Vehicle to Vehicle (V2V) Connectivity

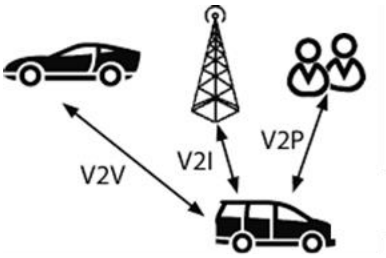
DETAILS

SECTOR | Transport

STAGE | Operations

TECHNOLOGIES | Applications, Bluetooth/Wi-Fi, 4G/5G Networks, Sensors

SUMMARY



Cooperative Intelligent Transport Systems (C-ITS) are emerging technologies that allow road users and roadside infrastructure to share information with each other. Connectivity can be primarily between vehicles (V2V) or between vehicles and infrastructure (*see Vehicle to Infrastructure (V2I) Connectivity and Smart Motorways use case).*

V2V technologies are C-ITS designed to enable communication between vehicles to avoid accidents and warn drivers of impending crashes, as well as to enable the optimisation of the overall traffic flow. They are being developed with a view to facilitate the implementation of Autonomous Vehicles in the future, which will heavily rely on their efficiency. Their functionalities include Turn Assist, which warns drivers not to turn in front of oncoming traffic, and Intersection Movement Assist, which warns drivers not to enter an intersection because the probability of colliding with another vehicle is high. When combined, Turn Assist and Intersection Movement Assist prevent up to 600,000 crashes per year, according to the US Department of Transport[1].

Road crashes have major and long-lasting impacts on communities, as well as on infrastructure and its costs. For example, the World Health Organization (WHO) estimated that globally road crashes cost more than USD 250 billion per year[2]. Australia's Bureau of Infrastructure, Transport and Regional Economics (BITRE) estimates the total cost of road crashes in Australia is AUD 27 billion per year[3]. Around 38% of this cost is attributed to injury or disability, 37% to fatalities and 25% to property damage[4]. V2V technology combined with autonomous vehicles will greatly reduce accidents caused by human error, which account for 94% to 96% of road traffic accidents in the US each year[5].

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[1] National Highway Traffic Safety Administration, Accessed 18 May 2020.
[2] "The global impact", World Health Organization, Accessed 18 May 2020.
[3] "Government estimates road crashes costing the Australian economy $27 billion a year", ABC News, Accessed 18 May 2020.
[4] "Australian Road Deaths Database", Australia Bureau of Infrastructure, Transport and Regional Economics (BITRE), Accessed 19 May 2020.
[5] "Evidence stacks up in favor of self-driving cars in 2016 NHTSA fatality report", Digital Trends, Accessed 17 May 2002.

V2V technology can also help improve traffic flow management, decrease congestion, and optimise utilisation of existing infrastructure, thereby minimising any unnecessary expansion of infrastructure capacity (e.g. more roads and/or more transit). V2V provides data on traffic flows, which is processed and used to share traffic information on variable message signs and variable speed limit signs, and to enable vehicle platooning if all vehicles are connected. It is also used for route planning (*See also the Demand Responsive Transport use case*).

A successful, safe and sustainable road transport network will continue to be a critical part of the mobility mix. The innovative deployment of connected technologies and the increased use of data, analytics and artificial intelligence will enable countries to stretch capacity and minimise infrastructure disruption while leveraging existing road infrastructure. The increased use of data from V2V, combined with smart technologies such as advanced telematics, the evolution of connected vehicles, and urban and inter-urban traffic flow management will all be essential to meeting major environmental and cost challenges. Critically, a key benefit of continued technological innovation is that for drivers, passengers and pedestrians, a safer future will be secured.

VALUE CREATED

Improving efficiency and reducing costs:

- Reduce infrastructure costs and disruption time and costs as vehicle traffic is optimised with better coordination. Existing infrastructure is fully utilised and less new road infrastructure expenditure is required.
- Reduce costs associated with road traffic accidents which will result in reduced expenditure on medical services, police, infrastructure repair etc.

Enhancing economic, social and environmental value:

- Reduce congestion and improve connectivity between destinations, as traffic flows are optimised.
- Enable longer term infrastructure investments through the data collected and the more efficient demand management removing the need for additional 'immediate' capacity improvement.
- Improve road safety (generating costs savings) and infrastructure management.
- Facilitate the use of private vehicles for new shared models: the usage and availability of connected vehicles can be managed in an area, thus it is easier for a private vehicle owner to integrate their vehicle into a shared transport fleet (such as ride-sharing).

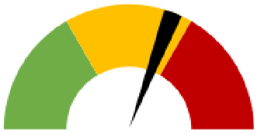
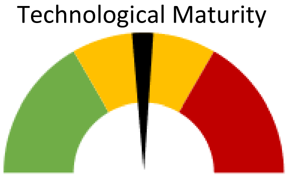
POLICY TOOLS AND LEVERS

Legislation and regulation: A diverse range of stakeholders need to cooperate; mobility regulators, telecommunications operators, manufacturers and technology providers. In 2010, the European Commission launched a group to internationally standardise C-ITS. International standards exist for the fabrication, accreditation and use of V2V technologies, focused on safety. Using international standards, governments should define accreditation and certification requirements to ensure all vehicles sold in countries with V2V technologies enabled are interoperable. The interoperability of the V2V technology is critical to realising its benefits.

Effective institutions: Governments must ensure they can affect necessary change in the market to support the upholding of public value. The connected aspects of V2V solutions and the use of data must provide an economic benefit to the user who 'agrees' to share their data. This should be established and communicated to the population.

Transition of workforce capabilities: Governments need to develop skills for the accreditation of manufacturers' vehicles. They also need to ensure there are enough mechanics to maintain V2V technologies in vehicles and they need appropriate skills in house to regulate the technology effectively.

IMPLEMENTATION

Ease of Implementation 	Implementing V2V technology is primarily executed by vehicle manufacturers who should follow (and jointly develop with governments) relevant international standards to ensure interoperability of vehicles, which today is proving challenging. For governments, to effectively utilise V2V, it is important to make sure that the right regulations are in place. These should comprise communications and international and local standards.
Cost 	Implementing V2V requires high upfront costs to 'connect' the vehicles with the right technologies, as well as to operate them in a consistent way. Manufacturers must heavily invest to develop these technologies, with the support of research funds from governments. The costs will be filtered through to consumers through the price of the vehicle or service.
Country Readiness 	To work effectively V2V requires widespread communications networks. There should also be a thoughtful integration with the transport network, that enables seamless and informed data sharing between transportation services.
Technological Maturity 	Many do not trust sensors like V2V to perform better than humans. Today not all V2V technologies can communicate with each other as they are provided by different manufacturers using different international standards. This is an area of continued development.

RISKS AND MITIGATIONS

Implementation risk

Risk: To work effectively V2V requires widespread communications networks. In addition, standards for the technology's development and uses should be aligned and followed by all manufacturers. There should also be a thoughtful integration with the transport network, that enables seamless and informed data sharing between transportation services.

Mitigation: To mitigate this issue, internationally agreed V2V standards should be developed with a plan that ensures the right communications networks are in place.

Social risk

Risk: Users may be reluctant to accept V2V technology due to perceived data privacy issues.

Mitigation: Businesses providing V2V should focus on the scenarios for the use of V2V to improve the experience of travel so that ultimately on-demand, personalised, and autonomous transport services *(see Autonomous Vehicles use case)*, utilizing V2V, can provide a tailored experience for individual customer needs. It is also important to encourage competition in order to provide users with greater choice and flexibility, and improve customer service standards, while driving innovation.

Safety and (Cyber)security risk

Risk: Communications network vulnerabilities are one of the most important cyber security risks as wireless communication introduces a different set of cyber problems called "WiFi like" network vulnerabilities: wireless services can be vulnerable to signal intercept, signal hacking or deterioration and other similar threats linked to the transmission of data. This main vulnerability points are located both at the level of the communication networks (the channel transmitting data) and its supporting devices on the roadside (which collect and emit the signal).

Mitigation: Organizations should ensure their systems are robust to eliminate the risk of a cybersecurity breach, and governments should set regulatory frameworks to outline the requirements of these systems to repel cybersecurity attacks.

Technological solutions include the use of licensed and standardised radio/comms channels to reduce exposure to the known problems and make sure all communications and V2V providers can comply with those requirements when developing their networks and devices. DSRC (Dedicated Short Range Communication), a wireless standard developed specifically to support V2V applications, has been developed to respond to this threat and is currently being developed to capture all communications threats and have a response program to stop them for all vehicle types.

EXAMPLES

Example	Implementation	Cost	Timeframe
Queensland CAVI Program	Trials of several V2V technologies from different manufacturers.	High costs and a lot of research contributions.	Trials are still on-going with Autonomous vehicles.
CETRAN Singapore	Centre of Excellence for Testing & Research of AVs-NTU (CETRAN) – LTA (Singapore).	High costs and a lot of research contributions.	Trials are still on-going with Autonomous vehicles.
Nevada	Certification and regulations are a key focus of the trials.	High investments to develop regulations guidelines.	Trials are still on-going with Autonomous vehicles.