Preparing highways and tunnels for the future of mobility

Nokia roadside cloud and wireless access

Nokia provides strategic technology advice that enables road operators to prepare for the future of transportation. The Nokia roadside cloud and wireless access network solutions help operators advance traffic flow and safety and virtualize roadside equipment. Together, they provide a flexible platform that supports agile deployment of new roadside services to meet future intelligent transportation system (ITS) demands. This platform eases integration of in-vehicle systems and roadside technology by supporting vehicle-to-everything (V2X) communications — a must for the automated future.
Using new technologies to reduce road fatalities and congestion

Traffic congestion and fatalities are major issues for road operators around the world. The traffic industry has made significant progress on these issues by deploying ITSs on highways and in tunnels. Despite these efforts, more than 1.25 million people die on roads each year\(^1\) and congestion is steadily increasing. These trends may be difficult to reverse: Industry analysts project that there will be two billion vehicles on the road by 2035.\(^2\)

For road operators, the challenge is to determine how to use technology advances to improve traffic flow and road safety today and prepare for the changes the future will bring.

| 1.25M road fatalities annually | 2B vehicles on the road by 2035 | 33M+ autonomous vehicles sold annually by 2040 |

**Moving beyond the capabilities of today’s ITS solutions with increased situational awareness**

Road operators need real-time situational awareness and the ability to respond immediately to traffic situations to bring Vision Zero to their highways and tunnels. These capabilities will enable them to detect dangerous traffic situations faster than ever before and mitigate emerging congestion before it causes heavy traffic delays.

Today’s roadside equipment generates many valuable data points. But operators want to deploy new and advanced detection equipment — including virtualized equipment — to benefit from even more data points. Solutions that can correlate data from multiple roadside systems and analyze it directly at the roadside could create opportunities for road operators to significantly enhance their situational awareness. But today’s roadside communications networks do not provide the scalability and responsiveness required to support these capabilities.

**Preparing highways and tunnel systems for V2X communications**

New mobile and transportation technologies are changing road travel. The first significant wave of self-driving vehicles will hit the road as soon as 2020. In 20 years, more than 90 percent of vehicles sold will be highly or fully autonomous,\(^3\) with more than 33 million autonomous vehicles sold annually by 2040.\(^4\) All of these vehicles will require reliable V2X communications.

As connectivity is introduced to vehicles, the silos of in-vehicle systems and roadside technologies are breaking up. Vehicles are now capable of receiving information from roadside systems and sending data to road operators’ traffic management systems (TMSs). These connected vehicles generate and receive massive amounts of data.

In-vehicle infotainment and mobile services will become essential once vehicles are capable of driving autonomously. These services promise to bring exciting new business models and significant economic opportunities to road operators. They will also impact the roadside communications network. The future of mobility is coming soon, but the requirements for road operators are not yet clear.

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1. World Health Organization estimate of global road traffic-related fatalities in 2013
2. Navigant Research estimate
How edge computing can transform roadside services

Edge computing enables road operators to address these challenges by bringing scalable processing power and storage to the roadside. It allows them to support new ultra-responsive roadside services by delivering real-time traffic data more accurately than ever before.

With edge computing, operators get a standard IT architecture that can host virtualized roadside equipment and ease on-boarding of new services throughout the lifetime of the communications infrastructure. By adding edge computing to roadside networks, operators will be prepared for the rise of connected and autonomous vehicles, which require reliable, low-latency integration with roadside systems.

How we are applying edge computing to highways and tunnels

Nokia roadside cloud is an edge computing platform that enables road operators to deploy advanced roadside services in a secure and agile way. It allows operators to extend their critical communications infrastructure to make roads and tunnels safer, reduce congestion and take advantage of business opportunities created by connected vehicles.

For Nokia Roadside cloud, a Nokia AirFrame open edge server runs the Nokia AirFrame Cloud Infrastructure for Real-time applications (NCIR) and Nokia virtual Multi-access edge computing (vMEC) technology from cabinets at the roadside. The AirFrame server is fully integrated into the road operator’s critical communications infrastructure. It adds distributed processing and storage along...
highways and in tunnels while integrating with wired and wirelessly connected roadside equipment. These capabilities allow operators to improve traffic flow and safety by supporting demanding roadside services such as real-time traffic analytics.

Road operators can use the Nokia AppFactory, a unique environment for the creation of applications designed to meet the specific needs of enterprises and industries, to ease onboarding of new roadside applications and prepare for future ITS requirements. Our roadside cloud solution is ready to support V2X communications. It allows road operators to efficiently integrate in-vehicle systems with roadside technology and TMSs.

How our platform changes roadside technology

The Nokia roadside cloud platform offers a unique approach that uses the benefits of edge computing to bring distributed processing and storage to highways and tunnels.

Applications

- Nokia roadside cloud is a scalable platform that allows road operators to host multiple critical and less-critical roadside applications on the same hardware without interference. These applications can include today’s virtualized weather detection, traffic detection and traffic analytics applications, along with tomorrow’s automated driving applications and in-car entertainment services.
- We offer a catalogue of roadside applications that help road operators keep traffic safe, on time and connected. The catalogue includes applications from Nokia and well-known traffic technology providers.
- Our AppFactory provides a framework that makes it easy to onboard new applications to the Nokia roadside cloud.
Platform

• The Nokia roadside cloud platform can run on any standard x86 hardware, including the outdoor-hardened Nokia AirFrame open edge server. This server is specifically designed for the harsh roadside environment.

• Roadside cloud includes the Nokia NCIR, which is the first edge-optimized cloud infrastructure for high-performance requirements.

• The platform leverages our vMEC technology. We are a leading MEC vendor and a founding member of the ETSI Industry Specification Group for MEC.

Network

• The Nokia roadside cloud platform can be fully integrated into a road operator’s critical communications infrastructure. It is deployed in cabinets along the roadside and connected to the roadside communications network.

• The Nokia roadside cloud is access technology agnostic. It integrates with wired and wirelessly connected roadside equipment, supports V2X communications, and supports mobile broadband communications that can meet future infotainment demands.

• All technologies and products in the Nokia roadside cloud are open and standards-based (ETSI and 3GPP compliant). They provide flexibility to grow with a future technology roadmap.

How road operators benefit

By deploying Nokia roadside cloud along highways and tunnels, road operators can bring scalable processing power and storage close to road traffic. Road operators can use these capabilities to:

• **Detect dangerous situations as they happen:** The roadside cloud supports real-time situational awareness with analytics at the point of action. It detects dangerous traffic situations by correlating valuable data from multiple roadside and in-vehicle systems analyzed directly at the roadside.

• **Keep traffic moving smoothly:** The Nokia roadside cloud allows operators to detect emerging congestion and mitigate it before it causes heavy traffic delays. They can provide prompt feedback to travelers using variable message signs (VMSs) today. Soon, they will be able to use V2X communications to provide updates through new channels such as smartphone applications and in-vehicle displays.

• **Roll out new applications today:** The roadside cloud enables operators to use existing infrastructure for new applications. For example, video analytics applications can use existing surveillance cameras as roadside sensors that abstract traffic information and send insights to the TMS.

• **Onboard new applications anytime:** With the roadside cloud, operators can easily onboard new roadside applications at any point in the lifecycle of the roadside infrastructure. This applies especially to applications that support automated driving such as precise positioning. Flexible onboarding allows road operators to protect their infrastructure investment.

• **Support connected vehicles:** The Nokia roadside cloud provides V2X communications capabilities that help road operators integrate connected vehicles with roadside systems. For example, it aggregates Cooperative Awareness Messages (CAMs) at the roadside and enhances them with traffic data from roadside equipment before providing insights to the road operator’s TMS.
Why choose Nokia?

Nokia is a strategic partner to road operators preparing for the future of mobility. We use our proven technology leadership and expertise to help the traffic industry architect the road communications future. By choosing our roadside cloud, road operators can take advantage of:

- 25-plus years of relevant traffic industry experience
- Global pilots and innovation engagements
- A broad ecosystem of traffic technology and automotive partners
- Industry thought leadership in edge computing and Cellular-V2X (C-V2X)
- Expertise in all wired and wireless access technologies
- The most complete end-to-end cloud portfolio in the telecommunications industry
- The broadest portfolio of telecommunication products for highways and tunnels
- A full range of services available in more than 140 countries
- Cutting-edge technology innovation from Nokia Bell Labs

Let us help you

Nokia can help you prepare your highways and tunnels for the future of mobility. Our roadside cloud and wireless access solutions provide a flexible platform that enables you to improve traffic flow and safety and deploy new roadside services to meet changing ITS demands. The platform also enables smart integration of in-vehicle systems and roadside technology by supporting V2X communications.

Contact us for more information on our solutions for highways and tunnels.