



# Overview of existing infrastructure and technology of highly and fully automated vehicles

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# Emerging Concepts in Smart Transport Systems


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- Smart City





# Autonomous Vehicles

## Levels of Automation

- **Level 0:** No-automation.
  - **Level 1:** Function-specific automation.
  - **Level 2:** Combined function automation.
  - **Level 3:** Limited self-driving automation.
  - **Level 4:** Full self-driving automation.
  - **Level 5:** An advanced driving support system on the vehicle can do all the driving in all circumstances.
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# Autonomous Vehicles





# Autonomous Vehicles

- Autonomous vehicles frequently refer to self-driving or driverless cars.
- Autonomous vehicles are able to travel without human interventions, which is the highest level of automation in vehicles.
- Technically, autonomous vehicles use the satellite positioning system and diverse sensors (i.e. radar, ultrasonic, infrared, laser, etc.) to detect the surrounding environment.



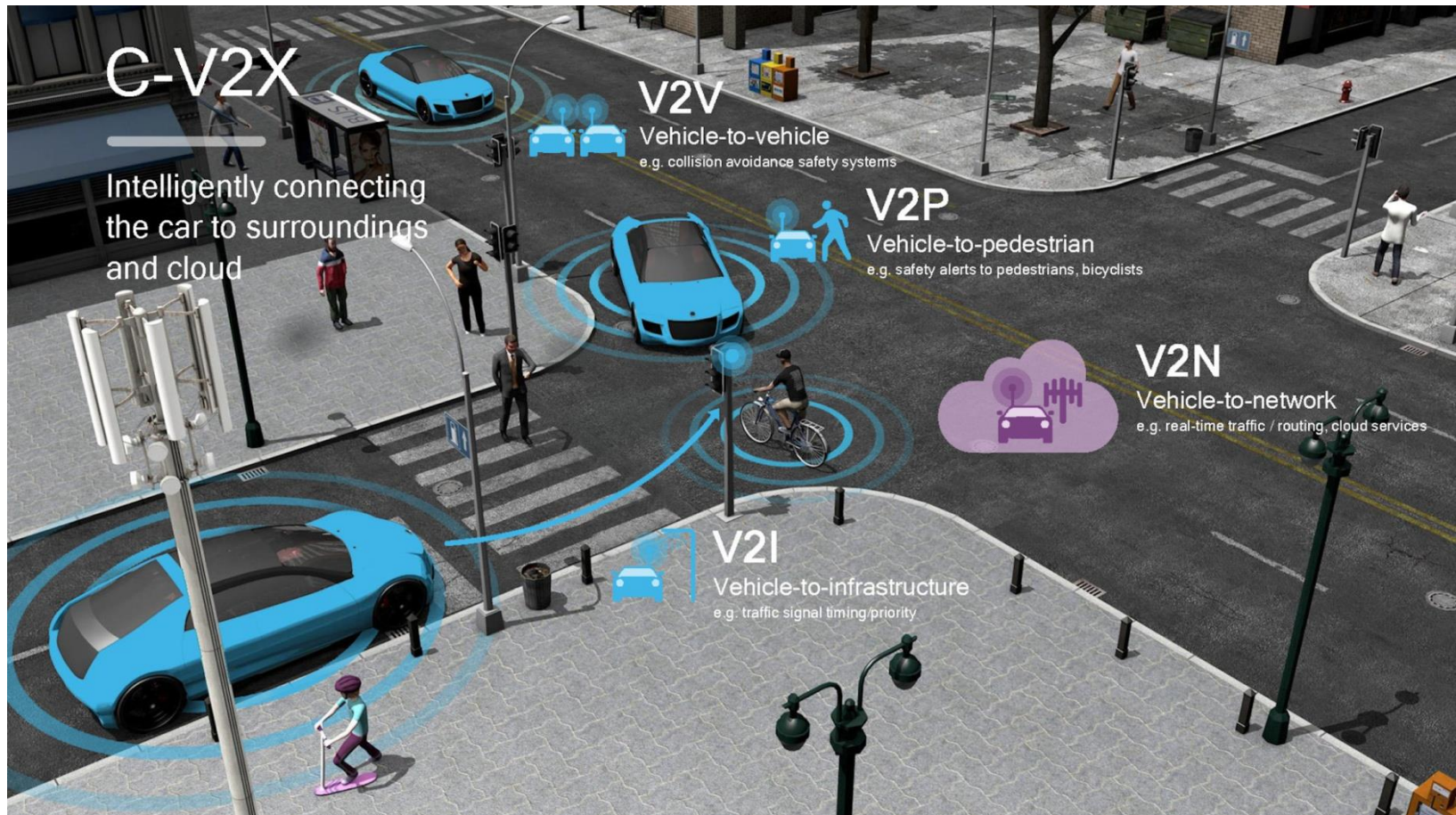


# Connected vehicles and Cooperative-ITS

- Connected vehicles and cooperative-ITS offer tremendous promise for major improvements in safety and mobility, and for reducing the environmental impact.
- Connected vehicles and cooperative-ITS function within a vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications that utilize numerous applications.




# Connected vehicles and Cooperative-ITS





# Smart City

- A technology-intensive city, with sensors everywhere and highly efficient public services, thanks to information that is gathered in real time by thousands of interconnected devices. All buildings are “intelligent”, with smart meters and energy saving systems, and transport is painless.
  - A city that cultivates a better relationship between citizens and governments—leveraged by available technology. They rely on feedback from citizens to help improve service delivery, and create mechanisms to gather this information.
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# Smart City



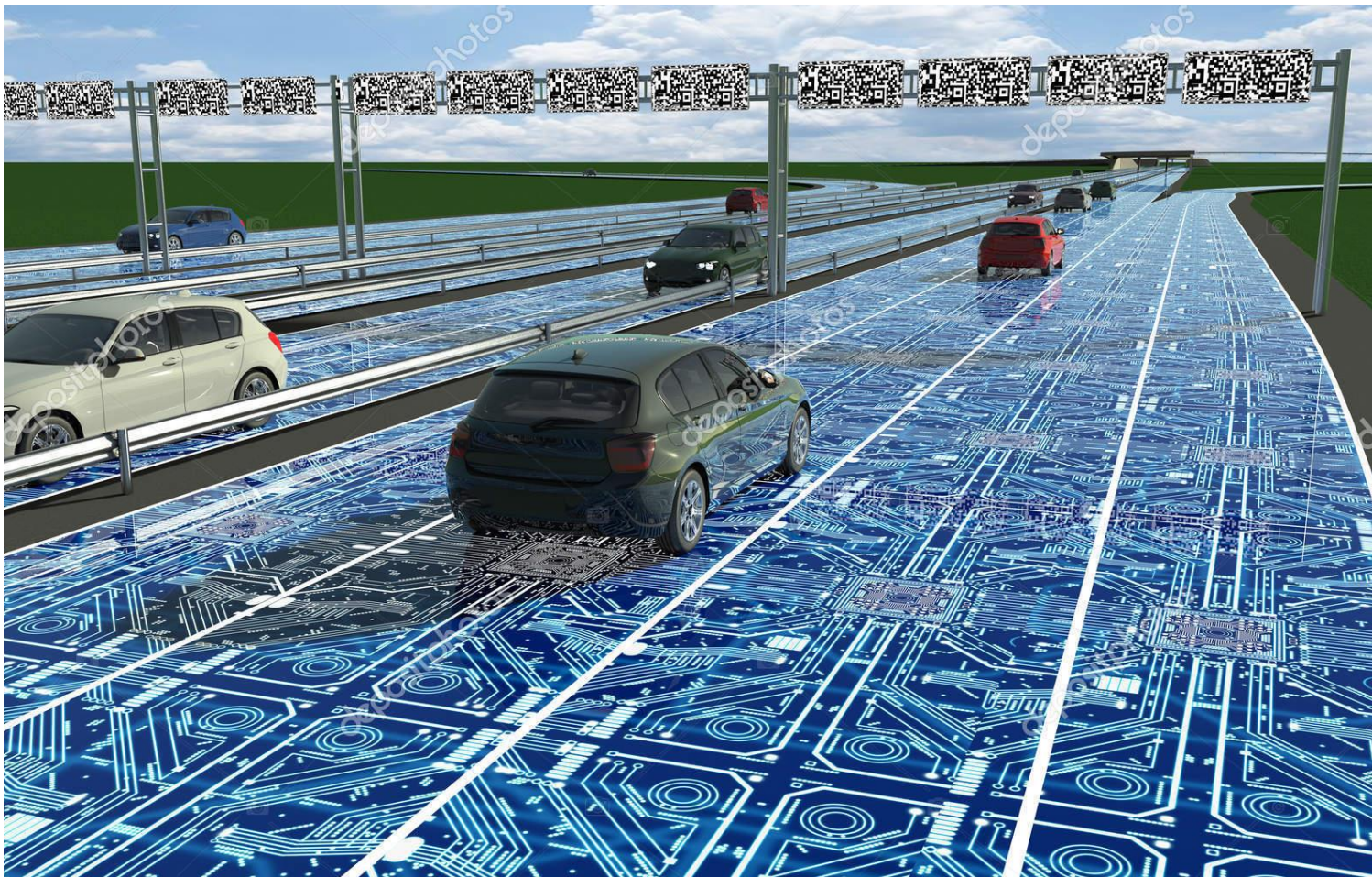


# Infrastructure Requirements

- The performance of many experiment-related automated vehicles are being actively examined on the test-bed before being introduced on public roads.
- The test-bed provides a virtual road environment, including signalized intersections. Identified information is interpreted to find appropriate paths considering obstacles and traffic signage by using wireless networks, digital maps, automated controls in vehicles, and communication with smart infrastructure and the control center.
- In addition, vehicle-to-everything wireless roadside equipment, lidar equipment for test monitoring and rainmaking facilities are provided for testing automated vehicles in a variety of road-traffic situations.



# Infrastructure Requirements





# Cases from Selected Countries

- Japan set up an “Autopilot System Study Group” to study automated driving on expressways.
- A joint industry-academia-government collaboration was organized called the “Cross-ministerial Strategic Innovation Promotion Program”, for the purpose of developing new technologies to avoid crashes and alleviate congestions, which focuses on a collaborative approach to the development and propagation of automated driving technologies.





## Cases from Selected Countries

- The Land Transport Authority in Singapore established the first test site for self-driving vehicle technologies and mobility concept in 2015.
- Singapore has also embarked a new phase of transformation of “Smart Nation”, developing their own vision of the city for the future.
- Singapore Smart Mobility 2030 is targeting to produce a more comprehensive and sustainable ITS ecosystem in Singapore until 2030.





# Cases from Selected Countries

- Australia's first driverless shuttle bus, “IntelliBus”, has been trialed in Perth, with a possible carriage of 11 people and maximum speed of 45km/h in controlled situations.
- South Australia had the first on-road trials of driverless cars in 2015 and driverless shuttle buses were trialed in Perth. The concept of connected and automated vehicles has attracted a lot of interest in Australia, approximately 30 related pilots, trials and case studies have being conducted.
- Connected and automated vehicle trials are being deployed and tested on the South East Queensland highway networks.





## Cases from Selected Countries

- The Republic of Korea is a leading contributor in the development of ITS technologies adopting regularly “National ITS Master Plan”. Recently, the Government of the Republic of Korea defined 15 traffic safety services based on the cooperative-ITS and initiated pilot projects.
- The objectives of the pilot projects are to test the performance of cooperative-ITS, in line with the advancement of the self-driving system, to develop related regulations in roads and traffic, and to support and promote the private sector in the cooperative-ITS domain.





# Cases from Selected Countries

- China aims to implement autonomous driving technology for all private cars in a cutting-edge metropolis near Beijing by 2035. A new city project is planned exclusively for AVs in Xiongan, which will be a model district designated for developing autonomous driving technology based on artificial intelligence, by providing support for related industries.
  - China determined opportunities in implementing cooperative-ITS with Cooperative system for Highway Ramp Safety in Beijing-Tianjin Expressway, for example, and Technology Development on Vehicle and Road Cooperation.
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# Potential Benefits

- Analysis for two potential applications of V2V and V2I - “intersection movement assist” (IMA) and “left turn assist”(LTA), indicated there could be a 50% reduction, on average, in crashes, injuries, and fatalities. Of course, the addition of other V2V and V2I safety applications would save even more lives.
- Pedestrian crash avoidance and mitigation systems could potentially address up to 46% of pedestrian crashes.
- Altogether, these applications could eventually prevent or reduce the severity of up to 80% of non-alcohol-related crashes.





# New Reality in the Automotive Industry

**MADE** dimensions:

**Mobility** – 65 %

**Autonomous** – 65 %;

**Digitalized** – 55 %;

**Electrified** – 55%.

- Significant share of customers is interested in MADE – relevant categories according to the analysis of customer survey in 18 countries (1000 in each country, 18 000 in total) in January 2021.





# Thank you!

