

**WG2 conclusions/recommendations on Connectivity for automation:**

1. Connectivity can enhance the effectiveness of automated systems to improve road safety and traffic efficiency by allowing better perception (tactic and strategic decisions) and communication with the environment. For perception, automated systems to be launched until 2020 will rely mostly on on-board sensors. Connectivity is therefore not a strict prerequisite for automation for 2020 systems except for platooning.

Although automated driving will rely on car sensor information, without cooperation amongst road users, vehicle-to-everything (V2X) connectivity can enhance autonomous driving by providing more sensory resources and a complete different level of redundancy, thus enabling collective perception and prediction with non-line of sight sensing and coordinated resolution of complex decisions. Indeed, V2X could contribute to many operational use cases as a complement to vehicle sensors. It also allows for better localisation by using information from traffic managers. This level of redundancy will further benefit from high penetration of V2X technology in both vehicles and infrastructure.

**Connectivity approaches**

The V2X connectivity approaches can be grouped under two distinct families – each of which has different characteristics and can respond, alone or in combination, to different scholar models:

- a) Vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and vehicle-to-pedestrian (V2P) connectivity, which relies on short-range, ad-hoc connectivity for time-critical safety applications (e.g. autonomous emergency braking in low visibility conditions). This type of connectivity is based on standardised protocols and data sets in a licence-exempt regulatory framework, would be operated in the 5855-5925 MHz (ITS) band and does not require any mobile network or subscription. Technologies enabling this mode of communication need to be available and tested on a large scale in 2019 as highlighted by the European Commission for Day-1 services in the C-ITS Communication.<sup>1</sup> The key technologies are the current ITS-G5 and the upcoming C-V2X (V2V ad-hoc mode 4) nearing completion in March 2017 and targeted for testing by carmakers in 2017 before future 5G evolutions.
- b) Vehicle-to-network (V2N) connectivity, which can be delivered over commercial mobile networks and bands based on 3G, 4G or 5G, e.g. the 3.5 GHz band identified as offering high potential to become a strategic band for 5G launch in Europe (e.g. for high-definition map updates).<sup>2</sup>

<sup>1</sup> A European strategy on Cooperative Intelligent Transport Systems, a milestone towards cooperative, connected and automated mobility, COM(2016) 766 final, 30 Nov. 2016  
<sup>2</sup> Communication from the EC, 5G for Europe Action Plan, COM(2016) 588 final, 14 Sept. 2016

**Comment [JJAB1]:** The basis for automated driving is that automated and autonomous vehicles will operate by their own with no strict need of connectivity.

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**Deleted:** thus eliminating common causes of failure for safety critical needs such as 'seeing through' big vehicles and non-line-of-sight objects

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**Comment [JJAB2]:** Depends on the adopted technology

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**Comment [JJAB3]:** In summary, Spain does not agree with this point, connectivity based on DSRC has serious problems related to investment, security (wi-fi), latency, reliability and maintenance cost (both for on-road equipment and use of spectrum fare). The present and future of connectivity will be based on cellular network (3G, 4G & 5G)

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**Comment [JJAB4]:** V2V based on on-board equipment is costly & not possible ...

**Comment [JJAB5]:** In Spain we have tested this technology 5-6 years ago ...

**Comment [JJAB6]:** There is no need on waiting for 5G technology, current ...

**Comment [JJAB7]:** This is not a problem

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**Comment [JJAB8]:** Currently, there are initiatives on traffic lights and ...

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