EUPAVE
EUROPEAN CONCRETE PAVING ASSOCIATION

CONNECTED, AUTONOMOUS AND ELECTRIC VEHICLES

CONCRETE INFRASTRUCTURE CAN PAVE THE WAY

Smart transportation will soon create a world in which vehicles are autonomous, electric and connected to other vehicles and the infrastructure, making decisions with minimal human input. Infrastructure will be an important component for these "vehicles of the future" to correctly operate, and so public administrations and road authorities must start preparing now for this inevitable development.

EUPAVE and its members are eager to facilitate the transition to autonomous and electric vehicles, not least because of the specific advantages that concrete pavements and infrastructure offer in this transition, but also because of their massive potential to enhance the sustainability of road transport.

The European Union has taken some steps to prepare for vehicles of the future (e.g. Digital Single Market Strategy[1], Intelligent Transport Systems Directive[2] and the Alternative Fuels Infrastructure Directive[3]), but more could be done to unleash the potential of these solutions. Infrastructure has a key role to play. Concrete has advantages in terms of each of these developments: **connectivity, autonomy** and **electrification.**

■ Connected vehicles

Connected vehicles will share information with other vehicles and with the infrastructure, via sensors, wireless systems and the internet. Connectivity is often the first step towards autonomy. Durable and predictable infrastructure – as offered by concrete pavements – is a necessary prerequisite to fully exploit the advantages of connectivity. For example, truck platooning, whereby trucks gain in efficiency by being wirelessly connected in a closely spaced chain of vehicles that brake and accelerate simultaneously, will be greatly facilitated by reliable and durable infrastructure.

■ Autonomous vehicles

The benefits of vehicles which are autonomous (partially or fully "self-driving") are potentially huge in terms of solving congestion and improving fuel efficiency[4]. Such vehicles will be able to "read" the road – both thanks to road markings and communication with the infrastructure itself and other vehicles – which means that durable, reliable road pavements will be essential. In addition, in order for the whole road network to be accessible, there will be a need for paving of roads which are currently unpaved[5]. Finally, the increased precision of autonomous vehicles will result in vehicles all moving on the same "track". For this reason, pavements will have to be more resistant to rutting due to this extra load.

Concrete pavements, thanks to their durability and strength, perfectly live up to such requirements. Concrete safety barriers also have a key role, both by offering additional safety and as host to guidance technology.

■ Electric vehicles

Electrification of vehicles, in combination with renewable electricity generation, will be an important part of decarbonising road transport. However, replacing all or part of the existing vehicles in the EU-28 by electric vehicles will result in a tremendous need for charging points. Today, there are 249.8 million passenger cars, or 491 cars per 1000 inhabitants in the EU[6]. One way to avoid potential problems of space and urbanisation consists of using **inductive charging** (see box below) to power electric vehicles wirelessly from elements

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embedded in the road surface as they drive, without affecting traffic flow. As regular roadworks or replacements in pavements may lead to disruptions, low-maintenance, durable concrete pavements are desirable.

Regarding electric trucks, batteries may not offer sufficient range, so charging by overhead wires (catenaries) is an ideal solution – and here again concrete pavements offer the required durability for such dedicated lanes[7].

INDUCTIVE CHARGING PROJECT IN FLANDERS

A 4-year research project[8] tested inductive charging of vehicles – both while moving or stationary – via special modules incorporated in the pavement. Of particular importance was the durability of the pavement with these modules incorporated. Concrete pavements were shown to have excellent results, thanks to their durability. Furthermore, precast concrete slabs allowed for very precise placing of inductive charging modules at bus stops, for stationary charging of buses.

For all these reasons, EUPAVE calls on:

1. Member States to utilise the new Public Procurement Directives to their full potential to incentivise road infrastructure with the lowest life-cycle cost, including provisions for vehicles of the future;
2. Member States and their road authorities to avail of the possibilities of the Intelligent Transport Systems Directive, the Alternative Fuels Infrastructure Directive and the Digital Single Market Strategy to facilitate the uptake of the vehicles of the future as well as the infrastructure they need to thrive;
3. The European Commission, European Investment Bank and National Development Banks to consider the momentum of the vehicles of the future and their needs for appropriate infrastructure by facilitating all relevant financial instruments to pave their way.

GLOSSARY

Automated and autonomous vehicles - Vehicles that fully or partially automate driving functions. Six levels, from no automation to full automation, are commonly identified[9].

Connected driving - Connected Driving (or C-ITS) is the term used to describe technology which allows vehicles to become connected to each other, and to the infrastructure and other parts of the transport network[10].

Truck platooning - Wirelessly connected trucks travelling in a closely spaced "platoon", accelerating and braking simultaneously[11].

Inductive charging - Use of an electromagnetic field to wirelessly transfer energy through electromagnetic induction.

Intelligent Transport Systems (ITS) - Advanced applications providing innovative services relating to different modes of transport and traffic management and enabling various users to be better informed and make safer, more coordinated and 'smarter' use of transport networks[12].

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[1] http://europa.eu/rapid/press-release_IP-15-4919_en.htm

[2] DIRECTIVE 2010/40/EU

[3] DIRECTIVE 2014/94/EU

[4] http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/573902/EPRS_BRI(2016)573902_EN.pdf

[5] Why transition to automation should be different in Eastern-Central Europe? T. Andriejauskas et al., 2016

[6] EU transport in figures - Statistical pocketbook 2016 (European Union, 2016)

[7] http://w3.siemens.com/topics/global/en/electromobility/pages/ehighway.aspx

[8] Inductive charging through concrete roads: a Belgian case study and application, A. Beeldens et al., 2016

[9] http://www.itf-oecd.org/sites/default/files/docs/15cpb_autonomousdriving.pdf

[10] http://ec.europa.eu/transport/themes/its/c-its_en

[11] https://www.eutruckplatooning.com/About/default.aspx

[12] DIRECTIVE 2014/94/EU

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