedicated Short Range Communications (DSRC) to regional adoption of a new cellular V2X (C-V2X) communications protocol. Regulatory organizations are determining the communications technology of choice. Additionally, 5G commercial availability is on the horizon and offers the potential for combined network and short-range communication services. Kapsch TrafficCom is actively participating in the development of new standards for V2X deployments, and we are actively contributing and constantly consulting with standards organizations, partners and customers to ensure that OCC projects are future-proofed against future technology or spectrum changes.

Begin your OCC journey

To discover more about OCC features and benefits, or to find out how Kapsch TrafficCom can help you realize your vision for improved safety and traffic management on a particular section of your roadway, visit our website or contact us today.

Kapsch TrafficCom

Kapsch TrafficCom is a globally renowned provider of transportation solutions for sustainable mobility with successful projects in more than 50 countries. Innovative solutions in the application fields of tolling, tolling services, traffic management and demand management contribute to a healthy world without congestion.

With one-stop-shop-solutions, the company covers the entire value chain of customers, from components to design and implementation to the operation of systems.

Kapsch TrafficCom, headquartered in Vienna, has subsidiaries and branches in more than 25 countries and is listed in the Prime Market segment of the Vienna Stock Exchange (ticker symbol: KTCG).

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