

Executive Summary

The third in-person meeting for PIARC Task Force B.2 Road Design and Infrastructure for Innovative Transport Solutions, was held in Abu Dhabi, UAE on Wednesday 9th October 2019, and coincided with the World Road Congress (6th – 10th October).

The meeting included 13 members of the B.1/B.2 Task Forces from France, Austria, Italy, Australia, Canada, Czech Republic, Japan, Kenya, South Africa and Spain and was chaired by Eric Ollinger. An additional Guest, Bernard Jacob, from IFFSTAR, France, also attended part of the meeting to provide an update on the latest work on Truck Platooning in Europe.

In addition to the meeting, the combined Task Forces B.1 and B.2 hosted a session as part of the World Road Congress (WRC) on Thursday, 10 October 2019. The session covered a summary of the completed B.1 work and the interim information available from the B.2 work-in-progress.

Task Force B.1, which has now concluded, was tasked to “*Identify major considerations in the development and deployment of Vehicles-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V) communication in road design and operations.*” The focus was to understand the implications of C-ITS specifically for road operators. Since the last Task Force meeting in April 2019, the completed work has now been published in a single report available through the PIARC website.

Task Force B.2 is currently investigating and will report on “*Automated vehicles: challenges and opportunities for road operators and road authorities.*” Task Force (TF) B.2 was formed mid-cycle to undertake the investigation in AV’s as an extension to the previous work of TF B.1. The Task Force will complete its task brief during 2020.

The meeting had a combined function. It was an opportunity to undertake final planning for the WRC session to be hosted by the Task Forces. The meeting was also used to assess the status and content to the draft chapters under development for the Task Force Report into automation. (The previously developed workplan for the TF determined that all members will work together to contribute to a single report addressing the topic and as such there are no separate work groups within the Task Force).

Background

The goal of Strategic Theme B is to encourage the improvement of access and mobility provided to the travelling public and industry through efficient road network operation and integration with other transport modes.

The formation of Task Forces, within the strategic plan, allows the investigation of critical issues. The smaller size and 2-year tenure of a task force enables a focused response to an issue as well as some flexibility to explore the topic. The aim is to produce targeted outcomes directly relevant to the topic being explored. The work and tenure of TFB.1 has concluded and the tenure of the TF B.2 will continue through to mid-2020. Task Force B.2 follows on from the work completed by Task Force B.1.

The work undertaken by TF B.1 was completed during the 2016-2019 PIARC cycle and reported on at the WRC 2019.

Term of Reference and Scope of Investigations

Topics to be covered as part of the TF B.2 investigation include:

- What will the impact of automated vehicles be on traffic management, on equipment requirements, on road safety, on maintenance strategies, on adaptive control and performance optimisation of the network, on infrastructure design.
- How to cope with the different timeframes: IT equipment in cars have a short life span and is evolving very quickly, while road infrastructure assets have a life span of 20 to 100 years.

- What roles can road authorities play and under what conditions, to support and encourage innovation and actual deployment, especially from the infrastructure-side; this includes business models.
- The work will focus more on policy issues and less on technology developments, as these are extensively discussed already across many forums.

The outcomes report is proposed to outline key topics explored and practical short- and medium-term recommendations for road authorities and operators. Among others: harmonised approaches, and suitable standard measures to road authorities and operators.

The TF will aim at representing a wide diversity of circumstances, including case studies from several countries and continents. The TF plans to make references, where available, to the work of other organisations (road agencies and associated national bodies), car manufacturers, IT companies, equipment manufacturers and service providers and their representative bodies.

Work Program

The source material collected and collated by the TF members is intended to represent state of the art from different countries (including roadmaps, pilot projects, research reports and relevant studies) and information for inclusion will come from bibliographical analysis of existing reports from various international organisations.

Task Force B.2 meetings to date include:

- Kick-off meeting in Québec City, Québec, Canada in July 2018, to develop the work program.
- Online Webex meeting in October 2018, to allocate the required bibliographic reviews to TF members to identify content for inclusion.
- In-person meeting in Melbourne in April 2019, to review the preliminary information assembled, identify gaps for further collection and allocate teams of authors for the development of draft outlines for report chapters.
- Online Webex meeting in June 2019, to review the draft outlines developed and commence chapter drafting.
- In-person meeting in Abu Dhabi (at the WRC) in October 2019, to prepare for the congress information session and review progression the report chapters.

An online Webex meeting is planned for early December 2019 to discuss the status of the draft chapters and to commence the chapter review process.

The final in-person meeting, to finalise the draft report contents and commence the review process, is proposed for March 2020. It is initially proposed that the meeting may be hosted in Nairobi, Kenya, although consideration may be given to considering an alternative location depending on the ability for various TF members to travel to Kenya.

Meeting Outputs

The October 2019 meeting (at the WRC) was structured in two parts. The early session involved each of the presenters for the WRC session (to be held on the following day), to run through their presentation content for review by the broader Task Force.

The latter session of the meeting was dedicated to reviewing the draft report chapter contents to determine consistency of information collected and presented and determine current gaps and identify any overlaps or need for cross referencing to be addressed.

As outlined in the previous update report, topics to be covered in the final report will include:

- Physical Infrastructure
- Digital Infrastructure - 1 - Connectivity
- Digital Infrastructure - 2 - Digital Maps and Positioning
- Digital Infrastructure - 3 - Data Issues Common to Connectivity and Maps

- Impacts on Road Network Operations
- Responsibility and Financing
- Social Issues

Each TF member ran through the available drafted chapters which enabled general discussion of the content and the identification of topics that required more input from the chapter authors or other TF members. Further opportunities for refining or expanding the included information were identified.

A webex progress meeting will be held in December 2019 and an in-person meeting to coordinate finalisation of the report in March 2020.

World Road Congress – Task Force Hosted Session

A copy of the Session Conclusion Report for the Task Force hosted WRC Session is provided in Appendix A. The conclusion report covers the program of the session, brief summaries of the speaker topics and presentation content and summaries of the Q&A at the end of the session parts.

Emerging Issues

There are no current emerging issues directly identified from the Task Force activities at this stage.

Learnings for/from Australia and/or New Zealand

A significant amount of content has been provided for inclusion in the draft report development, principally sourced from a number of Austroads reports prepared under the Austroads CAV Program over the last two years. It is noted that the most recent suite of Austroads Reports - Infrastructure Changes to Support Automated Vehicles on Rural and Metropolitan Highways and Freeways – have been provided to Task Force members for consideration of this up to date content. (Modules 1-5: AP-T347-19; AP-T348-19; AP-R604-19; AP-R605-1; AP-R606-19).

Completion of Task Force B.1 Reporting

The principal output from Task Force B.1 is a report to: *“Identify major considerations in the development and deployment of Vehicles-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V) communication in road design and operations.”*

The report titled “Connected Vehicles - Challenges and Opportunities for Road Operators” has now been finalised and published on the PIARC Website. [[Link](#)]

Conclusions and Recommendations

The Task Force will continue with the next steps as outlined in the meeting outcomes and work program.

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SESSION CONCLUSIONS

**SESSION TF B.1&B.2 “CONNECTED AND AUTOMATED
VEHICLES”**

THURSDAY 10 OCTOBER, 8:00-11:30

XXVITH WORLD ROAD CONGRESS

ABU DHABI, UNITED ARAB EMIRATES

6–10 OCTOBER 2019

Session Conclusions

Date: 25/10/19

Author: Eric OLLINGER

Keywords

Connected vehicles
Automated vehicles
Challenges
Opportunities
Road operators

Title of the session:

CONNECTED AND AUTOMATED VEHICLES

Topic of the session

The session has shown the results of the work of TF B.1 (2016-2018), whose report is available in English, Spanish and French on PIARC website, and the intermediate results of TF B.2 (2018-2020). It has analyzed the challenges and opportunities of connected driving (part 1) and of automated driving (part 2) for road operators.

Recommendation for Decision Makers

The question asked by decision makers on connected driving (also known as C-ITS) is where to start. The experience from the various pilots all over the world is that the best way to start with C-ITS is to start small and to learn by doing. Pilot deployments based on a few of the most mature services (the so-called Day 1 services as described in the session) are a good start. The section of the report on the pros and cons of each technology can help to make the best choice.

Examples of technical specifications are available from existing pilot deployments. Some are already harmonized, as in Europe, to ensure interoperability.

Security and privacy are important challenges that must be tackled with appropriate experts.

But the key point is not technical, it is to involve all relevant stakeholders: road operators cannot deploy C-ITS by themselves, they need to work in close relationship with car manufacturers and service providers who will be delivering the service to the end user.

COOPERATIVE ITS are indeed, above all, a matter of COOPERATION.

On automated driving, the work of the TF is still ongoing, and it is too early to come up with recommendations.

Technical Findings

1.1. PART 1

The first part has dealt with the challenges and opportunities of connected driving (also known as Cooperative Intelligent Transport Systems or C-ITS) for road operators, based on the final results of TF B.1. There have been 4 speakers:

1. Martin Thibault (Canada): analysis of the inputs gathered – 15'

The analysis of the 23 surveys received allowed us to draw some interesting statistics. The majority of the cases study come from Europe (20), one from Australia, one from South Korea and one from Japan.

These projects, all led by road network operators, are 80% in operation or in a trial period. The trial period is characterized by the fact that the project is deployed in a small area or the data is not yet available to the public.

The benefits expected from the projects are grouped into the following three main families: security, mobility and the environment.

V2I communication allows many "services" to users; projects considered send different types of warnings to users. The services present in the largest number of projects are mentioned in the graph above. Other services deployed in a smaller number of projects such as the priority of emergency vehicles to fire and the protection of vulnerable users are noteworthy.

Projects use different radio communication protocols. ITS-G5 is widely used in Europe while DSRC 5.9 or 5.8 is used in Asia (DSRC for Dedicated Short Range Communication).

2. Abdelmenname Hedhli (France): opportunities of connected driving for road operators – 15'

In terms of opportunities for road operators, C-ITS can potentially improve road safety, traffic efficiency and comfort of driving, by helping the driver to take the right decisions and adapt to the traffic situation. C-ITS can also help road design and asset management. These technologies can also reduce costs for road operators or even generate revenues.

Regarding automated driving, C-ITS will help increase the safety of future automated vehicles and their full integration in the overall transport system. C_ITS and automation are complementary technologies and will merge completely over time.

3. Ana Luz Jimenez (Spain): challenges of connected driving for road operators – 15'

For the deployment of services through C-ITS, the services have been established and prioritized. We can talk about services in the short term (called day 1 applications) and in the long term.

Business models for road and traffic operators: the wide variety of C-ITS services can be offered to road users and other stakeholders, from different suppliers, in an independently or en a collective manner.

Analysis of the advantages and disadvantages of the different technologies used: Short Range Communication, Long Range Communication and Wide Area Broadcast.

It is important to develop a common framework for the assessment of data quality that define clear processes for assessing and reporting on data quality. Besides, the opening and sharing of such data sources among the different C-ITS players it is necessary to bring benefits.

Security must be ensured throughout the entire service chain, from the generation of C-ITS services to the presentation of C-ITS services to the individual user. It is the responsibility of each stakeholder to ensure the security and protection of data within their own system.

It is important to promote the safety potential and effectiveness of C-ITS services so that this service can be trusted by road users to provide safer conditions for those utilising them. To achieve this, it is necessary for road users, the end-users of C-ITS services, to understand the available services and recognise the advantages through direct and indirect participation, and thereby encourage ongoing utilisation.

4. Rudi Botha (South Africa): a South African perspective – 15'

With the deployment and deployment of cooperative intelligent transport systems (C-ITS) speeding up in many "developed" countries, South Africa and other "developing" countries can't afford to get left behind. The South African National Roads Agency (SANRAL) recognizes the need to utilize technology, research and innovation to advance the provision, operation and management of the national road system; in order to better meet road user needs, through improved capacity, mobility and most importantly, road safety.

South Africa has among one of the highest road crash fatality rates in the world, with between 13,000 to 17,000 fatalities per year, of which 33% of these fatalities are pedestrians (VRU's). Before one can consider the opportunities that C-ITS can bring to "developing" countries, one must first understand their challenges.

This section looks at some of the “unique” developing world challenges being faced by the roads authority and looks at opportunities of where C-ITS could be a beneficial solution to these “developing world” challenges.

After these 4 presentations, a panel discussion has taken place. Main questions raised were as follows:

- (i) Noting that deploying DSRC/ITS G5 road side units requires major capital investments while governments are looking to reduce investments in road infrastructure (eg. France has an extensive road network of over 1million km), has the task force evaluated the cost/benefit of the technology options?

Response: The Task Force considered the technologies used in pilot projects: DSRC/ITS G5 is the most used. However, the report has recommended hybrid technology (use 5G or 4G if not available). Moreover, there is a French cost-benefit analysis showing that a scenario “start deployment now based on ITS G5 and hybridize with 5G once available” is more efficient than a scenario “don’t invest now and wait for 5G”.

- (ii) Has Task Force considered safety (security) of the communication equipment against vandalism, physical destruction (during protests, riots etc)

Response: The possibilities of vandalism are low since road side units will be situated 7-10m above the ground.

- (iii) Are there linkages between the work of this Task Force and other PIARC Task Forces?

Response: YES. There are linkages between TFs as Strategic Plan aligned each Task Force while Technical Sessions during WRC also enhance synergies.

It was noted that under the new Strategic Plan cycle, use of Big Data and CAV by RNO has been addressed and linkages among various TF to create value collectively

- (iv) Is there evidence that C-ITS will improve road safety?

Response: YES. Evidence that Connected Vehicles will mitigate fatalities is available.

1.2. PART 2

The second part has dealt with the challenges and opportunities of automated driving for road operators, based on the intermediate results of TF B.2. There have been 4 speakers:

1. Matthew Krech (Canada): Physical infrastructure – 15'

The lifecycle differences between information technology equipment, digital infrastructure and physical infrastructure are one of the key issues that will challenge road network operators and as such long-term asset planning should take connected and automated vehicles needs into consideration. With recognition that vehicles are manufactured for global markets, significant international efforts are needed to harmonize traffic signs and road markings to ensure consistent recognition and safety. Alternatively, some jurisdictions may elect to digitize all forms of signage by adding infrastructure-to-vehicle connectivity or machine-readable code (e.g. QR code). Road network operators may also consider analysis on designating lanes for vehicles with higher levels of automation or platoons which may enable the deployment of the technology while minimizing risks from interactions with non-automated traffic. Notwithstanding, consideration must be given to the optimum use of road networks and public transport needs. Automation has the potential to decrease vehicle headways and therefore increase road capacity, road network operators must account for pavement and bridge fatigue as well as rutting in their planning and design efforts.

2. Martin Böhm (Austria): Digital infrastructure – 15'

Data is one core-element when it comes to Automated driving. Hereby data is collected, transmitted, processed and analyzed to provide inputs to automated driving functions. Within the session all these elements will be discussed with a specific focus on responsibilities of and tasks for the Road Network Operators. Herby a link to big data analysis (including Artificial Intelligence) will be given to discuss the different kind of data. In detail the challenge is, that within Road Network Operations we have to deal with various kinds of data – small and big data, static and dynamic data, data in different formats, open and closed data etc. A specific focus will be given to the access to data. How is access to data, and especially to in-vehicle data handled in different areas of the globe? In addition, data analysis and generation of knowledge will be an additional focus. Gathered knowledge needs to be put together in so-called high definition maps. And such HD maps are a core element when it comes to automated driving functions. The session will deal with HD map concepts and discuss the responsibility of different actors to ensure a safe and secure operation of automated functions (advanced driving assistance systems – ADAS) within the vehicles of the future.

3. Matthew Hall (Australia): Impact on RNO – 15'

The emergence of automated vehicles on public roads is expected to deliver a range of operational improvements. Some forecasts indicate significant improvements while other forecasts are less optimistic. Recent studies suggest that in the longer term, higher penetration rates of AV's may provide some modest improvements to road capacity and utilisation, however, during the intervening period lower penetration rates may lead to reductions in operational capacity.

Automation and platooning of freight vehicles have the potential to improve the efficiency of road-based logistics through fuel savings and other reduced operating costs and a number of platooning trials are occurring in various jurisdictions around the world. Automation also presents new opportunities for new mobility services through the integration of automated shuttles for a range of user groups. Recent trials have highlighted challenges for automated vehicles to operate in mixed use environments such as zones shared with pedestrians. In addition to the difficulties associated with shuttles interacting with people, people also have varying expectations about how to interact and navigate in open spaces with automated vehicles.

With increasing penetration of AV's in vehicle fleets, there is an expectation that the expanded data and intelligence from connected and automated vehicles, available in real-time, will enable improved road network operational control and response. Challenges exist with the availability, type and consistency of data from vehicle manufacturers to make such improvement opportunities. Road agencies also need to shift the way that their road networks are operated to thoroughly leverage the available data and implement the tools and control systems that can optimise network operations."

4. Petr Zamecnik and Darina Havlickova (Czech Republic): Social impacts – 15'

The presentation will summarise the state of the art in the field of social issues connected with automated transport. It will be shown, that the potential benefits of automated transport may be limited by a range of human factors issues (e.g. technology over-reliance; driver overload or underload; driver distraction; failing to trust or accept the technology leading to system misuse or disuse; loss of driver skill; adoption of risky driving behaviours) and what are the current attitudes, needs and beliefs towards automated transport. Based on that will be concluded possible direct and indirect impacts of automated technology on individuals and society (e.g. impact on safety; mobility; travel behaviour; public finances; emission; environment; education, etc.). Consequently, pros and cons of automated transport for different types of countries will be discussed.

After these 4 presentations, a panel discussion has taken place. Main questions raised were as follows:

- (i) Has the Task Force considered the disruptive nature of the technology on human behavior? Are the schemes water tight? For example, police mistakenly chasing a drunk driver who is in an AV?

Response: Yes. Task Force recommends that human factors must be solved mainly by the OEMs through technology and not RNO. However, more studies are necessary to identify disruptive events and build in mitigation measures.

- (ii) Happy to note that the study introduces an index of service level for RNO. However, there is need to develop a unified single index covering both Road Infrastructure and Digital Transport Infrastructure?

Response: Concur that there is need for index which covers both quality of data and quality of service.

The study report will include a section on specific use cases. Further the study will consider the complementary nature of RI and DTI data.

- (iii) There is need to harmonize approaches/ perspectives on Road Infrastructure requirements by different professionals for example current debate on revision of the traffic signs (Vienna Convention) by Traffic Engineers and Road Safety professionals.

Response: Concur that there is need to adopt multi-disciplinary approach on CAV. One of the strategies is ensure diversity on the Task Force membership and encourage open communication.

Recommendations for PIARC and International Organisations

As these topics are evolving very fast, the recommendation of the TF to PIARC is to continue keep following these topics and to update the work done. At the end of TF B.2, recommendations will be made concerning the next topics to cover and

Preparation of the Session

The session has been prepared with all the speakers during a meeting of TF B.2 that took place in Melbourne, April 2019, and the presentations have been reviewed on a meeting in Abu Dhabi, on October 9.

Session Program

Chair: Eric OLLINGER

Moderator: Eric OLLINGER

Plan and timing:

Time	Topic/Presentation title	Speaker (title, role/position, organisation, if applicable include PIARC Technical committee)
08:00-08:05	Introduction	
08:05-09:35	Part 1 - Connected driving, challenges and opportunities for road operators	
08:05-08:20	Analysis of the inputs gathered	<i>Mr. Martin THIBault</i> , Member of PIARC TF B.1, Canada
08:20-08:35	Opportunities of connected driving for road operators	<i>Mr. Abdelmename HEDHLI</i> , Member of PIARC TF B.1, France
08:35-08:50	Challenges of connected driving for road operators	<i>Mrs. Ana Luz JIMENEZ</i> , Member of PIARC TF B.1, Spain
08:50-09:05	A South African perspective	<i>Mr. Rudi BOTHA</i> , Member of PIARC TF B.1, South Africa
09:05-09:35	Panel discussion	
09:35-10:00	Break	
10:00-11:30	Part 2 - Automated driving, challenges and opportunities for road operators	
10:00-10:15	Physical infrastructure	<i>Mr. Matthew KRECH</i> , Member of PIARC TF B.2, Canada
10:15-10:30	Digital infrastructure	<i>Mr. Martin BÖHM</i> , Member of PIARC TF B.2, Austria
10:30-10:45	Impact on Road network operations	<i>Mr. Matthew HALL</i> , Member of PIARC TF B.2, Australia
10:45-11:00	Social impacts	<i>Mr. Petr ZAMECNIK and Mrs. Darina HAVLICKOVA</i> , Members of PIARC TF B.2, Czech Republic
11:00-11:30	Panel discussion	