

PRAGUE 2023 – TOGETHER ON THE ROAD AGAIN



XXVII<sup>TH</sup> WORLD  
ROAD CONGRESS  
PRAGUE 2023

# 27<sup>TH</sup> WORLD ROAD CONGRESS PRAHA 2023

CONGRESS WON  
IMPORTANT AWARDS:

THE CONGRESS  
OF THE YEAR  
2023

INSPIRATION  
OF THE YEAR  
2023



# XXVII<sup>TH</sup> WORLD ROAD CONGRESS PRAGUE 2023



**This report was written  
by Václav Neuvirt and Pavel Šušák.**

**The authors would like to express  
their sincere gratitude to everyone  
who contributed to this unbelievable project.**

**Thank you all for being part of this adventure.**



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# 27<sup>th</sup> World Road Congress in Numbers

121

countries  
represented

40

more than 40 ministerial  
delegation participated

10

TOP 10 countries  
represented, CZ, JP, FR,  
MY, SP, SK, DE, UK, AT, IT

900

more than  
900 Presentations  
presented

4,001

Participants  
registered

500

more than 500 Speakers/  
Chairs/Panelists presented

386

Posters presented

104

Sessions took place  
during the Congress

26

extra 26 Sessions  
took place  
in the Czech-Slovakian  
Pavilion

301

Exhibitors Stands across  
4 Floors

4

Congress programme  
days

4,242

Total Sqm

20

University and Start-Up Stands

8

Keynote speakers

32

National Pavilions

9

Outside Exhibitions

1,300

More than 1300 participants joined us for Technical Tours

50

Hotels offered

2,000

high school / university students took part in special program

15

Technical Tours were organized

14

Session rooms used

1

Ministerial Day

2

Pre-congress Days, National Committees and Council Meetings

3

Technical Tours Days

1,974

Mobile App users

# Voices of the World Road Congress



**Nazir Alli**

President of PIARC

*"We thank our Czech host for going the extra mile to invite 2000 high school and university students to the Congress. They are the future!"*

We at PIARC were honored and delighted to have partnered with the Czech Republic to organize the 27<sup>th</sup> World Road Congress in Prague. Indeed we were "together on the road again". The success of the Congress is a testament to the cooperation between the Local Organizing Committee guided by Vaclav Neuvirt and the General Secretariat led by Patrick Mallejacq.

We enjoyed the compliments paid for the excellent quality of the technical sessions that featured over 900 presentations by some 500 members from the various PIARC Committees. Also, the contributions by our partners and keynote speakers provided a bird's eye view of developing trends to look out for in the future.

The record attendance of over 4000 delegates from more than 120 countries is evidence of the popularity and stature of the quadrennial PIARC World Road Congress. We thank our Czech host for going the extra mile to invite 2000 high school and university students to the Congress. They are the future!

Last but not least our sincere gratitude to the attendees, organizers, the exhibitors who added to the Congress experience, and our host – the Ministry of Transport of the Czech Republic and the Czech Road Society.



**Luděk Sosna**

1<sup>st</sup> Delegate of the Czech republic

*"Such a large-scale event with such a huge scope and impact was something completely different."*

The preparation and running of the Congress were incredible new experience for me. I have been involved in organizing several events of a similar format, especially sporting events, but such a large-scale event with such a huge scope and impact was something completely different. Thanks to the combined efforts of all the members of the organizing team, we have managed to produce a product that will inspire many others. I believe that this event will not be forgotten and will have a great impact on Czech road construction in the future.



**Václav Neuvirt**

Chair of the Czech National Committee

*"I hope to see more international projects following 'The Lighthouse'."*

The organization of WRC 2023 fulfilled my long-standing dream, which began in 1971 when we first hosted this Congress in Prague.

Hosting the Congress symbolized the start of a new stage for road economy and transport infrastructure, providing a new impulse and inspiration for the further development of this beautiful and socially crucial field.

I am proud that the Congress was a success and enriched with our ideas, approaches, and initiatives. I would like to express my gratitude to the entire team for their dedication, hard work, and friendship over the past 5 years. I hope to see more international projects following 'The Lighthouse', which I am committed to as the chairman of the Czech National Committee. Thank you, PIARC, for giving us the opportunity to participate in this prestigious project for the second time in our history, making us only the fourth country in the world to do so. It has been an absolute honor, and we are excited about the prospect of collaborating on future projects.



### Petr Mondschein

Chair of the Czech Road Society

*"As an educator, I am delighted to share that over 2000 students attended the Congress."*

The Czech Road Society accomplished a remarkable feat in managing this project. As the chairman and, at the same time, basketball coach, I must acknowledge the team's five-year effort that resulted in an outstanding outcome. It is a source of pride to receive numerous positive reactions from foreign colleagues who regard the Prague Congress as the best in history, a turning point, and unique. At the same time, we view it as a significant commitment. We are thrilled to announce that the World Road Congress will mark the start of our increased activity on the international stage. We believe that the contacts we have established during the preparation period will enable us to invite the world's leading experts to Prague and showcase the latest technologies and innovative approaches in our industry. As an educator, I am delighted to share that over 2000 students attended the Congress. We are thrilled to continue our cooperation with the new generation. We want to express our sincere gratitude to our partners for their invaluable support, which is essential for our existence as a professional organization. We are excited about the prospect of future joint projects and can't wait to see what we can achieve together!



### Pavel Šušák

PCO C-IN, PIARC GS, Czech Road Society

*"I am delighted that we have managed to create a large family of professional organizations."*

It's still all surreal to me. From the journey from Japan, where we fought, with the huge support of the Ministry for Transport and the Embassy in Japan, for the opportunity to bring the Congress to the Czech Republic, to the closing ceremony, which I had the honor to moderate together with the first PIARC delegate, Luděk Sosna. Such a distinguished, complex and organizationally demanding project will hardly be repeated and we hope that it has successfully showcased the Czech Republic and Slovakia as modern, innovative, and friendly countries with skilled professionals who invest in the next generation. The working team, consisting of both professionals and volunteers, demonstrated extreme commitment and enthusiasm. I am delighted that we have managed to create a large family of professional organizations, including the Czech Road Society and Slovak Road Association, PCO C-IN, Ministries of Transport of the Czech Republic and Slovakia, Road and Motorway Directorate, National Highway Company, State Fund of Transport Infrastructure, Transport Research Centre, companies, start-ups, universities, and high schools. Despite facing logical difficulties and obstacles, we have successfully completed this huge project and received a final standing ovation from the 121 countries present. Thank you for this opportunity and trust. I am certain that we can continue to build on this success with more national and international activities.



### Zbyněk Hořelica

Director of SFDI

*"It also enabled us to attract the young generation, to build 'bridges' between theory and practice."*

The organization of the World Congress was undoubtedly a hard nut to crack, but thanks to our dedicated and hard-working colleagues, it was a great success. Organizing a prestigious event of this magnitude is always a great honor and an unforgettable experience for all those involved. It was the perfect opportunity to connect various topics and share experience from all over the world in one place, in our beautiful Prague. It also enabled us to attract the young generation, to build "bridges" between theory and practice, between different areas of road management, all across different countries. The benefits for the whole transport sector are, in my opinion, enormous and offer a huge opportunity and hope for the future for all of us. I am very pleased and happy to have been able to be there in person at this memorable event.

# Voices



## Radek Mátl

Director General of the Road and Motorway Directorate

*"Finally, I would like to ask all of us: Let's appreciate what we can do here."*

The Road World Congress 2023 in Prague was a huge challenge for all of us involved in the road environment and an opportunity to show the world that we are not lagging behind in this area. Just winning the hosting of this most important event in our profession was a huge achievement for everyone involved. But the event itself surpassed all expectations, and I am extremely proud of all the Czech experts, led by Václav Neuvirt and Petr Mondschein and other representatives of the Czech Road Society and other organizations, who managed to prepare an absolutely great event in all aspects. They managed to combine everything that such an event should have – a great environment, professional and social program combined with a very pleasant atmosphere. I am convinced that all the participants will remember this event with pleasure, incl. a huge number of students, for whom the organizers have prepared a professional program, which I believe will contribute to the motivation to choose future employment in the field of road management. For this, my personal heartfelt thanks go to all those who helped make this event happen. It has taken a tremendous effort that many cannot even imagine. I am very happy that we have shown the world that road management in the Czech Republic is advanced and at a very high level. I am delighted that the Road and Motorway Directorate was also able to contribute to the success of the event, and I would like to thank all our employees who were involved in the event. Finally, I would like to ask all of us: Let's appreciate what we can do here.



## Čestmír Kopřiva

The Road and Motorway Directorate

*"The Congress was an unforgettable experience for me, and it still brings a smile to my face when I think about it today."*

My journey, on the road obviously, towards participating in the World Road Congress in Prague 2023 began four years ago, at the previous Congress in Abu Dhabi, although I was unaware of it at the time. In 2018, Václav Neuvirt approached the Road and Motorway Directorate with a request for Czech participation in the Congress, in the form of a paper and subsequent attendance. This time, he offered me a chance to participate in the preparatory committee of the Congress in Prague as a representative of the Road and Motorway Directorate. I accepted the offer without hesitation, maybe because I was not warned that it may require a significant time commitment. About a month before the Congress, the preparation for the participation of the Road and Motorway Directorate (ŘSD) in the Congress became the daily workload for me and my colleagues, including organizing the stand area, 9 blocks of the technical program in the Czech & Slovak Pavilion, outdoor exhibition, technical excursions, student excursions, and more. I was really excited to be a part of this event, which has been referred to as the road experts' Olympics. I would like to express my sincere gratitude to Václav for nominating me and to Radek Mátl for approving my nomination. Thanks to their efforts, I had the opportunity to participate in the Olympics for five days and experience the incredible atmosphere of the event firsthand. I would like to extend my heartfelt thanks to Václav, Petr, and Pavel for making it all possible. I was deeply impressed by the organizers' achievements and felt honored to represent the Czech Republic. The Congress was an unforgettable experience for me, and it still brings a smile to my face when I think about it today.



## Milan Dont

The State Fund for Transport Infrastructure (SFDI)

*"The organizers managed to prepare an excellent event with a huge range of topics, activities, and events."*

A World Road Congress that would take place in the Czech Republic was an unattainable goal for me personally. When the team won the nomination for Prague, I was thrilled. I knew that we could organize national conferences that were well-managed both organizationally and professionally, but I couldn't judge whether it was of an adequate quality in the global competition. In retrospect, I can see that I was worried for nothing. The organizers managed to prepare an excellent event with a huge range of topics, activities, and events. I am very happy to have been able to participate in this event and to showcase our sector to a large number of students, whom I hope we have attracted to road infrastructure topics.





### Michal Vojtíšek

Member of the Board of Directors and Council of the Czech Road Society

*"I was really impressed by the students' interest, the attractiveness of the professional excursions, and the friendly atmosphere at the Congress."*

I was so happy to hear that the World Road Congress in 2023 was to be held in Prague after 52 years! It was amazing to see all the hard work and preparation come to fruition. The positive feedback from the professional community at home and around the world is a testament to the success of WRC 2023. I was really impressed by the students' interest, the attractiveness of the professional excursions, and the friendly atmosphere at the Congress. I hope that the knowledge we gained and the contacts they made will help to improve the field. I'm sure that the experience the students gained at WRC 2023 will help them become great road engineers! Our field has so much to offer, including a wide range of employment opportunities, avenues for personal growth and fulfillment, and exciting creative activities. This was clearly demonstrated at the Congress.



### Tomáš Nejedlo

Ministry of Transport, Czech Republic

*"... which students rated as one of the best exhibits at the Congress."*

When I was appointed as the Czech Republic's delegate to the PIARC Road Safety Group over four years ago, I did not anticipate the significant results we would achieve by hosting the 27<sup>th</sup> World Road Congress in Prague. I am thrilled to say that the innovative linking of business, government, professional organizations, and students from across the country and Slovakia was a highlight of the Congress theme, and it was greatly appreciated by delegates from 121 countries worldwide. Over 2000 students were able to enhance their knowledge with practical examples and gain insights into new trends, not only in the Czech Republic but from all around the world. We're so glad that you were one of them! Hi there! I'm part of the BESIP unit of the Ministry of Transport. Recently, we presented an interactive demonstration on the consequences of aggressive driving, inattention to driving or speeding, resulting in needlessly lost lives, which students rated as one of the best exhibits at the Congress.



### Hana Obrázková

Prague Congress Center

*"WRC representatives appreciate the work of all those who participated in this exceptional Congress."*

At the beginning of 2018, Pavel Šušák requested to reserve all the space in the Prague Congress Centre building for 14 days at the end of September and beginning of October 2023 with the intention of organizing an extraordinary event – the World Road Congress (WRC). At that time, it was not yet clear what the event itself would look like. The big unknown was the size of the exhibition. The WRC is held every four years, and each destination has its own specifics. We all know that congresses in Prague attract a larger number of delegates and exhibitors, so we wondered whether our venue capacity would be sufficient. After five years of preparations, sometimes complicated, I can now say "finis coronat opus", i.e. "the end crowns the work". The WRC event is one of the few events that I can describe as a matter of the heart. I fondly recall the challenging negotiations with one of the toughest, but at the same time most sympathetic clients – Pavel. Brainstorming about the optimal location of the exhibition, the use of the outdoor area, and being as accommodating as possible were an essential part of the preparation. And of course, I like to remember the positive atmosphere created especially by the members of the local organizing committee. Walking through the national pavilions, watching not only the enthusiastic experts, but also the high school students literally devouring information about their field was exceptional. It was a great honor for me to be awarded a commemorative certificate from the President of the Czech Road Society, Mr. Petr Mordschein, and the President of the PIARC National Committee, Mr. Václav Neuvirt.



### Irena Votrubová

Prague Congress Center

*"Although the event brought many sleepless nights and stressful situations, I must admit that it was really worth it!"*

The WRC was an exceptional reminder of our capabilities at the Prague Congress Centre. For the first time in a long time, it was a Congress that occupied every room down to the smallest lounge. The main role was played by the extensive exhibition, which for me personally opened a window to almost the whole world. For me, the WRC meant working with the great people at C-In, with whom I love to work. Of course, without all the colleagues at the Prague Congress Centre who were involved in making the event happen, it would not have been possible. Thanks to them everything was successfully managed. I would also like to thank my clients – Mr. Václav Neuvirt and Mr. Peter Mondschein – for the opportunity to meet them. Although the event brought many sleepless nights and stressful situations, I must admit that it was really worth it!



### Jan Čelko

Rector of the University in Žilina

*"... will enhance the university's global image and promote academic and scientific pursuits."*

Firstly, I want to express my gratitude to my Czech colleagues and friends for their excellent organization of the Congress. They managed the long and challenging process exceptionally well, and we were pleased to offer them some assistance. The University of Žilina represented Slovak higher education at the Congress, and I believe we did so with distinction. Participation in CS Day and bilateral negotiations with foreign partners, as well as foreign interest in our work, will enhance the university's global image and promote academic and scientific pursuits. I'm thrilled about the new joint projects that were discussed during our negotiations.

### Ján Šedivý

Chair of the Slovak Road Association

*"History will always record that, for the first time ever, two countries – the Czech Republic and Slovakia – organized the World Road Congress together."*

History will always record that, for the first time ever, two countries – the Czech Republic and Slovakia – organized the World Road Congress together, thus presenting our superior relations. On behalf of the Slovak Road Association, I would like to thank you for your trust, the offer of cooperation, and the opportunity to present ourselves at this extraordinary event of global importance. I am proud and happy that I could be there in person, because something like this only happens once in a lifetime, and even more so when I receive words of praise for the Congress from all sides. Perhaps never before have I seen the efforts and endeavors of so many people united by one exceptional goal, and I therefore believe that we need to harness this potential in our future joint activities and solutions to current problems. I am pleased that it has been possible to enrich the Congress with some new initiatives, especially the idea of involving secondary and university students. I consider this to be an excellent investment in the future, in order to prepare the conditions for the emergence of a new generation of professionals ready to tackle the problems of the third millennium in our sector.



## Marián Hanták

Secretary of the Slovak Road Association

*"My impression of the Congress was excellent and I have no hesitation in emphasizing that the effort put into its preparation was worth it."*

I have been a participant at several world road congresses, but in Prague it was the first time on home soil, so to speak. By joining the Slovak Road Association as a co-organizer of the Congress we got a chance to present ourselves not only with our expert contributions, but also by participating in its accompanying activities. By participating in the accompanying exhibition, offering a technical excursion and contributing to the cultural programme for the delegates, we tried to present and raise the profile of our country. In spite of the challenges, especially financial, we managed to convince our members and supporters to come to Prague, to see how the world is moving forward in our industry and to be inspired. The Congress opened a "window to the world" for many, old friendships were deepened, new ones were formed and the Congress enabled personal contacts of participants across the globe, which are crucial for good mutual cooperation. Personally, I was delighted with the interest in a technical excursion to Slovakia and the friendly atmosphere on the bus and at lunch. In today's divided world, it is a success to have experts from countries as different as Japan or Tunisia or the USA and Iran at the same table. The Congress also offered a wealth of professional information, new challenges, conveyed rich experiences and initiated new projects. It is up to the participants and the organizers to capitalize on this capital in the future. My impression of the Congress was excellent and I have no hesitation in emphasizing that the effort put into its preparation was worth it.



## Jan Bízik

Czech Invest

*"I believe that this was the first impetus to continue a similar model of cooperation for the entire ecosystem at the national level and other events."*

WRC 2023 was an all-round well-organized and crucial event where innovative, young companies were given the opportunity to address key global markets and organizations in one place. Innovation proved to have a logical and solid place at such events and was positively perceived as a revival and inspiration even by traditional participants. I believe that this was the first impetus to continue a similar model of cooperation for the entire ecosystem at the national level and other events.



## Jan Švarc

Member of the Board of Directors and Council of the Czech Road Society

*"It is a great satisfaction for all of us that the congress met with an extremely favorable response not only from the vast majority of participants, but also from the leaders of the World Road Association."*

It was with great joy that we received the news from the World Road Association Executive Committee meeting in Yokohama, Japan, in October 2018 that our bid to host the XXVII World Road Congress in 2023 in Prague won with a high number of votes. The Congress has thus returned to Prague after 52 years. The then XIV World Road Congress in 1971 was the first and only Congress in a country east of the Iron Curtain. We are only the fourth country to hold the Congress for the second time and with 4,250 delegates, it is the largest congress in the more than 100-year history of their organization. I have attended every congress since 1995, in three periods as a corresponding member of the Technical Committee for the Streamlining of Road Administration and as co-author of the national reports for the Czech Republic. Therefore, I considered it not only an honor but also a certain obligation to participate in the preparation of the XXVII Congress in Prague. It is a great satisfaction for all of us that the congress met with an extremely favorable response not only from the vast majority of participants, but also from the leaders of the World Road Association. The benefit is not only the hundreds of professional meetings held in a very friendly atmosphere. The discovery of a large number of buildings from the present to the relatively distant past embedded in our beautiful countryside attracted more than 1000 delegates in 14 excursions. For the first time, the Congress was attended by an extraordinary number of high school and university students from all over the country and I believe that the experience they gained here will help them to better orient themselves when deciding on their future professional career.

# Voices



## Petr Laušman

President of the Association for the Road Construction

*"It is hoped that the promotion of road management in the Czech Republic will not be limited to the organization of this Congress..."*

The Association for Road Construction participated only partially, within its capabilities, in securing the nomination to host the World Road Congress, which the Czech Republic achieved as the fourth country in the world. After the nomination was approved, we made every effort to actively contribute to the organization of the event during the preparation and execution stages. It is important to remain impartial and avoid making subjective assessments. Our members have been active in various areas within the Congress, and we have received predominantly positive feedback. Based on the reactions from over 300 members worldwide, it seems that our country has not been brought into disrepute. Our members have been active in various areas within the Congress, and we have received predominantly positive feedback. During high school excursions and presentations with the Czech Road Society, RSD, MD, SFDI, and BESIP, as well as lecture blocks held in the Czech & Slovak Pavilion, I had the privilege of attending presentations at most of the stands. It is worth noting that all evaluations presented are based on objective criteria and are free from any potential bias. It is hoped that the promotion of road management in the Czech Republic will not be limited to the organization of this Congress, but will continue to be developed through cooperation within the World Road Association PIARC and beyond. As the President of our Association, I will make every effort to achieve this.



## Luděk Bartoš

Member of the Board of Directors and Council of the Czech Road Society

*"Our road construction industry is keeping pace with global development, and we can take pride in our work."*

I observed the preparations for the Congress with concern, as the global pandemic had a negative impact on them. However, those concerns were alleviated during the inspiring Congress in Prague in October, where we had the opportunity to meet and collaborate with colleagues from all over the world. The Congress Centre proved to be a fitting venue for the event, providing ample space for delegates and exhibitions. The pleasant weather was also advantageous. The Congress presented a rare opportunity to meet with the world's foremost road construction experts, who visited our country. I am pleased to note that many Czech colleagues availed themselves of this opportunity. The Congress provided motivation for the younger generation, who showed great interest. Our road construction industry is keeping pace with global development, and we can take pride in our work. Knowledge and experience were shared during the Congress, allowing for comparison and growth in the field. We appreciate the knowledge and contacts gained from the Congress and believe they will inform our work in the coming years. We will, proudly, remember this Congress in the upcoming years. I would like to express our gratitude to all those involved in the preparation and management of the Congress, who maintained a friendly and optimistic atmosphere, even during difficult moments.



## Dagmar Kočárková

Member of the Board of Directors and Council of the Czech Road Society

*"It is worth noting that colleagues from foreign committees have consistently provided positive feedback, rating the Congress as best they have ever attended."*

The World Road Congress was a fascinating gathering of road engineering experts from various parts of the world, each with their own unique cultures and perspectives. The attendees were very hospitable, and the overall atmosphere was warm and welcoming. It is worth noting that colleagues from foreign committees have consistently provided positive feedback, rating the Congress as best they have ever attended. We had the pleasure of introducing the atmosphere and passion of the road construction profession to a number of students from our high schools and universities. We are delighted with the outcome.



### Alois Vybíral

Member of the Board of Directors and Council of the Czech Road Society

*"Another important achievement was the large participation of students at the Congress, for whom we prepared a very engaging programe."*

I had the opportunity to attend the World Congresses in Seoul, South Korea, and also in Abu-Dhabi, UAE, and I am proud to say that the Congress in Prague did not fall behind in any way. I dare to say that it even surpassed these previous congresses. We have shown that we know how to organize such a big event as the "Road Olympics" is without any doubt, and that all the meetings have met the expectations more than 100%. This is evidenced by the great, and universally positive, response from delegates from all over the world. Another important achievement was the large participation of students at the Congress, for whom we prepared a very engaging programe. We, who accompanied the students during their organized excursion, observed their interest and surprise at what the road sector entails. The Czech-Slovak cooperation also resonated well throughout the Congress. And the delegates were able, thanks to the great weather and sunny days, to enjoy the panoramic view of Prague itself! I believe that for our road professionals the World Congress in Prague has become a great motivation and a great commitment for the future!



### C-IN XXII World Road Congress Secretariat Team

*"It is always a pleasure to work with a client who has the energy and desire to think of ways to do things in an original and interesting way for others."*

It was an honor and a great pleasure to be part of the team that organized the WRC 2023 Congress at the Prague Congress Centre. As the agency in charge of the complete logistical organization of the Congress, we were aware, as with other projects, that we are the "first line" contact for delegates, sponsors and exhibitors. We always see this as a huge commitment. Together with our key suppliers, we did our utmost, to contribute to the fact that at the end of the project our client, the Czech Road Company, will be praised by all involved for a great organization. And here, we think, we succeeded without fail. On behalf of C-IN, the "crème de la crème" of the project was the C-IN team of 13 professionals from different areas of congress organization (from registration, to exhibition, AV, social programe and finance). We would like to thank the Czech Road Society and its representatives for their cooperation and enthusiasm for a common cause. Their leadership, enthusiasm and ideas were the cornerstone for the success of the event. It is always a pleasure to work with a client who has the energy and desire to think of ways to do things in an original and interesting way for others. Thanks also go to PIARC, which provided an excellent technical programe for the Congress and were always readily available to local organizers, including us, for advice, suggestions and consultation. We wish the road industry all the best and hope to have the opportunity to collaborate in the future.



### Denisa Cihlářová

Member of the Board of Directors and Council of the Czech Road Society

*"I am also thrilled with the participation of more than 2,000 students from high schools and colleges."*

Attending the World Road Congress will remain a tremendous experience for me – to see the whole world under the roof of the Congress Centre. It is great that we have managed such a challenging project as the 2023 World Road Congress, and I am proud that it is rated as one of the best ever. I am also thrilled with the participation of more than 2,000 students from high schools and colleges. I believe that the Congress engaged them and broadened their horizons in road transport and related fields. I hope to build on this success with further international projects.



## Zuzana Fabianová

Slovak Road Association

*"... our exceptional relations and another imaginary stepping stone towards new joint projects and activities that go beyond the borders of our countries."*

Congratulations to the Czech Road Society and the organizers for a successful Congress and thank you for the opportunity to participate and collaborate in the preparation of this important event. We have supported our colleagues and, dare I say, our friends from the Czech Republic and kept our fingers crossed for them already when they applied to organize the Congress. Therefore, we know how much time, work, effort and dedicated people several years of preparation of the Congress requires. We appreciate very much that we could be present and participate in the organization of the Congress. It is therefore a great satisfaction for us to see that our joint efforts were worth it and that the Congress is very positively evaluated in terms of professional, organizational and social aspects. I firmly believe that the joint experience of organizing the Congress is only a confirmation of our exceptional relations and another imaginary stepping stone towards new joint projects and activities that go beyond the borders of our countries.



## Martina Peřínková

Patron of the Student Project  
VŠB University in Ostrava

*"I was impressed by how expertly the company's management handled the campaign and by how well-designed the expert training program is."*

Dear colleagues,  
From all sides, we hear arguments about how difficult it is to obtain qualified experts in the field of civil engineering, how young people do not see a future in this field, and how construction is unattractive to the youth. That is about all that is visible and audible in this context.  
Lastly, I had the opportunity to meet the Czech Road Company, a smart and proactive participant in the construction business, skilfully presenting its area of expertise. Passion for a cause and professional pride are contagious and can have a big impact on everyone, including young individuals.  
I was impressed by how expertly the company's management handled the campaign and by how well-designed the expert training program is. The academic staff of VSB – TU Ostrava's Faculty of Civil Engineering VŠB considers it an honor to be included as part of it. We will do our best to support similar activities and thank you for being a part of them. Globally speaking, the World Road Congress was an extraordinary event, and I'm glad VSB – TU Ostrava got the chance to showcase itself here, this time held in Prague. With gratitude, I wish the organizers continued success in their future work.



## Michal Varaus

Member of the Board of Directors  
and Council of the Czech Road Society

*"The atmosphere of the Congress was uplifting and we can proudly say that we really showed ourselves to the world in the best light."*

When my colleagues from the Czech Road Society arrived from Japan with the information that the World Road Congress would be held in Prague, I admired in my mind their courage with which they went for it. At that time, no one had yet realized what it would all entail. Successive preparations, countless meetings, rejections and partial victories became their daily bread. It is not quite ideal to mention by name those who were personally involved in the whole event, because you always forget someone who also deserves this praise. For me, however, the World Road Congress will remain inextricably linked to three people whom I will always respect and remember in this context: Václav Neuvirt, Petr Mondschein and Pavel Šušák. In my opinion, this trio did an incredible amount of work, which resulted in a wonderful congress environment where both foreign and domestic participants felt great. The atmosphere of the Congress was uplifting and we can proudly say that we really showed ourselves to the world in the best light.  
Not to forget the beautifully prepared CZECH&SLOVAK pavilion, I must mention one more person who made the overall atmosphere here. This person is our Slovak friend Ján Šedivý, who impressed us with a beautifully prepared folklore afternoon.  
Nothing can be done by itself, and I am proud that we managed such a demanding event in our country and improved the names of the Czech and Slovak Republic.

Nazir Allı



# Feedback from the Delegates

**I ENJOYED  
THE WORLD  
CONGRESS VERY  
MUCH AS WELL  
AS THE BEAUTIFUL  
LANDSCAPE  
OF PRAGUE.**

No doubt this was a huge task that should not be understated. I'm sure you all have a **GREAT SENSE OF PRIDE** on what you achieved and rightly so.

I would like to thank you and the whole Czech team for organising this congress. **WE WERE VERY DELIGHTED** with our visit and all the events at the congress.

I would like to **CONGRATULATE YOU ON THE SUCCESS** of the 27<sup>th</sup> edition of the World Road Congress and to also thank you for coordinating the logistics of our delegation to the Congress in Prague.

Actually, I think this was one of **THE BEST WRC'S** that I have attended (although this was only my fifth one).

**It was my pleasure to work with you and your team...thoroughly enjoyed the experience and more importantly making new friends. Your welcome made it special for me.**

Thanks again for your amazing help before and during the GB!

**IT WAS  
A SUCCESS**

Thank you very much for your warm welcome. The congress in Prague in my opinion was **DEFINITELY ONE OF THE BEST WORLD ROAD CONGRESSES** in terms of organisation.

**THANK YOU PAVEL.**

The Congress in Prague was very successful, extremely well organized and your personal creativity and inputs really inspiring.

Taking this opportunity to express our sincere gratitude to you personally and to your staff for hosting PIARC in Prague. The success of the Congress is a mark of the close cooperation between our respective teams and the leadership you provided in putting it all together. **THANK YOU!**



It was **TRULY A REMARKABLE** event and we also received excellent feedback from our participants, experts, exhibitors and companies.

## **IT WAS AN HONOR TO PARTICIPATE IN AN EVENT**

that was not only highly informative but also flawlessly organized, reflecting the dedication and collective effort of everyone involved.

**Připomínky ke kongresu z naší strany nejsou. Naopak velká pochvala za luxusní produkt.**

Our experience at the congress surpassed mere satisfaction; **IT WAS PROFOUNDLY ENRICHING AND INSPIRING.** The knowledge shared and connections forged during the event are invaluable and will undoubtedly have a lasting impact on our work.

# **JOB WELL DONE,**

this was the best World Road Congress ever :-). Thank you very much for your warm welcome, your patience and last but not least your endurance.

It was indeed a **MEMORABLE EXPERIENCE.** Well done all, in particular the host country with its caring staff.

Congratulations on **THE SUCCESS** of the congress. You have made it.

**The event PROVED TO BE IMMENSELY ENRICHING** from both technical and personal standpoints.

**Tak, jedním slovem: bylo to na výbornú, SKVELÁ PRÁCA! Ďakujeme!**

We express our **SINCERE GRATITUDE TO YOU** and the whole team of the Organizational Committee of the Czech Republic.

**ALL THIS MAKES OF THE CONGRESS A GREAT ACHIEVEMENT, NOT TO TALK ABOUT THE OBVIOUS JOY OF PARTICIPANTS. WELL DONE!**

**I REALLY ENJOYED** talking with the students! They gave me hope for the future!

**I my děkujeme za tuto V MĚ HISTORII KCP NEJVĚTŠÍ AKCE** a budeme se těšit na další spolupráci! Your kindness and professionalism were amazing.

S akcí jsme byli moc a **MOC SPOKOJENÍ.**

Kolegové, kteří se za naši společnost akce účastnili, byli opravdu velice **SPOKOJENÍ S CELKOVÝM PRŮBĚHEM** a zajištěním akce a předali mi jen pozitivní zpětnou vazbu.

Thank you for organising of such remarkable event! It was indeed a **MEMORABLE EXPERIENCE.**

I wanted to let you both know that our team was VERY happy with how organized your show was. They are very interested in exhibiting next year, so **PLEASE KEEP ME ON YOUR CONTACT LIST.**

They were extremely please with their location, as well.

We would like to thank you for this great congress. **IT WAS A GREAT EVENT** and we enjoyed it very much.

**WELL DONE, YOU'RE SMASHING THIS EVENING... GREAT STUFF!**

What a **GREAT EVENT**, I know it takes a tremendous amount of work – so well done to all. Congratulations to all.

Congratulations!!! **JOB, WELL DONE!!**

**BEST WRC EVER!**

Shared pleasure, great event, **GREAT COOPERATION.**

**THE CONGRESS WAS SIMPLY AMAZING!**

Just a very short comment: Awesome! Great event! Very well done! Congrats!

**HISTORIAL ACHIEVEMENT FOR THE CZECH AND SLOVAKIAN REPUBLICS!**

Všude slyším, jaký to byl sukces. Velké díky za veškerou spolupráci, **BYLA TO JÍZDA :-)**.

**YOU'RE AMAZING** and so is the rest of the team at Prague, you made us feel at home and thank you for that.

**GRATULUJI** k úspěšně zvládnutému kongresu.

**SUPER :-)**  
Dooopravdy velká spokojenost.

Congratulations to you all for ensuring that the conference was **SUCH A GREAT SUCCESS.**

Myslím, že **MŮŽETE BÝT PRÁVEM HRDÍ NA VÝSLEDEK**, který se ČSS a Národnímu komitétu PIARC pod Vaším vedením a SCS spolu se všemi zúčastněnými partnery opravdu moc povedl. Navíc čas ukáže, že budou všichni rádi a dlouho na tuto skvělou akci v Praze vzpomínat.

**THANK YOU FOR  
A GREAT CONGRESS!  
VERY PROFESSIONAL  
AND VERY  
INTERESTING!**

Děkujeme  
za možnost se účastnit  
WRC v Praze. **BYLO  
TO PERFEKTNÍ.**

Z celého srdce Vám jménem naší školy  
a především žáků děkuji, že jsme se WRC  
2023 mohli zúčastnit.

**DĚTI PŘIJELY  
NADŠENĚ, PYŠNĚ  
A SE SPOUSTOU  
KRÁSNÝCH  
FOTOGRAFIÍ,** které budeme  
v nejbližší době prezentovat na našich  
sociálních sítích a v oblastním tisku.

**BYLO NÁM VELIKOU CTÍ,** že se téměř padesátka  
našich žáků mohla zúčastnit XXVII. ročníku  
SVĚTOVÉHO SILNIČNÍHO KONGRESU V PRAZE.

**DĚKUJ  
ORGANIZÁTORŮM**

– České silniční společno-  
sti za skvěle zvládnutou  
náročnou akci světového  
formátu

Nejdřív velká gratu-  
lace za zvládnutí tak  
**MONSTRÓZNÍ  
AKCE.**  
Až do úplného  
konce. :-)

**OPRAVDU  
SE NÁM LÍBILO.** Děkuji  
za možnost zúčastnit  
se akce takového  
formátu. Pro naši skupinu  
vše šlapalo parádně.

Ještě jednou děkuji –  
spokojenost i u kolegů  
z DE. Perfektní akce!

**IT'S CLEAR THAT WE HAVE  
TO THANK YOU FOR ALL  
THE EFFORTS OF ALL  
THE ORGANIZERS, SINCE  
THERE'S NO LONGER  
ANY DOUBT THAT  
THIS CONGRESS WAS  
A RESOUNDING  
SUCCESS.**

Díky této akci jsme získali  
**PŘEHLED O SOUČASNÝCH  
POSTUPECH A BUDOUCÍCH  
TRENDECH V OBLASTI SIL-  
NIČNÍ INFRASTRUKTURY  
A SILNIČNÍ MOBILITY**  
jak českých, tak i zahraničních firem. Velkým přínosem  
byla i možnost využít znalosti cizích jazyků. Celý  
kongres zpříjemnilo velmi chutné občerstvení. Velice  
kladně hodnotíme i jeho organizaci a v neposlední  
řadě propagační materiály a milé dárky.

# Program at Glance

	Plenary Kongresovy sal 1–4 2766 seats (plus) 1 <sup>st</sup> & 2 <sup>nd</sup> floor	Parallel 1 Jizni 2AB 448 seats 2 <sup>nd</sup> floor	Parallel 2 Jizni 1AB 448 seats 1 <sup>st</sup> floor	Parallel 3 Jizni 3AB 400 seats 3 <sup>rd</sup> floor	Parallel 4 Panorama sal 400 seats 1 <sup>st</sup> floor	Parallel 5 Jizni 3C 300 seats 3 <sup>rd</sup> floor	
<b>2 Oct AM</b> 09:00–13:00	Opening Session 09–10:30 Ministers Session: Road Safety 11–12:45. Ministers Photo						
13:00–14:30	Lunch						
<b>2 Oct PM</b> 14:30–16:30	Ministers Session: Cycling 14:30–16:00 Cultural performance 16–16:30						
16:30–17:00	Opening of the Exhibition						
17:00–19:00	Welcome Reception						
<b>3 Oct AM</b> 8:30–9:15	Keynote 1						
<b>3 Oct AM</b> 9:30–13:00		Strategic Direction Session 4 – Resilient Infrastructure	Foresight Session 1 – Sustainable financing & policies for SDGs 2030	Technical Session TF2.2 – Electric Road Systems	Technical Session 1.5 – Disaster Management	Foresight Session 2 – Artificial Intelligence & Big Data for safer & optimized mobility	
13:00–14:30	Lunch						
<b>3 Oct PM</b> 14:30–18:00		Technical Session 4.1 – Pavements	Strategic Direction Session 3 – Safety and Sustainability	Technical Session TF2.1 – New mobility and infrastructure	Technical Session TF1.1+1.3 – Well-Prepared Projects	Foresight Session 4 – LATAM rural roads: Low volume but high impact	
<b>4 Oct AM</b> 8:30–9:15	Keynote 2						
<b>4 Oct AM</b> 9:30–13:00		Technical Session 4.2 – Bridges	Technical Session 3.1 – Road Safety	Strategic Direction Session 2 – Mobility	Technical Session 1.4 – Climate Change and Resilience	Foresight Session 7 – Global supply chains and national road authorities	
13:00–14:30	Lunch						
<b>4 Oct PM</b> 14:30–18:00		Technical Session 4.3 – Earthworks	Technical Session 3.2 – Winter Service	Technical Session 2.1 – Mobility in urban areas	Strategic Direction Session 1 – Road Administration	Foresight Session 8 – Investments & partnerships for road safety	
<b>5 Oct AM</b> 8:30–9:15	Keynote 3						
<b>5 Oct AM</b> 9:30–13:00		Technical Session 4.4 – Tunnels	Technical Session 3.3 – Asset Management	Technical Session 2.2 – Accessibility and mobility in rural areas	Technical Session 1.1 – Performance of Transport Administrations	FS9 – Physical and digital for CCAM for all / Technical Session PIARC Road Statistics	
13:00–14:30	Lunch						
<b>5 Oct PM</b> 14:30–18:00		Technical Session TF4.1 – Road Design Standards	Technical Session 3.4 – Environmental Sustainability	Technical Session 2.3 – Freight	Technical Session 1.2 – Planning for social & economical development	Foresight Session 11 – A gender Inclusive Transport system	
<b>5 Oct Evening</b>	Gala Dinner						
<b>6 Oct AM</b> 8:30–9:15	Keynote 4						
<b>6 Oct AM</b> 9:30–13:00		Foresight Session 12 – Managing the energy transition: scaling up deployment of charging	Technical Session TF3.1 – Security	Technical Session 2.4 – Red Networks Operation & ITS	Technical Session 1.3 – Finance and procurement	Foresight Session 13 – Stress tests tool to assess the resilience of road asset	
13:00–14:30	Lunch						
<b>6 Oct PM</b>	Closing Session						

Parallel 6 Maly 286 seats Ground floor	Posters & National Reports Severini Sal North Hall 2 <sup>nd</sup> floor	Workshops Klub A 170 seats 1 <sup>st</sup> floor	Workshops Klub E 170 seats 1 <sup>st</sup> floor	Workshops Klub H 170 seats 1 <sup>st</sup> floor	PIARC Pavilion activities 3 <sup>rd</sup> floor Exhibition area	Side events Komorni Sal 200 seats 3 <sup>rd</sup> floor
	Posters for National Reports					
	Posters for National Reports					
Foresight Session 3 – Enhancing transportation equity globally: Outlook	Posters for National Reports	WS01 – Decarbonization & circular economy of road construction & maintenance equipment	WS02 – Urban road safety (90 min, starts 11h30)	WS03 -Digital Infrastructure for Road Network Operations		Close Side Event 1 – CEDR Governing Board
Foresight Session 5 – Safe active mobility / FS6 – RoadTech: Project delivery	Posters for topics 13, 14, 15, 28 & National Reports	WS04 – Weigh in Motion (WIM)	WS05 – Transport administrations of the future	WS06 – Climate change adaptation framework	Gender inclusion and diversity networking Session (18h to 19h30)	Close Side Event 1 – CEDR Governing Board
Special Project Session 1 – Social equity and Accessibility	Posters for topics 16, 27, 39, 40, 41 & National Reports	WS07 – Asset management & ISO55000 (90 min, starts 11h30)	WS08 – Digitalization and environment			
Special Project Session 2 – Carbon neutrality	Posters for topics 10, 11, 12, 29, 30, 42, 43, 44, & National Reports	WS09 – Concrete pavements (90 min) / WS11 – Disaster Management Manual (90 min)	WS10 – Resilience and asset management			Open Side Event 1 – Digitalization of the road sector (CHTS – To be confirmed)
Foresight Session 10 – Engineers & Environmentalists for sustainability	Posters for topics 17, 18, 19, 31, 32, 33, 45, 46 & National Reports	WS12 – Airfield pavements	WS13 – Road Safety in LMIC			Open Side Event 2 – Bridges smart construction (CHTS – To be confirmed)
Special Project Session 3 – Cycling infrastructure	Posters for topics 1, 2, 3, 7, 8, 9, 20, 24, 25, 26, 34, 38, 47, 48 & National Reports	WS14 – BIM Part 1	WS15 – New inspection and rehabilitation techniques for bridges	Open Side Event 3 – Italian tunnels		Close Side Event 2 – iRAP innovation workshop (Part 1)
Special Project Session 4 – Innovation policies	Posters for topics 4, 5, 6, 21, 22, 23, 35, 36, 37, 49 & National Reports	WS14 – BIM Part 2	WS16 – HDM-4			Close Side Event 2 – iRAP innovation workshop (Part 2)
	All poster sessions are scheduled in the following time slot to the relevant Technical Session, except for those marked in red, which happen before the relevant Technical Session					

# Technical Visits

**TV1**

**The Prague Outer Ring Road (PORR): D1 motorway junction – Slivenec + Rudná control centre**

1/2 day, 04. 10. 2023

**TV2**

**The Prague Inner Ring Road: Myslbekova Street to Pelc Tyrolka (the Blanka Tunnel Complex) + control centre**

1/2 day, 04. 10. 2023

**TV3**

**Construction of the Dvorce Bridge and the Štvanice Footbridge**

1/2 day, 03. 10. 2023

**TV4**

**The History of Prague's Bridges**

1/2 day, 03. 10. 2023

**TV5**

**V4 Road Rodeo finals, visit to SIT Port – robotics centre, drone demonstration, Pilsen**

Full day, 05. 10. 2023

**TV6**

**Historical and technically interesting bridges, south part of Prague and Central and Southern Bohemia**

Full day, 03. 10. 2023

**TV7**

**The first PPP project in the Czech Republic: The D4 motorway from Příbram to Mirovice**

1/2 day, 05. 10. 2023

**TV8**

**The D35 motorway from Opatovice nad Labem to Vysoké Mýto Vikýřovice Road Museum**

Full day, 04. 10. 2023

**TV9**

**The Brno City Ring Road – road I/42 and connecting radial roads, the Traffic Management Center (TMC) a Traffic Information Center (TIC)**

Full day, 04. 10. 2023

**TV10**

**The D6 motorway: Nové Strašecí – Karlovy Vary – Sokolov – BMW research centre and proving ground, Sokolov**

Full day, 05. 10. 2023

**TV11**

**The D1 motorway: Říkovice – Lipník nad Bečvou – Ostrava – Czech Polish border / Road Data Bank and the National Traffic Information Centre**

Full day, 03. 10. 2023

**TV12**

**Bratislava's Danube bridges and bypass**

Full day, 04. 10. 2023

**TV13**

**The Prague Inner Ring Road: Myslbekova Street to Pelc Tyrolka (the Blanka Tunnel Complex) + Strahov and Mrazovka Tunnels**

1/2 day, 04. 10. 2023

**TV 16**

**The Forest Road Network managed by the Czech University of Life Sciences**

Full day, 04. 10. 2023

# Keynote Speakers

## Keynote 1

### Geopolitical and economic connections of the transport infrastructure development

Tuesday, October 3, 08:30–09:15

Room: Congress Hall, 1<sup>st</sup>, 2<sup>nd</sup> & 4<sup>th</sup> floor



**Ivan Mikloš is former Deputy Prime Minister and Minister of Finance of the Slovak Republic (2002–2006, 2010–2012), Deputy Prime Minister for Economy (1998–2002), and Minister of Privatization (1991–1992). He has co-founded and led the economic think tank MESA10 (1992–1998). Between 2006–2010 and 2012–2016, he was a Member of Parliament.**

#### Ivan Mikloš

Distinguished Associate Fellow for Economic Growth & Sustainability Programme at GLOBSEC, President of MESA10, and Former Deputy Prime Minister and Minister of Finance of the Slovak Republic

In 2014, he was reappointed as the President of MESA10. During 2015–2016 he served as a Chief Advisor to the Minister of Finance of Ukraine and as an Advisor to the Minister of Economic Development and Trade of Ukraine. Since April 2016 until August 2019, he served as a Chief Economic Advisor to the Prime Minister of Ukraine. After the change of the government, from November 2019 until March 2020, he was in position of an Economic Advisor to the Prime Minister of Ukraine. In years 2016–2020 he chaired the Strategic Advisory Group for Support of Ukrainian Reforms (SAGSUR). He is also Co-Founder of the Ukrainian economic think tank Centre for Economic Strategy. He served as an Advisor to the Prime Minister of Moldova (2021–2022). In March 2022, he became an Advisor to the President of the Slovak Republic in the field of economic policy.

Ivan Mikloš was one of the leading figures of economic transformation in the Slovak Republic. He significantly contributed to the entry of the Slovak Republic into the OECD and instigated an extensive and effective tax reform. He led the government agenda on economic restructuring and fiscal consolidation. The second Dzurinda's government (2002–2006) gained a very reformist reputation thanks to severe austerity measures and a comprehensive program of structural reforms (tax, social sector, pension, healthcare, public finance, labour market) backed by Ivan Mikloš. Thanks to these reforms, Slovakia was able to join the Eurozone in 2009. In 2004, he was awarded "Best Minister of Finance of the Year" by Euromoney, and "Top Business Reformer" by the World Bank's Doing Business report.

Ivan Mikloš is the author of "Book of Reforms" (2005), "Rewriting the Rule" (2001) and dozens of studies and articles in the expert and popular press. He is also the author of the chapter about Slovak reforms in the book "The Great Rebirth: Lessons from the Victory of Capitalism over Communism" (2014). In 2019, under his leadership SAGSUR published the book about Ukrainian reform process "Reforms in Ukraine after Revolution of Dignity: What was done, why not more and what to do next" (2019), to which he contributed the chapter "Political Economy of Reforms: Political system, governance and corruption".

## Keynote 2

# Innovation of the road sector: inclusion, diversity and digitization

Wednesday, October 4, 08:30–09:15

Room: Congress Hall, 1<sup>st</sup>, 2<sup>nd</sup> & 4<sup>th</sup> floor



**Zdeněk Zajíček**

President, Chamber  
of Commerce,  
Czech Republic

**Born 1967 in Prague. Politician and lawyer. He graduated from the Faculty of Law in Prague. He worked as the deputy minister in Ministry of Finance, Ministry of Justice and Ministry of Interior. Currently he holds a position of an advisor to Czech Prime Minister and Minister of Transport for digitization and digital transformation. He is also active as ICT Union President and Vice-Chairman of the Government Council for Information Society. Since June 1, 2023 he has been President of Chamber of Commerce.**

At the political level he is a member of Civil Democratic Party (ODS), 2022 – May 2023 vice chairman of ODS, since 2018 he has been representing the party in the Prague Municipality Council.

He is considered an imaginative innovator and one of the key figures of digitization in the Czech Republic. He participated in authorship, legislation and implementation in the projects such as CzechPOINT, Data Boxes, Basic Registeres, Bank Identity, Digitalization of Construction Procedures and Digital Technical Maps.

He has been active in sports as an active basketball player, international basketball referee and than Chairman of the Czech Basketball Federation.

Zdeněk Zajíček is married and has three sons.





## Young Tae Kim

Secretary General  
of the International  
Transport Forum (OECD)

**Young Tae Kim is the Secretary-General of the International Transport Forum (ITF). He was re-elected for a second term by the transport ministers of ITF member countries at their Annual Summit on 19 May 2022. He took office in his first term as Secretary-General in August 2017.**

Prior to his election as ITF Secretary-General, Dr Kim distinguished himself in the civil service of his native Korea, most recently serving as Director General in the Ministry of Land, Infrastructure and Transport (MOLIT). As Deputy Director-General from 2015, he was responsible for co-ordinating various transport policies including on autonomous vehicle, greenhouse gas reduction, urban transport, Intelligent Transport Systems and road safety, among others.

After joining the MOLIT in 1994 as Deputy Director for Urban Transport, Dr Kim also held several Deputy Director and Director positions with responsibility for housing welfare, integrated city development and overseas infrastructure construction. He was seconded to the Prime Minister's Commission on Administrative Reform in 1996 and the Presidential Committee on Social Inclusion in 2005–2007. From 2010 to 2014, Dr Kim worked in Washington, D.C., as Counsellor for Construction, Transport and Maritime Affairs at the Korean Embassy.

Dr Kim earned his Master's degrees in Public Policy from Seoul National University, Korea, and in Urban Studies from Paris University de Vincennes-Saint-Denis, France.

He also received his Doctorate degree in Political Sociology and Public Policy from the Institut d'Etudes Politiques (Sciences-Po), Paris, France.

Dr Kim speaks fluent English, French and some Spanish, in addition to his native Korean.

**Emanuela Stocchi is an expert in EU legislation and policies and she is the Director of International Affairs for AISCAT (Associazione Italiana Società Concessionarie Autostrade e Trafori), the Italian Association of Toll Highways Concessionaires Companies. In this role she ensures the Association's contacts with the EU Institutions and other European and International organizations active in the transportation field. She fluently speaks Italian, French, English and Spanish.**

## Emanuela Stocchi

Chair  
of PIARC's Promotion  
of Gender Inclusion  
and Diversity team

Emanuela has an outstanding International background: she holds a degree in Political Science with a specialization in EU law and policies and she has worked in Brussels for eight years with ASECAP, the European Association of Toll Highways Concessionaires Companies, gaining a solid and comprehensive knowledge of all the EU Institutional and public affairs and expanding at the same time her EU and International network in the transportation area.

Emanuela is still very active within ASECAP, being Deputy Member of the ASECAP Executive Committee and Chair of the ASECAP Permanent Committee of Road Safety, Environment and Sustainability; she is also serving as member of the PIARC (World Road Association) Executive Committee, as French-speaking Secretary of the PIARC Terminology committee and as Chair of the PIARC Gender Diversity and Inclusion Team, directly reporting to the Executive Committee.

Emanuela served as well IBTTA (International Bridge, Tunnel and Turnpike Association – the worldwide alliance of toll operators and of the businesses that serve tolling) and its members through work on several committees before being appointed to the Board of Directors in 2011. Emanuela served a two-year term as International Vice President, before a three-year term as Second and then First Vice President followed President in 2017 and finally, Immediate Past President in 2018. She is currently serving in the Advisory Council of the IBTTA Past Presidents, as well as in the IBTTA WIT (Women in Tolling) Council.

## Keynote 3

# Roads for international development

Thursday, October 5, 08:30–09:15

Room: Congress Hall, 1<sup>st</sup>, 2<sup>nd</sup> & 4<sup>th</sup> floor



**Guangzhe Chen**

Vice President  
for Infrastructure,  
World Bank

**Guangzhe Chen, a Chinese national, is the Vice President for Infrastructure at the World Bank as of February 1, 2023. In this position he leads the Bank's global efforts to build sustainable infrastructure in developing and emerging economies and supports the World Bank Group's strategic priorities such as the climate change action plan and the private capital mobilization and enabling efforts. He oversees the Bank's work across energy and transport sectors, digital development, and efforts to provide access to renewable energy, low-carbon transportation, digital connectivity, and quality infrastructure services to communities through public-private partnerships. Infrastructure represents around \$72 billion of the Bank's portfolio.**

Prior to his current position, Mr. Chen served as the Regional Director for Infrastructure in the South Asia Region at the World Bank. He provided leadership and oversaw the formulation and implementation of the knowledge and financing programs across energy, transport and digital development in the region covering Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. The regional department has a portfolio of over 60 projects amounting to approximately \$17 billion.

He was the World Bank's Global Director for the Transport Global Practice from 2018 to 2020 and prior to that was Senior Director for the World Bank's Water Global Practice. He has also served as World Bank Country Director for Ethiopia, in Addis Ababa, and subsequently for Southern Africa, covering Botswana, Lesotho, Namibia, South Africa, Swaziland, Zambia and Zimbabwe, based in Pretoria. His earlier career positions at the World Bank include roles as team lead and manager in the transport and urban, water and disaster risk management units.

An economist by training, Mr. Chen has over 25 years of international experience in the field of sustainable development, infrastructure finance and management with the World Bank Group and the Asian Development Bank.

Mr. Chen holds a graduate degree in Economics from Harvard University, USA, and B.A. in Economics from Zhongshan (Sun Yat-Sen) University, Guangzhou, China.



**Antonio Silveira**

Vice President,  
Latin-America  
Development Bank (CAF)

**Antonio H. Pinheiro Silveira is Manager of Physical Infrastructure & Digital Transformation of CAF. He has a PhD in Economics from the Federal University of Rio de Janeiro.**

He was the Deputy Chief of Economic Advice of the Ministry of Planning, Secretary of Economic Monitoring of the Ministry of Finance and Minister of the Secretariat of Ports of the Government of Brazil. He participated in Directories of public and private companies, which include Caixa Econômica Federal, Vale S.A. (Fiscal Council) and Banco do Nordeste. He worked as Executive Director for Brazil at the World Bank and the IDB.

## Keynote 4

# Roads for decarbonization and adaptation

Friday, October 6, 08:30–09:15

Room: Congress Hall, 1<sup>st</sup>, 2<sup>nd</sup> & 4<sup>th</sup> floor



**Nancy Daubenberger**

Minnesota Department  
of Transportation (USA)

**Nancy Daubenberger has worked for the Minnesota Department of Transportation for over 22 years, in engineering and management positions and was appointed by Governor Tim Walz and Lt. Governor Peggy Flanagan as the agency’s Commissioner in May 2022 after serving for three years as Deputy Commissioner and Chief Engineer.**

Prior to her current role, she served as the Assistant Commissioner for Engineering Services, the State Bridge Engineer, and also previously served in planning, project management and design roles for the MnDOT Bridge Office and Metro District. Before coming to MnDOT, she worked in consulting for about six years, in both bridge and road design.



**Christophe Saintillan**

Deputy Managing  
Director of VINCI  
Autoroutes (France)

**Christophe Saintillan currently is Deputy Managing Director of VINCI Autoroutes, France’s leading freeway concession company, in charge of 4,400 km of motorway. Previously, he was with the French Ministry of Transport for twenty years, in charge of various road design, road policy and infrastructure management roles. He was a Member of the PIARC Executive Committee from 2010 to 2016 and First Delegate for France. He joined the Great Paris (Île-de-France) regional council for 4.5 years, where he was in charge of housing and transport.**

Christophe Saintillan will present how VINCI Autoroutes address decarbonization and adaptation. VINCI Autoroutes has been working with academics on the decarbonization of the road: starting from the observation that in France, the transport sector has become the most emitting sector and the only one whose emissions are not being reduced, Vinci Autoroutes has studied the concrete actions to be taken to bring mobility on freeways in line with the trajectory imposed by the Paris Agreement and French national policies. These include welcoming electromobility for light vehicles (massive installation of charging stations) and heavy goods vehicles (charging stations, ERS), encouraging the most virtuous modes of transport (car-sharing, public transport thanks to reserved lanes, parking facilities and multi-modal platforms) and, more generally, making freeways part of a logic of urban and environmental integration and adaptation to climate change, given their impact on the weather (reducing the consequences of flooding, protection against the risk of fire). This calls for a massive and urgent investment plan, broken down by action and costed.





# Technical Program

# Strategic Theme 1

## Road Administration

**The external operating context related to road infrastructure and road transport is constantly evolving in response to large social, economic, and environmental shifts. This affects the financing and risk managing for the construction, rehabilitation, and maintenance of road assets that are priorities in transportation, since some times the public-sector budgets are not enough to meet future funding requirements. In addition, safety and security in road systems, technological advances, data-driven and digitalization of road infrastructure, as well as resilience to climate change and extreme weather events are challenged issues that all Road Administrations are facing. This external context meets with the Strategic Theme 1 to study “Road Administration” developing five Technical Committees and two Task Forces. The main objective is to analyze how Road Administrations are addressing these issues for a better performance, an accurate planning of road infrastructure and transport to enhance economic and social development, obtaining the necessary funding for construction and maintenance of road networks, increasing resilience to climate change and the disaster management. This objective takes into account the impact of the Covid-19 pandemic, since the issues addressed will be affected by this pandemic and therefore, it is something to take into account within this Strategic Theme.**

### TS 1.1 Technical Session 1.1 Performance of Transport Administrations

This TC focuses on identifying best practices for establishing a framework for measuring the efficiency and effectiveness of Transport Administrations, including the establishment of assessment indicators/evaluation indexes (benchmarking) that can be used to recognize opportunities for improving the overall performance of transport administrations, with a particular focus on overall customer experience and communication of performance information. All this, taking into account the impact of the sharing economy and other disruptive technologies on the performance of Transport Administrations. In addition, TC analyzes effective approaches for defining and promoting diversity in opportunity across the roads and transportation sectors, as well as how to attract new employees into the transport industry/profession, specially, young professionals.

### Introduction

In accordance with the approved Terms of Reference of the PIARC 2020–2023 Strategic Plan, TC 1.1 focused their work on identifying best practices for establishing a framework for measuring the efficiency and effectiveness of Transport

Visual reminder: Technical Session 1.1: Performance of Transport Administration  
Thursday October 5, 2023, Panorama Sal, 1<sup>st</sup> Floor, 09:30–13:00



Administrations, including the establishment of assessment indicators/evaluation indexes (benchmarking) that can be used to recognize opportunities for improving the overall performance of transport administrations, with a particular focus on overall customer experience and communication of performance information. All this, taking into account the impact of the sharing economy and other disruptive technologies on the performance of Transport Administrations.

In addition, the TC analyzed effective approaches for defining and promoting diversity in opportunity across the roads and transportation sectors, as well as how to attract new employees into the transport industry/profession, specially, young professionals.

During this technical session, the Technical Committee on Performance of Transport Administrations presented the achievements of the Committee over the current work cycle (2020–2023). In addition, selected papers from the international call for papers will also be presented by their authors.

The general topic of TC 1.1's Technical Session is "PERFORMANCE OF ROAD AND TRANSPORT ADMINISTRATIONS". There is a growing interest and appreciation in the benefits that derive from performance management and there is an increasing call for measures that go beyond the traditional asset management related measures. Now Transport Administrations are being asked to consider how to capture societal outcomes and benefits from the transportation network and how well they are delivering on customers and citizens expectations.

More specifically, during this cycle, on how to respond to the increasing pressure to achieve and demonstrate results linked with improving the quality of people's life and the creation of "value" for the citizens; effective approaches for defining and

promoting diversity in opportunity across the roads and transportation sectors, as well as how to attract new employees into the transport industry/profession, especially, young professionals; all the while, taking into account the impact of the sharing economy and other disruptive technologies on the performance of Transport Administrations.

## Technical findings and recommendations

### Presentation of the session

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as how to attract new employees into the transport industry/profession, especially, young professionals; all the while, taking into account the impact of the sharing economy and other disruptive technologies on the performance of Transport Administrations.

## Working Group 1

Over the 2019–2023 cycle, Working Group 1 (WG1) focused on measuring the efficiency and effectiveness of customer experience and public value creation in road and transport administrations. Following is a summary of WG1's recent accomplishments as reported at the 27<sup>th</sup> World Road Congress on October 2–6, 2023.

**Alan COLEGATE**, Executive Director Strategy and Communications, Main Roads Western Australia, defined customer experience as the sum of all interactions in the journey between a customer and an organization in the delivery of a service. Colegate highlighted research findings that indicate there are six elements of the customer experience: Culture, Leadership, Process, Insights, Value, and Improvement.

**Ilaria COPPA**, Director of Technical Management, ANAS S.p.A. in Italy, discussed trends in customer experience. A case study identified how customers want to feel:

- In control of their journeys;
- Stress-free on journeys;
- To be listened to;
- Trust what they are being told;
- Feeling safe on the network.

One of the findings was that tolling organizations are more likely to survey customers.

**Deanna BELDEN**, Director of Performance, Risk and Investment Analysis at the Minnesota Department of Transportation, USA, presented on public value creation. The public sector faces challenges that are different from the private sector. Belden presented a potential public value model for a transport agency that can help to document what an agency is trying to achieve and report on measures to track progress. It is recommended that transport agencies increase their focus to encompass integrated thinking which is about creating and protecting value.

**Michael PLATZER**, Deputy Head of Regional Roads Planning, Public Administration of Lower Austria, discussed a case study about the estimation of public added value on the provincial road sector. The methodology used was Extended Impact Analysis (eIA). Fairness, equality, and conformity should be included in public value estimation

of transport infrastructure and fulfillment of key objectives should be checked regularly.

**Paul HILL**, Head of Customer Service Development, National Highways, UK, presented an evidence-based approach to improving customer experience. They drew on a range of customer insights for their approach which focused on:

- Improving journey times;
- Better end-to-end experience;
- Providing better information;
- A well maintained and safe network;
- Developing better relationships;
- Empowering people.

Hill emphasized that public trust is at the heart of being a customer-centric and outward looking organization and that measuring customer service over time is important.

## Working Group 2

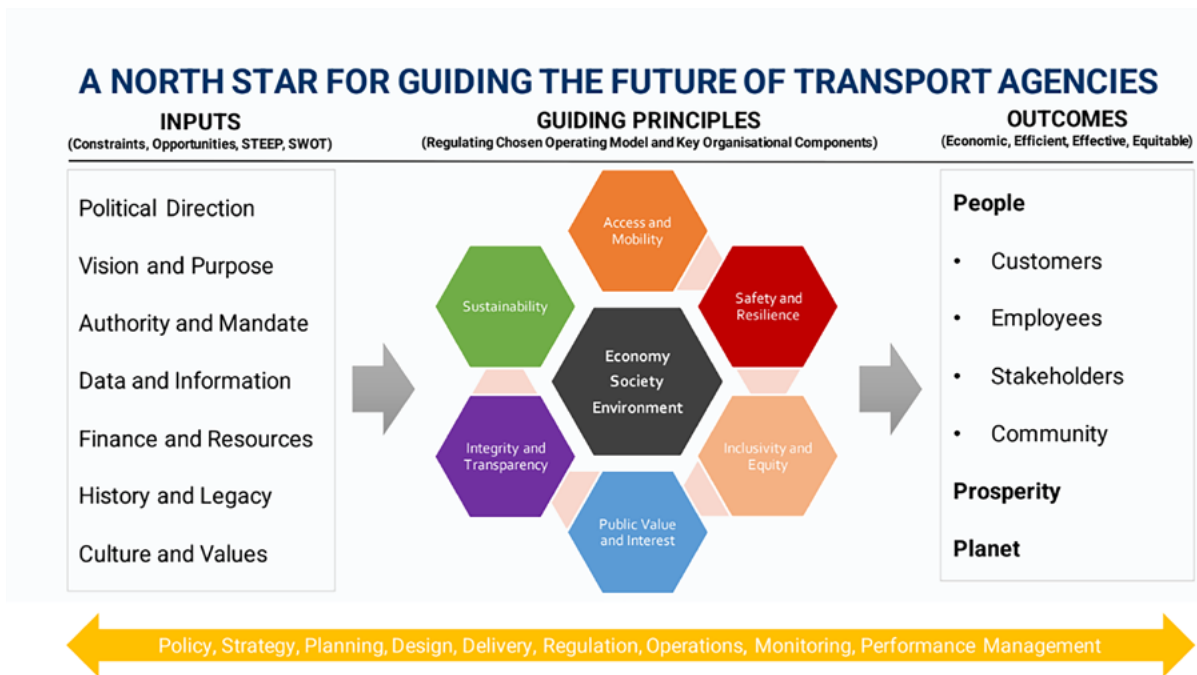
Over the 2019–2023 cycle, Working Group 2 (WG2) examined the role of transport agencies in shaping disruptive technologies and service models. Following is a summary of WG2's recent accomplishments as reported at the 27<sup>th</sup> World Road Congress on October 2–6, 2023.

**Anne-Séverine POUPELEER**, Flanders Agency for Roads and Traffic (Belgium), presented an overview, methods, and outputs. A survey identified the following as top high impact technologies: Electric vehicles/alternative fuels, connected & autonomous vehicles, and remote working technologies. The survey also found that almost half of organizations have appointed a person with responsibility for technologies and service models, or plan to do so. Detailed case studies were reviewed, and some of the observations are:

- Agencies need to maintain a strong learning mindset;
- Partnerships, governance, and standards are critical;
- Communication (and a strong business case) is a key ingredient to sustainable innovation;
- Organizations need to change to enable innovation;
- Agencies must prepare for a future where mobility is flexible, demand-responsive, tech-enabled, and environmentally friendly.

**Matthew DAUS**, President of the International Association of Transport Regulators (IATR) and an Associate Member of TC 1.1 presented the findings of the WG 2' work on the role of transport agencies in shaping disruptive technologies and service models, an effort that was a joint collaboration of TC 1.1 and IATR.





Picture 1.

**Jonathan SPEAR**, Transport Policy and Strategy Advisor, AtkinsRéalis, presented potential future roles for transport agencies. He shared a future mobility maturity model along with information on developing benchmarks for the model. Spear advised that public entities will often not deliver directly because the private sector will lead in many aspects. Highlighted recommendations for transport agencies included:

- Preparing for (rather than reacting to) disruption;
- Using self-assessment regarding roles, activities, and maturity model;
- Creating an innovative organization;
- Prioritizing stakeholder mapping and engagement;
- Regulating (proportionately) the private sector;
- Investigating the implications for public infrastructure;
- Agreeing on protocols for data governance;
- Imagining the Transport Agency of the Future.

### Working Group 3

Over the 2019–2023 cycle, Working Group 3 (WG3) organized virtual discussions to explore methods worldwide transportation agencies use to promote diversity, equity, and attract new employees. Following is a summary of WG3's recent accomplishments as reported at the 27<sup>th</sup> World Road Congress on October 2–6, 2023.

**Anna WILDT-PERSSON** (Swedish Transport Administration), **Sisanda DYUBHELE** (SANRAL

South Africa), **Marit DUE** (Norwegian Road Administration), **Karen BOBO** (U.S. Department of Transportation), and **Alex WALCHER** (ASFINAG Austria), and **José Manuel BLANCO SEGARRA** (Directorate General of Roads, Spain) provided examples of how to promote diversity and talent. The strongest motives according to transport administrators are increased overall performance and innovation, customer orientation and value perception and representation. Diversity management focuses on strategies to recruit, retain, and develop individuals from a variety of different backgrounds and facilitate good relationships among them. Talent management is the systematic attraction, identification, development, engagement, retention, and deployment of talents. Many of the strategies are the same in diversity and talent management.

Diversity dimensions analyzed were age, disability, gender, ethnicity, indigenous people, language, and sexual orientation. Talent management should emphasize developing a culture of continuous learning. Diversity management goals should be linked to Key Performance Indicators (KPIs). Although it is difficult to predict what skills and competencies will be required in the future, working environments will be more interdisciplinary.

### What's Next for TC 1.1

**Christos XENOPHONTOS**, Chair of TC 1.1 closed the TS11 with a summary of what is next for TC 1.1 in the upcoming 2023–2027 Cycle. PIARC's Technical

Committee 1.1 will next be addressing a strategic framework for the transport agency of the future. People and society are at the center of the framework. Concepts surrounding customers, staff, stakeholders and users include equity, inclusivity, mobility, public value, resiliency, and sustainability. Another area of emphasis is public value creation by transport agencies. As agencies redefine their strategic frameworks there is a need to better represent a focus on more holistic societal expectations.

Building on the work of TC 1.1, the issue of strengthening the workforce through modernizing skills, enhancing diversity, equity, and inclusion will be further developed under the umbrella topic of the Transport Agency of the Future. The North Star guiding the future of transport agencies encompasses inputs, guiding principles and outcomes. (Picture: 1).

## TS 1.2 Technical Session 1.2 Planning Road Infrastructure and Transport to Economic and Social Development

One of the aims of this TC is to analyse the role of innovation in road planning. Other objectives are to analyse the area of transport studies and traffic models applied to freight transport, bimodal and multimodal, including the metropolitan context; and to review new approaches to the study of mobility of people and freight, based on the Internet, big data and other innovative sources of information. Within the concept of sustainability in transport network planning – also related to accessibility and equity-, one aspect that is analysed is public health, probably included in the objective of “identifying, investigating and documenting the social value of transport”. For this activity, the TC advances both in the analysis of impact analysis techniques and in the identification of best practices in ex-post project evaluation. With all this, it will deepen in the relationship between transport investments and economic growth.

Visual reminder: Technical Session 1.2 Planning Road Infrastructure and Transport to Economic and Social Development, Thursday October 5, 2023, Panorama Sal, 1<sup>st</sup> Floor, 14:30–16:00



## TS 1.3 Technical Session 1.3 Finance and Procurement

Obtaining sufficient funding for road infrastructure construction and maintenance remain a key challenge for roads authorities globally. In addition, likely there will be an impact of new propulsion techniques on funding that should be considered. One of the aim of this TC is to analyse traditional funding and financing options and explore for developing innovative and hybrid solutions, addressing especially the needs and circumstances of LMIC's. STRATEGIC PLAN 2020–2023 20 Other TC's aim is to develop fundamental criteria that will govern procurement practices internationally through the evaluation of current processes and techniques. These overarching principles would form the basis of procurement guidelines for agencies.

## TS 1.4 Technical Session 1.4 – Climate change and resilience of Road Network

Road owners and operators are required to manage a very broad spectrum of threats in the future. The aims of this TC are to identify hazards and environmental threats within the context of road infrastructure resilience, in consultation with other relevant TC's, and to assess several approaches to increase resilience –taking in to account the economic, environmental and social aspects of resilience management TC will update the PIARC Climate Change Adaptation Framework with the integration of best practice case studies within an approach to resilience from climate change.

## TOPIC OF THE SESSION

It is recognised that road networks are exposed to various threats/hazards that affect their operation and structural integrity. To reduce vulnerabilities to these threats/hazards, road authorities and other organisations have implemented policies, strategies, and actions to increase the resilience of the transportation system.

The session was divided into two parts.

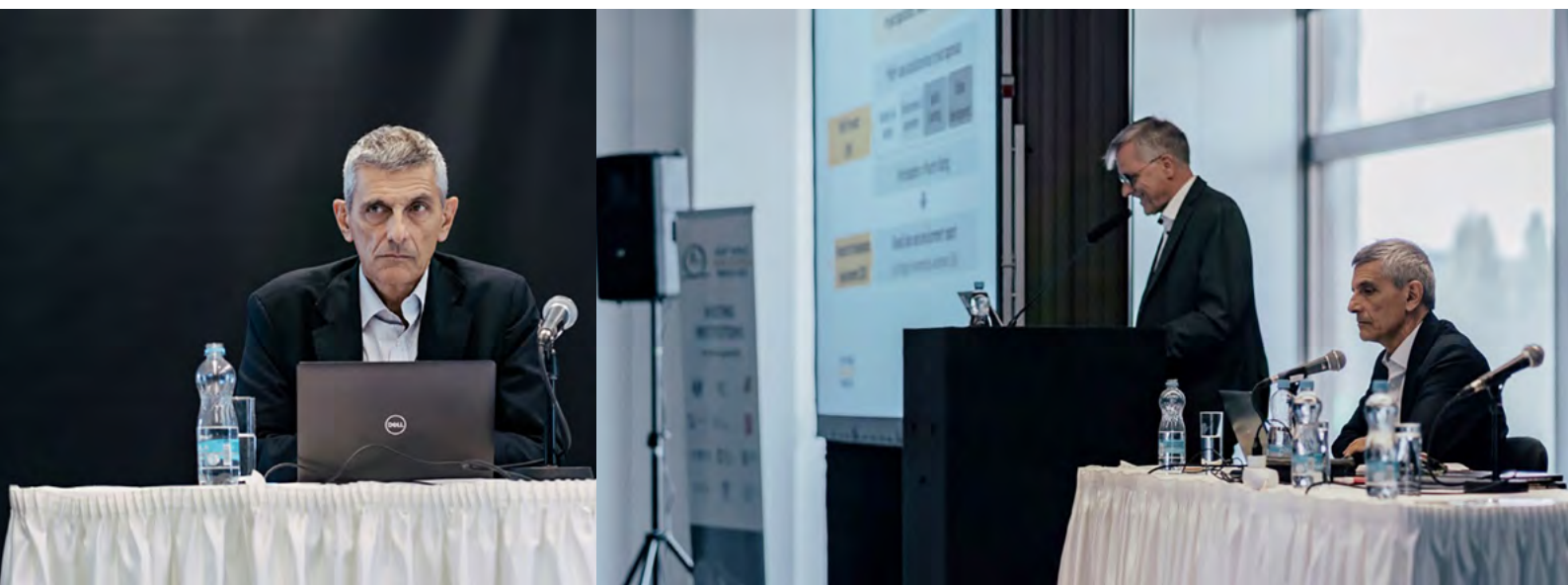
Part 1 presented the results from the work of PIARC Technical Committee 1.4 Climate Change and Resilience of Roads, including:

- Case study task force. A summary of the process for obtaining case studies, the analysis and selection of case studies, and the report.
- Uniform and holistic methodological approaches to climate change and other hazards resilience. An analysis of resilience management based on case studies will be presented to address the different hazards currently faced by road infrastructure.
- Update of the PIARC Climate Change Adaptation Framework for Road Infrastructure. A summary of the new 2023 version of the Framework based on case studies and a comprehensive resilience approach was presented.

Part 2 of the session involved presentations selected from the *Call for Papers*, based on three topics:

- Practical studies to increase the resilience of the road network.
- Climate change adaptation actions for road infrastructure.
- Cross-cutting issues of resilience and climate change.

A total of seven papers were selected from the call for papers. These showed interesting methodologies for the identification of sites vulnerable to climate



change hazards in different countries and case studies to increase resilience. Best practice techniques such as artificial intelligence was presented, as well as different approaches to resilience assessment, risk management approaches, a range of adaptation measures and finally examples of application of the PIARC Framework were presented.

Two studies from Mexico and Brazil were presented, showing two different approaches for the identification of vulnerable sites in the road network, one based on historical records and the other based on the use of artificial intelligence. These methodologies may help other road agencies to develop their network vulnerability assessment methodology with some confidence. The paper from Brazil received the PIARC LMIC award at the Congress.

To assess the vulnerability of the road network, the Rwanda case study was presented, which allowed them to identify the most vulnerable sites on the network, and develop capacities for adaptation and increase resilience. The presentation outlined that adaptation to climate change involves actions to help reduce vulnerability to the effects of climate change, and ways to ensure that the transport infrastructure can better withstand the physical impacts of climate change. Therefore, it is important to identify which hazards are prone to occur and where, then assess whether each road section will be affected by such hazards, and then decide which road sections are the most vulnerable.

Given that road networks can be very extensive, a case study from Germany was presented, where the impact of climate change on the trunk road network was assessed. The methodological framework includes exposure analysis, sensitivity analysis and critical analysis. In particular, the project objective was to develop the basis for increasing the resilience of the federal transport system to climate change and extreme weather events.

It focused on the potential impacts of floods, storms and gravitational mass movements as well as on waterway-specific aspects of navigability and water quality.

Adaptation measures are important to reduce the risk of climate change on road infrastructure. A presentation was provided on climate resilience measures for roads in the mountains of California (USA). These include adaptation measures such as road maintenance; positive road surface drainage systems; adequate culvert and bridge scour protection; trash racks on culverts; stream diversion prevention measures; conservative drainage designs using stream simulation concepts; roadway stabilization methods; cost-effective slope stabilization measures such as deep patch, bioengineering, and geosynthetic reinforced soil slopes; and thorough erosion control measures including drainage control, ground cover, and use of deep-rooted vegetation.

The identification of vulnerable sites is related to the establishment of risk thresholds, therefore during the session a study conducted in Spain was presented. The presentation covered assessment of impacts through understanding the characteristics of a territory, and identifying thresholds to ensure that the effects of climate events are minimized. This work is based on the PAIRC framework, and through a pilot study, it defines thresholds for precipitation for both exposure and probability. This paper received a PIARC Award for Climate and Resilience at the Congress.

The session concluded with a presentation from India, which proposed a resilience assessment methodology focusing on a system approach based on three fundamental conditions from resilience perspective. This channelized global evidence for mainstreaming of resilient road infrastructure through standards.

Visual reminder: Technical Session 1.3 Finance and Procurement, Thursday October 6, 2023, Panorama Sal, 1<sup>st</sup> Floor, 09:30–16:00



## TECHNICAL FINDINGS

The following findings were identified from the presentations and discussions:

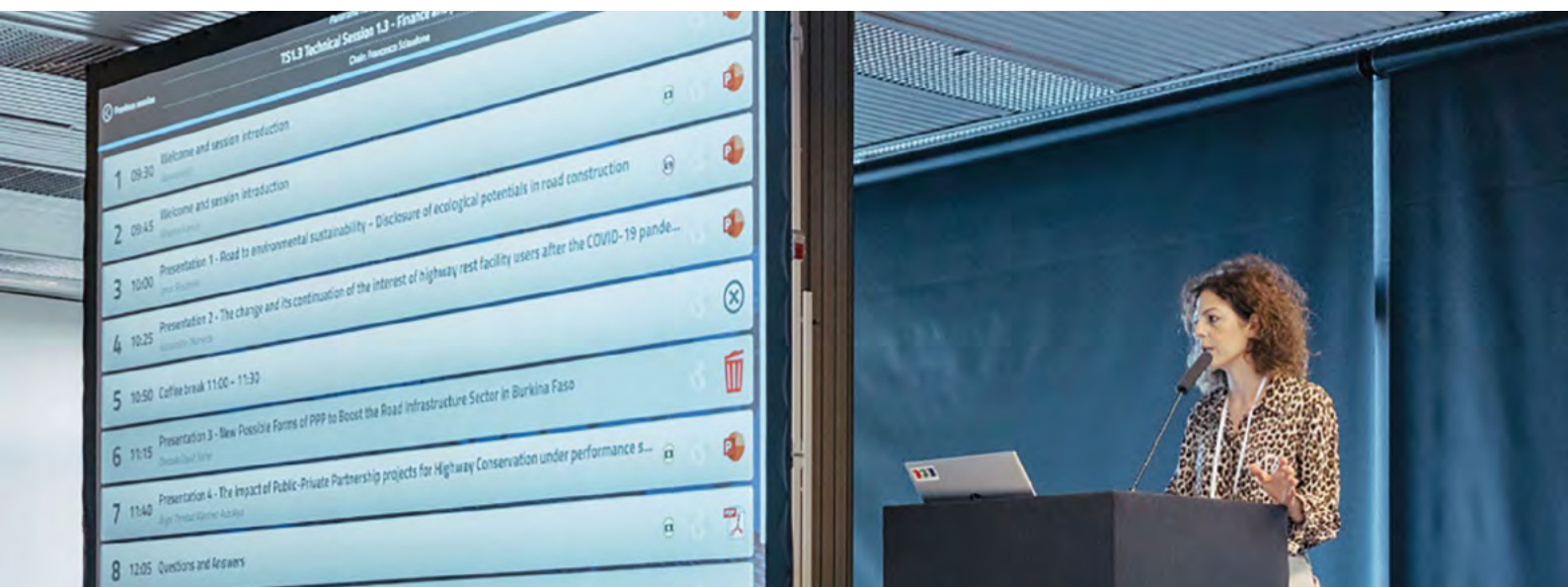
- The geospatial representation of the risky or vulnerable sites of the road network allows it to be better visualized and understood, but more detailed field research is required.
- The use of artificial intelligence will be a future challenge, which can help in the collection and analysis of data from different sources for the assessment of the vulnerability of roads to any threat.
- Exposure, sensitivity, and criticality are still the key variables in determining the levels of vulnerability of roads to climate change.
- The establishment of risk thresholds is still a challenge for all countries, which will allow to reach a certain level of resilience of the road network.
- The methodological frameworks are practical tools that assist countries in identifying vulnerable sites on the road network.
- Although there are many examples of climate change adaptation measures, both engineering and ecosystem-based, there is a need to continue to disseminate and monitoring best practices, which will increase resilience in roads.
- Resilience is a comprehensive approach to reducing the risks of climate change on roads and road networks, so further study is needed to identify best practices in each country.
- The use of standards adapted to climate change is a key factor in increasing the resilience of roads.
- Sustainability and social aspects must be included in climate change adaptation and resilience assessment.
- Frameworks for road adaptation should consider all possible risks, not only those related to extreme weather events and climate change, but also geotechnical, social, safety and environmental risks.

## Recommendation for Decision Makers

PIARC TC1.4 has undertaken an extensive collection of case studies to identify best examples to assess climate risks and other hazards, to help decision-makers to increase the resilience of the road network. It was identified that the updated Framework, assists road owners and managers in high and low-middle income countries to tailor and apply specific sections of the Framework according to their particular requirements. This is intended to assist users in recognising systems and routines that are already in place and provides a good basis for adaptation work by ensuring that it is accessible, flexible, interactive, and applicable for all geographic areas and all starting points for adaptation.

PIARC TC1.4 has also published a report on uniform and holistic approaches to climate change and other hazards resilience. The purpose of this report is to explore the concept of resilience, beyond climate change to consider other hazards. The complex interrelationships between different types of hazards are explored, offering a nuanced understanding of how they interact. This report includes coverage of the triggering, amplification, and compound relationships, with chronic and acute threats underscoring the need for a comprehensive approach. It is recommended that decision makers implement resilience in practice across all organisational levels and consider an all-hazards approach to resilience and interdependencies between transport modes.

It was also highlighted that it is important that decision makers take action to reduce the risks of climate change on road networks. The use of methodological frameworks such as PIARC is very useful to simplify and organize the activities



for an adaptation process, as it has an engineering approach.

The session also outlined the importance of awareness raising and training of road administration staff on climate change adaptation and risk management. These are key actions to increase the adaptive capacity of the institutions.

Effective communication of climate change risks and road vulnerability will allow for informed and assertive decision making.

It was also noted that it is important to continuously monitor adaptation actions to evaluate their effectiveness. This is covered in the framework and was highlighted in a number of presentations provided.

## Recommendations for PIARC and International Organisations

The dissemination of best practices and lessons learned on climate change adaptation and resilience should continue through technical reports, seminars, and other ways to share information.

Since countries continue to face different hazards in addition to climate change on their roads, it is important to consider other risks that they are facing (geotechnical, social, etc.), and ways to improve the resilience of road networks.

## TS 1.5 Technical Session 1.5 Disaster Management

Developing a reliable information collection and sharing system is the first step of proactive disaster management toward engaging with internal and external stakeholders and understanding their information needs and expectations. The aims of TC are to study disaster management techniques using Big Data and Social Network Data as well as to analyse the financial aspect of disaster management in preparedness, mitigation response, and recovery phase, and to update the Disaster Management Manual.

### TOPIC OF THE SESSION

Disaster management encompasses a series of activities and actions performed by various actors (road administrators, technicians, road users, stakeholders, etc.) who must be trained, coordinated and informed, according to the function that corresponds to them, during every phase of a disaster management (mitigation, preparedness, response and recovery). For disaster management to be effective and efficient, it must be based on a clear understanding of the role and fulfilment of responsibilities of each actor as well as the timely implementation of appropriate interventions. A good disaster management practice is to integrate disaster management into national, provincial and district development plans, and to change the thinking and attitudes of individuals from disaster vulnerability to disaster resilience. Lessons learned from past disasters can drive the development of new management strategies and new structural intervention and monitoring techniques, can also serve as test

Visual reminder: TS 1.4 Technical Session 1.4 – Climate change and resilience of Road Network



cases to evaluate the effectiveness of what has been put in place. In this sense knowledge sharing among road administrations, as well as practical experience, will be crucial. This session will showcase the activities and results developed by PIARC TC 1.5 – Disaster management, referred to Information and communication management, financial aspect for disasters and update disaster management manual. Topics are complemented by selected presentations, which represent very good examples of each theme.

## TECHNICAL FINDINGS

### Disaster Management Manual

- Disaster Management Manual (DMM) is the world's first manual to compile various road disaster management techniques with international knowledge and experience.
- DMM is designed on a user-friendly structure. DMM also covers the cutting-edge disaster solutions and tools for the development of a resilient road network. DMM can be used as a textbook or as a dictionary.

### Use of cutting-edge digital technology for disaster management

- Data and information management supported by the current digital technology development is becoming crucial in disaster management. Data and information acquisition is becoming more extensive and analysis is becoming more complex and diverse. Further application including digital twin technology is expected.

### Vulnerability Indicator

- Need of vulnerable index such as Flood Index was discussed for disaster management.

### Social resilience

- Societal demand was reported to be one of the key factors deciding recovery methods. Discussions reconfirmed the importance of social resilience in disaster management.

## RECOMMENDATION FOR DECISION MAKERS

### Social resilience involving all parties

- Disaster threats, in other word "Sustainability threats", vary within countries and across countries, therefore **it is important to prepare for resilience and to improve resilience involving all parties.**
- **Currently social capital and social resilience is considered as a very important component of the disaster resilience.**

### Supply chain resilience for roads

- Roads play an important role in economical and societal activity by supporting the supply chain. Therefore, **roads must keep functioning even during a disastrous event. The economic impact to the society must be taken into account in disaster management.**



## Financial aspects of disaster management

- **Build Back Better approach in disaster recovery is very important for sustainable development.**
- Thus, the financial aspects and economic sustainability regarding disaster management are keys for short term and long-term sustainability.

## Investing to save

- **Investing in resilience activities prior to events can limit the consequences and impacts from them.**
- Research has shown that for every dollar invested there is an opportunity to save significantly on recovery costs. Threats take many forms. Conventional disaster management focuses on natural disasters. However, human-made threats are becoming increasingly relevant and require enhanced activities to plan and prepare for.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

### Information and knowledge sharing

- Both developed and developing countries are still facing significant challenges to the adverse effects of disasters on their transportation systems. Addressing this issue requires international collaboration in information and knowledge sharing even across national and language barriers. It is encouraged that the International Road Organizations pursue closer collaboration to disseminate information and to share experiences.

The permanent updating of the manual with the results of the activity of the Technical Committee, new case studies, best practices, and lessons learned from disaster management is the key to perfecting the manual in the following years.

## TF 1.1+1.3 Technical Session 1.1+1.3 Well-Prepared Projects

A good preparation of infrastructure projects is of utmost importance to secure their proper financing, wide acceptance and seamless implementation. The aims of this TF are to review literature and existing project preparation software and analyse good practices of project management for improving and optimizing public and private investment, as well as to define strategies to accelerate project delivery and reduce project lifecycle costs. It will also facilitate to identify how well-prepared projects contribute to a culture of transparency and accountability.

### TOPIC OF THE SESSION

The topic of the session was to present the findings of the two Taskforces dedicated to the preparation of transport projects in the PIARC strategic cycle 2019–2023, and to present outstanding papers collected in the call for papers.

### TECHNICAL FINDINGS

#### TF1.1 Well-prepared projects findings

- Overall, the review highlighted similar practices in the preparation of projects across the ten countries considered within the study,

Visual reminder: [TS 1.5 Technical Session 1.5 Disaster Management](#)





suggesting these aspects form key roles in project preparation.

- Significant importance of sustainability, social value, stakeholder, and public engagement.
- A need to better develop problem identification.

### TF1.3 Well-prepared projects in LMICs findings

- While findings identified in TF 1.1 (mainly dealing with high-income or upper-middle-income countries) are also valid for low-income countries, additional hurdles were identified for LMICs:
  - Financing of preliminary studies
  - Training and retention of qualified staff within local administrations
  - Availability of technical reference documents
  - Availability of reliable input data
  - Ability to control the quality of deliverables provided by Consultants in charge
  - Alignment between deadline/budget of the studies and the content of the services
- Financing of preliminary studies will become even more challenging with the decision of Multilateral Development Banks (MDBs) to align their investments on the Paris Agreement. This is an emerging issue which will need further consideration by PIARC.

## RECOMMENDATION FOR DECISION MAKERS

### TF1.1 Well prepared projects recommendations for decision makers

Decision makers in transport administration should make sure the following characteristics are included

in the preparation of projects to be qualified as « well-prepared »

- Stakeholder management
- Risk management
- Communication management

Other important aspects:

- Clarity of the ownership
- Procurement
- Human resources
- Time dimension

Tools – BIM, SOURCE.

### TF1.3 Well prepared projects in LMICs; recommendations for decision makers

In addition to the above recommendations, TF 1.3 has recommended a more widespread use of the Project preparation platform SOURCE specifically for LMICs.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

### TF1.1 Well prepared projects

Limitations of the study.

- No countries from Low-income and limited countries from Lower middle income and low income; this should be a point of concern for PIARC.
- In times of COVID-19 – limited access to developing banks.
- Via PIARC, access to national road systems (basically at the ministry level) at the exclusion of regional and local contributions to the preparation of projects (Also a point of concern for PIARC).





### TF1.3 Well prepared projects in LMICs

Facilitate webinars and hybrid meetings for better participation of LMICs.

Improve communication between international organizations such as MDBs, CICA (construction industry), FIDIC (consulting industry), in particular on the specific topic of project preparation.



Visual reminder: TF 1.1+1.3 Technical Session 1.1+1.3 Well-Prepared Projects



# Strategic Theme 2

## Mobility

Roads and transportation services delivered by roads are, besides other transportation services a key element of mobility policies. Mobility policies take now into account multimodality to optimize the use of transportation assets, but mobility policies are not an end by themselves. They contribute to broader goals for communities (cities, rural communities, regions and countries) such as providing a good quality of life, welfare, social equity, or a better environment. Indeed, broader goals for communities depends on the level of development of countries, cultures, types of communities (rural or cities), or size of those communities (local or regional).

Mobility policies are facing increasing challenges such as: Climate Change and the need of decarbonizing our transport services, road construction, road maintenance, but also the need to provide more resilient services; lack of public space, congestion and health impacts in urban areas; lack of roads and transportation services and, as a result social exclusion in rural areas; overloaded trucks, poor vehicle conditions, driver fatigue and speeding in road freight transport, and related safety problems especially in LMIC's.; new mobility services which are disrupting the existing transportation ecosystems; how to implement the potential of digitalization, or data driven solutions which offer new possibilities of optimization of road operations and services; and lack of public funds to maintain and modernize our assets, or to finance new infrastructures

Broader goals for communities are changing because people behaviours are evolving (circular economy, share economy, etc.). Furthermore, they will probably change after the Covid-19 pandemic. Many questions are open, but we can imagine some long term effects such as boundaries between home and work, or between home and purchase might change thanks to the new technologies (remote working, etc.). The severe economic crisis will make the lack of public funds more acute. The pandemic may also affect international trade and thus goods transport systems.

The goal of this Strategic Theme is to provide good knowledge and some sustainable answers to all communities in the fields of people mobility and goods transportation, taking into account what follows: challenges for mobility policies mentioned above, the opportunity of new technologies, and the increasing need to have a good alignment between mobility policies and the broader goals of communities, in a context where those goals are changing.

This external context meets with the Strategic Theme 2 to study "Mobility" developing four Technical Committees and two Task Forces.

## **TS 2.1 Technical Session TC 2.1** **Mobility in Urban Areas**

Cities deliver a lot of services (jobs, education, culture, hospitals, ...) not only for citizens, but also for rural communities around the cities. This TC focuses on inhabitant's mobility needs in the commuting areas in order to make sure that all transportation needs in relation with the services delivered by cities will be taken into consideration. It will take into account the complexity of urban areas (integration with land planning, multimodality, public support, new mobility modes).

### **TOPIC OF THE SESSION**

The session shared the results of the work completed by the Mobility in Urban Areas Technical Committee through the analysis of three main issues strictly related to the work made by the 3 WGs of the TC. The first focused on data survey and accessibility analysis, the second has opened the discussion and collected all the contribution on innovation and "new mobility" and finally the third has putted together all the results and the advantages on "Multimodal solutions" for the mobility in urban areas. A dedicated part of the session has focused on the needs of LMICs.

### **TECHNICAL FINDINGS**

The mobility in urban areas is today a priority for all city administrations and governments. Making cities less congested, cleaner and ecological means using all forms of transport more efficiently, improving accessibility and developing multimodality.

In the last report of the 2016–2019 period, the committee examined the travel demand of residents in urban areas and the analysis of existing transportation networks. Recommendations were shared: "Present diverse and varied mobility solutions based on the collection systems to be performed, on a new use of traffic lanes, on the strategic role of connection points and on the impacts that the breakthrough of new shared services could have". To continue the reflection, the report asked for building "accumulative database".

This is what we have done with this 2020–2023 cycle: more than 41 good practices for optimizing road space have been selected, 16 of which are described in the "Collection of Case Studies" in terms of resilience, efficiency, and sustainability as well as the analysis of 16 surveys about general guidelines carried out among some PIARC member countries in this Briefing Note.

One common strategy is the "Reduce-Transfer-Improve" approach, in order to reduce the carbon footprint. Solutions are emerging such as the increase the attractiveness of collective transport, the encouragement of active mobility, shared mobility, the flexible use of road space for dynamic bus, carpool or bicycle lanes.

Another common and structuring strategy is the development of Multimodal Transit Centres (MTC), whatever the existing mobilities, their location or size. This point of connection between mobilities must be easily accessible, offer daily services and make the journey as simple and secure as possible for users.

We hope that this report and its recommendations on multimodal solutions for optimizing road networks, based on the policies and strategies of the different countries and feedback from case studies, will enlighten and feed the projects

Visual reminder: [Technical Session 2.1 Mobility in Urban Areas, Wednesday October 4, 2023](#)



of decision-makers in all countries, whatever their level of development.

The road of tomorrow will have a major role to play in the mobility of goods and people. Faced with the challenges of climate change, roads will have to be more resilient, more shared, more low-carbon and provide the essential link between urban centres and outlying areas.

In PIARC's future work, the cooperation between transport modes in urban and peri-urban areas remain an important area to analyse in order to meet the challenges of tomorrow. The work will consist also in better understanding new type of urban vehicle access regulations (UVARs) policies and to assure a more secure mobility of vulnerable road users in crowded street and for highly frequented infrastructures.

## RECOMMENDATION FOR DECISION MAKERS

The installation of small MTCs at the train stations or nodal points on the trip route which are near from trip origins is recommended, with the aim of (i) providing attractive alternative mobility offer competitive to driving cars, (ii) enhancing the use of public transport, (iii) reducing emissions of green-house/exhaust gas and (iv) providing mobility opportunities to persons with disabilities and to people who do not have access to private cars. Providing user-friendly one-stop services using ICT is already operational and highly recommended.

The installation of dynamic bus lanes is recommended, with the aim of (i) better quality of service for bus during peak hours, (ii) enhancing the use of bus, (iii) reducing emissions of green-house gas and exhaust gas.

The installation of dynamic carpooling lanes is recommended, with the aim of (i) reducing traffic congestion by increasing car occupancy, (ii) reducing emissions of green-house gas and exhaust gas and (iii) reducing the cost of travel.

Bicycle lanes and dedicated paths not only reduce journey times for cyclists, but also improve safety, also improve pedestrian safety as they eliminate the mixing of cyclists and pedestrians.

Bicycle lanes are inexpensive, have a short construction period and only require appropriate traffic signage.

Non-motorised transport (NMT) is the cheapest and most accessible mode of transport, and the provision of social services along the NMT corridor, such as schools, hospitals, libraries and markets, has the potential to meet the mobility needs of all people.

NMT corridor can be a model for cities without sufficient infrastructure for motorized transport if it proves to be successfully implemented.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

To understand the travel behaviour of the people living in urban and peri-urban areas, transport data is essential. The most representative type of data to understand the inhabitants' travel behaviour is household travel survey microdata. Other types of transportation data, such as floating car data, time use data, weekend household travel data, GPS-based travel data and so on, are also helpful to understand travel behaviour of the inhabitants. However, household travel survey microdata, based



on each household member's travel diaries, should be prioritized to support transport-related analysis and policy making.

The importance of transport data cannot be over-emphasized. If transportation data is the very beginning to understand the mobility and accessibility of people, we also need to examine what type of transportation data has been produced in different countries and metropolitan regions. To standardize the types of transportation data each different country and metropolitan region produces could be one of the valuable criteria that PIARC should archive in its database. And if there are countries and metropolitan cities which strive to build up a proper type of transportation database.

## **TS 2.2 Technical Session TC 2.2** **Accessibility and Mobility** **in Rural Areas**

Rural areas provide goods, industries, and workforce for all communities, and roads are the most important way to exchange goods and services. This TC focuses on accessibility in rural areas and on mobility needs in coordination with T.C 2.1. Road networks in rural areas are very extensive compared to the low density of population, and as a result it is difficult to finance the construction and the maintenance of those networks and the safety conditions are generally poor. Therefore, this TC also focuses on improving road safety and technical solutions for paved and unpaved roads in rural areas.

## **TOPIC OF THE SESSION**

The first presentation of the session was about different technical solutions for the construction of rural roads. This was followed by a very technical and interesting presentation pertaining to the relationship between surface layer bearing capacity and unsealed road corrugation.

Both the above-mentioned presentations emphasised the importance of maintenance of rural roads. These are the roads used by the agricultural sector to transport fresh produce to the markets and if not properly maintained corrugation etc. can lead to huge financial losses and wastage. It could be interesting if these losses could be calculated and quantified so that it can be used as motivation or justification of improved maintenance programs and research.

The presentation titled "Practical guide of road safety measures on semi-urban crossings" was very enlightening. It pointed out the relationship between land-use and transportation needs especially the safety of vulnerable road users. The work proposes a practical approach to identify and specify the intervention of infrastructure in a semi-urban crossing, based on conclusions derived from the Chilean experience. It is expected that this research could contribute to the dissemination of best practices in road safety for low- and middle-income countries.

It was also about presenting, the experience of Cameroon in transitioning rural roads to municipal ones, highlighting the need for continued external support, to Romania's emphasis on adapting technical solutions to regional specifics and maintaining accurate databases, and Mexico's focus

Visual reminder: Technical Session 2.2 Accessibility and Mobility in Rural Areas, Thursday October 5, 2023



on empowering women in road programs for economic and community benefits.

Furthermore, the session highlighted the critical issue of safety in rural road management, as discussed by Malaysia, emphasizing the global concern of road traffic deaths and the integration of safety management with asset management. Lastly, the environmental impact of using lime milk to combat asphalt bleeding phenomena was evaluated in a changing climate, with the results suggesting a promising and environmentally friendly solution.

## TECHNICAL FINDINGS

All nine (09) presentations of the session, collectively demonstrate the complexity and significance of rural road management, emphasizing the need for tailored solutions, financial support, gender inclusion, and environmental responsibility. The lessons and insights shared in this session contribute to a more comprehensive understanding of rural road management practices worldwide and particularly in low and middle-income countries.

## RECOMMENDATION FOR DECISION MAKERS

- Allocated more financial resources for rural roads;
- Encourage the introduce of new technical in the construction of rural roads;
- Encourage engineers from member countries to become more involved in PIARC activities.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

One key concern has been the inactive participation of certain member countries. While the committee has a diverse membership, it is imperative that all member countries actively engage in the work to ensure a holistic approach to rural accessibility and mobility. To address this, it is essential to encourage greater involvement from these nations through targeted outreach and engagement initiatives. Identifying and addressing the reasons for their inactivity is crucial to ensuring comprehensive solutions that meet the needs of all rural areas.



## **TS 2.3 Technical Session TC 2.3 Freight**

This TC focuses on vehicles overloading and its related consequences. Road freight transport is heavily depending on fossil fuel and this TC will also investigate the strategies and measures to reduce greenhouse gas emissions of road freight transport. It will take into account the potential of new technologies onto logistics and transport services of goods.

### **TOPIC OF THE SESSION**

This session shared results, findings and recommendations of the work completed by the PIARC TC 2.3 Freight on the following topics:

- Best practices, monitoring and regulation to reduce overloading and associated infrastructure damage on road networks
- Greening of freight transport
- Application of emerging technologies in freight transport and logistics

Overloaded trucks, non-compliance or poor vehicle conditions, driver fatigue and speeding remain as primary challenges in road freight transport, especially in Low-Middle-Income Countries (LMIC). These issues can cause severe road safety problems, substantial damage to the road infrastructure and environmental impacts. In the first part of the session the challenges, suitable approaches and good practices mitigating truck overloading were presented and discussed.

Reducing greenhouse gas emissions will remain a significant challenge and will require the greening of road freight transport. There are increased demands from various stakeholders to identify strategies and measures to reduce the climate impact from the transport system and phase out the use of fossil fuels. Greening freight transport was presented and discussed in the second part of the session. The challenges, suitable approaches and good practices were highlighted types of solutions that continues to evolve.

Innovations and advances in emerging technologies are changing the logistics and management of the freight transport system. These technologies have the potential to increase productivity, efficiency, reliability, flexibility, safety, sustainability, and economic benefits. A discussion of emerging technologies was included in each part of the sessions referenced above.

Besides the results of the TC 2.3 Freight work during the cycle also some very good papers were

presented. One of the papers won a PIARC Prize for “Road, Design, Construction, maintenance and operation.”

The papers covered truck overloading, greening freight transport, the application of new technologies and bridge related asset management:

- Reducing Overloaded Vehicles Impact on Indonesia Road Agency Cost by Design Approach.
- Bridge Monitoring and Data-Driven Structural Asset Management (PIARC Prize for “Road, Design, Construction, Maintenance and Operation).
- Use of WIM data for Overload Enforcement and Mitigation of Bridge Collapse.
- Sustainable urban logistics roadmaps to green freight transport.
- A self-driving cycle rickshaw for autonomous urban passenger and freight transport.
- A Comparison between rail and road transport as a strategy to reduce GHG’s in Mexico.

### **TECHNICAL FINDINGS Mitigation of Truck Overloading using emerging technologies**

- There is a common understanding that mitigation of truck overloading is and remains a big challenge in Low- and Middle-income countries and in high Income countries as well. There are massive overloading rates and also massive overload levels, especially in low- and middle-income countries. Overloading risks could increase in the future due to the pressure on transport productivity and implementing a new generation of truck engines – especially in high income countries. Mitigating truck overloading therefore needs continuous high attention. Moreover, the extra weight of low emission truck engines should be compensated by allowing an increase of the maximum weight of a truck. This requires an adjustment to the regulation of mass and weights of trucks – as already done for instance in European countries.
- It is difficult to get a consistent picture of the overloading situation and comparable figures due to different approaches for measuring overloading and vehicle random sampling. Aggregate figures on overload rates and overload levels must be disclosed and well documented. Whenever possible, the characteristic values related to overloading should be made comparable. Therefore, more data on overloading should be gathered in a comparable manner; especially in cooperation with low- and middle-income countries.
- Due to limited resources and the necessary effectivity and efficiency of control processes



it is important to develop a nation or state wide enforcement strategy. These strategies should aim at finding an optimum on overall costs taking into account the controlling cost, transport costs and also costs of accidents and especially fatalities. The strategies should be based on the main challenges and objectives of mitigating truck overloading considering the suitable existing and emerging technologies.

- As presented WIM and virtual WIM can help to increase the efficiency of weight controls by pre-selection, in combination with conventional static measuring facilities as weigh bridges. WIM systems with high accuracy and certification could in the future be used for direct enforcement.
- WIM could also be used in connection with new road design approaches as seen from Indonesia using actual and not standard axle loads. Substantial cost reductions and a reduction of overloading rates can be expected.
- In the presentation from Australia, we saw that for oversized and overweight vehicles used for indivisible loads, the peak loads and measuring the loads are a challenge. The proposed advanced Bridge and Traffic Monitoring (BTM) supporting evidence-based bridge access which improves asset management and investment decisions.
- To avoid damages and failures for bridges a mitigation of large overloads is needed. For this an admonition policy is proposed which requires only a basic and inexpensive Video-WIM system.
- Advanced and emerging technologies could support further applications as Automated overweight permitting or Intelligent Access for trucks enabling the appropriate vehicle on the right road at the right time. Telematics applications with an advanced data management are therefore needed.
- Advanced business models using Public Private Partnerships (PPP) – The Roads Authority builds and owns the Weighbridge facilities; the weigh bridges are operated by suitable private Operators – have shown reductions in overloading and also cost reductions (South Africa). PPP approaches are also valuable to prevent overload risks (Indonesia).
- Stakeholder involvement, as seen in several presentations, is also key to reach a better compliance with regulations. This helps to create a shared interest in respecting the vehicles weight and dimensions rules and thus preventing overloading. Such initiatives should be widely shared and encouraged.
- The good practices showed that overloading rates and overloading levels could be reduced and that there are benefits as cost reduction and increased road safety. The mitigation of truck overloading will stay on the agenda for the next PIARC cycle.

## Greening of Freight Transport and emerging technologies

- There is a common understanding that there is an urgent need and a responsibility to reduce GHG emissions of road freight transport, as far as possible without jeopardizing the viability of the transport and logistics sector.
- HICs and LMICs both, should strongly consider investing in green freight solutions, in addition to other critical issues like maintenance and renewal of road infrastructure or traffic safety.
- We saw that there are many approaches to make freight transport greener: national, regional, and local transport authorities should consider the investigated and presented approaches during development of their freight strategies and concepts. Depending on the availability of green energy, the mix of approaches and measures might vary between countries and also change over time.
- When the green solutions also are economically beneficial for the decision maker, implementation is of course easier. Both, the public and the private sector need to consider that without financial support, policy measures will not likely be implemented quickly enough. Collaboration is key to getting the best available practices implemented.
- It is crucial not to underestimate the role of road infrastructure. There is a need to provide infrastructure (for instance for charging of vehicles) to initiate and accelerate a sustainability process of freight transport. Large infrastructure investments are needed to reach ambitious sustainability targets.
- Because of the exploding urban freight deliveries there is a special challenge in urban areas. Sustainable urban mobility plans including freight and urban logistics roadmaps should be developed by cities and regions. Approaches for consolidation, electrification, transport optimization and modal shift are ways to make urban freight more sustainable. Also land use (e.g., the preservation of land for logistics purposes) have to be taken into account because of the big impact on road mileage.
- Emerging technologies should be considered to make freight transport more sustainable. For example, a shift to higher energy efficiency should be part of the research. Research shows that hydrogen is not as energy efficient as using electricity directly. Also, inductive charging of vehicles has some steps to take as well. Knowing how to cost-effectively capture CO<sub>2</sub> could also be part of the solution.
- Within the strategies avoid, shift, improve the biggest potential is seen in improving freight transport (e.g., electrification) and lowest in avoiding freight transport. Avoiding can play a role in road construction site delivery or also

circular economy. To change behaviour (e.g., for e-commerce) will be very difficult.

- Good practices could be recognized by awards or certification as proposed in the Mexican case. In Europe the lean and green initiative – a carbon reduction program for logistics and freight transport – goes in the same direction. In Mexico also tax cuts are an incentive for modal shift from road to rail and intermodal transport.
- Examples from France and Germany have shown that pilot projects are important taking into account approaches and technologies for which the feasibility and impacts are probably not yet that clear (e.g., for special vehicles, electric road system, multimodal strategies).
- Modal Shift policies (from road to intermodal transport using rail or inland waterway) are widespread in European countries but also in other countries. There is still potential depending on the freight transport structure and today's level of the rail or intermodal share. The presentation from Mexico showed substantial emissions reductions for the transfer to rail freight transport.
- Instead of waiting for the one major solution, the sector should aim for feasible emission cuts, even smaller ones. Making small reductions is better than waiting.
- Sharing knowledge and good practices for greening freight remains important. The topic will therefore be further tackled during the upcoming cycle.

### Emerging technologies in Freight Transport

- Emerging technologies are not only relevant for the compliance control of weight and dimensions of trucks regulation and greening freight but also for further applications in freight transport and logistics; Examples have been shown by Caroline in different application fields.

- These technologies have potential to make freight transport greener, smarter, safer, and more sustainable. The maturity of the technologies varies, and technical feasibility and the financial viability have not been verified for all technologies. Also, the real impacts are not fully known yet. Positive examples with real world experiences showed the application of emerging technologies for truck management and border crossing management to be beneficial.

### RECOMMENDATION FOR DECISION MAKERS Mitigation of Truck Overloading

- The reasons for overloading need more investigation. More data on overloading rates and levels need to be collected, especially in cooperation with LMIC's. The extra weight of low emission truck engines should be compensated by allowing an increase of the maximum weight of a truck. This requires an adjustment to the regulation of mass and weights of trucks – as already done for instance in European countries.
- National or state authorities should develop and implement overloading enforcement strategies on national or state level. These strategies should aim at finding an optimum overall costs taking into account the controlling cost, transport costs and also costs of accidents and especially fatalities. The use of emerging technologies should be considered.
- Stakeholder involvement and PPP should be applied more in order to improve the effectivity and efficiency of overloading mitigation.

### Greening of Freight Transport

- National, regional, and local transport authorities should consider the investigated and presented

Visual reminder: Technical Session 2.3 Freight, Thursday October 5, 2023



approaches during developing their freight strategies and concepts.

- HICs and LMICs both, should strongly consider investing in green freight solutions,
- The road administration should use their purchasing power to reach greener freight transport in connection with road construction sites (bundling platforms, low emission vehicles and machines, use of rail transport, etc.). This is especially true for big construction sites.

### Application of Emerging Technologies

- It is recommended that road authorities and decision makers develop a vision and framework to facilitate the adoption of emerging freight technologies. Public-sector decision makers should clearly articulate their vision and role, as well as the regulatory framework to support innovation.
- It is recommended that Road Authorities and decision makers encourage innovation and work with the private sector to realize the benefits of emerging freight technologies, and to inform future policies and regulations by support pilot projects to identify and address the challenges that will move an emerging technology from concept to adoption/implementation.
- It is also recommended that Road Authorities and decision makers collaborate with the private sector to document and disseminate the findings of pilot projects. Specifically, it is important to document and develop an understanding of the lessons learned, challenges experienced, how to overcome challenges, and resource and institutional requirements.
- It is recommended that Road Authorities support pilot projects which have the potential to make freight transport more efficient and sustainable.
- It is recommended that Road Authorities and decision makers continue to monitor and

benchmark the adopted/implemented emerging technologies to continue to understand the costs; impacts on safety, infrastructure, sustainability, and traffic operations; the need for workforce development; and any changes in public sentiment.

### RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS Mitigation of Truck Overloading

- Mitigation of truck overloading should be given a high priority in PIARC activities. This also includes a closer look at the economic and regulatory roots for overloading and identifying the benefits of the enforcement of overloading control – which can reduce infrastructure damage costs and increase road safety.
- Collection of better data for truck overloading rates and levels in a comparable manner. Look at data collection and mitigation strategies.
- Avoiding freight transport could further be investigated in the upcoming cycle taking into account optimising deliveries to construction sites and circular economy approaches.

### Greening of Freight Transport

- Continue sharing knowledge and collecting good practices for greening freight transport.
- Continue addressing greening freight transport in PIARC activities.

### Application of Emerging Technologies

- It is recommended that PIARC conduct follow-up studies to continuously identify and evaluate new emerging technologies and their



applicability to the freight and logistics sector. For the next Cycle Emerging technologies will therefore remain a topic to be tackled.

## TS 2.4 Technical Session TC 2.4 Road Network Operation / ITS

Road network capacity is not fully utilized, as traffic demand is concentrated on only small sections of the road network. This TC focuses on how new mobility, new technologies and digitalization are incorporated to Road Network Operation. This T.C investigates the concept Mobility as a Service (MaaS). It will also update the RNO / ITS Manual.

Besides, almost all TC are dealing with common topics such as mobility of people between urban and rural areas, or data-driven solutions.

## TS 2.1 Technical Session TF 2.1 New Mobility and its Impact on Road Infrastructure and Transport

### TOPIC OF THE SESSION

The mobility ecosystem has experienced significant change in recent years: connectivity, cooperative systems, automated driving, mobility as a service (MaaS), micromobility, low emission vehicles – new technologies and use cases that need new approaches and answers from road authorities, agencies and Road Network Operators.

The session would be organized in two parts, including 7 presentations in total. In the first part, the 4 presentations were developed by members of the task force and were based on the findings of the analysis developed in the literature review and the survey developed by the Task Force. The second part of the technical session was reserved to 3 experts that had submitted papers that were selected by the expert panels due to their interest for PIARC.

### TECHNICAL FINDINGS

The topics presented during the first part of the session were:

- Results of the external survey launched by the TF to PIARC members and sector stakeholders regarding the likely impacts and responses to new mobility technologies in different regions, and expectations for the future.
- Mobility innovations impacting Road Network Operators, focused on six main topics: Autonomous and Connected Vehicles,

Visual reminder: Technical Session 2.4 Road Network Operation / ITS, Friday October 6, 2023



Cooperative ITS, Digital Highways, Platooning, MaaS (Mobility as a Service) and Electric Vehicles.

- Horizontal Issues related to mobility technologies overall, including financial issues, social impacts and implications for Low- and Middle-Income Countries (LMICs).
- Conclusions obtained by the TF through the analysis of the bibliographical sources, use cases and case studies, including those of specific relevance and interest to the PIARC new cycle.

This highlight the need for a comprehensive approach to addressing the challenges and opportunities posed by new mobility technologies. Cooperation among different regions and a focus on social and financial impacts are crucial for success.

During the second part, these were the main topics:

- Evaluation of machine detection of road markings for connected and automated vehicles under adverse weather and light conditions with camera and lidar.
- The effect of Connected and Automated Vehicles on Traffic Management observed through a national project in Hungary.
- The effect of truck platooning on rutting formation of flexible pavements

During the session, it was pointed out that current mobility is changing every day. There are new business opportunities, improved connectivity, and opportunities for road administrations. Here are some of the opportunities that the new mobility presents:

- Various business models involve revenue generation through fees, partnerships, and funding.
- Reducing externalities like congestion, pollution, or accidents.
- Provide a more inclusive mobility (people with disabilities, young or elderly people).
- Increase road capacity through digitalization.

This highlights the positive aspects of new mobility, where technology not only offers economic benefits but also promotes inclusivity and sustainability. Embracing digitalization can lead to more efficient road networks.

On the contrary, there are also challenges to face:

- High initial costs for implementing innovative mobility.
- Complexity of regulations.
- Cybersecurity.
- Data exchange and management.

These challenges underline the need for robust cybersecurity measures, streamlined regulations, and efficient data management systems to ensure the successful.

The Task Force launched a survey to mobility related actors to learn about their expectations, concerns and solutions to come. From the initial survey, we can conclude that almost every organization finds that the predominant impact for AV, E-deliveries, Connected vehicles, EV, Alternative fuel vehicles and MaaS will be positive. These positive impacts are expected in terms of efficiency and congestion, accessibility, climate change, resilience, economic development, and energy efficiency. In the case of road safety, a very positive impact is expected.

From the experience presented in the national Hungary project, it was discussed how a transport system using the highest-level state of the art technology to develop and demonstrate a holistic solution to support and operate autonomous vehicles in cooperation with infrastructure elements can be developed. The Hungary project exemplifies the potential for close collaboration between infrastructure and autonomous vehicle technology, paving the way for more efficient and advanced transportation systems.



Additionally, it was highlighted that platooning is expected to have a negative predominant impact on pavements if it is not corrected. The study about the effect of Platooning in flexible pavements was presented during the second part of the session presented from a Gustave Eiffel University Research Group and concluded that if the truck's path is deviated 20 cm between them, it will help distribute the load in the pavement. Also, if the distance between trucks is increased, it will help to reduce the effects of the platoon in the pavement.

..The results show that truck platoon configurations can be optimised to reduce the impact of this new type of load on pavement structures. It emphasizes the importance of optimizing platoon configurations to minimize pavement wear and tear, which is crucial for the long-term sustainability of road networks. The study aims to help transport policymakers in the definition of policies to allow a proper deployment of platoons without impacting the current performance of pavement structures.

Regarding CCAM, Administrations are going to play a big role, so it is very important to define ways to cooperate with the market. Road administrations need to be familiar with short- and long-range communication systems and edge computing. To be able to deploy this new mobility concepts, private sector needs to have the Administrations support. Cooperation between road administrations and the private sector is vital for the successful deployment of Connected and Cooperative Automated Mobility (CCAM) solutions. It underscores the importance of staying updated with communication technologies and fostering collaboration between the public and private sectors.

Concerning, camera and LIDAR vision for road markings, which is a key element for CCAM, a study was presented in the second part of the session. The study concluded that for camera vision, it is needed at least 0,5 contrast for the camera

to properly detect the road markings. Contrast is much greater at night, and it gets lower as we get farther from the camera. Also, with heavy rain or the sun against the camera, the contrast will decrease drastically. Regarding LIDAR, contrast will not change much during the day or with heavy rain, so this technology will always help to detect the road markings in different conditions. The findings about camera and LIDAR vision emphasize the need for robust and versatile sensor technologies to ensure the safety of Connected and Cooperative Automated Mobility systems under varying conditions. Preparing for situations where both sensors fail is crucial to maintain road safety. The conclusion is drawn that CAV could benefit from the combined use of camera and lidar detection under certain adverse driving conditions. Finally, the future demand for innovative road markings when both sensors fail in critical situations is discussed.

During the session, there were some questions from the audience. These are the questions and answers registered:

**Q: What needs to be considered for data transmission in ITS regarding artificial intelligence?**

A: We need to know how to manage this information. We don't know which sources we can trust. We have to figure out how to use data more efficiently. For a road administrator, it's best to look at what others are doing. We need to educate ourselves and learn from these new technologies and artificial intelligence.

**Q: When do the necessary transitions occur regarding CAV?**

A: There are studies indicating that with a 15% penetration rate of CAV (Connected and Autonomous Vehicles), traffic significantly improves. It's very difficult to get all vehicles to switch at once.

[Visual reminder: Technical Session TF 2.1 New Mobility and its Impact on Road Infrastructure and Transport, Tuesday October 3, 2023](#)



We need to prepare for the coexistence of vehicles with different levels of automation. We will have 100% mixed traffic; the issue to deal with is how it can be managed.

**Q: What aspects do you consider most important from an infrastructure perspective to ensure vehicles perform properly?**

A: It's important for the infrastructure to be well-maintained so that sensors can detect everything accurately. Traffic management is also crucial. The infrastructure side and traffic management will always be necessary.

**Q: What has been the most challenging aspect to define in traffic management (Hungarian project)?**

A: It's always very difficult to deal with vehicle operators. They don't articulate their needs for testing. They are collaborating with a major Hungarian company, and they still don't know what they need.

**Q: In this project, will you also communicate with commercial vehicles (Hungarian project)?**

A: Yes, having a receiver is crucial. For the implementation of these connections, we need a security layer.

**Q: In platooning, similar tire tracks occur, but could this same study also be conducted for autonomous vehicles (Platooning study)?**

A: Since road behavior is measured with heavy vehicles, no study has been conducted. It will likely behave similarly.

## RECOMMENDATION FOR DECISION MAKERS

From the session, some recommendations for decision makers regarding new mobility concepts were obtained:

- **Regulation for Public Value:** Policy makers and public administrations must regulate to ensure public value and societal benefits. Economic profit vs public services had to be balanced.
- **Risk Identification and Management:** Policy makers and public administrations must identify and manage risks, externalities, and market failures.
- **Balanced Partnerships:** Stress the importance of sound public policy and balanced partnerships with the private sector.
- **Operational Design Domain (ODD):** Offering practical ODD (Operational Design Domain), and adapting to the changing transportation landscape, RNOs can contribute to the development of more efficient, sustainable, and resilient transportation systems. Roads may look similar in the near term, but, scaling up Automated, Connected, Electric and Shared Mobility concepts offers the long-term potential for fundamentally re-engineering of how roads are built, managed, and maintained.
- **Demand Management Measures for CAVs:** If a smaller number of driverless vehicles will be used more intensively than manual operation, with resulting congestion, carbon emissions, severance, and other undesirable externalities, scaling up of CAVs may require demand management measures, including dynamic pricing. In the long-term, this is an urban design issue.
- **Benefits of C-ITS:** C-ITS offer numerous benefits for improving expressway network operation. To maximize the effectiveness of C-ITS, it is recommended that public-private initiatives and implementation strategies are established to collect and utilize data from road users. Addressing legal concerns related to IT systems,



data interchange, accountability, and openness is important. Furthermore, the introduction of CAVs necessitates the development of new approaches to traffic management, and thorough studies should be conducted to establish appropriate regulatory structures.

- **Facilitating Platooning Formation:** To facilitate platooning formation and cost-sharing, the implementation of mediating services and careful planning are necessary.
- **MaaS Solutions:** When considering MaaS solutions, enhancing road safety, promoting sustainable mobility, prioritizing convenience, and fostering collaboration among stakeholders are included in key considerations. Compliance with regulations, standards, and obligations is crucial to ensure reliability and standardized dissemination of information.
- **Role of RNOs:** RNO's will have a crucial role to deploy new mobility concepts. Decision makers need to define the different roles and establish cooperation with the different stakeholders. It is important to have a constant training in new mobilities and build a knowhow.
- **Gender equality issues need to be considered in the deployment and development of new technology and its application.**
- **Positive Social Impacts:** Positive social impacts could help decision makers guarantee acceptance.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

For PIARC and international organisations, there are some recommendations as well:

- It is important to clearly define the roles of each stakeholder regarding CCAM.

- Enhance cooperation among stakeholders related to new mobility is a key topic.
- **Provide training and expertise** in cybersecurity and Artificial Intelligence.
- Continue to conduct research and disseminate information.
- Need to share knowledge already applied for LMIC.
- Assists countries with lower incomes to develop new mobility concepts avoiding failures experimented in other countries yet. Learning from best practices.
- Sustain ongoing analysis of the evolution of new mobility to try to anticipate and avoid possible negative effects and optimize positive potential for transport efficiency, road safety and the decarbonisation of the transport sector.

Establish a Technical Committee regarding new mobility for next PIARC cycle.

## TS 2.2 Technical Session TF 2.2 Electric Road Systems

There is a need for decarbonizing the road transport all over the world both for freight and passengers. ERS is one possible solution for diminishing the carbon footprint. This TF plays a leading role in exchanging knowledge and experience in ERS globally, addressing as well road operation, road safety, road maintenance and cyber security aspects.

### TOPIC OF THE SESSION

Electric road systems (ERS) represent a complement to stationary charging by charging the vehicles while they are moving. Electric roads can substantially increase the efficiency of e-mobility, increase the available utilization time of the vehicles, reduce

Visual reminder: Technical Session TF 2.2 Electric Road Systems, Tuesday October 3, 2023





battery size, and create a new profitable infrastructure for operators of electric road infrastructure.

## TECHNICAL FINDINGS

Discussions and presentations gave for example these findings

ERS can contribute to decarbonisation of the road transport sector by:

- Providing zero emissions while driving,
- Offering an unlimited cruising range,
- Abolishing charging congestion,
- Reducing the size of on-board batteries,
- Reducing the vehicle's weight and potentially increasing its payload,
- Lowering vehicle cost, and
- Benefitting other road users, buses and cars.

Example of from countries (France, Sweden, Germany and US) that are working intensively to make ERS to happen shows that it is important to involve many stakeholders. Co-operation among the stakeholders, for example, energy providers, grid owners, road administrations/owners, ERS providers, vehicle industry and policy makers, is an absolute key for success.

Number of ERS technologies are existing and mature to be deployed firstly as pilots. ERS Pilot deployment is important to show a total system perspective for implementation and interaction between all possible solutions to decarbonise the road transport sector.

Standardization of all ERS technologies is ongoing and will in the upcoming years be fully standardized.

LMIC member states has not so far been active regarding ERS and the cost is an important issue. The TCO (Total cost of ownership) for ERS has potential to be one of the lowest compared to both battery electric vehicles and much lower than

hydrogen. ERS is a solution that is both cost and energy efficient.

## RECOMMENDATION FOR DECISION MAKERS

- Road administrations should seriously explore how ERS can support their road transport system to be decarbonised by establishing strategies for ERS.
- Countries should create national and international roadmaps for large-scale ERS deployment.
- Road administrations should continue to work with ERS suppliers and other stakeholders to further develop and validate the various ERS technologies.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

- PIARC member should stay tuned and continue to share knowledge on ERS. ERS are evolving rapidly and collaboration is a win-win exercise.
- PIARC member should promote ERS as a practical route to Net Zero to PIARC Member Countries and to vigorously engage with its collaborators and partners, such as the World Bank, OECD and IRF, on the TF's ERS analyses and findings, and developing a joint roadmap to promote ERS deployment.



# Strategic Theme 3

## Safety and Sustainability

Nowadays, there is a growing awareness worldwide that the strategy and policies, which are formulated by road administrators and transport-related organizations, enhance safety and security in road systems during the design, construction, and operation of road infrastructure. This environment steers them to producing practical solutions to improve road safety with further developed technologies and to raise awareness of cybersecurity for strengthening road and transportation security.

**Pursuing the efficient road operation especially in winter service, optimizing the maintenance cost of road assets, and contributing to the sustainable environment are also essential for road administrators and transport-related organizations to manage road infrastructure successfully.**

**This external context meets with the Strategic Theme 3 to study “Safety and Sustainability,” developing four Technical Committees and one Task Force.**

**Here, the issues of road safety, winter service, asset management, environmental sustainability, and security are featured, since they involve practical and pressing issues for road administrators to confront. The Strategic Theme 3 aims at comprehensively enhancing road management capacity in terms of operational, financial, and environmental perspectives,**

**taking into account the impact of crisis such as the Covid-19 pandemic. At the heart of the Strategic Theme 3 is demonstrating the appropriate direction for these issues with the past achievements and the development/introduction of new technologies.**

### TS 3.1 Technical Session TC 3.1 Road Safety

Road Safety committee observes a fact that ninety percent of traffic deaths occur in LMICs, and then assesses and identifies the best practice of road safety activities for LMICs. This T.C also explores proven countermeasures that are effective in reducing the likelihood and severity of crashes at a given location. Remarkably, “Road Safety Manual” and “Road Safety Audit Guideline” are to be updated, pursuing efforts to disseminate and encourage the application of these manuals. T.C plays a fundamental role in providing access to well-chosen safety measures and its dissemination among LMICs.

Visual reminder: Technical Session 3.1 Road Safety, Wednesday October 4, 2023



## TS 3.2 Technical Session TC 3.2 Winter Service

This TC focuses on road networks particularly vulnerable to the winter weather. Maintaining acceptable levels of winter service remains a challenging issue amid the struggle with snow and ice on roads. In-depth research on extensive use of new technologies provides a practical approach and application to winter service. Case studies and the major findings of winter maintenance from various countries are expected to form the basis of updating “Snow and Ice Data Book,” and winter service in urban areas and the implication of connected and automated vehicles on winter service are investigated as well. It should be noted that T.C is actively engaged in preparing the technical program for the 2022 “World Winter Service and Road Resilience Congress” in Calgary, Canada.

### Topic of the session

Ploughing snow and use salt or abrasives sounds much less complex than it is in reality. New types of sensors, weather forecasts, decision support systems, spreading technologies and techniques and much more develop constantly. A good example is the use of liquid de-icing and anti-icing agents which was introduced in many countries around the world.

This session gives an overview of the TCs work in the past cycle as well as selected Presentations representing the development of winter service around the world.

### Technical findings

The wide use of neuronal networks or often called AI brought interesting products for winter service, [Visual reminder: Technical Session 3.2 Winter Service, Wednesday October 4, 2023](#)

especially with the use of the data available with new cars or road weather sensors. With the TC Issues mostly presenting new developments in classical engineering parts the presented papers give a glimpse of the future and “new technologies”. Based on the presentations and discussions one could conclude that winter maintenance is rather conservative but very interested in new technologies.

Other presentations showed that classical methods like using brine instead of salt or pre-wetted salt could also lead to a big step forward. Even more if the switch of the technology is complemented with training and structured action plans.



## Recommendation for Decision Makers

Data driven technology is not the future it is already in the winter service market. It should not be ignored as it will be developed further even if road authorities do not participate. However, there is the risk that road authorities don't keep the pace with development and miss out good opportunities to be part of the future while some else will.

## Recommendations for PIARC and International Organisations

Companies using data from modern cars might be able to know more about the state of a road network than most road authorities might believe it is possible. It would be very interesting for most TCs to know what's possible today and what's next.

## TS 3.3 Technical Session TC 3.3 Asset Management

Asset Management committee develops, implements, and integrates an asset management framework based on ISO 55001 so that road organizations manage their performance, risks, and costs more effectively and efficiently. The results of the study will bring a guideline for implementing the asset management system. Notably, a web-based asset management manual will be updated through the survey among HMLICs. Extensive efforts are made to explore not only asset management but also the resilience of road networks and renewal and rejuvenation of aging infrastructure.

Visual reminder: Technical Session 3.3 Asset Management, Thursday October 5, 2023



## TS 3.4 Technical Session TC 3.4 Environmental Sustainability in Road Infrastructure and Transport

This TC identifies traffic operations to minimize the health impact of vehicle emissions, and improvement of pavement design, construction, and maintenance to reduce traffic noise. Also, understanding the road and road transport impact on wildlife habitats and their interconnections is essential for road construction to be implemented in the area affluent with natural environment. T.C carefully considers environmental sustainability, and diligently presents how road organizations commit to restraining air pollution and traffic noise, and the impact on wildlife habitats.



Visual reminder: Technical Session 3.4 Environmental Sustainability in Road Infrastructure and Transport, Thursday October 5, 2023



## **TS 3.1 Technical Session TF 3.1** **Road Infrastructure** **and Transport Security**

Road Infrastructure and Transport Security task force forges links with the relevant sectors to assemble knowledge of transportation security issues and their contribution to system resiliency. With the increasing use of cyber-physical systems in monitoring and management, more disciplines involved in the lifecycle of road assets need to have an understanding and appreciation of the security issues that arise. T.F will provide road infrastructure specialists with high-level guidance on embedding security and security-mindedness so that the number and severity of security incidents decrease throughout the lifecycles of the road assets.

### **Topic of the session**

This session is based on the work carried out by the experts of the Technical Committee on Sustainability (TC 3.4) during the 2019–2023 cycle. The Committee's experts worked on the TOR themes of the Strategic Plan, striving to be open to global issues and to other actors outside the Committee.

This openness was reflected in the organisation of a number of international conferences, seminars and workshops, which provided opportunities for high-quality exchanges. These dialogues have enabled the issues arising from the TOR to be integrated into the global issue of sustainable development, including decarbonisation, pollution, biodiversity impacts, energy transition and resilience.

The session recalls the international events organised or co-organised by the 3.4 "Sustainability" Committee, and presents the deliverables produced by the Committee during the 2019–2023 cycle.

After the break, the session gave the floor to international experts on aspects of sustainable mobility in relation to the major challenges of sustainable development.

### **Technical findings and Recommendation for Decision Makers**

The main technical findings of the session were presented in the presentations and round table discussions that took place during the session.

They concern a definition of the concepts and issues of global sustainability challenges for mobility, the impact of road mobility on the environment, a proposition of a road sustainability rating system, the challenge of the social acceptability of decarbonising road transport, the feasibility of biodiversity-friendly linear infrastructures and ecologically sustainable transport and the sustainability of noise mitigation measures.

The full papers by the various authors provide a comprehensive overview of the concepts discussed and the formulation of the various recommendations made in different areas of sustainable mobility.

### **Recommendations for PIARC and International Organisations**

We would recommend PIARC to give experts more opportunity to refine the topics to be addressed during the cycle according to their knowledge, and to scale the deliverables and outputs in relation to the number of active members of the TC.

We also recommend organising seminars and workshops with other TCs on topics that have a common basis and allow each TC to address cross-cutting issues such as climate change, energy transition or resilience, as well as collaborating with other associations.



Visual reminder: Technical Session TF 3.1 Road Infrastructure and Transport Security, Thursday October 5, 2023

# Strategic Theme 4

## Resilient Infrastructure

Roads are important, and in some cases even critical, infrastructures that make an important contribution to the social and economic well-being of the society. In this context, ensuring the availability, safety and reliability of road transport infrastructure is crucial. This should include, in addition to normal operation, in particular planning, preparation, response and rehabilitation in the event of unplanned and unforeseen natural or other events, and also includes the safe operation of road networks in the event of events that may have an indirect impact on availability and reliable operation, such as pandemics or black swan events.

Against this background, owners and operators of roads are required to proactively manage risks for the infrastructure itself and its users. This poses the challenge of assessing all existing threats and, if necessary, taking measures to ensure availability as far as possible under all conditions.

Based on the above mentioned challenges, the Strategic Theme 4 “Resilient Infrastructure” addresses topics such as: technologies and innovations, design and construction, safety, preservation, sustainability, resilience, as well as, standardization, developing four Technical Committees and one Task Force.

Due to their special and overarching importance, innovation and resilience have been identified as cross-cutting issues within the Strategic Plan 2020–2023.

Overall, in selecting the topics for the Strategic Theme 4 Resilient Infrastructure, importance was given to achieving a good balance between more traditional topics, such as construction materials and methods including sustainability aspects, infrastructure management, operation and user safety, and more innovative topics such as resilience, new technologies as well as challenges and opportunities arising from the rapidly advancing digital transformation.

### TS 4.1 Technical Session TC 4.1 Pavements

This TC focuses not only on topics relating to innovative methods and procedures for maintenance, including the identification of solutions for maintaining the availability during the execution of maintenance measures as well as the future use of data-driven approaches for the monitoring of pavements, but also on aspects of sustainability (recycling and carbon footprint). Issues related to the improvement of the resilience of pavements are also addressed within a specific topic.

#### TOPIC OF THE SESSION

The presentations in this session illustrate the deliverables from the Technical Committee on Pavements from the 2020–2023 cycle. In addition, several World Road Congress papers are presented during this session as well.

The themes from the 2020–2023 cycle were recycling, innovative pavement maintenance and repair, road monitoring and big data, pavement resilience, and the carbon footprint of pavements.

#### TECHNICAL FINDINGS

An overview of the five tasks with a total of nine deliverables developed by the PIARC TC 4.1 committee during the 2020–2023 work cycle:

- Use of recycled materials in pavements
- Innovative pavement maintenance and repair.
- Road monitoring based on Big Data.
- Measures for improving the resilience of pavements.
- Carbon footprint for road pavements.

Presentations in this session include summaries of deliverables developed by the TC as well as papers that pertain to the deliverable topics.

“Measures for Improving the Resilience of Pavements” was presented by TC member Leila Hashemian from Canada.



This presentation presented the work of TC 4.1 for the development of the report “Measures for Improving the Resilience of Pavements”. In addition, the “Measures for Improving Resilience of Pavements: A Collection of Case Studies” was also noted. The report outlines climate change, vehicular traffic, and natural or man-made pavement stressors. Strategies for mitigating the effects of these stressors were discussed. Case studies illustrating how mitigating measures were used in projects across the globe were also presented. An accurate assessment or prediction during design can help design an adaptive pavement. Adapted design should take into account future changes to climate and traffic and use of innovative materials.

The paper **“A digital tool to support decision makings and to reduce the carbon footprint of road networks”** was presented by Koji Negishi from France.

This presentation discussed how material control is an untapped lever for resilient, sustainable, and inclusive roads. Data management is a challenge with digitalized life cycle assessment (LCA) as a solution. A case study in Central Asia was presented. Data collection can be difficult, there may be a lack of systematic and consistent approach and LCA tools may be unavailable to non-LCA experts. A data visualization tool can assist with overcoming these challenges and provide outcomes for decisions. The case study illustrated the cumulative emissions over the project life cycle of 29 years by the visualization tool. The case study showed that different materials choices could result in up to a 20% reduction in emissions. In conclusion future steps is to deploy in other countries and to include new LCA insights such as social aspects for example.

**“Use of Recycled Materials in Pavements”** was presented by TC member Emanuele Toraldo from Italy.

This presentation discusses the contents of three reports on recycling during the PIARC 2020–2023 work cycle. A literature review, a collection of case studies, and a briefing note were developed. Recycling of asphalt and concrete pavements was discussed in all the deliverables. The content of the reports was discussed in sections for importance of a preliminary investigation, in-place recycling with hydraulic binders, in-place recycling with bituminous binders, in-plant reuse of Reclaimed Asphalt Pavement (RAP), recycling of materials in a concrete pavement with mixes made in-plant, and recycling of materials in base layers with mixes made in-plant. 33 case studies from 20 countries highlight recycling examples from high and low- and middle-income countries. Finally, a briefing note provides a high-level summary of the use of recycled materials

in pavements. In summary, pavement materials can be recycled 3 or more times in a circular economy.

The paper **“Assessment of alternative pavement materials: case of Moroccan phosphogypsum”** was presented by Amina Alaoui Soulimani from France.

This paper discusses a company that uses fertilizers and physogypsum. The material investigated is generated during wet phosogypsum process. During the laboratory investigation phase the physico-chemical characterization of phosphogypsum was investigated to evaluate their exact materials. Once formulas were based on mechanical properties and pollutant potential. A pilot project was used to evaluate the materials and approach and inform future designs. The material was used in the sub-grade with protection from a waterproof membrane for containment. Traffic, mechanical, and environmental monitoring was conducted at the test site. Results were presented to illustrate how the material was mixed with phosphogypsum-steel slag cement. Various pavement structures with varying PG layer thicknesses and total pavement thicknesses were evaluated with the results from the test site. This first experimental pilot demonstrated that the material can be used with good performance, with no significant environmental impacts, and good cost. Additional studies will be explored including additional environmental impact studies.

A Question and Answer session was moderated by TC 4.1 member Margo Briessinck from Belgium.

Question for Amina: What is the need for mixing the physogypsum material? A secondary source for road material is necessary as the material cannot be used alone. As a result, the material had to be stabilized with cement. Mixing with a secondary materials like steel slag was used because material is so fine, incorporating with another material helped constructability.

Question for Emanuele: Can recycling of geotextile reinforced pavement be done? This could be an option. It may be possible with different grinders. It was noted that there are challenges.

Question for Emanuele: Have you identified the limitations of what can be done with rigid layers and materials such as RAP and bricks? More focus has been on the use of recycled aggregates from old concrete pavements being recycled. More work may be needed to look at using concrete from building or other building material into concrete.

Question for Nigiki: For the evaluation of pavement performance, were the structures the same? This platform is based on standardized solutions and is at the planning level. Detailed project level

information to identify specific solutions is not available yet.

Question for Leila: With increasing temperature and rainfall, how do you integrate different measures? Measures should be considered for drought and flooding conditions. Good design can be achieved by taking various factors into account ahead of time.

Question for all: It is seen that the pavement industry is resistance to change. How do we make innovations standard? Many aspects need to be considered. There is not one solution for all situations. Perhaps sharing knowledge will allow more innovations to become more standard practice. Sharing of case studies is important.

**“Innovative Pavement Maintenance and Repair”** was presented by TC member Eugénia Correia from Portugal.

This presentation presented a summary of the report developed by TC 4.1 during the 2020–2023 cycle. This report is a collection of 17 case studies. They are very diverse and address different pavement types, different road types and functional and structural aspects. Technical and organizational aspects are also covered in the collection of case studies as well. An overview of several case studies was presented, and the audience was invited to gain more details and all case studies in the published collection. There were no examples from low middle income countries, but these examples could be applied in these countries.

The paper **“Development of the Double-Layer Type Precast Concrete Paving System”** was presented by Takahiro Yokoyama from Japan.

This paper discusses a new type of precast concrete paving system. MPCP stands for Multi-layer Precast Concrete Pavement. There are four lower slabs that support one upper slab. There are no load transfer devices across the joints and the slabs are vertically connected with pins. Advantages of this design is that it is easy to replace the upper slabs if needed. Advanced functions can be added to the upper slabs such as wireless power supply devices, automatic driving guides, and solar panels. A disadvantage is this system is that it is more expensive than traditional pavements. However, areas that would benefit from this design are intersections, bus stops, and industrial pavements. This new pavement design was applied at an intersection of a factory roadway with heavy traffic and severely damaged asphalt pavement. For the test site, investigations were done. Initial results indicate that the MPCP has sufficient durability. Future structural design methods should be established.

**“Road Monitoring Based on Big Data”** was presented by TC member Mehis Leigri from Estonia.

This presentation covered road monitoring with Big Data. Big data for the purposes of this report include CAN bus data, smartphone data, images, open data, crowdsourced data, and satellite data. Large sets of data collection with “traditional” methods and LiDAR and point cloud data were excluded from this report as this type of data is standardized and tools are available for its use. The report describes the various data sources and how they can be used. A chapter on data collection and how data is collected from sensors and transferred to various storage locations. A limitation is the availability of a data pipeline to collect data, process the data, and store the data for future use. Data quality, correction tests, artificial intelligence (AI) and machine learning is discussed. Surface distresses, roughness, and friction are different road condition indicators that can be collected. Case study examples on 12 ongoing or finished projects are included. There was one project from a middle-income country and the rest were from high income countries. Most solutions discussed are not standardized or defined so work is needed to combine with existing pavement condition data. These data sources are more applicable for network level data collection and to use the analysis to understand trends and make predictions.

The paper **“Bonus System Contract-Smart Motivator for Improving Paving Quality and Sustainability”** was presented by Anti Palmi and Marek Truu from Estonia.

This paper discusses the creation of a bonus system contract in Estonia. This bonus system was first used in 2018 to use in contracts based on performance indicators of the pavement. In Estonia, quality has improved and the data collected illustrates conclusions that can be made from implementing this bonus contracting system. A bonus system rewards extra effort resulting in better quality. IRI, thermographic homogeneity, and avoiding stoppages are the quality indicators for the bonus rate. Rates vary for overlays, pavement reconstruction, and new construction. Case study examples were provided to illustrate the bonus system concept on construction projects. The bonus paid out and the money saved for the Road Authority over 20 years was provided. More savings can be realized for higher volume roads. Quality needs to be measured and many times can't be seen visually. Can be seen that poor quality leads to road repairs 20–50% earlier.

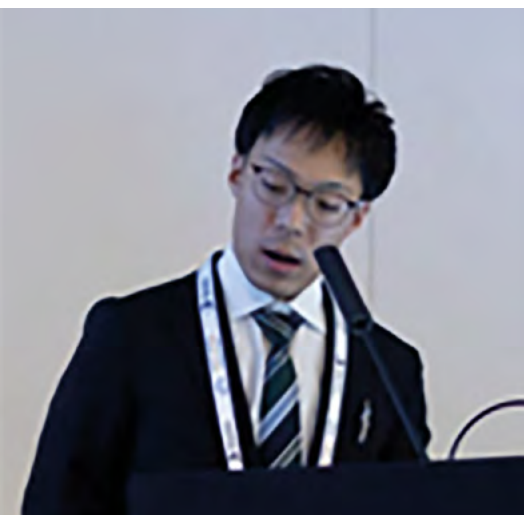
The paper **“Development of Solar Pavement in Japan and its Contribution to Carbon Neutrality”** was presented by Tetsuri Kaji from Japan. This paper was awarded the PIARC Young Professionals Award.

Solar pavements are being developed worldwide. There is the potential for a renewable power source. The pavement section consists of a textured finish, a protective plate, a power generation sheer, resin mortar, and asphalt pavement base layer. The features include the ability to follow traffic loads stress and deflect it. Various laboratory tests were conducted to assess viability and durability. Indoor testing was also done to evaluate how much power generated by the panel decreases when exposed outside. The power generate rate can be lower for the panel when exposed outdoors. A test pavement was constructed, and it was found that the power generation panel will not break even if vehicles pass every day. The test pavement has been in place for three years and is still performing well. The test site is exposed to both sun and shade and still generates power successfully. A Road Energy Management System (REMS) is a concept developed as a smart community initiative as a pathway towards carbon neutrality. More research will be done to develop this application for practical use.

Conclusions for this session were provided by Margo Briessinck from Belgium and he thanked all the members of the TC, authors, and presenters for this session.



Visual reminder: Technical Session 4.1 Pavements, Tuesday October 3, 2023



## **TS 4.2 Technical Session TC 4.2 Bridges**

The subject of resilience also plays a major role in the field of Bridges. Here, the focus is on questions of adaptation to the consequences of climate change and on improving the resilience of bridges in the case of seismic events. In addition, TC will work on the further development of procedures and methods for bridge inspections and the implementation of these new technologies within bridge management systems. Lessons learnt from forensic engineering of bridge collapses will also be considered. Additionally, the use of innovative construction materials for the repair of ageing bridges will be addressed.

### **TOPIC OF THE SESSION**

This Technical Session is organised by PIARC Technical Committee 4.2 on Bridges. It will present the work accomplished by the Committee during the 2020–2023 work cycle on the following issues:

- Issue 4.2.1: Measures for increasing adaptability to climate change
- Issue 4.2.2: Forensic engineering for structural failures
- Issue 4.2.3: Advancement of inspection techniques / technologies and bridge management systems
- Issue 4.2.4: New rehabilitation materials and technologies
- Issue 4.2.5: Damage-resilient bridges in seismic areas

This session will also present the best articles identified through PIARC's international call for papers on call topics including

- Topic 42: Bridge resilience considering natural hazards
- Topic 43: Advancement of inspection, repair and rehabilitation techniques / technologies
- Topic 44: Forensic engineering for structural failures.

In addition, a round table discussion on "Measures for increasing adaptability to Climate Change" will be included.

### **TECHNICAL FINDINGS**

The technical findings reported below were drawn from the presentations on the documents produced by TC4.2 to address the 5 themes of the session.

### **Measures for Increasing Adaptability to Climate Change**

- All countries that responded report being affected by climate change.
- Climate change exposes bridges to increases in both the frequency and magnitude of precipitation, temperature, and/or wind forces, and sea level rise.
- Understanding how climate change driven effects impact bridges is key to designing or adapting bridges to be more resilient to the hazards created.

### **Forensic Engineering for Structural Failures**

- The circumstances associated with bridge failure are too diverse to establish a detailed formal forensic investigation process.
- In most countries it is primarily the responsibility of the bridge owner to investigate a failure.
- Forensic investigations are conducted to determine the probable cause of failure and to clearly communicate that cause so that similar failures do not occur elsewhere.

### **Advancement of Inspection Techniques/Technologies and Bridge Management Systems**

- Not all deterioration, defects or damage on a bridge can be identified using visual inspection.
- As such, advanced inspection techniques are sometimes required to establish the condition of a bridge.
- The information produced by these techniques can be of significant value to road authorities in the development of remedial measures or preservation activities.

### **New Rehabilitation Materials and Technologies**

- Fiber reinforced polymers and ultra-high performance concrete are promising technologies for rehabilitation, but they are still not widely used.
- Before standards for new technologies are established, it is important to validate the technologies through pilot projects and share the results broadly.
- When implementing new technologies, coordination between the designer and the contractor is essential to success.

## Damage-Resilient Bridges in Seismic Areas

- Provisions to ensure unseating does not occur during a seismic event are included in all bridge design codes.
- Although a general retrofit strategy cannot be developed for all bridges, there are a variety of effective techniques to improve bridge resiliency to seismic effects.
- When seismic retrofit can be delayed, it is economically favorable to be carried out simultaneously with general rehabilitation work.

## RECOMMENDATION FOR DECISION MAKERS

The technical findings reported below were drawn from the presentations on the documents produced by TC4.2 to address the 5 themes of the session.

### Measures for Increasing Adaptability to Climate Change

- For new bridge construction, it is not necessary to understand with all certainty the effects of climate change before adapting design codes to account for potential impacts.
- For existing bridges, a risk management framework should be used to identify what bridges can be effectively retrofitted to improve resiliency.

### Forensic Engineering for Structural Failures

- Maintain a detailed bridge file on the data and information on each bridge in an inventory.
- Establish a centralized database or repository to collect and maintain bridge files.
- Archive the results of a forensic investigation in order to be of information to future engineers.

### Advancement of Inspection Techniques/Technologies and Bridge Management Systems

- These technologies can be a

### New Rehabilitation Materials and Technologies

- Consider the capabilities of the contractor organizations available before implementing new materials and technologies.

## Damage-Resilient Bridges in Seismic Areas

- Seismic retrofits may be combined with other planned rehabilitation work to minimize costs and limit the duration of construction and traffic disruptions.
- It is necessary to identify lifeline bridges and establish post-event performance requirements for those bridges in order to effectively retrofit them for seismic impacts.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

### Measures for Increasing Adaptability to Climate Change

- This continues to be an emerging and critical issue that should be a regular focus of PIARC for infrastructure in general in addition to bridges.

### Forensic Engineering for Structural Failures

- As they contain substantial information on lessons learned from bridge failures, continue to collect and share case studies for the benefit of all engineers.

### Advancement of Inspection Techniques/Technologies and Bridge Management Systems

- Support Lower and Middle Income Countries in the development of standards and deployment of new inspection techniques/technologies and bridge management systems.
- Continue to share information on these solutions so that bridge owners will have the benefit of other's experiences in choosing which technologies are best fits for their programs.

### New Rehabilitation Materials and Technologies

- Support Lower and Middle Income Countries in the development of standards and deployment of new rehabilitation materials and technologies.
- Continue to share information on these solutions so that bridge owners will have the benefit of other's experiences in choosing which technologies are best fits for their programs.

## Damage-Resilient Bridges in Seismic Areas

- As this topic has been covered sufficiently through multiple PIARC cycles, it is recommended to delay any further investigation until additional approaches and tools can be developed and implemented.

## TS 4.3 Technical Session TC 4.3 Earthworks

In addition to questions concerning the improvement of the resilience of earth structures to natural hazards, this TC focuses in particular on the identification of technologies and innovations in their construction and maintenance. The knowledge gained within the framework of this work will then also be incorporated into the further development of the Earth Work Manual, which will be made available in an updated and expanded version.

**TOPIC 45** “Resilience and Innovation of Earth Structures to natural hazards” & **TOPIC 46** “Earthworks for Environment”

These two sessions were organized by TC4.3 Earthworks.



Visual reminder: Technical Session 4.2 Bridges, Wednesday October 4, 2023

**TOPIC 45** gathered the presentations of TC4.3 works. Patrick Boisson was the chair of this session. He introduced the session with a presentation of Incredible Earthworks, based on more than 30 pictures of earth structures failure. Followed three presentations made by the TC leaders. The title of this session represented the main topics of our Technical Committee.

- The first presentation, presented by Enrico Mittiga (Italy) gathered the main conclusions on how we can increase Resilience of Earth Structures against Natural Hazards;
- The second presentation was about the 36 case studies about Techniques and Innovations collected among our TC members and the Conclusions of our Full Report. Jason Hastings (USA) started, and Alexandra Ferreira (Portugal) ended the presentation. They explained the ongoing conclusions our TC expected to publish in a full report, at the end of 2023;
- The last presentation summarized an overview of the Earthworks Manual. Yasmina Boussafir (France) presented the progress in publishing the different booklets.

**TOPIC 46** was dedicated to presentation of papers proposed by different authors. These papers were collected after the call for papers of PiarC. The title of this session was supposed to illustrate future issues for Earthworks, inspired by best practices in other countries. TC4.3 made a choice among 14 papers for oral or poster presentation. The paper that received the Best Innovation Price Award was included in the oral presentation.

## TOPIC OF THE SESSION

The issues for Earthworks are (1) Protection of the Environment and promote Sustainable Earthworks and (2) Resilience of aged Earth Structures

These two issues will be the next deliverables of TC4.3 Earthworks

## TECHNICAL FINDINGS

Earthworks need specific asset management, maintenance, monitoring and minor works.

Attendees asked few questions during the first session:

- Does the part 2.A.1 of the manual give a classification for "tropical soils"? Yasmina Boussafir answered that laterites or Black Cotton are specific soils and need their own classification. She invites all the people that know these soils to join the TC4.3 and write about their knowledge and experience.

- Does the Earthwork Manual give indication about monitoring of embankments built with dry soils? Or are they any case history about this in PiarC literature? Yasmina Boussafir answered that there is no case study about this specific case in the manual. Patrick Boisson thought that the use of dry soils was not a problem.
- Is it interesting to talk about Resilience for Earthworks? Can we increase Resilience of Earth structures? Enrico Mittiga answered that we tried to give keys for this in the full report. He also thinks that managing resilient structures is very important for Stakeholders and it doesn't imply expensive methodologies.
- Is it possible to write an Asset management for Earth Structures? Alexandra Ferreira thought that it is a very important task and that there many things to write about it.

During the second session, attendees focused their attention on presentations of works that were not done by our Technical Committee. They wanted to know for example:

- How can we explain that the experience with trees transplantation was not as much successful (72% of success may be less)? Julien-Michel Blondin-Provost explained that the tool they used for transplantation had a little diameter and cut the roots during the work. The period they transplanted the trees was very dry and they did not give enough water during the first two months. They must improve the technique.
- Is there any database recording the use of alternative material in Czech Republic? Frantisek Kresta answered that he created a personal database. As it is not mandatory, there is no official database.
- More information was requested about the strategy for earthwork in Japan: Hiroaki Miyatake completed his presentation with more information
- Were the vibratory measurements for anchors difficult to obtain, as it seemed? Mitsuru Yamazaki answered it was a new technique that needed improvement. He estimated it was an easy technique, very interesting because non-destructive testing.

We all agreed that the oral presentations were very interesting with a high quality and easily understandable works.

We cannot say that they were all in the scope of the session but they all presented the up-to-date works in Earthworks and Geotechnical structures. It seemed difficult to point out more technical issues. Environment is a crucial topic for Earthworks, but it was not really discussed during the Q&A session. It should depend on how attendees understand this wide question. It is also

a difficult topic as there are no clear and easy answers for all countries around the world.

## RECOMMENDATION FOR DECISION MAKERS

Earth Structures are not so well known by owners although they represent, more or less, 80% of the infrastructures and are very vulnerable to natural hazards in a context of climate changing.

Resilience is a new methodology based on an asset management of Earth Structures. TC4.3 highly recommended decision makers to pay more attention to their Earth Structures. TC4.3 suggested preventing failures with a better knowledge of the assets, a specific maintenance, in particular, for drainage systems, and a specific health monitoring with an organized backup experience, that means a case history of each unexpected events or something went wrong with the designed performance, to improve the geotechnical design or the asset management. The sustainability must be considered in all phases of the asset life cycle. It should be mandatory to develop an Asset and a Risk Management prioritizing the interventions, in order to leverage resilience to Natural Hazards on Earth Structures.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

- TC4.3 appreciate the very good organisation of this World Road Congress. Meeting people was very interesting, and the National Stands were very attractive. Only prepaid lunches should be better organized.
- We noticed that the program was only accessible through the application. There were no papers presenting the detail of the session, with the full programme. May be a compromise between too many papers and a minimum of printed information should be recommended to PIARC organisation.
- TC4.3 Session was in a big room, with translation and enough screens to watch the presentation, even for the speakers. Everything worked very well and well thought. We only regretted that attendees were not so many in the second session. At the opening session, at 02:30 pm, we were around 80–100 people, but many left at the end of the first session. Only 20–30 were in the room during the second session including TC members. Is it the reflect of owners and stakeholders' interest for earthworks or a lost battle against another more interesting parallel session?
- TC4.3 organized a very nice animation during the poster session. We invited all the authors to present orally their work during an "oral tour" of all the posters. We thought it was more attractive, both for authors and for attendees. We thought it was really appreciate. At each poster, we took pictures and applauded the author. The "oral tour" was a friendly troop, that many asked questions .

Visual reminder: Technical Session 4.3 Earthworks, Wednesday October 4, 2023







## **TS 4.4 Technical Session TC 4.4 Tunnels**

As with the TCs mentioned above, the subject of resilience will also be dealt with in a separate issue in this TC, where both the construction and maintenance as well as the future use of data-driven approaches for preventive and/or predictive maintenance are addressed. Operating and ensuring the safety of users is a major challenge for owners and operators of road tunnels. Therefore, best practice approaches and successful solutions for the safe operation of heavily traffic urban tunnels as well as the impact of new propulsion technologies on tunnel operation and safety will be investigated. Further work of TC will address ITS applications for tunnels including the identification of the potential of big data and data analytics applications for the operation of road tunnels as well as the update and improvement of the DG-QRAM risk assessment software for the transport of dangerous goods in tunnels. The results of the work will then also be incorporated into the further development of the Road Tunnels Manual.

### **TOPIC OF THE SESSION**

**1<sup>st</sup> PRESENTER: INGO KAUNDINYA, CHAIR OF PIARC TC 4.4 TUNNELS, GERMANY**

**Topic: Brief overview of TC 4.4 tunnel activities**

Ingo Kaundinya gave a brief overview of the TC4.4 Tunnel activities developed during the present cycle, with particular emphasis to the completed twelve outputs in this cycle, seven of which have been already published in the PIARC website. He appreciated the work done by TC Members and invited participants to access the work done at PIARC Website.

**2<sup>nd</sup> PRESENTER: RONALD MANTE, LEADER OF WORKING GROUP 2, PIARC TC 4.4 TUNNELS, NETHERLANDS**

**Topic: Improving road tunnel resilience, considering safety and availability**

Ronald Mante summarised the contribution of WG2 and outlined the concept of road tunnel resilience in terms of the definition, the theoretical and practical applications towards safety for tunnel

users. He expressed satisfaction that the WG2 has successfully produced and published three reports during this 2020–2023 cycle.

**3<sup>rd</sup> PRESENTER: ARTHUR KABUYA, LEADER OF WORKING GROUP 1, PIARC TC 4.4 TUNNELS, BELGIUM**

**Topic: Good practices in maintenance and traffic operation of heavily trafficked urban tunnels**

Arthur Kabuya provided an overview of the work done by WG1, outlining best practices in tunnel operations particularly on tunnels carrying heavy traffic volumes. He thanked the PIARC leadership, reviewers, and WG1 members for this accomplishment. The WG1 Final Report has been published by PIARC and the French and Spanish versions will follow soon.

**4<sup>th</sup> PRESENTER: DANIEL FRUHWIRT, WG4 MEMBER, PIARC TC 4.4 TUNNELS, AUSTRIA**

**Topic: Impact of new propulsion technologies (NEC) on road tunnel operations and safety**

Daniel Fruhwirt provided an overview of the work done by WG4 outlining the current research being done in partnership between academic researchers and the industry on impacts of vehicles with new propulsion technologies on road tunnels. The meeting appreciated the contribution of Peter Sturm (Leader of WG4) who retired few weeks before this WRC.

**5<sup>th</sup> PRESENTER: RAPHAEL DEFERT, PIARC TC 4.4 TUNNELS, SWITZERLAND**

**Topic: Updating and improving of DG-QRAM**

Raphaël Defert provided an overview of the work done by the Task Force regarding the upgrading and improvement of the DG-QRAM software. He equally noted other further upgrading of the software which could be done in the 2024–2024 work cycle.

**6<sup>th</sup> PRESENTER: RAFAEL LOPEZ GUARGA, PIARC TC 4.4 TUNNELS, SPANISH SPEAKING SECRETARY**  
**Topic: Good practices for the Design, Construction and Operation of a Tunnel using the BIM methodology**

Rafael Lopez Guarga provided an extensive overview of the BIM Methodology for tunnel design and operation. The presentation was well received by the attendance.

**7<sup>th</sup> PRESENTER: ALI MAHDMINA, PIARC WG3 MEMBER, TC 4.4 TUNNELS, UK**  
**Topic: Operational Safety considerations for HGV Platooning in Tunnels**

Ali Mahdmna provided an overview as to how platooning of HGV in tunnels can contribute for safety for other tunnel road users. Platooning created a healthy debate related to exit of other vehicles from the tunnels.

**8<sup>th</sup> PRESENTER: TIAGO MASSINGUE AND RAHUL GUPTA, SOUTH AFRICA & INDIA**  
**Topic: Challenges in design, construction, and operations of tunnels in Low- and Medium-Income Countries (LMIC)**

Tiago Massingue provided an overview of different LMIC contributions in tunnel design and tunnel construction, taking as example, Colombia, India, and South Africa. Rahul Gupta extended the discussion sharing the experience of LMIC in the Asian continent currently investing in tunnel infrastructure.

## QUESTIONS AND ANSWERS

All presenters were invited to address questions raised by the audience. Several questions were addressed to Daniel Fruhwirt who clarified that there is a need to move fast with the technology but at the same time there is a gap of information regarding fires of NEC vehicles and how they impact tunnel operation and safety. This is why this topic will be further addressed in the coming work cycle.

## TECHNICAL FINDINGS

The session gave clear commitment to the relevance of tunnel operation and safety. There is a need to promote resilience and safety in the tunnel environment. The outputs of the TC 4.4 may assist road governments and private institutions to effectively manage tunnel safety, maintenance and operations.

## RECOMMENDATION FOR DECISION MAKERS

WG2 Final Report provides a road map to decision makers and heads of road organisations showing what needs to be done to promote resilience of the tunnels under their responsibility while at the same time ensuring safety for tunnel users. WG1 Report provide recommendations as to how tunnel operation and maintenance can be done effectively in heavily trafficked road tunnels.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

The TC 4.4 Chair made recommendations on topics to be developed at the next cycle namely safety measures in tunnels used by pedestrians, cyclists and vehicles, digitalization of operation, maintenance and inspections, BIM methodology and digital twins. He noted that the next cycle will deal also with energy efficiency, monitoring of energy consumption, including optimization of tunnel equipment and reduction of operational costs. Ingo Kaundinya requested PIARC GS and PIARC member countries to continue to fund the work of DG-QRAM Task Force as it provides a widely used software solution which could be further developed.

Visual reminder: Technical Session 4.4 Tunnels,  
Thursday October 4, 2023



## **TS 4.1 Technical Session TF 4.1** **Road Design Standards**

In view of the importance of guidelines and standards in the field of road infrastructure, this TF focuses on collecting these standards from several countries and analysing analogies and differences, taking into account the type of road. This TF will also analyse the current reliability of geometric models addressing the new mobility – new propulsion techniques and connected and autonomous driving – as well as will investigate the use of new tools such as Big Data to reconsider design parameters and models based on road user's behaviour.

### **TOPIC OF THE SESSION**

The following topics were discussed during the presentation:

- Comparison of standards in the road geometric design.
- Models for road design.
- Selected aspects of road design standards.
- BIM in Road Design Standards.

The importance of the above topics results from the development of new technologies in vehicles, the vehicles themselves and changes in mobility. As a result, it is necessary to periodically review road design standards. This is particularly important for LMIC countries, but not only them, which do not necessarily have to develop their own guidelines but can use ready-made guidelines and recommendations.

The second important topic is the use of BIM in road design, which is a methodology based on the digitalization of the process of planning, design, construction and operation of road infrastructure. Hence the need to exchange experiences in the implementation and use of BIM technology around the world.

### **TECHNICAL FINDINGS**

- Comparisons of road design standards should be conducted on a continuous basis.
- There are still large differences in the models used in design standards.
- Road classification, which is especially linked to functional design, is quite heterogeneous across countries.
- Safety is one of the focal points in the design and operation of road assets,
- BIM technology in road design requires a large exchange of experiences in order to accelerate its implementation.

- BIM is only one component in the project cycle, and needs to be coordinated with an adequate management practice.
- The use of BIM accelerates the road design process and helps avoid design errors.

### **RECOMMENDATION FOR DECISION MAKERS**

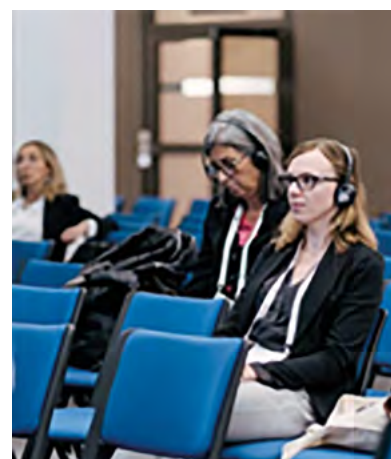
- The basic models used in road design standards need to be revised.
- Try to standardize the design standards, which result from rapid technological changes, taking into account the specificities of selected countries.
- Use available tools and technologies to optimize road safety.

### **RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS**

Future studies should include:

- Continuation of reviews of design standards along with the creation of a uniform database with comparison of its most important aspects.
- Collecting and comparing experiences in the field of BIM implementation in road infrastructure design.

Visual reminder:  
[Technical Session TF 4.1](#)  
[Road Design Standards](#)



# Workshop 01

## Decarbonisation and circular economy of road construction and maintenance and their equipments

**Road infrastructure is and will remain a symbol of social and economic progress: resilient and sustainable road infrastructure will be a key element in the transition towards green and smart mobility. All actors of the road community are now looking at solutions in this sense as well as to reduce GES and save energy consumption.**

**Routes de France and the European Union Road Federation, together with their partners all over the world have boosted discussion over those topics.**

### Workshop 01 decarbonisation and circular economy in road construction, maintenance, and equipment

#### TOPIC OF THE SESSION

Road infrastructure serves as a symbol of social and economic progress, and the imperative for resilient, sustainable road systems is paramount in the shift towards eco-friendly and intelligent mobility. This session addresses the collective effort within the road community to reduce greenhouse gas (GHG) emissions and save energy. It showcases global initiatives across five continents, unveiling roadmaps and tools to quantify and promote progress over time.

#### TECHNICAL FINDINGS

**Australia**, Anna D'Angelo presented interesting initiatives in Australia to achieve decarbonization objectives. These include the AfPA sustainability framework, encompassing various sustainability aspects across social and environmental domains. Additionally, the life cycle analysis (LCA) calculator offers verifiable data on asphalt products for environmental assessment and product comparisons, along with the Australasia environmental product declaration (EPD).

**Mexico**, Mauricio Centeno shared insights, including the feasibility of achieving 100% warm mix asphalt (WMA) production (even with 20% recycled asphalt

product (RAP) for a large local administration like Mexico City.

**Europe**, Brice Delaporte detailed decarbonisation roadmap of the asphalt industry proposed by Routes de France and how France is planning to achieve the EU "Fit for 55" objective by 2030 and carbon neutrality by 2050.

He presented a scenario by 2030 with a reduction of 57% of GHG emissions per ton of asphalt mixture. He stressed the need for a multifaceted approach to reach this goal.

Furthermore, Christophe Nicodème emphasized the importance of enhancing dialogue with provincial & national authorities, who are key clients of the road sector, and informing them about innovations and their potential contributions.

**Japan**, Kazunari Hirakawa discussed how the Japanese industry maintains high levels of recycling asphalt and the essential role of combining it with other carbon-neutral technologies, such as WMA, for the future.

**USA**, Joseph Shacat presented NAPA's efforts to achieve carbon neutrality in the US asphalt paving sector, showcasing tools for emissions reduction, including life cost analyses calculator, LCA calculator, and forthcoming environmental product declarations (EPD). He acknowledged that achieving net-zero emissions will necessitate further research, deployment, and education.

**South Africa**, Phil Hendricks explained South Africa's progress in developing technologies to reduce carbonization in the road industry, emphasizing the potential for road authorities to introduce specifications for sustainable materials,

technologies, and practices, along with life cycle assessment methodologies.

**International Bituminous Emulsion Federation,** Maria del Mar Colas demonstrated the advantages of emulsion techniques in producing more sustainable mixes, highlighting their role in achieving global decarbonization goals.

## RECOMMENDATION FOR DECISION MAKERS

The success of initiatives in road construction and maintenance, aimed at reducing carbon footprints, saving energy, and promoting circular economies, hinges on policies favoring environmental considerations within innovation and tendering procedures.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

Road infrastructure and public works contribute 3.5% of the total greenhouse gas emissions, while

usages account for 50% (source French Federation of Public works, FNTP) Current environmental policies predominantly focus on reducing road infrastructure use and transitioning to electric or hydrogen vehicles.

As well as reducing greenhouse gases and saving energy by optimizing construction and maintenance processes and products, preventive maintenance can also have a direct impact on reducing GHGs and saving energy in road transport and vehicle traffic.

Research indeed indicates that preventive road maintenance can lead to noteworthy reduction of greenhouse gas emissions and energy consumption generated by the vehicles circulating on such a proactively maintained infrastructure, for an amount ranging from 6 to 10%.

Therefore, future working groups should explore decarbonization, the circular economy in road construction and maintenance, and effective preventive maintenance as vital components of the energy transition and climate change compliance.

# Workshop 02

## Zero means a lot: do urban mobility organizations have what it takes?

**Public authorities at international, national, and local levels are setting ambitious targets for Road Safety. Many have committed to reducing traffic fatalities by at least 50% before the end of this decade, with many cities going beyond: zero deaths. Leadership and “political will” are indispensable, but not enough. Commitment at the top level must be matched by capacity throughout all levels of the organisation. Is the capacity there?**

**Technological innovation is bringing new tools, e.g., for road risk assessment, data sharing, and decision-making. But are organisations, and their professionals, able to reap the full benefits from these innovations? If not, why? What are the obstacles, and how can we best overcome them?**

**This Congress provided a unique opportunity to focus on this challenge, by sharing with, and then learning from, the road professionals in attendance. This was the goal of this interactive workshop.**

**The workshop began with providing food for thought: the New Paradigm for Safe City Streets, the work underway for EU-funded Project PHOEBE, insights already collected from road professionals through a series of focus groups, and a kick-off panel discussion.**

**This was followed by a discussion with all workshop participants, focusing on how public authorities and transport professionals can unlock the benefits of innovative Road Safety technology innovations. Collected insights will feed Road Safety work by POLIS and iRAP.**

## Workshop 02

### ZERO MEANS A LOT: DO URBAN MOBILITY ORGANIZATIONS HAVE WHAT IT TAKES?

## Workshop 03

### Digital Infrastructure for Road Network Operations

This workshop session was organised by the PIARC TC2.4 Road Network Operations and ITS – WG2.4.2 (Optimizing road network operation decision-making through new technologies and digitalization). The key objective of WG2.4.2 in this cycle was to identify opportunities and best practices related to the application of data related technologies and data driven decision-making in order to improve the performance of the road network.

In this session, the dynamic impact of data and technology on the operation of road networks, which are undergoing rapid transformation, was explored. The availability of enhanced data access and advanced data analytics has opened up exciting possibilities and applications for

road network operators. These advancements not only facilitate the performance monitoring and planning for system improvements but also empower real-time operations. This workshop session showcased ongoing projects and cutting-edge research in this domain from a wide range of countries and regions, while also delving into the potential opportunities for the future.

### Workshop 03

#### DIGITAL INFRASTRUCTURE FOR ROAD NETWORK OPERATIONS

## Workshop 04

### Mitigation of bridge failure by large overloads

Existing bridges, above all aged or partly damaged structures, are sensitive to traffic overloads. Legally loaded vehicles, within the general weight limits and regulation in force, authorized abnormal loads, or illegally overloaded vehicles may cross bridges above their capacity. Crossing a posted bridge above the limit is an infringement, but with penalties much lower than the potential consequences for the bridge. The consequences may be very costly in case of severe damages, or even because of a bridge closure, and in case of a collapse, fatalities and severe injuries may occur. Vehicles, loaded above

an acceptable limit, if this limit is unknown or not displayed, may also cross non-posted bridges.

To mitigate such adverse events, a procedure in several steps may be implemented. It was presented and analysed in this workshop:

1. Identify the sensitive existing bridges exposed to high loads and overloads.
2. Monitor the traffic loads on each sensitive bridge, either permanently or during survey periods.
3. Various and graduated measures can be implemented to mitigate (large) overloads on bridges.



**The workshop was co-organised and supported by PIARC Committee TC2.3 (freight), and above all its WG2.3.1 on “Overload detection by WIM”, and PIARC Committee TC4.2 (bridges). The output of the PIARC special project on Overloads carried out in 2020 was also used. International organisations were involved such as: ASECAP, FEHRL, FHWA, ISWIM...**

## Workshop 04 MITIGATION OF BRIDGE FAILURE UNDER HIGH OVERLOADS

### RATIONALE

Existing bridges, above all aged or partly damaged structures, are sensitive to traffic overloads. Legally loaded vehicles, within the general weight limits and regulation in force, authorized abnormal loads, or illegally overloaded vehicles may cross bridges above their capacity. Crossing a posted bridge above the limit is an infringement, but with penalties much lower than the potential consequences for the bridge. The consequences may be very costly in case of severe damages, or even because of a bridge closure, and in case of a collapse, fatalities and severe injuries may occur. Vehicles, loaded above an acceptable limit, if this limit is unknown or not displayed, may also cross non-posted bridges.

To mitigate such adverse events, a procedure in several steps may be implemented and is analysed in this workshop:

1. Identify the sensitive existing bridges exposed to high loads and overloads, the failure mechanisms, and the sub-structures mostly exposed to overloads. Then, the load capacity and critical load cases should be assessed for each bridge. Axle or group of axle loads are governing local effects, single vehicle loads are governing semi-local effects, and accumulation (multiple presence) of heavy vehicles are governing global effects. Inspection and reassessment of bridges may also help.
2. Monitor the traffic loads on each sensitive bridge, either permanently or during survey periods. Data collection by WIM may allow identifying critical load cases, critical vehicles, and the frequency and intensity of overloads. Identification of overloaded vehicles by AVI (automatic vehicle identification) may help to send warnings or admonitions, or even to initiate an investigation or a procedure against violators.
3. Various and graduated measures can be implemented to mitigate (large) overloads on bridges. Signs displayed are mandatory to post a bridge.

Additional signs and camera may complement the signs. However, physical barriers are neither the easiest nor the most efficient mean to prevent overloading. Local or regional authorities, in partnership with the bridge owner, should develop and implement a policy of warnings, admonition, company profiling, and even enforcement, adapted to each case. Direct enforcement of overloads by WIM may significantly reduce the rate of overloads on a road network or in a region or country. However, it is a quite heavy procedure, requiring certified and costly weighing instruments, not suitable for single bridges. IAP (Intelligent Access Programme) is also a tool, which may help to ensure that the heavy vehicles comply with the infrastructure capacity, above all the abnormal loads with special permits, or PBS (performance based standard) vehicles.

### ORGANISATION AND SUPPORTS

The workshop was co-organised and supported by the TC2.3 (freight), and above all the WG2.3.1 on “Overload detection by WIM”, and the TC4.2 (bridges). Some output came from the PIARC special project on Overloads carried out in 2020.

International organisations supported the workshop, such as: ASECAP, FEHRL, FHWA, ISWIM.

The workshop was organised in two parts: (1) a series of 7 keynote speeches, and (2) a panel discussion with 9 panellists and two moderators, from different regions and domains.

### PROGRAMME

#### Part I – Keynote Presentations

**Moderators:** Bernard Jacob (TC2.3), Gonzalo Arias Hofman (TC4.2)

**Speakers:**

Joey Hartman, FHWA, USA, TC4.2 – *Overloads and Bridge Safety in the USA.*

Imai Kiyohiro, Honshu-Shikoku Bridge Expressway Co., Japan, TC4.2 – *Overloaded vehicles, fatigue damage and enforcement on the Honshu Shikoku Bridge Expressway in Japan*

Bernard Jacob, Université Gustave Eiffel, France, TC2.3 – *Mitigation of large overloads on sensitive bridges using WIM systems*

Pierre Gilles, Service Public de Wallonie, Belgium, TC4.2 – *Traffic overloads on bridges in Belgium: from traffic mitigation to WIM direct enforcement*

Yvonne-Christine Gunreben, BMDV, TC4.2 & Jens Dierke, BAST, TC2.3, Germany – *How WIM-systems help to protect bridges; Identification of sensitive bridges by the load-bearing index*

Aleš Žnidarič, ZAG, Slovenia & Dimitrios Papastergiou, OFROU, Switzerland, TC4.2 – *Effect of modern traffic on safety of older bridges*

Rob Heywood & Torill Pape, Queensland, Australia – *Managing the impacts of non-compliant heavy vehicles on Queensland bridges*

## Part II – Panel Discussion

**Moderators:** Olivier Quoy (TC2.3), Imai Kiyohiro (TC4.2)

Nicolas Bardou (Vinci Autoroutes, France), Heungbae Gil (Korea Expressway Corporation, South Korea), Joey Hartmann (FHWA, USA), Rob Heywood (Queensland DoT, Australia), Bernard Jacob (UGE, France), Livia Pardi (Autostrade, Italy), Dr Erwin Pilch (Asfinag, Austria), Matias Valenzuela (Pontificia Universidad Católica de Valparaíso, Chile), Aleš Žnidarič (ZAG & FEHRL President, Slovenia).

## OUTPUT OF THE PRESENTATIONS

**Joey Hartman** reported the situation in the USA. Bridge safety relies on regular inspection of all bridges, quick reaction to critical findings and assessment of load rating/posting. The Federal Bridge Formula (F-BF) reduces the risk of damage by requiring more axles or a longer wheelbase to compensate for increased vehicle weight. The load rating determines the safe live load capacity of a bridge. About legal load enforcement, in July 2023 New York enacted a law that permits the use of weigh-in-motion on the Brooklyn Queens Expressway to help enforce truck weight limits. License plate cameras are synched with the weight sensors to identify overweight trucks so that tickets can be issued to the registered owner of the vehicle. Each violation has a penalty of \$650. The penalties could be applied for exceeding gross vehicle and/or axle or tandem weight limits.

**Kiyohiro Imai** presented amounts of steel deck plate on Honshu Shikoku Bridges, fatigue issues on steel deck plate in Japan, investigation of overloaded vehicles on Honshu Shikoku Bridges and enforcement of overloaded vehicles by Expressway Company in Japan. He pointed out that although total road length of Honshu Shikoku Bridge Expressway is about 1.7% of total expressway length

of Japan, area of steel deck plate dominates 16% of total steel deck area of Japanese Expressway. He reported that fatigue cracks on steel deck plate in Japan are dominated by three types including (1) U-rib to Cross beam, (2) Vertical stiffener to deck plate joint and (3) U-rib to deck plate joint. In addition, he presented the distributions of single axle weight with respect to Honshu Shikoku bridges as well as Expressways in Urban area. He pointed out that maximum single axle weight on urban area is 253kN/axle and that on Honshu Shikoku Bridges is 166kN/axle. So, he concluded that fatigue condition on urban area is much more severe than that on Honshu Shikoku Bridges. In order to prevent overloaded vehicles, he explained two efforts on expressways including on-site enforcement and enforcement by WIM. He noted that road owners issues “warning letter” as well as “corrective guidance letter” according to the level of overloaded violations. He also reported that if no improvement is made, road owner issues (1) Post Corrective guidance on the website, (2) Cancel special vehicle permit and (3) Criminal prosecution.

**Bernard Jacob** presented a policy to mitigate large overloads on sensitive bridges using WIM. The stock of bridges is aging and in many cases, the loading capacity is reduced, because of corrosion, fatigue or other wears. Moreover, the bridge lifetime are often extended beyond the design lifetime for economic and environmental reasons. The permitted GVW increased in Europe by 80% over the last 60 years. 10% of trucks are overloaded (in average) by 10% or less, while a few are overloaded by 100% or more. That lead to a series of bridge collapses in Europe and worldwide over the last decade; some examples are reported and briefly analysed.

In France a Senate report pointed out in 2019 that 25,000 bridges, mainly on local and secondary roads, were in critical state. Three years later, this number increased to 35,000. Most of the bridge collapses under highly overloaded vehicle occur after many crossings of overloads, increasing along the time. Therefore the proposed policy consists of identifying overload crossings (e.g. above 50%) with a simple WIM system coupled to a camera (video-WIM), and to issue warnings (admonestation) to the faulty companies. These companies are exposed to high penalties for violations such as “attempt to destroy a public asset”, or “endangering the life of third persons”.

A WIM system was installed in 2022 near Toulouse in south of France near a bridge exposed to overloads, to implement this policy. After one year a series of high overloads were identified, however the rate of overloads was significantly reduced.

**Pierre Gilles** described the situation in Belgium. He reported that signage has no effect on truck

behavior and the truck drivers don't always use truck version GPS (more expensive). He pointed out the drawbacks of the physical barriers for size limitation: risks to other users, not fully respected and frequently impacted by trucks, only indirect way to limit weight, need a detour way. Direct enforcement by WIM was recently implemented in Wallonia and may be a solution, coupled with drivers' education.

#### **Yvonne-Christine Gunreben and Jens Dierke**

presented the situation in Germany. Jens reported about the network of WIM stations on German motorways, used for bridge management among others (statistics, pavement management, preselection of overloads etc.). B-WIM is tested to complement roadside WIM. Yvonne showed the example of a WIM station with barriers which was installed for the protection of the Rhine bridge of Leverkusen on the motorway A1 (GVW < 3.5 t). Yvonne showed the increase of maximum loads (axles and GVW) over time since a century and of the traffic volume, leading to a saturation of the road network and bridges. 10 to 15% of the bridges along federal motorways and trunk roads have deficiencies, assessed by a load-bearing index. A policy of bridge modernization started for 4,000 underperforming bridges on appr. 7,000 km of federal motorways (incl. TEN-T core network).

**Aleš Žnidarič** explained the impact of modern traffic loads on safety of older bridges in Slovenia and Switzerland, with the contribution of Dimitrios Papastergiou. Older bridges, short to medium spans, made of traditional materials/technologies are often under-designed however robust, sometime damaged, with a lack of shear resistance, no redundancy, corroded, and insufficient fatigue details. In Slovenia, 60% of state road bridges and 1% of motorway bridges have structural safety issue. There were 8 bridge codes in Slovenia and 4 in Switzerland over the last 50 years. Bridges are facing an increase of truck loads (EMS, cranes). Dynamic amplification is considered, however is found to be negligible for pavements in very good or excellent state; additionally, the higher the load the lower the dynamic amplification. B-WIM is in use to monitor loads and bridge loading. B-WIM data allowed targeting the most critical bridges for reinforcement and repair. WIM combined with law enforcement can help to protect the infrastructure of overloading.

**Rob Heywood (& Torill Pape)** explained how to manage the impact of non-compliant heavy vehicles on Queensland bridges. The GVW limits varies from 50.5 to 135.5 t, while oversize/over-mass vehicles may be operated at 59.5 to more than 150 t (up to 650 t). Bridge and traffic monitoring is done by WIM, OBM (on-board weighing), etc., and a survey of bridge strains and fatigue. The data

allows assessing extreme loading. IAP (Intelligent Access Program) balances transport productivity, risk and asset consumption. The process includes the identification of the most risky vehicles. However, it is difficult to weigh wide loads by WIM (offset wheels on the sensors). An example of a 347 t combination (abnormal load with special permit) is reported, which was estimated at 433 t by WIM (+25%). The axle load was permitted up to 15 t, however, it reached 21 t with the dynamic amplification. Finally Rob listed the factors contributing to bridge overloading: load distribution to wheels, axle group with closer spacings, lifted axles, dynamics/speed, HV side by side of in convoy, reduced load capacity.

## **MINUTES OF THE PANEL DISCUSSION**

The panel discussion was organized around three topics: future trends, funding and political advisory, and innovative solutions.

The future trends is that demand for road freight will continue to grow, with heavier and larger trucks. This growth could lead to major changes such as a gross weight limit raising from 44 to 60 t. Therefore, the need for investments could raise quickly with the design loads, which has already started in Korea and Chile. In such a context and under economic constraints, is it consistent to design bridges for lifetimes of 100 years or more, while the demand and vehicles change every 10 years? Is a lighter design, for shorter lifetime, worth and achievable? Is it possible to close the gap between design loads and current operation loads, with the help of load monitoring? How to adjust the design and maintenance to the real traffic loads, on local roads or main highways, and to the types of structures? The sub-structures should also be considered as well.

Several panelists – mainly road managers – suggested to distinguish illegal overloads and permitted overweight vehicles (also called « abnormal loads »). Enforcement measures, which all panelists feel very necessary to develop, may reduce, or at least limit, illegal overloading. However, the demand for abnormal loads is growing, for both higher dimensions (e.g. wind turbine blades) and higher loads (indivisible industrial elements). The frequency of abnormal load demand (special permits) also increases. The monitoring of special permit use and conditions is very relevant to protect overpasses on motorways as shown in France and Italy. In Australia the Performance Based Standards (PBS) scheme, is very efficient to reduce illegal overload but can lead to an increase of heavier and longer vehicles.

Structural health monitoring coupled with load monitoring seems to be a relevant technological trend, developing in Italy and other countries. Even if the demand is growing for heavier and longer commercial vehicles, short trucks should also be considered and monitored, since they can cause damages and be critical for some types of bridges because of a high load intensity per unit of length; mobile cranes are among the most aggressive vehicles in the Netherlands and throughout Europe.

The funding situation largely varies among countries, and the need for more advocacy is widely shared. The most relevant and lacking resource is engineering skill and human staff. In the USA, funding has been well granted, but human skills are now lacking to go into action. A loss of skill is also noted in Europe. Money must be targeted where it is more needed and efficient. Any lack of money could be – at least partly – overcome by technology. The balance between construction and maintenance effort, and the integration of bridge instrumentation from the design and construction could also help taking the best of scarce funding. Funding needs should address not only the main network but also the secondary network, which can be used as diversion route during maintenance or renewal works, as Austria pointed out.

WIM systems deployment should not only rely on fines as the main funding source. Fines should

contribute to reduce violations, which ideally would tend to zero. WIM funding should be based on maintenance cost reduction. Moreover, load monitoring by WIM contributes to a better design a more accurate survey of functional and structural use of bridges.

For abnormal load (authorised overweight or over-size), it is legitimate to ask the hauler to contribute financially. Permit prices, or toll prices as in Italy, should depend on vehicle characteristics, above all if they have an impact on the structure maintenance cost or lifetime. The bidding process of new structures and projects should include the whole lifecycle cost as done in Chile.

Other mentioned innovative solutions involve more communication between connected infrastructure and vehicles. WIM device can send warning light when detecting an overloaded truck to inform drivers that « we know you are overloaded », but also send a warning to companies if using a bridge with an overloaded truck. Tracked record of overloads crossing posted bridges may also be used to issue warning letters (admonestation), or even to start prosecution by the court. The need for more stakeholders involvement was recalled, and data analysis was also pointed as crucial, not only with “big data” but more simply with human curiosity!

## Workshop 05

# The transport agency of the future

**This Workshop brought together the work of PIARC’s Technical Committee 1.1, Performance of Transport Administrations as it relates to the vision of the “Transport Administration of the Future”; AASHTO’s NCHRP 20–24(138) Moonshot project on the development of a national transportation vision for the United States; and TRB’s NCHRP 08–127 research project on the impacts of disruptive technologies on the performance of transportation agencies.**

**It also provided a global perspective on the vision of the Transport Administration of the future by inviting representatives from Africa, Australia, Europe, and America to share their perspective and vision for the future of transport administrations.**

**It was particularly interesting to share the perspective on the “North Star” of Transport Administrations as it relates to serving customers**

**and creating public value; the transformational approach needed as a result of the new technologies and business models; and the significance of the Transport Administration of the future addressing issues of equity, diversity, and inclusiveness in the workforce of the future.**

## Workshop 05

### THE TRANSPORT AGENCY OF THE FUTURE

#### TOPIC OF THE SESSION

**ABSTRACT:** This workshop discussed how the Transport Agency of the Future can adapt to the challenges and opportunities of the 4<sup>th</sup> Industrial Revolution

and the imminent 5<sup>th</sup>, which are bringing rapid changes in technology, customer behavior, and stakeholder expectations. It built on the research and findings of PIARC's Technical Committee 1.1, AASHTO's NCHRP 20–24(138) Moonshot project, and TRB's NCHRP 08–127 project, which have explored the vision, framework, and impacts of disruptive technologies on transport administrations. It will also invite representatives from different regions and sectors, such as ERTICO, IATR, IBTTA, UITP, Australia, Sweden, Singapore, and Low- and Middle- Income Countries (LMICs) in Asia, Africa and South America, to share their views and experiences on the future of transport and transport agencies. The workshop also focused on the “North Star” of transport agencies, which is to serve society at large, create public value, and fulfill the expectations of the customer; the transformational approach needed to embrace new technologies and business models; and the importance of equity, diversity, and inclusiveness in the transport sector workforce, with emphasis on the workforce of transport agencies.

**DETAILED:** The arrival of the 4<sup>th</sup> Industrial Revolution and the rapid development and fusion of multiple disruptive and innovative technologies are changing the behavior and the expectations of customers and stakeholders all over the world. At the same time demographic, economic, development, environmental, technological, and other trends are changing the demand for moving people and freight; the mobility options available to serve our customers; and the capacity of Transport Administrations to carry out their mission.

This Workshop brought together the work of PIARC's Technical Committee 1.1, Performance of Transport Administrations as it relates to the vision of the “Transport Administration of the Future”; AASHTO's NCHRP 20–24(138) Moonshot project on the development of a vision framework for the future of transportation and to develop in the next phase tools that state DOTs can use to implement individual and collective actions to advance the vision framework; and TRB's NCHRP 08–127 research project on the impacts of disruptive technologies on the performance of transportation agencies. It also provided a global perspective on the vision of the Transport Administration of the future by inviting representatives from Africa, Asia, Australia, Europe, and South America to share their perspective and vision for the future of transport administrations. Of particular interest was the perspective on the “North Star” of Transport Administrations as it relates to serving customers and creating public value; the transformational approach needed as a result of the new technologies and business models; and the significance of the Transport Administration of the future addressing issues of equity, diversity, and inclusiveness in the workforce of the future.

Presenters and panelists included member(s) of TC 1.1 and delegates from AASHTO/TRB representing the United States, ERTICO (Europe), and IATR, IBTTA, and UITP representing different global perspectives. The Workshop also presented examples from other nations including perspectives from Australia, South Africa, Sweden, the United States, as well as presented the challenges faced by LMICs in facing these same issues and opportunities.

### The panel discussion addressed the following questions:

- The future is an ecosystem of multiple players; who are these players going to be and what is their role? What do we want this ecosystem to look like? What would it look like in 2030 or in 2050?
- What would the agency itself look like? What would the agency's North Star be? What is the role of public authorities in the Transport ecosystem?
- How do we engage our people and empower them to see this vision through? How would you create lines of sight to different levels within the organization so that this vision is embraced?
- What is the regulatory role and framework of these agencies? Is there a regulatory framework to support a systems approach in transport?
- How is the negotiation for the use of urban space among stakeholders impacting the Transport Agency of the future?
- What is the link between ITS and the management of mobility flows (Mobility Network Management)?
- What are the critical actions that need to be taken now to achieve the goals of the Transport Agency of the Future?
- What are the specific challenges and opportunities that the Transport Agency of today must meet and how should it evolve to address them?
- Interaction with local communities: our agencies and/or road operators are supposed to connect places, territories of course, but they also connect people, businesses, communities, cities and the interaction and collaboration with them will become more and more important in the future; if we want to serve our users, our customers in the best possible way, we need a permanent dialogue with them. How do we create this interaction and strategic partnerships and create this on-going dialogue?

### Challenges:

- Increasing demand for transportation services
- Aging infrastructure
- Rising costs of transportation
- Environmental impacts of transportation
- Abundance of data and AI

## Opportunities:

- New technologies, such as self-driving cars and drones, can improve efficiency and safety
- New business models, such as ridesharing and car-sharing, can provide more affordable transportation options
- Data analytics can be used to improve traffic management and planning
- Abundance of data and AI

## TECHNICAL FINDINGS

### Part 1: Describing the Vision – The Transport Agency of the Future

**Jonathan SPEAR:** The basic road-based mobility paradigm has not changed in over a century, but it is about to change. So, what got you here, won't get you there. Need to focus on a North Star for guiding the future of transport – people/society, prosperity/economy, planet/environment.

**Nazir ALLI:** Evolution and changes of road administrations – need a game plan that supports funding priorities, flexibility, innovations, and systems thinking.

**Alan COLGATE:** COVID brought the focus that we're not just delivering transport, but societal benefits. It's all about achieving a vision – customer centric that is safe, reliable, and sustainable.

**Susanne NIELSEN:** Focus on those we serve, climate change, new technology, a new generation, and changed security situation will form the transport agency of the future.

**Carlos BRACERAS:** To look forward, you have to look back. Utah DOT is no longer an agency that moves cars but one that moves people the way they want to be moved.

### Part 2: From Vision to Actions – Implementing the Vision for the Next Era of Transportation

**Carlos BRACERAS:** The NCHRP “moonshot” project suggests a new vision for community centered transportation; set aspirational goals that can be adopted by individual states at whatever level works.

**Christina ANAGNOSTOPOULOU:** Mobility of information and data should be included in a holistic approach to mobility and transport moving forward.

**Matt DAUS:** Reconciling taxi and ride share, moving toward a regulatory agency of the future. Could include self-regulation, allowing for the honor system with audits.

**Emanuela STOCCHI:** To address the challenges faced ahead, Transport Agencies of the future must prioritize investing in young professionals, addressing diversity, equity and inclusion, boosting innovation and promoting sustainable mobility. It is important that they also develop international cooperation.

**Patrick MALLEJACQ:** Coordination is complicated – how should we coordinate local with national strategies? Exciting topics can distract from important work – A question to ask: why are autonomous driven taxis better than with a driver? The end service might not be there; taxis are unlikely to be free.

**Sylvain HAON:** Need anticipation, resiliency and capacity if agencies are going to be able to deliver. Will need to anticipate complexity, anticipate change, and be ready to address customers' reaction to change. Need resiliency, the ability to adapt is fundamental for transport agencies to deliver on their objectives. Need capacity – build a workforce ready for a changing environment and one that represents society.

## RECOMMENDATION FOR DECISION MAKERS

### Part 1: Describing the Vision – The Transport Agency of the Future

- Agencies need to plan for uncertainty and look at alternative futures in multiple dimensions.
- Agencies may need to pick things that are making the most noise/bubbling to the surface and test to see if we can make a difference.
- Diverse society – young people might have different priorities now – agencies need to listen and act.
- Need to encourage innovation and experimentation – perhaps a budget for innovations. Or do pilots, have a proof of concept stage or testing ground for innovations. Change the language and don't regard anything as a mistake, but instead an experiment that didn't work.
- Focus on leading people rather than managing them; engage in active leadership rather than passive.
- Agencies should be aggressive on internships and integrating them into the organization.

## Part 2: From Vision to Actions – Implementing the Vision for the Next Era of Transportation

- People need to be at the center. Need to move people from one place to another but also serve communities. Starting point should be the customer – we think modes but need to think people.
- Need to see data and technology as enablers.
- To deliver on solutions, need to ensure diverse talents in transportation agencies.
- To avoid being dragged down by politics, consider a non-partisan transportation czar in every US state.

### RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

To address the challenges faced ahead, PIARC and international road and transport agencies should be:

- Committed to the creation and the maintenance of public value.

- Clear about purpose, mission and functions and how these are changing.
- People-centric, listening to people to harness their power and moving decision makers to invest and support.
- Flexible and agile to respond to the evolving demands of people (customers, workforce, and partners) and external factors (socio-economics, climate, etc.), constantly adapting tactics to meet the need.
- Comfortable with uncertainty, prepared for a range of plausible futures and using scenario planning, back casting and other methods to minimize regret.
- Harnessing modern communicators and technology to gain traction, help media and popular culture understand what is needed and why.
- Shifting from infrastructure and asset managers to mobility managers, conveners and regulators to deliver an enhanced seamless experience to its customers.
- Innovative in attitude, culture, methods and tactics.
- Diverse on multiple levels, celebrating and utilizing difference.

# Workshop 06 Climate Change Adaptation Framework

**PIARC International Climate Change Adaptation Framework was presented at the Congress in Prague, in the workshop session.**

**The purpose of this workshop was to introduce the Framework step by step, provide examples and answer questions from potential users.**

**The Framework guides road organisations through the process of developing an adaptation plan to address the impacts of climate change. It identifies the main issues and risks of climate change on road infrastructure and systems, through to selecting measures to address these impacts and integrate them, into decision-making. It is composed in a way that makes it applicable both for countries that have done some adaptation work earlier, and countries that are just starting to recognise climate change challenges.**

**The Framework consists of four main stages: Preparation, Assessment of vulnerability or risk, Identification and prioritisation of measures and**

**integrating the findings into decision-making. Each step has been explained and supported by examples.**

## Workshop 06 CLIMATE CHANGE ADAPTATION FRAMEWORK

### TOPIC OF THE SESSION

Road networks are exposed to various threats/hazards that affect their operation and structural integrity. With the advent of climate change, these threats/hazards are increasing in intensity and frequency. In order to reduce impacts to these threats/hazards, road authorities and other organisations are developing and implementing policies, strategies, and actions to increase the resilience of the transportation system.

For that reason, PIARC developed the International Climate Change Adaptation Framework for Road Infrastructure. The first edition was published in 2015, but a refinement was sought to incorporate experiences and developing practice, which were captured in reports that reviewed the Framework in the PIARC 2016–2019 cycle.

TC1.4 Working Group 2 produced an update of the PIARC International Climate Change Adaptation Framework for Road Infrastructure, published in 2015. The new version seeks to update the methodologies based on new case studies and establish a more interactive and flexible methodological structure, which is useful for any country, regardless of its level of progress in terms of adaptation to climate change.

The main objective of this session was to present in summary the updated International Climate Change Adaptation Framework 2023, which was the output of Technical Committee 1.4 Working Group 2. This was a key activity identified in the TC1.4 work programme as outlined in the PIARC Strategic Plan 21–24 being progressed by the Technical Committees of the current PIARC cycle.

The Adaptation Framework can help organisations identify adaptation principles and increase the climate resilience of transportation assets, operations and services. The purpose of this workshop was to introduce the Framework step by step, provide examples and answer questions from potential users.

## TECHNICAL FINDINGS

The Framework guides road organisations through the process of developing an adaptation plan to address the impacts of climate change. The updated Framework enables road owners and managers in high and low-middle income countries to tailor and apply specific sections of the Framework according to their particular requirements. This is intended to assist users in recognising systems and routines that are already in place and provides a good basis for adaptation work by ensuring that it is accessible, flexible, interactive, and applicable for all geographic areas and all starting points for adaptation.

It identifies the main issues and risks of climate change on road infrastructure and systems, through to selecting measures to address these impacts and integrating them into decision-making. It is composed in a way that makes it applicable both for countries that have done some adaptation work earlier, and countries that are just starting to recognise climate change challenges.

The Framework consists of four main stages: “Preparation”, “Assessment of vulnerability and risk”, “Identification and prioritisation of measures” and “Integrating the findings into decision-making”. Each step was explained and supported by examples.

In response to recommendations from the review report of the Framework in the previous 2018–21 cycle, this update of the Framework sought to improve the Framework’s:

- Applicability: particularly to LMIC’s.
- Flexibility: No specific methods or pathways were recommended or advised, rather I focused on providing a framework and a “menu” of options.
- Continuous improvement nature: Each outcome is a new start, likely informed by previous activities.
- Compatibility with its context: It is important to build on what you have.
- Additional content on two important issues: Adaptive capacity, Criticality.

## RECOMMENDATION FOR DECISION MAKERS

The primary recommendation for Decision-Makers is to “Use the PIARC framework!” Additional recommendations are:

- Invest in good preparations work – adjust the ambitions to the level of data and resource availability. Use the findings of the preparation work as an indication of what should be improved for the next round of work.
- Adjust / tailor your assessment – select the steps that are most important for your needs and resources.
- Provide the basis for an iterative process – provide sustainable institutional setup and capacity to carry out planning and implementation of adaptation work. Anchor climate change adaptation capacity development in institutionalised planning systems and processes for sustainable implementation.
- Share and publish your experience – experience from the use of the framework is valuable for others! Ensure good communication and documentation!

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

The Framework provided two recommendations for PIARC:



Develop a resilience framework for climate change and other hazards – a more general resilience framework, including other hazards (in line with the scope of WG1 in this cycle). The resilience framework should address complexity, such as compounding events and amplifying effects, interdependencies and cascade effects, etc. General instability because of climate change challenges may add to aspects of vulnerability.

Support implementation and feedback – it is important to assess the value of a product developed and prepared through the current TC process. Define the process for dissemination and endorsement of the product. Following publication, actively encourage application by member states and establish mechanisms to collect feedback from implementation.

## Workshop 07

# Road asset management and ISO 55000 series

**The Asset Management standard (ISO 55000) and its extensions describe how it should be implemented in an organization without specifying the type of assets to which it can be applied. It is somewhat expensive to find examples of how an agency that oversees managing a road network should proceed to implement such a standard.**

**This workshop enabled participants to work on a practical example and acquire knowledge in response to their concerns. The objective was to quickly describe the scenario of activities, equipment and resources required to solve the practical case proposed.**

## Workshop 07

### HOW TO IMPLEMENT ISO 55000 IN ROAD ASSET MANAGEMENT

#### TOPIC OF THE SESSION

The Asset Management standard (ISO 55000) and its extensions describe how it should be implemented in an organization without specifying the type of assets to which it can be applied. It is somewhat expensive to find examples of how an agency that oversees managing a road network should proceed to implement such a standard.

We are going to work on a practical example during the workshop and try to generate knowledge for the people who participate by motivating their concerns. The objective is to quickly describe the scenario of activities, equipment and means

that are required to solve the proposed practical case.

#### TECHNICAL FINDINGS

The technical findings of the session can be summarised as follows:

- Asset Management is a high-level process, should not be put in one department, it should be included in all departments.
- Without addressing the use of external involvement, ISO 55000 emphasizes the importance of establishing strategic external partnerships to improve asset management if necessary.
- To provide the best outcome, Asset Management must make decisions based on high quality data and be aligned with the objectives of the road organization.
- Flexibility within the organization is important, prioritizations and top topics changes according to shifts in the society and politics.
- To achieve effective asset management, the following key methods must be considered: Condition Assessment, Performance Monitoring, Asset Inventory, Financial Data, Environmental Data, Safety Data and Customer Feedback.

In relation to emerging issues:

- There is also a need for all detailed pavement information to be fully integrated, using global KPIs.

#### RECOMMENDATION FOR DECISION MAKERS

Asset Management plays a very important role today, allowing assets to be managed effectively to achieve the objectives set. For this reason, with

the implementation of ISO 55000, organizations can improve the efficiency, reliability, and performance of their assets, leading to better overall business outcomes.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

As we have discussed above, we need to have the highest quality data, so we could continue

to work on innovative methods to obtain high quality data and approaches to process data to anticipate our actions.

The organisation needs to create goals, to create a common vision by provoking communication at all levels of the organisation.

# Workshop 08 Building a climate-responsive road sector

**The use of digital solutions based on data science and artificial intelligence, shows promising results in being able to anticipate, adapt and mitigate the impact of road construction on climate. Road construction is a materials intensive sector which participates in global carbon emissions. Measuring and optimising the carbon impact of road networks at pavement design stage is essential for the sector to participate in the low-carbon transition.**

**Climate change and its extreme weather events – floods, heat waves, etc. – are exposing our road networks to greater risks. Anticipating those risks will be essential to build climate-ready roads.**

**This session explored how new approaches – in particular digital solutions – support the road sector to both mitigate its carbon footprint and anticipate climate change impact to avoid early repairs.**

**Discussions focused on digitalization and its contribution to building a climate-responsive sector and on the role of digital twins in reducing carbon footprint and anticipating resilient road networks.**

## Workshop 08 BUILDING A CLIMATE-RESPONSIVE ROAD SECTOR

### TOPIC OF THE SESSION

The use of digital solutions, including artificial intelligence and data science, shows promising results in being able to anticipate, adapt and mitigate the impact of road construction on climate.

Road construction is a materials intensive sector which participates in global carbon emissions. Construction materials are responsible for 85% of a road's carbon footprint.

Measuring and optimising the carbon impact of road networks at pavement design stage is essential for the sector to participate in the low-carbon transition.

Climate change and its extreme weather events – floods, heat waves, etc. – are exposing our road networks to greater risks. Anticipating those risks will be essential to build climate-ready roads.

During the session, Philipp Kamaryt, a sustainability and digitalization expert, shared his perspective on the role of digitalization to solve three challenges our world is facing: low-carbon power, food for all and low-carbon mobility. Digital platforms can be a vector of change and support all stakeholders in this journey. They support strengthening the link

between research, industry and policy-makers. This transformation should impact every stakeholder.

Nicolas Miravalls, CEO of ORIS Materials Intelligence, explained that the historical way of doing roads was through mechanical designs. Today we want to solve an impossible equation, to make low carbon roads, more resilient, less new resource-intensive while controlling budget costs. Digitalization can make it happen, through the use of digital twins. ORIS has developed a platform to deal with the complexity of such decision makings. It is based on robust scientific models and links construction materials, data on sourcing with projects. The impact assessment of road projects already achieved on the platform shows that there is more complexity to the very idea that making roads green is more expensive – which is why looking for the right solution through innovative solutions is what makes a big difference.

Jessica Tuck, Technical Director, Construction Materials, AECOM Europe & India, described all the benefits of using circular economy principles when choosing construction materials in road designs. Such approach enables the use of less virgin materials, reduces waste and pollution, ensures longer lifespan as well as better designs and repair options. With costs of schemes increasing fast in the UK, circular economy principles also give greater certainty on costs and supplies. Assets should be considered as our quarry on the ground and as an under-valued resource.

Pawan Karki, Principal Transport Specialist at the Asian Development Bank (ADB), shared insights from the ADB Strategy 2030 which includes the use of digital solutions. AI offers an opportunity to be faster and more efficient in improving road project analysis and preparation. M. Karki shared a case study from a project in Uzbekistan, for the upgrade of a section of the A380 highway. The government was under pressure to deliver this project in a short time frame, as this specific section of the road infrastructure supports access to the sea. To support financing, the ADB requested an environmental impact assessment, looking at the impact on carbon emissions, water, natural resources, etc. Using the digital platform ORIS, the project team was able to assess in a couple of weeks all those aspects and identify levers to reduce the negative impact (-10% on costs, -20% on carbon emissions, -30% of natural resources and -5 million litres of water used).

## TECHNICAL FINDINGS

- Panel discussion raised the need to study in more depth the way roads are designed in the light of future intensive use by electric vehicles. This new type of traffic will have an effect on road

pavements and consequently in the way road pavements are designed.

- The discussions also showed that digitalization allows to make generative designs. If the industry is not yet ready, the sector should prepare for it as we can expect it to happen.

## RECOMMENDATION FOR DECISION MAKERS

- Digitalization is a key lever to improve the climate performance of a road. Modelling the role of construction materials through digital twins is a new lever at our disposal to improve the climate impact of road networks. By optimising construction materials and evaluating their behaviour over the long term, we are able to mitigate the effects of climate change and anticipate the resilience to climate change through design improvements.
- The use of Artificial Intelligence will support new ways of visualising data and design options, but the decision making should remain in the hands of engineers.
- The traditional way of building road networks is very siloted. Decision-making should be “de-siloted” through the use of advanced digital solutions that embark the whole construction eco-system.
- Digital platforms should be secured and transparent, especially on the way data is collected and secured. Such platforms should be open and scalable solutions.
- The carbon impact of road networks should be measured through the whole lifecycle, from the raw materials footprint to the end of life.
- Design using circular economy principles should be made a priority. The role of distances should also not be under-valued in models as using local materials is essential towards sustainability.
- Regulation on pavement norms should also allow for more flexibility. Solutions used in some countries can work in others. This raises the necessity to move towards performance-based standards to make sure that we look at the end goal rather than a standardised approach. Regulation drives the change and this is how the industry can make the net zero journey.
- There’s a need for revision of procurement procedures in order to allow faster uptake of these technologies and solutions.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

- If we leave the decision making on construction materials at the end of the value chain (ie. to contractors and material suppliers), projects

can go the wrong way. Taking control of decision makings in road designs and construction materials choice is going to support the achievement of the UN SDGs in the road sector.

- Discussions underlined the need to have common methodologies and approaches to measure the impact of road networks.

## Workshop 09

# Optimised and sustainable concrete pavement concepts for the future

**Major global trends and challenges, in particular climate change, energy issues and demographic trends, have also an effect on the mobility of goods and people. The way transport infrastructure is designed, built and operated will also adapt accordingly.**

**This workshop showed examples of innovative concepts in concrete road construction related to these changes.**

**In a first presentation, a new type of concrete containing recycled magnetic particles, was presented by “Magment”. It is a magnetizable concrete, which is amongst others used for inductive charging of electric vehicles.**

**A second case was about the “Optipave” system, a special concept of thin concrete slabs, providing a cost-effective and sustainable design, reducing construction and maintenance costs while maximizing performance and service life. This design boasts 20+ years of proven performance in the South American market where it was first developed. The success story of the development in Ecuador was presented.**

**Finally, the contribution of pervious pavements to a sustainable water management system was highlighted. They can be a solution for flooding but also prevent water shortage in long periods of drought. Various solutions are available for pervious concrete pavements, both with in-situ cast concrete and with precast concrete products.**

## Workshop 09

### OPTIMISED AND SUSTAINABLE CONCRETE PAVEMENT CONCEPTS FOR THE FUTURE

#### TOPIC OF THE SESSION

Major global trends and challenges, in particular climate change, energy issues and demographic trends, have also an effect on the mobility of goods and people. The way transport infrastructure is designed, built and operated will also adapt accordingly. This workshop will show examples of innovative concepts in concrete road construction related to these changes.

#### TECHNICAL FINDINGS

In the first presentation, a new type of concrete containing recycled magnetic particles, was presented by “Magment”. It is a magnetizable concrete, which can be used for inductive charging of electric vehicles. The electrification of the worldwide car park is on its way and is growing rapidly. Consequently, battery charging infrastructure also needs to be deployed urgently. Next to the static charging systems, also the so-called Electric Road Systems provide solutions for this. Mr. Esguerra explained us the benefits of inductive charging as a wireless, ecological and efficient system. The pilot projects make us believe this technique has a promising future. Finally, Tim Alte-Teigeler showed how precast concrete slabs can be installed in a fast and correct way.

The second case was about the “Optipave” system, a special concept of thin concrete slabs, providing a cost-effective and sustainable design, reducing construction and maintenance costs while maximizing performance and service life. This design boasts 20+ years of proven performance in the South American market where it was first

developed. The success story of the development in Ecuador was presented by Eugen Florescu and Juan-Pablo Covarrubias.

In the 3<sup>rd</sup> presentation, the contribution of pervious pavements to a sustainable water management system was highlighted. They can be a solution for flooding but also prevent water shortage in long periods of drought. Various solutions are available for pervious concrete pavements, both with in-situ cast concrete and with precast concrete products. Elia Boonen shared with us the results of a recently finished research project including laboratory tests and field measurements. The examples of the latest developments in precast pavers, tiles and slabs prove that the combination of concrete and grass can be aesthetical and environmental-friendly at the same time.

### RECOMMENDATION FOR DECISION MAKERS

Be open to new techniques and solutions.

Ensure a competitive market that allows diverse solutions in terms of materials, design, execution techniques, etc.

Make long-term and full lifecycle assessments – from cradle to grave – including the use phase.

Consider future-oriented, resilient concepts.

### RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

Keep on supporting and promoting innovative solutions, that will be needed to tackle the important challenges of our society: climate change mitigation and adaptation, climate resilience, water management, circular economy.

General and applied research, in collaboration with the industry, is key in developing these solutions. New clear and well-illustrated technical reports remain important to inform a young generation of designers and construction managers.

## Workshop 10 Disaster Management Manual: A Guide to Resilient Transportation Systems

**For disaster management to be effective and efficient, it must be based on a clear understanding of the role and fulfillment of responsibilities of each actor as well as the timely implementation of appropriate interventions. A good disaster management practice is to integrate disaster management into national, provincial and district development plans, and to change the thinking and attitudes of individuals from disaster vulnerability to disaster resilience.**

**Lessons learned from past disasters can drive the development of new management strategies and new structural intervention and monitoring techniques, can also serve as test cases to evaluate the effectiveness of what has been put in place. In this sense knowledge sharing among road administrations, as well as practical experience, will be crucial.**

**This workshop showcased the Disaster Management Manual prepared by PIARC, which**

**offers guidance on effective and efficient strategies and methods for PIARC member countries and regions to manage various disasters. The manual covers basic concepts and case studies, including lessons learned and best practices to apply these basic concepts in practice. These ideas and examples are categorized and cover each stage of the disaster management cycle.**

# Workshop 10

## DISASTER MANAGEMENT MANUAL (DMM)

### A GUIDE TO RESILIENT TRANSPORTATION SYSTEMS

#### TOPIC OF THE SESSION

Disaster management encompasses a series of activities and actions performed by various actors (road administrators, technicians, road users, stakeholders, etc.) who must be trained, coordinated and informed, according to the function that corresponds to them, during every phase of a disaster management (mitigation, preparedness, response and recovery).

For disaster management to be effective and efficient, it must be based on a clear understanding of the role and fulfilment of responsibilities of each actor as well as the timely implementation of appropriate interventions. A good disaster management practice is to integrate disaster management into national, provincial and district development plans, and to change the thinking and attitudes of individuals from disaster vulnerability to disaster resilience.

Lessons learned from past disasters can drive the development of new management strategies and new structural intervention and monitoring techniques, can also serve as test cases to evaluate the effectiveness of what has been put in place. In this sense knowledge sharing among road administrations, as well as practical experience, will be crucial.

This workshop showcased the Disaster Management Manual prepared by PIARC, which offers guidance on effective and efficient strategies and methods for PIARC member countries and regions to manage various disasters. The manual covers basic concepts and case studies, including lessons learned and best practices to apply these basic concepts in practice. These ideas and examples are categorized and cover each stage of the disaster management cycle.

#### TECHNICAL FINDINGS

[The world first user friendly and comprehensive road disaster management manual]

- The workshop participants recognized that this Disaster Management Manual (DMM) is the world's first manual to compile various disaster management techniques for the road

sector based on international knowledge and experience.

- The workshop participants also found that the DMM is designed on a user-friendly structure. It covers each phase of the disaster management cycle and different types of measures. It can be used as a textbook or as a dictionary.
- The cutting-edge disaster solutions shared in the manual cover many of the best tools for the development of a resilient road network.

[Information and communication in disaster management]

- The workshop participants discussed that the effects of climate change are becoming more intense so a balanced approach should be taken using structural measures, non-structural measures, and social capital.
- They also discussed that dissemination of the current disaster risk to the drivers is a very effective tool to reduce the impact of the disaster. In this sense, the manual covers such information and communication technologies in disaster management.

#### RECOMMENDATION FOR DECISION MAKERS

[How to mitigate or avoid the effects of climate change]

- Assessing the risks to infrastructure will be important. The only way to do this is to continually strengthen disaster resilience based on this assessment.
- Digital twin technology is emerging. It is important to use this technology to simulate disasters in the cyber world, assess their impact on society, and gradually strengthen infrastructure efficiently and appropriately.
- Mitigating the impacts on infrastructure is essential, but mitigating or reducing the impacts on drivers, residents, and society is also very important. They need to be discussed in the same way.
- Each country's disaster management manual can be improved by utilizing the PIARC Disaster Management Manual.

[How to improve disaster resilience using DX technology]

- Information and communication technology improves disaster management especially in the area of risk warning to the drivers. For example, the use of big data and social networks for disaster management dramatically reduce the impact and risk to the drivers.
- Collaboration with other Technical Committees will enhance the perspective on disaster resilience. Sharing experience at all levels will improve

the disaster management understanding for both High Income Countries and Low- and Middle-Income Countries.

[Investing in disaster resilience from a regional perspective]

- Disaster management aims to maximize the management effectiveness with limited resources. We can deal with this problem in the same way. This manual presents several tools that can be used as a reference.
- The government must have a policy of sustainable development regarding disaster management, and the government must make efforts to communicate with all the parties involved and affected by disasters.
- We have to consider not only the regional aspect, but also the digital divide aspect.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

[Sharing the manual and experience]

PIARC should promote the usefulness of this manual at PIARC seminars and conferences so that many road engineers can learn and benefit from this manual.

Sharing experiences is very important in disaster management. PIARC member countries should share their disaster experiences for enriching the manual.

The permanent updating of the manual with the results of the activity of the Technical Committee, new case studies, best practices, and lessons learned from disaster management is the key to perfecting the manual in the following years.

# Workshop 11 Resilience and asset management

**Resilience has been defined as “the ability of a system or systems to survive and thrive in the face of a complex, uncertain and ever-changing future” and this definition serves as the basis for the workshop.**

**On the one hand, the workshop addressed the uncertain and ever-changing future that is largely, but not exclusively, influenced by climate change. Aspects of resilience and the possibilities of integrating resilience into asset management were discussed. On the other hand, the workshop presented – on the basis of case studies – both preventive and remedial interventions that can effectively improve resilience. Furthermore, the relationship between risk and resilience approaches was discussed with a focus on the temporal dimension that characterises the resilience approach. TC 1.4 “Climate Change” and TC 3.3 “Asset Management” contributed to this workshop.**

**This session included a presentation of issues such as risk and resilience, holistic approaches to climate change and other hazards and the importance of network and asset management in enhancing resilient infrastructure. A summary of the results of PIARC’s TC 1.4 and TC 3.3 in relation to the areas identified concluded the session.**

## Workshop 11 RESILIENCE AND ASSET MANAGEMENT

### TOPIC OF THE SESSION

This workshop was organised jointly between PIARC Technical Committee (TC) 1.4 Climate Change and Resilience of Road Networks and TC 3.3 Asset Management. It sought to discuss aspects of resilience and the possibilities of integrating resilience into asset management. It also presented a range of case studies covering both preventive and remedial interventions that can effectively improve resilience. Furthermore, the relationship between risk and resilience approaches were discussed with a focus on the temporal dimension of recovery that characterises the resilience approach.

The session was introduced with presentations from TC1.4 and TC3.3. These presentations outlined the work of the Committee’s and the need to integrate resilience into asset management to enable the prevention, protection, robustness and recovery of road infrastructure both currently and into the future. These were followed by presentations relating to risk and resilience approaches. The first

presentation gave a theoretical perspective on similarities and differences between risk & resilience analyses. It is demonstrated how these analyses are in fact complementary in decision-making. It is highlighted that consideration of interdependency of systems is essential for prudent recovery planning and adaptation of infrastructure systems in the face of natural hazards.

A key theme of the next presentation was on “The preservation of transportation infrastructure in the face of natural hazards is paramount to insuring the mobility of people and goods” and discussion of low cost, low risk resilience projects in New Zealand. This presentation covered impacts of the 2016 Kaikōura earthquake on the road transportation system and lessons learned. Low cost, low risk resilience projects are aimed at preventing or mitigating an incident or event, which impacts on the serviceability of the road network. They can help deliver real improvements quickly and can often buy more time before large-scale improvements are required. Dealing with natural hazards in Austria to ensure a resilient high-level road network was also provided. This presentation showed a risk-based approach for tailoring maintenance needs. The importance of digitalization in information management, especially applied to activities of hazard identification, monitoring and mapping, is emphasized as crucial in a management process. It is underlined that the resilience is a significant part of the natural hazard management.

The costs of climate risks and importance of investment in maintaining and repairing roads was outlined in a presentation by the World Bank. The presentation also covered projects on road infrastructure resilience and asset management. Examples of projects led by the World Bank and with client countries around the world, were provided. These included assessment of vulnerability, criticality, prioritising interventions and investments. Money invested in transport resilience was shown to be money well spent, with resilience efforts focusing on planning ahead, updating design standards, investing in appropriate maintenance and building redundancies. Additionally, examples of network resilience and context-specific adaptation measures were highlighted.

PIARC TC1.4 has published a report on *Uniform and holistic approaches to climate change and other hazards resilience*. This presentation outlined the concept of resilience, beyond climate change to consider other hazards. The complex interrelationships between different types of hazards were explored, offering an understanding of how they interact.

Approaches to network and asset resilience was also covered from the perspective of the Uganda

National Road Authority. The factors influencing road network and asset resilience, approaches to enhance resilience through engineering and non-engineering solutions, the role of procurement including green procurement options and the benefits of public involvement and stakeholder engagement. Ways to address resilience in project management and key elements of a project-level resilience study were also demonstrated.

The session highlighted the collaboration between the two PIARC Technical Committee's with resilience as a cross-cutting issue. This is one of many opportunities for collaboration throughout the cycle to connect on these topics.

## TECHNICAL FINDINGS

Key areas discussed at the session included risk and resilience, holistic approaches to climate change and other hazards and the importance of network and asset management in enhancing resilient infrastructure.

The session included a panel discussion addressing the following questions:

- How can we improve/better include resilience in asset management practices in general?
- How can resilience and asset management be effectively incorporated into guidance and decision-making processes?
- Is resilience only related to natural hazards?
- Are resilience metrics sufficient for decision making in asset management?

The technical findings following the presentations and panel discussion included:

- The risk and resilience analysis share the same tools and approaches and their separation is neither practical nor meaningful. The main difference is in the choice of consequences i.e., measure for resilience.
- The risk and resilience approaches to certain extent mirror opposites of each other. Both approaches are dynamic and by system adaptation, the probability of sudden events and consequences of the related risks can be reduced i.e., the resilience increased.
- The demand and supply approach to resilience can be used to guide recovery and adaptation of infrastructure systems (non/recoverable losses need to be included).
- The maintenance solutions, which target specific resilience aspect(s), can be simple and budget friendly, but still be effective against threats coming from natural hazards.
  - Low costs Low Risk approach (NZTA, New Zealand) deliver real improvements quickly and buy time before large-scale improvements are required.



- The complexity of applied risk/resilience approaches in practice around the world depends mainly on the GDP, experience of road owners/operators with infrastructure failures and exposure of transportation networks to natural hazards.
  - Hazard identification and mapping, risk analysis, tailoring and prioritizing measures and increasing risk awareness, are essential steps in comprehensive management of infrastructure as shown on the example of ASFINAG, in Austria.
- The unpredictable nature of climate risk makes the use of sophisticated decision-making models more relevant than ever (e.g., Decision Making Under Deep Uncertainty).
- Road network and asset resilience is affected by physical, operational, and organizational factors.

## RECOMMENDATION FOR DECISION MAKERS

- Learn from (own) past experiences of infrastructure failures to improve/adapt current asset management approaches.
- Better understand current and future hazards; vulnerabilities; how to assess risk and which adaptation actions can be implemented.
- Further expand currently applied risk-based approaches to account for recovery of infrastructure i.e., adopt a resilience as a core component of decision making.
- Increase the level of digitalization in information management.
- Budgets are limited and therefore we need to spread it as evenly as possible according

- to targeted needs e.g. funding plans such as in New Zealand
- Network and asset resilience is vital and helps to ensure business continuity, reduce costs, and protect the well-being of individuals and communities.
- Collaborative efforts are essential and should be perused across all aspects of assessing resilience.
- We need to be prepared for the future rather than reacting to past events.
- Successful resilience involves integration into standards.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

- Continuation of the topics on resilience in asset management in the future PIARC cycles towards development of guidelines for resilience improvement.
- Steer and join efforts to comprehensively investigate interdependency between infrastructures for resilience, impact on communities and the society as a whole.
- Work on the coverage of resilience aspects in standards.
- Work is encouraged in the next PIARC cycle on exploring the effectiveness of a resilience framework for road networks, covering climate change and other hazards. The framework should build upon the reports from the previous cycles.
- Further work should be considered on complexities, such as coinciding events and amplifying effects, interdependencies and cascading effects.

# Workshop 12 Research and innovation for the benefit of greener and more sustainable airfield pavements

**Sustainability and Resilience is of major concern for airport community whose new challenge is to reduce carbon footprint and promote environmentally friendly solutions for civil aviation. In the field of airfield pavements, several ways exist for carbon footprint reduction: material optimizations – thanks to advanced design methods and pavement assessment strategies; recycling and reuse (R&R), low embodied carbon materials or processes, and enhanced durability.**

**As embodied carbon is inherent to the process of constructing airport pavement infrastructure, rather than something that can be addressed after a project is completed, there is an urgent need to address embodied carbon now.**

**This technical session, co-organized by the French Civil Aviation Technical Center (STAC) and the Federal Aviation Administration (FAA) Airport Technology R&D Branch, and**

**involving international experts from the STAC, the FAA, Airbus, University Gustave Eiffel (France), US National Asphalt Pavement Association (NAPA) and Pavexpert, gave an overview of the state of the art and the major innovations and ongoing research in terms of pavement evaluation, asset management, Life Cycle Assessment (LCA), “green” materials, and technical solutions, for more sustainable airfield pavements.**

## **Workshop 12**

### **RESEARCH AND Innovation**

#### **for the benefits of Greener and more sustainable airfield pavements**

#### **TOPIC OF THE SESSION**

In a context of climate change, the airport community is now facing new challenges: while the passenger traffic is increasing fast, the infrastructures sustaining it have to be adapted considering a strain on the resources and a need to cope with the targets for reducing CO<sub>2</sub> emissions. Hence, it is essential to reduce both economic and environmental costs, ensuring a high level of service and safety.

This workshop aimed at raising awareness on the upcoming issues resulting from global warming. The presentations made during this session tend to give some keys towards more sustainable methodologies and tools for airfield pavement design, evaluation and asset management.

#### **TECHNICAL FINDINGS**

During this workshop, it was demonstrated that due to global warming, changes in material field properties may have a severe impact on the infrastructures life expectancy. Thus, further experimentations are needed to confirm the influence on pavement damage, in particular through temperature monitoring in airfield pavements.

However, it is worth noting that new tools are still developed to better characterize the assets (e.g., ovalization tests for interface characterization). Combined with digital transformation and new technologies (e.g., AI or BIM), it can lead to a predictive maintenance. Indeed, it opens the path to more reliable input data for the models (automated and simplified processes, accuracy of the information collected, facilitation of the cross-checking

of the information, etc.) and a more accurate overview of the pavement condition.

The possibilities to decrease the environmental cost while acting directly on the material were also discussed. The accessibility of the information can be easily achieved (EDPs, LCA) and influence the final decision. Moreover, R&D programs are now undergoing and aim at promoting recycling and reuse in the pavements or WMA. More projects may be expected to take into account the possibility of including biobinders, combined with R&R to reduce the environmental impact of pavement projects.

#### **RECOMMENDATION FOR DECISION MAKERS**

Based on the presentations and the discussions that followed, it could be recommended that decision makers open the requirement specifications to encourage companies to propose innovative solutions. Furthermore, economic incentives could help to accelerate implementation of the greener solutions in operational projects.

It could also be interesting that road and airport organizations sustain R&D programs by duplicating experimentations on the field, with an actual traffic mix, providing feedback on the solutions tested, or equip in-service pavements with temperature or mechanical sensors.

Finally, there is an urge for decision makers to become familiar with the existing tools for a quantification of the environmental cost of their projects. Integrating those tools in the decision-making process could help identifying the levers on which one can act to efficiently reduce the impact of the project.

#### **RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS**

Further studies are needed on the impact of global warming on airfield pavements. This particular topic could lead to future collaborations between different countries and entities (e.g., public/private collaborations).

As sharing the knowledge is of prime importance to raise awareness and launch new research programs, it could be interesting to continue organizing workshops/technical sessions dedicated to airfield pavements.

It could also be recommended to encourage comparison campaigns and round robin tests between entities and among countries.

## Workshop 13

# Boosting sustainable road safety solutions in LMICs

**PIARC has an active role in the efforts to improve road safety worldwide through evidence-based studies, technical reports and other type knowledge products. Technical Committee for Road Safety recognizes that 90% of traffic deaths occur in Low- and Middle-Income Countries, and uses this information to assess, identify and share best practices of road safety activities for LMICs through the development of documents and cases studies highlighting international practices and lessons learned. The Technical Committee is focused on making proven countermeasures that are effective in reducing the likelihood and severity of crashes, available to LMICs for consideration in safety project development.**

**This workshop was dedicated to Effective Road Safety Management and Targeted Road Safety Solutions for LMIC and vivid discussions with key international road safety experts. Important results from key PIARC Publications were demonstrated, like the famous PIARC Road Safety Manual and the recent Reports on LMIC Specific Issues and Successful Case Studies. Emphasis was given to Infrastructure, Human Factors, Speeding and Vehicles and the related data and analyses as well as the management and research infrastructure needed in LMICs. A comprehensive set of key recommendations for the successful implementation of best practice was provided and thoroughly discussed.**

## Workshop 13

### BOOSTING SUSTAINABLE ROAD SAFETY SOLUTIONS IN LMICs

#### TOPIC OF THE SESSION

Fatalities and serious injuries represent an unacceptable consequence of the road transport system across the world. Road crashes continue to be a major cause of death and serious injury for

low- and middle-income countries (LMICs). At global level, 90 per cent of traffic fatalities occur in these countries, a number which is three times higher than in high-income countries.

PIARC Technical Committee 3.1 – Road Safety uses this information to assess, identify and share best practices of road safety activities for LMICs through the development of documents and cases studies highlighting international practices and lessons learned. The Technical Committee is focused on identifying proven countermeasures that are effective in reducing the likelihood and severity of crashes, available to LMICs for consideration in safety project development.

Important results from key PIARC Publications were presented, such as the PIARC Road Safety Manual and the recent Reports on LMIC Specific Issues and Successful Case Studies. Emphasis was given to Infrastructure, Human Factors, Speeding and the related data and analyses as well as the management and research infrastructure needed in LMICs.

#### TECHNICAL FINDINGS

The first session focused on the practical implementation of the Safe System Approach, the guidance of government actions through legislation, education, enforcement, and technology, and the crucial need to establish sustainable knowledge and research infrastructure in LMICs. It also delved into key road safety management practices and the significance of data analysis in formulating effective safety measures.

Issues such as political will, capacity building, safety culture and the need of reliable data collection were highlighted as crucial for LMICs.

The second session expanded on this foundation, offering valuable insights into successful case studies in LMICs, strategies for providing safer road infrastructure, considerations of human factors in road safety, and the management of speed for

all road users. Additionally, the session provided an essential perspective on conducting road safety assessments on access routes to transit systems.

Aspects such as cultural differences, compliance challenges, placing the human at the centre of the Safe System Approach and using pilots to demonstrate success were discussed during the session.

## RECOMMENDATION FOR DECISION MAKERS

The Safe System Approach is universal, and while applicable to LMICs, tailor made approaches should be employed to ensure results. Gathering accurate data is of critical importance to make informed decisions and formulate evidence-based road safety policies and while LMIC may have road safety strategies in place, they may not be suitable for their specific contexts.

Capacity building in LMICs is critical. Currently there is a lack of research in LMICs, while the authors of LMIC use cases are majorly from the international community. More focus should be on national authors and national expertise. Therefore, capacity building through initiatives such as including road safety in university curriculums can prove effective in the long-term.

Applying the Safe System principles on the whole network is difficult – using pilots is proving more successful. However, more emphasis should be put on data collection – as few countries focus on the evaluation of implemented approaches and solutions.

Improvements in infrastructure over medium to longer term will be essential in providing a forgiving system. The self-explaining road should be designed having considered new/emerging modes in the network (e.g., automated driving), receive at least a 3\* rating, be consistent, visible and legible and place special emphasis on protecting Vulnerable Road Users.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

The following questions were addressed during the workshop:

- How to improve the knowledge infrastructure in LMICs?
- Is there any point in having road safety strategies in LMICs if there is no safety culture?

- How to decrease resistance to change?
- How to achieve the optimum balance between societal benefit and personal benefit when it comes to road safety?
- Would a road safety audit manual tailor made for LMIC be possible?

The Road Safety Manual remains a critical resource for LMICs, as there are still many differences between high-income and low- and middle-income countries. Collecting case studies is extremely useful to demonstrate practical steps in the implementation of the Safe System Approach and to decrease resistance to change. The inclusion of representatives such as national experts and auditors in PIARC is of crucial importance to ensure that their input is included in the development of tailor-made solutions for LMICs.

# Workshop 14

## Digital transformation in road infrastructure – Parts 1 & 2

**For many road authorities today's digital technology provides a wide range of opportunities to improve the planning, design, construction and asset management of their road network.**

**For instance:**

- **Artificial intelligence enables the planner to automatically investigate a number of maintenance scenarios and choose the optimum one,**
- **Building Information Models provide a digital model a (part of) the road consisting of objects with their specific properties and relationships,**
- **Scanning techniques enables the planner, designer and contractor to obtain the latest information of the existing road and its environment and**
- **Common data environments and semantic techniques assist the asset manager to make the road data FAIR (Findable, Accessible, Interoperable and Reusable)**

**However, it is evident that digital assets are also assets and need to be managed appropriately in order to be able to benefit from it at the fullest. It is fair to say that the digital transformation of infrastructure in every phase in its lifecycle has (just) started.**

**This session showed the audience what can be expected from further future digitalisation focusing on paths that different road agencies and consultants are taking toward fully digitalized Asset Management.**

## Workshop 14

### DIGITAL TRANSFORMATION IN ROAD INFRASTRUCTURE – PARTS 1 & 2

#### TOPIC OF THE SESSION

- Presenting the level of digitalization in asset management in authorities/agencies, road owners/operators, consultants and contractors.
- Addressing expectations and innovative strategies for future developments in the field of digitalization in road management (e.g.,

scanning technologies, data sharing/exchange, AI).

#### TECHNICAL FINDINGS

- Digitalization is becoming an increasingly mature practice.
- The current main issue for establishing BIM of assets in road agencies: Fragmented and unstandardized asset data models and different file formats.
- BIM can foster asset management over lifetime of assets, with the focus on:
  - Asset data (e.g., basic properties, state, historization, damages, remote inspection/quality control).
  - Data fusion of inventory and diagnostic data i.e., structural health monitoring and non-destructive tests, with the goal to enhance deterioration prediction and structural assessment.
  - Data visualization in different phases (in construction phase e.g., clash control, in inspection phase e.g., damages in vulnerable zones).
  - Maintenance/repair planning (e.g., for standardized types of damages).
  - Information at your fingertips (e.g., on-line availability, updated information, quick calculations/simulations).
  - Comprehensive disaster prevention information system
- It is becoming viable to generate BIM bridge models from point clouds using trained neural networks, engineering knowledge and available information from databases.
- AI can considerably accelerate calculations while considering multiple optimization goals in planning/design of road-rail routes.
- AI can foster damage detection from the digitally collected information.

#### RECOMMENDATION FOR DECISION MAKERS

- Invest more in BIM modelling making it useful for the entire life of assets.
- Make the BIM solutions as simple as possible and do not wait until there is a best solution – open BIM is desirable. Focus on modularity

in development of BIM solutions not to silo-based approaches.

- Define roles and responsibilities for data collection & management (storing, processing, governance, integration and security).

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

- Position of digitalization in PIARC could be fostered and embedded as some kind of a cross-sectional body.
- Continuation of the topics on digitalization in asset management in the future PIARC cycles.

Steer and join efforts in elaboration of common national standards for asset BIM including a collaboration with building SMART.

# Workshop 15 New inspection and rehabilitation techniques for bridges

**Bridge inspection, repair and rehabilitation form an essential part of bridge management. New technologies such as remote sensing and the use of a variety of sensors have the potential to significantly improve the quality of the results of structural inspections. On the other hand, aging infrastructure with limited functional capacity pose a major problem in terms of maintaining mobility for the traveling public as well as the transportation of freight and services. Identification of new repair and rehabilitation materials can accelerate and improve the repair and rehabilitation of bridges under traffic. In addition, new technologies and construction methods can also be applied to repair or rehabilitate aging bridges under traffic. For these reasons, this workshop was organized into two parts titled “New Inspection methods” and “Assessment and Rehabilitation”.**

## Workshop 15 NEW INSPECTION AND REHABILITATION TECHNIQUES FOR BRIDGES

### TOPIC OF THE SESSION

Bridge inspection, repair and rehabilitation form an essential part of bridge management. New technologies such as remote sensing and the use of a variety of sensors have the potential to significantly improve the quality of the results

of structural inspections. On the other hand, aging infrastructure with limited functional capacity pose a major problem in terms of maintaining mobility for the traveling public as well as the transportation of freight and services. Identification of new repair and rehabilitation materials can accelerate and improve the repair and rehabilitation of bridges under traffic. In addition, new technologies and construction methods can also be applied to repair or rehabilitate aging bridges under traffic. For these reasons, this workshop will be organized into two sessions titled “New Inspection methods” and “Assessment and Rehabilitation”.

### TECHNICAL FINDINGS

The first session highlighted the significant role of Non-Destructive Testing techniques in identifying internal defects and underlying structural issues without inflicting damage to the bridges under inspection. Similarly, monitoring sensors demonstrated their invaluable role by providing continuous, real-time data on structural conditions. Additionally, remote-sensing technologies (e.g., drones) have emerged as transformative facilitating safe, efficient and detailed inspections, particularly in hard-to reach areas of bridges, and thereby minimizing the risks associated with human inspections.

The second session focused on new bridge assessment techniques and rehabilitation methods. Advanced materials such as ultra-high performance concrete are quickly transforming the way owners address infrastructure needs. Technology advancements are happening so fast especially with the use

of unmanned aerial systems to collect data, diagnostic surveys that clearly define the bridge condition and software programs that perform advanced analysis for design. Accelerating project delivery with the use of prefabricated elements to minimize the impacts to the traveling public is changing the way owners evaluate construction methods.

## RECOMMENDATION FOR DECISION MAKERS

While considering the implementation of the aforementioned inspection techniques, heads of road organizations should ensure these techniques are specifically tailored to meet operational needs, aligning with the specific infrastructural, financial, and logistical contexts of their respective organizations.

New bridge assessment techniques and rehabilitation methods through the use of advanced materials, progressive technology and accelerating project delivery construction methods will allow bridge owners to have better data and to make

better decisions in managing and maintain their bridge inventory.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

International organizations are encouraged to prioritize collaborative research, especially to improve the accuracy and efficiency of bridge condition assessments using the aforementioned inspection techniques. Developing and confirming universal metrics and protocols is crucial to ensure consistency and reliability in technology-driven inspection methods.

International organizations are encouraged to continue to support research for advancing materials, technology, and project delivery construction methods. All of these areas allow bridge owners to make better decisions based on better data to improve the way bridge owners plan, design, manage and maintain the bridge inventory.

# Workshop 16 HDM-4 – the past, the present, and the future

**The current Highways Development and Management tool (HDM-4) has been available for almost 20 years. During that time it has built on the success and reputation of its predecessor, HDM-III to become the internationally recognised software tool recommended and used by aid-agencies worldwide. It has been distributed to over 120 countries and used by government agencies, construction agencies, research institutions, funding/development banks, and individual consultants in developed and developing countries.**

**This workshop looked at the wide number of studies that HDM-4 has been used on, as well as looking at some current applications of the software which show how to integrate the tool with Asset Management systems to leverage data for an analysis as well as evaluation of new pavement materials. Finally, the workshop looked to the future, and introduced the role of the World Bank's initiative to update HDM-4 to produce a tool which will address the requirements of users into**

**the future. There was an opportunity to ask questions to the presenters and HDM-4 experts present at the workshop.**

## Workshop 16 HDM-4: THE PAST PRESENT AND FUTURE

### TOPIC OF THE SESSION

This workshop looks at the wide number of studies that HDM-4 has been used on, as well as looking at some current applications of the software which show how to integrate the tool with Asset Management systems to leverage data for an analysis as well as evaluation of new pavement materials.

Finally, the workshop looks to the future, and introduces the role of the World Bank's initiative

to update HDM-4 to produce a tool which will address the requirements of users into the future.

## TECHNICAL FINDINGS

The key findings of the workshop include:

- HDM-4 is a flexible tool that with calibration can be used to model the economic benefits of new resilient materials.
- Using a tool such as HDM-4 is essential for multi-lateral development banks and other donors to analyse the benefits of road investment schemes and HDM-4 continues to be used to unlock essential funds.
- Since HDM-4 was first introduced there are a range of emerging themes that should be included in a robust analysis which it does not support, therefore an update to the software is essential to maintain its applicability in today's environment.
- The World Bank project to update HDM-5 is an essential project that deserves wide backing and support.
- The World Bank have an ambitious range of enhancements they wish to bring to the new version of the software, but there should also be a way for all users to provide feedback and suggestions that are not lost or forgotten.
- Although HDM-4 is often considered as a stand-alone tool, greater advantage can be gained from it by integrating it to a road management system. This allows it to be used consistently through many different Asset Management tasks.

## RECOMMENDATION FOR DECISION MAKERS

The workshop confirmed that HDM-4 is a flexible tool and still applicable for use today for a wide range of use-cases.

As HDM-5 develops further road agencies should evaluate the cost and benefits of moving to HDM-5 to leverage the enhancements that are planned.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

HDM-4 is a popular and highly trusted software tool for decision making. It continues to be used in many different countries, and new users are still coming on board. It is therefore important to disseminate best practise and illustrate successful applications of HDM-4 at an international level through organisations such as PIARC and others.

The applications of HDM-4 given in this workshop illustrate that although HDM-4 is an aging system, it is still a flexible tool that can be used successfully at project, programme, and strategic levels and international organisations should still promote its use and further encourage those countries who currently do not use asset management tools and decision support tools should consider HDM-4.

Given the new version, HDM-5, is now on the horizon, it is equally important that PIARC and international conferences keep users up to date and disseminate the advantages/disadvantages of adopting to the new version and compare the performance of any new models that are introduced in the new version.



# Foresight session 01

## Sustainable finance and international policies for the SDGs 2030

The Foresight Session, co-organized by PIARC/ World Road Association's International Technical Committee 1.3 – Finance & Procurement and the International Transport Forum (ITF) at the OECD, brought together lead officers and senior experts from main international institutions, organizations and financial sector, involved in the transport and road sector.

The prestigious panel of speakers analysed and discussed both the latest international policies, including innovative sustainable procurement and Public-Private Partnerships' schemes, and the structuring and deployment of mechanisms and instruments of sustainable finance, as well as alternative sources of funding, for road networks, road infrastructure projects and mobility at the international level.

A high-level debate (keynote presentations plus a panel discussion/Q&A session) focussed on fundamental topics in line with the 2030 Agenda of the United Nations (17 SDGs) and related to current and future main issues for the road and mobility sector worldwide; including goals as the progressive decarbonization of road infrastructure and the correct development of carbon neutral mobility, in order to reach a balanced and comprehensive long-term sustainability for the road and mobility sector. Considering multiple implications at different levels (e.g. policy, financial, fiscal, environmental, social) and connecting successful sustainable policies and best practices in funding and financing. Sharing the latest trends both in the road and mobility sector (i.e. transport sector) and in the financial sector at the international level.

The Foresight Session addressed the following questions/topics:

- Trends regarding sustainable funding/financing in the road infrastructure and mobility sector at the international level, including decarbonising road infrastructure and developing carbon-neutral mobility
- Innovative sustainable finance schemes/ instruments applied to main road sector's projects and national networks, as well as in the mobility sector

International sustainable policies, procurement mechanisms and PPPs for the road and mobility

sector worldwide, aligned with the 2030 Agenda of the U.N. (17 SDGs).

## Foresight session 01

### SUSTAINABLE FINANCE AND INTERNATIONAL POLICIES FOR THE SDGs 2030

#### BACKGROUND CONTEXT AND TOPICS OF THE SESSION

##### Background Context

International policies aligned to the SDGs 2030's requirements (as sustainable procurement schemes and innovative PPPs), the structuring and deployment of mechanisms and instruments of sustainable funding and financing, as well as the climate resilience of road infrastructure and networks are currently fundamental themes for the road and mobility sector worldwide. Crucial for its future development, considering sector's progressive sustainable transition in the next years.

The Foresight Session, co-organized by PIARC/ World Road Association's International Technical Committee 1.3 – Finance & Procurement and the International Transport Forum (ITF) at the OECD, with the participation of leading international institutions and organizations involved in the transport, road and financial sector (UNECE, World Bank Group, European Bank for Reconstruction and Development, Asian Development Bank, Climate Bonds Initiative) and PIARC's International T.C. 1.4 – Climate change & Resilience, focussed on them.

Primary topics related to challenges for the sector, aligned with the 2030 Agenda of the U.N. (17 SDGs), the Paris Agreement, etc. Including goals for the progressive decarbonization of road infrastructure and networks and the correct development of carbon-neutral mobility to reach a comprehensive long-term sustainability for the road and mobility sector worldwide, considered different implications (political, financial, fiscal, social, environmental).

Furthermore, latest international trends in transport and financial sectors highlight and link successful sustainable policies and best practices in funding and financing, including sustainable finance. Given the need to meet the SDGs 2030 for the sector finding solutions to the financial constraints and available public-private funds for necessary significant investments in road infrastructure projects and national networks worldwide.

## Topics

The Foresight Session addressed these following topics for the road and mobility sector at the international level (detailed references available in speakers' presentations):

- International trends regarding sustainable funding and financing in the sector, including decarbonising road infrastructure and developing carbon-neutral mobility.
- Innovative sustainable finance schemes and instruments applied to road sector's projects, national networks and mobility.
- Sustainable policies, procurement mechanisms and PPPs aligned with the U.N. SDGs 2030.

## TECHNICAL FINDINGS

The technical findings from the range of presentations included:

- Critical connection between achieving successful sustainable policy outcomes for the sector (i.e. decarbonisation/carbon-neutrality's goals, socio-economic benefits, road upgrade, safety), contemporary increasing the resilience of road infrastructure and networks (i.e. mobility systems) to climate change's impacts worldwide.
- Road infrastructure and mobility investments assessed for compatibility and alignment with the SDGs 2030, Paris Agreement's climate targets (i.e. 1.5 degree, net-zero 2050 decarbonization

pathway) and main frameworks (e.g. European Green Deal).

- Necessary optimization of the investment decision making's efficiency to fund resilience and decarbonisation. Implementing successful existing and/or innovative mechanisms and action plans is pivotal for targeting and prioritising public-private investments for road networks. Identifying vulnerable infrastructure, addressing risks, adopting climate change adaptation frameworks.
- Design as a tool for resilience; strengthen resilience for sustainable urban mobility plans. Enhance and fund preventive maintenance regimes to preserve road assets, improving sustainability and safety.
- Significant increasing level of financial resources needed for the sector. Reforming traditional public budgets, in line with the sustainable transition, widening a comprehensive adoption of integrated alternative funding schemes for road infrastructure and networks (e.g. alternative fuels taxation, user charges as tolls and distance-based pricing, PPPs, value capture). Primary role of sustainable finance to support investments.
- Sustainable finance is exponentially rising worldwide (e.g. ESG bonds, loans, guarantees); just well-established in developed countries, relevant opportunities for developing countries. Regarding the ESG bonds market (i.e. green, social, sustainability, sustainability-linked, transition bonds), fundamental for mobilizing relevant financial resources towards sustainable investments, cumulative GSS+ aligned volume crossed \$ 4 tn in H1 2023 (source: Climate Bonds Initiative); transport sector between the three principal sectors.
- Mobilizing concessional finance and blended financing for LMICs is crucial. Pricing externalities, addressing ongoing bankability and equity

Visual reminder: Foresight session 01 Sustainable finance and international policies for the SDGs 2030, Tuesday October 3, 2023



concerns, scaling up smaller projects to engage the private sector.

## RECOMMENDATION FOR DECISION MAKERS

The key conclusions for decision makers within the industry included the following:

- Report on compatibility of road organisations' investment and spending commitments with the SDGs 2030 (e.g. indicators for resilience and maintenance planning, road safety performance linked to U.N. Decade of Action).
- The ITF Transport Outlook 2023 showed that the transport (road) sector isn't on track to achieve Paris Agreement's goals; necessary acceleration in pursuing a low-carbon high ambition scenario globally to reduce emissions. Investment patterns will shift given sector's transition (roads will remain the largest share, more investments in rail and public transport). Policy and investment recommendations for a long-term vision-led planning for integrated sustainable transport systems and road infrastructure's quality, aligned with the U.N. SDGs and the Paris Agreement.
- The UNECE PPP and Infrastructure Evaluation and Rating System (PIERS) represents a methodology for governments and private sector to evaluate and score PPPs and infrastructure projects' quality based on their contribution to the SDGs, promoting sustainable and impactful infrastructure development. Enhancing their sustainability and attractiveness to catalyse investments, including for the road sector.
- Pivotal role of the MDBs (WB, EBRD, ADB) in mobilizing finance for the road sector, with specific sustainable finance programmes embedding sustainable aspects. Access to capital markets, strong support to the ESG bond market (e.g. green and road safety bonds).

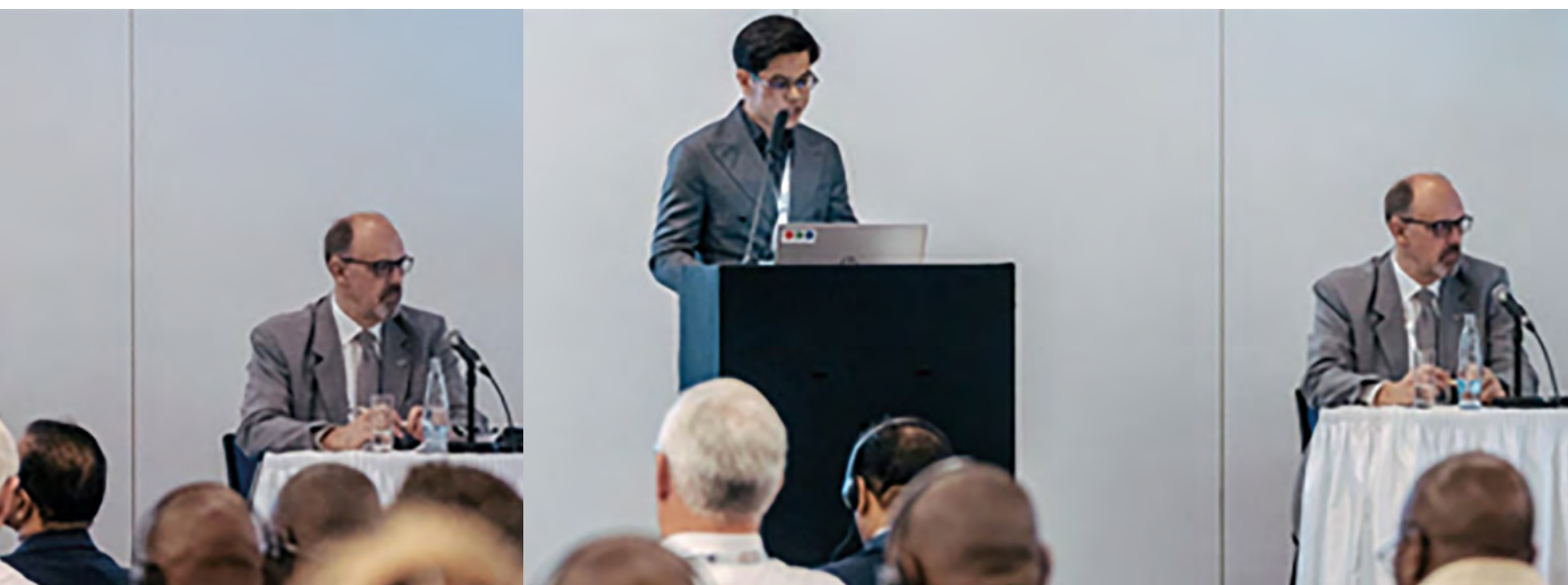
- Adoption of main international sustainable taxonomies and standards.
- Concerted action with leading international institutions and organizations, also improving capacity building (policy support programmes).

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

The overarching conclusions for PIARC and other international organisations included:

- International policies aligned with the SDGs, sustainable funding and financing of the sector, its progressive transition, climate change adaptation and resilience can only be achieved globally working together. Therefore, it is recommended that PIARC/World Road Association, with its committees and global network, could continue to pursue an effective and coordinated collaboration with leading international institutions and organizations, as for this Foresight Session.
- Interconnected common challenges faced by the sector worldwide; fundamental focus on specific necessities for different categories of countries (e.g. developed / developing countries) and geographical areas.

With the aim of incentivizing the sharing of common knowledge, updated information, successful action plans in the sector about these crucial topics, it would be relevant realizing joint high-level international policy guidelines and studies. Focussing on sustainability and innovations; considering market's developments and best practices, aligning multiple information.



# Foresight session 02

## Harnessing artificial intelligence and big data for safer and optimized road mobility

**Artificial Intelligence (AI) and Big Data are at the forefront of a transformational shift in the way transportation agencies conceptualize, plan, and implement essential road services. Powered by Machine Learning (ML) algorithms, these emerging technologies are supplanting decades-old, rigid methodologies based on limited variables and inflexible formulas. Unlike these traditional approaches, AI-driven methods offer the flexibility to continuously adapt, providing ever-improving solutions as they process increasingly vast and complex sets of data.**

**This session aimed to equip road agencies with foundational knowledge in AI and Big Data, by delving into both theoretical frameworks and practical applications for mining road asset and traffic data. It focused on leveraging this invaluable information to make informed decisions in the realms of predictive road maintenance and enhanced safety management.**

**Participants left the session with a nuanced understanding of current capabilities, as well as a forward-looking perspective on upcoming advancements. Most importantly, attendees will be wellpositioned to spearhead or contribute to initiatives that utilize AI and Big Data for the creation of safer and more efficient road systems.**

## Foresight session 02 Harnessing Artificial Intelligence & Big Data for Safer & Optimized Road Mobility

### TOPIC OF THE SESSION

Artificial Intelligence (AI) and Big Data are at the forefront of a transformational shift in the way transportation agencies conceptualize, plan, and implement essential road services. Powered by Machine Learning (ML) algorithms, these emerging technologies are supplanting decades-old, rigid methodologies based on limited variables and inflexible formulas. Unlike these traditional approaches, AI-driven methods offer the flexibility to continuously adapt, providing ever-improving solutions as they process increasingly vast and complex sets of data.

This comprehensive session equipped road agencies with foundational knowledge in AI and Big Data, by delving into both theoretical frameworks and practical applications for mining road asset and traffic data. The focus was on leveraging this invaluable information to make informed decisions in the realms of predictive road maintenance and enhanced safety management.

Visual reminder: Foresight session 02 Harnessing artificial intelligence & big data for safer and optimized mobility, Tuesday October 3, 2023



Participants gained a nuanced understanding of current capabilities, as well as a forward-looking perspective on upcoming advancements. Most importantly, attendees were well-positioned to spearhead or contribute to initiatives that utilize AI and Big Data for the creation of safer and more efficient road systems.

## TECHNICAL FINDINGS

Key technical findings from the session:

- Road deaths and injuries continue to be unacceptably high around the world.
- The cost of road deaths and injuries are a significant economic burden, costing an estimated \$2.2 trillion annually worldwide, with a disproportionate share of this cost borne by low and middle income countries.
- Artificial intelligence and big data offer opportunities to significantly scale up safety analysis, planning and action.
- There are several promising examples of safety projects making use of a broad range of data and machine learning, including in Australia, Africa, Europe and the USA. Data sources include LIDAR surveys, satellite imagery, video imagery, travel time monitoring and asset databases.
- AiRAP offers the first road safety accreditation scheme for AI and big data approaches to safety assessments for infrastructure.
- There is a need to support countries in building capability to harness existing and new sources of data for large scale safety analyses. This includes identifying complementary benefits of advanced data collection programs that cross several sectors including road safety, asset management and commercial applications.
- AI, Computer Vision, and Big Data technologies are mature enough to provide real-time, accurate information for effective, economically responsible, and sustainable decision-making.

- GIS contributes to high-quality training datasets for AI models.
- Using AI to detect and categorize road distresses, enhancing inspection efficiency
- There is a need to find adaptable solutions that ensure cost savings, and data privacy.

## RECOMMENDATION FOR DECISION MAKERS

Key recommendations for decision makers:

- Make the Safe System Approach the basis for action on Road Safety.
- Adopt the voluntary UN Global Road Safety Performance Targets, as set out in the Global Plan for the Decade of Action for Road Safety 2021–2030.
- Identify opportunities to pilot test advanced data collection techniques, including through collaboration with the private sector.
- Build a business case for investment in advanced data collection by identifying complementary benefits that cross not only road safety and asset management but also other sectors including, for example, energy and drainage management, and use planning, environment planning and commercial applications.
- Prioritize long-term investments in AI to advance transportation technologies.
- Develop effective methods for collaboration between human experts and AI systems.
- Address ethical, legal, and societal implications of AI in transportation.
- Establish standards and benchmarks to evaluate AI technologies.



## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

The international community bears a critical responsibility in reducing global road traffic fatalities and injuries. Many nations struggle with the necessary resources for effective road safety initiatives. International donors and financiers can significantly contribute by supporting various projects, including infrastructural improvements. Countries excelling

in road safety, along with international organizations, should offer technical assistance, knowledge sharing, and training to others. This global cooperation and coordination can be further bolstered by organizations like PIARC, which can establish standardized data management and AI application frameworks in transport, foster international research partnerships, and develop comprehensive capacity-building programs. Such collaborative efforts are essential for enhancing global road safety, efficiency, and sustainability.

# Foresight session 03 Enhancing transportation equity globally: outlook, challenges and future issues

**The concept of equity per the World Health Organization is “the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically or geographically.”**

**In the context of the work done or impacted by transportation investments, policies, programs, and services this can generate lengthy, multi-layered, and intersectional conversation about how to develop solutions, who are the owners, stakeholders, and partners, when is the most effective time to include the various roles in the process of determining what, when, where, and how much to spend. Throughout the global transportation sector there are initiatives to address the various attributes of equity.**

**This Foresight Session brought together representatives who in the first part discussed the “why” of addressing equity in transport. This part presented the historical role of equity in transportation, the current state of policies, research, and activities. It also provided case studies that establish the framework for global framing of equity in transport. Lastly it included identification of the challenges to address the cultural, social, economic, demographic, and geographic attributes of equity and identify areas for application of current research.**

**The second part focused on the typology of transport equity, future research focusing on development of metrics, data collection (quantitative and qualitative data) and responses**

Visual reminder: Foresight session 03 Enhancing Transportation Equity Globally: Outlook, Challenges and Future Issues, Tuesday October 3, 2023

to the “why” of addressing equity in transportation. It ended with a Call to Action.

The panelists presented the work underway in the United States, Europe, Africa, and the Asian Pacific regions.

## Foresight session 03 ENHANCING TRANSPORTATION EQUITY GLOBALLY: OUTLOOK, CHALLENGES, AND FUTURE ISSUES

### TOPIC OF THE SESSION

The concept of equity per the World Health Organization is “the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically or geographically.”

In the context of the work done or impacted by transportation investments, policies, programs, and services this can generate lengthy, multi-layered, and intersectional conversation about how to develop solutions, who are the owners, stakeholders, and partners, when is the most effective time to include the various roles in the process of determining what, when, where, and how much to spend. Throughout the global transportation sector there are initiatives to address the various attributes of equity.

This Foresight Session focused on the approaches and need to address equity in the transport sector in the past, currently, and in the future. Experiences were shared from Benin, Uganda, Sweden, the European Council of Transport Institutes (ECTRI), PIARC (World Road Association) and the Transportation Research Board (TRB).

The topic of equity has been designated an emphasis area by the PIARC Executive Board and by many of the members of the PIARC Road Congresses. Equity is important in the areas of services and facilities provided by road transport agencies, workforce attraction, recruitment, and retention, as well as the ongoing relationships with those who use transport services, investments, are impacted by policies, project selection or delivery.

### TECHNICAL FINDINGS

PIARC’s Secretary General opened with the why of the prioritization of the topic.

- No singular definition for Transportation Equity.

- Cardinal Directions – Be Intentional, Acknowledge, Prioritize, and Respect overburdened populations, Implement authentic actions, Recognize equity as a dynamic and ever evolving practice.
- A thriving society is dependent on a transport system that serves and benefits all.
- The explicit addressing of social and environmental plans is new to transport agencies and will continue to evolve in the future.

### RECOMMENDATION FOR DECISION MAKERS

There is a need to recognize and strive to provide equitable outcomes for all when making road transport decisions for investments, policies, and project related actions.

Equity is not a destination but a journey that all road users and transport stakeholders and owners will need to continually travel.

Equity considerations help in the communication of the value of transport to the economy, the social good.

Establish the who the investment is intended, assess the benefits and burdens using a rigorous methodology and determining the sustainability of the actions.

Shift toward a performance based rather than prioritization-based decision-making model.

Establish accountability mechanisms for assessing the agency’s performance.

### RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

Need to develop tools that balance the benefits and burdens to all the customers/users/owners of the transport system. This will require collaboration with land use and economic impact agencies/organizations.

Develop and use data driven tools for determination of needs and solutions. Integration with data managers will be important.

Make the case for the value of transport investments through collaboration with economists, environmentalists, customers of the services, facilities, and policies of the transport system.

# Foresight session 04

## Latin american and caribbean rural roads: a gateway to development

As 90% of the rural road network in Latin America and the Caribbean is unpaved, most rural inhabitants lack decent mobility, thus hindering the exercise of various human rights such as access to education, health, culture, and work (OHCHR 2008). This situation leads to the emigration of rural dwellers to cities, causing uprooting of families and the growth of megacities.

Rural transport infrastructure contributes to national cohesion and a more balanced territorial occupation. They are often the only manifest government intervention in remote areas – whose inhabitants traditionally exhibit a feeling of abandonment – and the precursor of other services such as drinking water, electricity, and telecommunications.

The objective of this session was to highlight the social benefits that rural road programs generate in Latin America and the Caribbean. They usually demand rather modest investments, although they can promote productive,

institutional, and socially inclusive and sustainable transformations, contributing to sustainable development and the creation of new job opportunities.

During this session, CAF presented its newly publication Rural Roads, A Door to Development and territorial connectivity. This document includes guidelines for the construction of these important low-traffic roads. Latin American experiences with a strong impact on development were also shared.

Ministers and authorities from Latin America and the Caribbean gave their viewpoints on institutional challenges in the rural road network.

### Foresight session 04

#### LATIN AMERICAN AND CARIBBEAN RURAL ROADS: A GATEWAY TO DEVELOPMENT

Visual reminder: Foresight session 04 Latin american and caribbean rural roads: a gateway to development, Tuesday October 3, 2023





# Foresight session 05

## Safe designs and speeds for active mobility and multimodal transport

**The Global Plan for the Decade of Action for Road Safety 2021–2030 sets a target of halving deaths and injuries by 2030, and jurisdictions are increasingly aiming to achieve vision zero by 2050. With more than 70% of the global population expected to live in urban settings by 2030, ensuring that road designs and speeds are fundamentally safe for all modes, abilities, and journeys in villages, towns and cities will be essential in achieving not only safety targets but also in facilitating efficient movement of large and growing populations and minimising climate and environmental impact.**

**In this session participants discussed recent experience in the application of safe system approaches to creating environments that promote active mobility and multimodal transport. They also shared updates on tools that help planners, designers and managers create safe roads and streets.**

### Foresight session 05

#### SAFE DESIGNS AND SPEEDS FOR ACTIVE MOBILITY AND MULTIMODAL TRANSPORT

##### TOPIC OF THE SESSION

The Global Plan for the Decade of Action for Road Safety 2021–2030 sets a target of halving deaths and injuries by 2030, and jurisdictions are increasingly aiming to achieve vision zero by 2050. With more than 70% of the global population expected to live in urban settings by 2030, ensuring that road designs and speeds are fundamentally safe for all modes, abilities, and journeys in villages, towns and cities will be essential in achieving not only safety targets but also in facilitating efficient movement of large and growing populations and minimising climate and environmental impact. In this session participants discussed recent experience in the application of safe system approaches to creating environments that promote active mobility and multimodal transport, and share updates on tools that help planners, designers and managers create safe roads and streets.

##### TECHNICAL FINDINGS

Key technical findings from the session:

- Road deaths and injuries continue to be unacceptably high in many cities around the world.
- 59% of participants in the session said that since COVID numbers of pedestrian and bicycle crashes have increased.
- Some of the most significant barriers to creating safe speeds identified by session participants include: politics, funding, narrow streets and driver behaviour.
- Session participants identified lack of safety as the main reason discouraging people from using cycling as a transport mode (ahead of not practical, physically tiring, long trips, and lack of parking)
- Changing street design can send signals to drivers that they should travel more slowly, while giving vulnerable road users more space.
- Evidence shows that as kilometres of bicycle lanes are increased, more people bicycle, and bicyclist risk tends to decrease.
- There are extensive case studies from around the world where safety to support multimodal transport has been dramatically improved through intersection designs and speed reductions. These include in Addis Ababa, Mumbai, Bogota, and Fortaleza.
- In Fortaleza, changes to street designs and reducing speed limits from 60km/h to 50km/h led to a 42% reduction in injury crashes and 83% reduction in pedestrian crashes.
- There are freely available tools to support decision makers, planners and designers, including iRAP, Cycle RAP and Star Ratings for Schools (SR4S), and new tools are being developed in the EU-funded PHOEBE project.

##### RECOMMENDATION FOR DECISION MAKERS

Key recommendations for decision makers:

- Make the Safe System Approach the basis for action on Road Safety. In particular, prioritise the safety of people ahead of travel times for vehicles.
- Adopt the voluntary UN Global Road Safety Performance Targets, as set out in the Global



Plan for the Decade of Action for Road Safety 2021–2030.

- Invest in infrastructure and safe speed limits to support safer walking and cycling is a priority.
- Use successful case studies from the world as models to adapt for local implementation.
- Develop plans for improvements that can be implemented as soon as the opportunity arises.
- Make use of evidence-based tools to support planning, design, implementation and evaluations.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

The international community has a responsibility to help reduce road traffic deaths and injuries in all countries. Road safety initiatives require investments, and many countries lack the resources to implement them effectively. International donors and financiers can provide financial support for a variety of road safety initiatives, including infrastructure improvements. International organizations and countries performing well in road safety can provide technical assistance to help countries implement road safety best practices, including knowledge sharing and training for government officials and other stakeholders. The international community can also countries by promoting global cooperation and coordination on road safety issues and sharing good practice.

Visual reminder: Foresight session 05 Safe designs and speeds for active mobility and multimodal transport, Tuesday October 3, 2023



# Foresight session 06

## Game-changing trends in road project delivery

**Emerging technologies are poised to revolutionize not just how we use the roadways of the future, but also how we design and construct them. Organizations that effectively harness the power of Building Information Modelling, construction automation, and advanced decision-support tools will experience a significant transformation in their operational efficiency and financial performance.**

**Designed as an interactive stakeholder roundtable, this forward-looking session explored groundbreaking trends and dissected their implications, fostering enhanced collaboration between road agencies and contractors.**

### Foresight session 06

#### GAME-CHANGING TRENDS IN ROAD PROJECT DELIVERY

#### TOPIC OF THE SESSION

Emerging technologies are poised to revolutionize not just how we use the roadways of the future, but also how we design and construct them. Organizations that effectively harness the power of Building Information Modelling, construction automation, and advanced decision-support tools will experience a significant transformation in their operational efficiency and financial performance. Designed as an interactive stakeholder roundtable, this forward-looking session will explore ground-breaking trends and dissect their implications, fostering enhanced collaboration between road agencies and contractors.

#### TECHNICAL FINDINGS

- Space data, particularly GNSS and EO, are instrumental for innovation in road and mobility projects. They offer valuable capabilities for environmental impact monitoring, infrastructure planning, and monitoring. Space data provides precise positioning, timing, and historical data, all available free of charge.
- To achieve efficient and rapid project completion, it is recommended to employ innovative project

delivery techniques, ground-breaking physical advancements and a robust safety culture.

- GEO-AI solutions can help road authorities to keep up to date with the quality of the infrastructure.
- The concept of Building Infrastructure Information Modelling (BIM) can improve the planning and execution of infrastructure projects.

#### RECOMMENDATION FOR DECISION MAKERS

- Collaboration between space agencies, road market stakeholders, and providers is essential for harnessing these capabilities. Investments in research and development are crucial to address road-related challenges.
- To enhance environmental sustainability during the construction phase and to ensure greater safety for road users, it is recommended to prioritize innovative approaches and safety protocols.
- It is advisable to consider the adoption of BIM and parametric design in infrastructure projects, along with the exploration of digital twin models, to improve project efficiency and effectiveness.

#### RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

Overall, the recommendations encompass the importance of leveraging space data, embracing innovation, ensuring safety, democratizing technology, and adopting advanced technologies like BIM and parametric design in the road and infrastructure sector.



Visual reminder: Foresight session 06 Game-changing trends in road project delivery, Tuesday October 3, 2023

# Foresight session 07

## Envisioning scenarios for global supply chains and what they mean for national road authorities

**The COVID-19 pandemic brought global supply chains to the forefront of attention. The re-industrialisation of many countries to build more resilience continues to reshape our networks. These build on pre-existing developments around digitalisation, decarbonisation, automation, demographics and consequences of a changing climate. Freight being an important factor in sustainable development and of logistics as a glue for a cohesive and vibrant society, Therefore, for governments and national road authorities it is essential to have an understanding of these ongoing developments. Considerations include the possible need to replan freight corridors to reflect changing routes and priorities. In addition, new services for the electrification and digitalisation of road freight and its better integration into the entire supply chain are required.**

**This session, in two parts, first considered the scenarios envisioned by key actors in the global logistics sector and subsequently the consequences for road network operators. The session focused on improving understanding and developing dialogue. This interactive session established a basis on which interaction will continue in future PIARC and other stakeholder activities (eg CEDR COMPASS, TRB/AASHTO Moonshot).**

### Foresight session 07

#### ENVISIONING SCENARIOS FOR GLOBAL SUPPLY CHAINS AND WHAT THEY MEAN FOR NATIONAL ROAD AUTHORITIES

##### TOPIC OF THE SESSION

Issues presented:

1. Findings and recommendations on how to anticipate new trends in production, trade and transport.

2. Findings and recommendations on how to build roadway systems for resilient supply chains.

Importance:

The recent re-industrialisation together with the COVID-19 pandemic brought global supply chains to the forefront of attention and made countries all over the world reshape their networks in an attempt to build more resilience. This global reshaping includes developments around digitalisation, decarbonisation, automation, demographics and climate change, among others.

For National Road Authorities, it is of utmost importance to have a complete understanding and consequences of the ongoing developments described above.

##### TECHNICAL FINDINGS

Findings on how to anticipate new trends in production, trade and transport:

- Post COVID-19 supply chain disruptions have created new trends including: chip, driver and warehouse worker shortages, port congestion, longer delivery times etc.
- Production – the main current trends identified in production are: concentration (economy of scale), automation and specialisation (specialised producers); all the three trends mean more outputs.
- Trade: the fall of trade barriers (tolls, legal insecurity, communication and transport costs) has led to increased international trade, national transport and again more outputs.
- Transport – main trends / actions to build resilience are: dual sourcing of raw materials, increased inventory of critical products, nearshoring and expanding suppliers' base and regionalising supply chain
- Other trends:
  - influx of people into cities will continue (urbanisation);
  - sharp increase of light goods vehicles (and decreased use of large vehicles);
  - sharp increase of e-commerce;

- personnel-intensive transport leading to cost-intensive transport – new automated and industrialised processes can be a solution.

Findings on how to build roadway systems for resilient supply chains:

- Support of robust international trade – more efficient private sector operational decisions and better adjustment to large-scale disruptions including COVID-19.
- Accurate customer service level expectations at general public and freight industry levels.
- Funding and support for electric vehicle charging infrastructure, hydrogen / propane / natural gas fueling infrastructure, reduction of truck emissions at port facilities, retrofit of vehicles etc.
- Improvement of road safety: reduction of serious injuries and fatalities through the safe system approach, safe (and secure) track parking facilities with more capacity etc.
- Workforce issues and skills – expedition of commercial motor vehicle driver licensing, increase of diversity of driver pool and recruitment, increase of quality of driver experience etc.
- Use of available digital services: truck parking information and appointments systems at ports, border wait time information, real-time travel information systems, intelligent access, freight automation etc.

## RECOMMENDATION FOR DECISION MAKERS, PIARC AND INTERNATIONAL ORGANISATIONS

Recommendations on how to anticipate new trends in production, trade and transport and how to build roadway systems for resilient supply chains:

The global reshaping of road networks due to recent developments such as the re-industrialisation and the COVID-19 pandemic has proved the need to replan freight corridors to better reflect the global changing routes and priorities. In this context, new services and actions for the necessary digitalisation, electrification and overall efficiency of road freight as well as its better integration into the entire supply chain are required.

Detailed recommendations:

- Trade: take actions to anticipate the global trade blocks and relationships which will emerge and stay and understand how these will influence value and supply chains.
- Urbanisation: consider and analyse the involvement and impact of freight in cities' transformation and the future redistribution of public space.
- Electrification / decarbonisation: act to support the electric vehicle charging infrastructure, hydrogen / propane / natural gas fueling infrastructure and reduce the overall truck emissions.
- Road safety: take actions to reduce serious injuries and fatalities through the safe system approach and promote safe (and secure) track parking facilities with more capacity.
- Digitalisation: foster the use of new technologies, data and automation – e.g. real-time information systems, intelligent access and freight automation.

Workforce and skills: take actions to expedite and make more transparent the commercial motor vehicle driver licensing, increase the diversity of driver pool and recruitment and provide better training for truck drivers.



Visual reminder: Foresight session 07 Envisioning scenarios for global supply chains and what they mean for national road authorities, Wednesday October 4, 2023



# Foresight session 08

## Mobilising investments and partnerships to deliver impact in road safety

**Road crashes are the biggest killer of young people worldwide. More than 100,000 people are killed and injured on the world's roads every day. The proven, high-return and evidence-based infrastructure solutions to save lives exist. Yet, there is currently a significant underfunding of infrastructure for road safety and a latent need to mobilize private financing and partnerships that deliver. It is estimated that an additional US\$260 billions of financing will be required to achieve the road safety related Sustainable Development Goals (SDGs) 3.6 and 11.2 in low and middle-income countries (LMICs) over the coming decade.**

**This session explored the business case for investment in safer roads and mechanisms by which the investments and partnerships – necessary to achieve the target of the Decade of Action – can be mobilised.**

**The session addressed the following questions:**

- **What's the business case for investments in safer roads and how does it translate in different regions of the world?**
- **How to create a conducive environment for private sector to engage?**
- **How can private investments be mobilised to close the funding gap?**

## Foresight session 08

### Mobilising Investments and Partnerships to Deliver Impact in Road Safety

#### TOPIC OF THE SESSION

Road crashes are the biggest killer of young people worldwide. More than 100,000 people are killed and injured on the world's roads every day. The proven, high-return and evidence-based infrastructure solutions to save lives exist. Yet, there is currently a significant underfunding of infrastructure for road safety and a latent need to mobilize private financing and partnerships that deliver. It is estimated that an additional US\$260 billions of financing

will be required to achieve the road safety related Sustainable Development Goals (SDGs) 3.6 and 11.2 in low and middle-income countries (LMICs) over the coming decade. This session explores the business case for investment in safer roads and mechanisms by which the investments and partnerships – necessary to achieve the target of the Decade of Action – can be mobilised.

#### TECHNICAL FINDINGS

Key technical findings from the session:

- Road deaths and injuries continue to be unacceptably high around the world.
- The cost of road deaths and injuries are a significant economic burden, costing an estimated \$2.2 trillion annually worldwide, with a disproportionate share of this cost borne by low and middle income countries.
- There is a significant shortfall in investment in road safety. The multilateral development banks (MDB) estimate that up to \$700 billion over 10 years is needed to fill the gap, equating to almost 10% of more than US\$800 billion that is estimated to be invested globally in road infrastructure each year.
- Investment in safer roads would generate significant returns. Achieving Global Road Safety Performance Target 4 (more than 75% of travel on roads rated 3 stars or better) would prevent 460,000 deaths each year with a benefit cost ratio of 7.6.
- The mobilisation of partnerships involving both public and private sector partners is essential.
- There are several good examples from around the world of partnerships that have mobilised investment for safety including:
  - in innovative concession road agreements in Brazil that embed financial rewards for exceeding Star Rating targets;
  - in Tanzania where the Ten Step Plan Project built significant capacity to leverage investment for safety;
  - in companies such as Holcim which have achieved outstanding safety performance of drivers in low- and middle-income countries (often outperforming high income countries)
  - in private sector road safety coalitions like those initiated by TotalEnergies and IRF in Tanzania,



Morocco, Zambia, Pakistan, India, coordinating efforts to build awareness and local capacity.

- in Mexico where Aleatica Foundation has been established and is making an active contribution to safety performance of both Aleatica assets and road safety more broadly;
- projects funded by the UN Road Safety Fund, including helping to make the business case for investment in affordable, large-scale road improvements.
- IFC has led significant work on the development of innovative mechanisms for financing road safety, that could unlock significant private sector engagement including Sustainability Linked Financing (SLF), and development banks such as World Bank and ADB are increasingly focusing on Results Based Lending.
- There are also potential lessons that road safety may take from other sectors such as funds to support climate change impact.
- There is a need to support countries in building investment-ready projects that can link with various forms of finance.

## RECOMMENDATION FOR DECISION MAKERS

Key recommendations for decision makers:

- Make the Safe System Approach the basis for action on Road Safety.
- Adopt the voluntary UN Global Road Safety Performance Targets, as set out in the Global Plan for the Decade of Action for Road Safety 2021–2030.
- Ensure that the linkages between investment in road safety and costs of road crashes, particularly on the health sector, are well understood and considered in transport planning decisions.

- Explore innovative solutions to help mobilize funding to save lives on the road, including with the private sector.
- Build capacity to plan projects that can leverage a range of financing options.
- Develop investment-ready projects that can be implemented as soon as the opportunity arises.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

The international community has a responsibility to help reduce road traffic deaths and injuries in all countries. Road safety initiatives require investments, and many countries lack the resources to implement them effectively. International donors and financiers can provide financial support for a variety of road safety initiatives, including infrastructure improvements. International organizations and countries performing well in road safety can provide technical assistance to help countries implement road safety best practices, including knowledge sharing and training for government officials and other stakeholders. The international community can also support countries by promoting global cooperation and coordination on road safety issues and sharing good practice.



Visual reminder: Foresight session 08 Mobilising investments and partnerships to deliver impact in road safety, Wednesday October 4, 2023

# Foresight session 09

## Physical and digital infrastructure to facilitate large-scale CCAM adoption for all

**The development of automated functionalities in the road transport sector industry has been sparked by the quick development of new technologies on the one hand, and the ongoing demand for safe, clean, comfortable, efficient, and sustainable transportation on the other. Despite much hype, the future of automated mobility isn't about the autonomous vehicles themselves, but in what they can offer when fully integrated with the whole mobility ecosystem, including the road infrastructure. What's the value that AVs bring to the sector, and what are the gains they provide to road authorities in terms of safety, green and efficient mobility?**

**What's the role that road infrastructure plays in supporting and enhancing the capabilities of Cooperative, Connected and Automated Mobility (CCAM) solutions in large scale deployment? This session's goal was to critically examine the 'business case' for road authorities to invest in supporting CCAM and the supporting Physical and Digital Infrastructure (PDI) initiatives. The session utilised knowledge from the US and Europe to illustrate principles through completed and ongoing projects (e.g. TM4CAD, AUGMENTED CCAM, HI-DRIVE), and discussed the real needs of infrastructure owners and operators preparing for the decades to come.**

### Foresight session 09

#### PHYSICAL AND DIGITAL INFRASTRUCTURE TO FACILITATE LARGE-SCALE CCAM ADOPTION FOR ALL

##### TOPIC OF THE SESSION

The session addressed issues concerning the development of automated functionalities in the road transport sector and emphasized the critical role of infrastructure. The significance lies at the intersection of rapid technological advances

and the growing demand for safe, clean, efficient, and sustainable transportation. Key points include the recognition that the future of automated mobility extends beyond autonomous vehicles to their integration within the broader mobility ecosystem.

The importance of these issues is underscored by the potential value that autonomous vehicles bring to the sector, encompassing enhanced safety, reduced environmental impact, and overall transportation efficiency. The session highlighted the critical role of road infrastructure in supporting and enhancing Cooperative, Connected, and Automated Mobility (CCAM) solutions, emphasizing that the success of automated mobility is intricately linked to the adaptability and scalability of the supporting infrastructure.

The session also aimed to critically evaluate the 'business case' for road authorities to invest in supporting CCAM and related Physical and Digital Infrastructure (PDI) initiatives. Insights from completed and ongoing global projects, such as TM4CAD, AUGMENTED CCAM, and HI-DRIVE, provided practical illustrations and showcased the real needs of infrastructure owners and operators preparing for the future.

In essence, the session emphasized the need for a strategic and holistic approach to automated mobility and infrastructure integration. Decision-makers are urged to consider the broader value proposition, invest wisely in supporting technologies, and engage in long-term planning to navigate the evolving landscape of transportation effectively.

##### TECHNICAL FINDINGS

The development of automated functionalities in the road transport sector demands a shift in focus from individual autonomous vehicles to the integration of AVs within the broader mobility ecosystem. The benefits of these advancements rely heavily on the supportive role of road infrastructure and necessitates strategic investment by road authorities in CCAM and related infrastructure initiatives.

In particular, these four points are the key findings of the session:

## Value of Automated Mobility Beyond Vehicles:

The true potential of automated mobility lies not just in the autonomous vehicles themselves but in the comprehensive benefits they bring to the sector. The session suggests that road authorities should explore the value AVs can offer in terms of safety, environmental sustainability, and overall efficiency in transportation.

## Critical Role of Road Infrastructure:

Road infrastructure emerges as a critical factor in supporting and enhancing Cooperative, Connected, and Automated Mobility (CCAM) solutions at a large scale. The discussion implies that the success of AV deployment is intrinsically linked to the capability and adaptability of the road infrastructure.

## Business Case for Road Authorities:

The session aims to critically evaluate the 'business case' for road authorities to invest in supporting CCAM. This involves considering the gains in safety, environmental impact, and efficiency that can be achieved through coordinated efforts in both physical and digital infrastructure initiatives.

## Long-term Planning for Infrastructure Owners and Operators:

The session recognizes the need for infrastructure owners and operators to prepare for the decades to come. This implies that the deployment of CCAM solutions requires long-term planning, emphasizing the importance of forward-thinking strategies in developing and maintaining physical and digital infrastructure.

## RECOMMENDATION FOR DECISION MAKERS

### Holistic Integration Strategy:

Embrace a holistic integration strategy for automated mobility. Recognize that the true potential lies not only in autonomous vehicles but in their seamless integration with the broader mobility ecosystem.

### Long-term Planning for Sustainable Deployment:

Recognize that successful deployment of CCAM requires long-term planning. Infrastructure owners and operators should develop forward-thinking

strategies that align with the evolving landscape of automated mobility over the coming decades.

## Knowledge Sharing and Collaboration:

Foster knowledge sharing and collaboration between decision-makers, industry experts, and stakeholders. Utilize examples from completed and ongoing projects, such as TM4CAD, AUGMENTED CCAM, and HI-DRIVE, among others, to inform decision-making and promote best practices.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

### Establish International Standards:

Encourage the development and adoption of international standards for automated mobility and infrastructure. Standardization will facilitate interoperability, enhance safety, and streamline the global integration of autonomous technologies.

### Facilitate Knowledge Sharing Platforms, and Invest in Education and Training Programs:

Create and support platforms for international knowledge exchange and collaboration. Establish forums where stakeholders, experts, and policymakers can share insights, best practices, and lessons learned from various regions to accelerate progress. Allocate resources to education and training programs that enhance the skills of professionals in the field of automated mobility. Support initiatives that promote a global workforce well-versed in the development, deployment, and maintenance of autonomous technologies.

### Promote Cross-Border Research and Development, including Data Sharing:

Foster collaborative research and development initiatives that transcend national boundaries. Encourage partnerships between organizations, governments, and industries to pool resources, expertise, and innovation for the advancement of automated mobility. Furthermore, advocate for responsible and secure data sharing practices. Facilitate mechanisms for international organizations to share anonymized data for research purposes, enabling a more comprehensive understanding of the performance and impact of automated mobility solutions.



Visual reminder: Foresight session 09 Physical and digital infrastructure to facilitate large-scale CCAM adoption for all, Thursday October 5, 2023

# Foresight session 10

## Engineers and environmentalists teaming up for a more sustainable and biodiversity friendly mobility

**Defining and developing sustainable transport is a critical societal and global challenge transport is facing in this century. Roads have an important part to play in achieving sustainability and tackling the sustainable development goals (SDG) and its components such as biodiversity preservation, climate action, adaptation, energy transition or resilience. Connected economies, societies, and nature with safer roads for road users and wildlife are a shared ambition for both the engineering and environmental sectors.**

**In line with these challenges PIARC's Environmental Sustainability committee (TC 3.4) and IENE, the Infrastructure and Ecology Network Europe, organized this foresight session deliberately positioned at the nexus of a changing transport sector. This foresight session aimed to address global biodiversity and sustainability challenges (climate, energy, resilience, etc.) by strengthening cross-sectoral collaboration. It notably highlighted two PIARC work streams carried out during 2020–2023:**

- **Sustainability of transport and mobility for societies and economies and**
- **Interaction of transport with wildlife habitats and corridors.**

## Foresight session 10 ENGINEERS AND ENVIRONMENTALISTS TEAMING UP FOR A MORE SUSTAINABLE AND BIODIVERSITY FRIENDLY MOBILITY

### TOPIC OF THE SESSION

Defining and developing sustainable transport is a critical societal and global challenge and roads have a protagonist role to play in achieving the Sustainable Development Goals (SDG) addressing crucial components of sustainability such as biodiversity preservation, climate adaptation, energy transition and resilience. In line with these challenges this foresight session was organized

at the nexus of achieving connected economies, societies and nature with safer roads for road users and wildlife.

Recognizing the lack of mainstreaming of biodiversity in the transport sector PIARC TC 3.4. and IENE cooperated in various events during 2019–2023. This foresight session – short titled “sustainable mobility and biodiversity” – addressed the common responding to the global challenges highlighting the urgent need for cooperation between engineering and environment on sustainable transport in the 21<sup>st</sup> Century in order to overcome existing gaps and barriers.

Three questions opened the discussion with the audience of the session:

1. Why is biodiversity still not part of sustainable transport and how can it be included?
2. What are the main challenges for cooperation between engineering and environment in 21<sup>st</sup> Century on sustainable transport?
3. How can we cooperate in order to overcome gaps and barriers?

### TECHNICAL FINDINGS

The summary of the overall discussion with the participants of the session includes the following themes:

1. There is lack of awareness for including biodiversity in sustainability considerations in a multiple level from the policy and decision-making level to the implementation of the transport project in practical level.
2. Transport networks must be evaluated in same map of ecological networks realizing the need of an “ecosystem approach” that “resiliency of transport can only be achieved in resilient ecosystems”.
3. Safe transport networks must secure the mobility of both societies and wildlife species so “safe roads for wildlife mobility are safe roads for societies”:
  - In low-income countries “roads mean access” for local communities. The challenge to avoid the fragmentation of the ecosystems does not mean to “not build a road” but “how to build a road” in the most appropriate way. Access

to poaching and animal trafficking is also a critical issue in the key biodiversity areas of these countries.

- In countries with existing and developed transport infrastructure and already fragmented ecosystems a “defragmentation approach” needs to be adopted in their policies.
4. Sustainable financing is crucial ensuring the budgeting of mitigation and compensation of the environmental impacts, which must be considered in the early strategic planning and policy making.
  5. Adopting sustainability in the transport development in all the spectrum of humans’ activities in 21<sup>st</sup> century is essential based on four basic pillars:
    - The social and cultural wellbeing of societies.
    - The resilience of economies in balance with nature.
    - The quality of the environment and the biodiversity conservation.
    - Keeping the impacts of human activities on environment reversible.

## RECOMMENDATION FOR DECISION MAKERS

For mainstreaming biodiversity in transport in an effective and sustainable way three main conditions must be addressed:

- Safe roads for wildlife mobility are safe roads for societies.
- Resiliency of transport and climate change adaptation can only be achieved in resilient ecosystems.

The investments for mitigation and compensation of impacts have to be related with economic losses of human lives and ecosystem services. To achieve safe, sustainable and biodiversity friendly transport infrastructure and mobility the following concepts must be recognized:

1. Genetic isolation and wildlife mortality as the main problem.
2. Habitat fragmentation and land degradation as the main cause.
3. Ecological and landscape connectivity as the main aim.
4. Green (Biodiversity) and Grey (Transport) Infrastructure as the main crossing point and conflict areas.
5. Sustainability as the main objective.
6. The Mitigation Hierarchy as the main solution.

These concepts must be expressed as concerns of political will and as critical environmental challenges that must be translated in political decisions for strategic planning, for appropriate impact assessment and design, as well as for effective

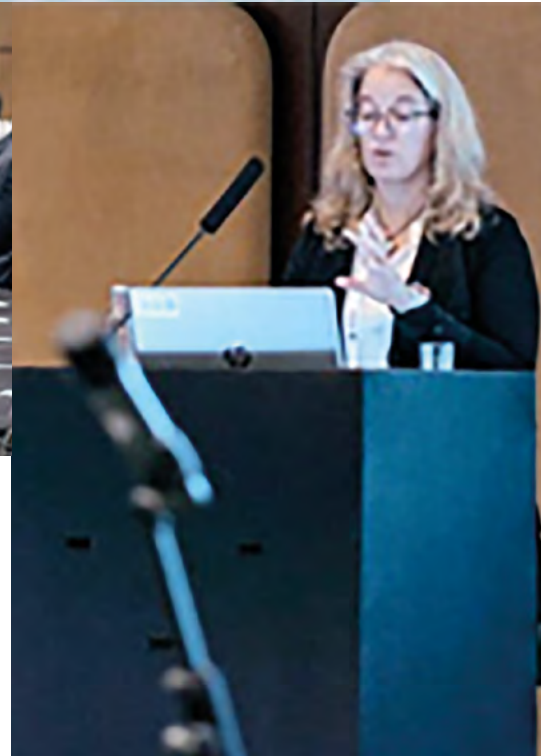
implementation during construction, operation, and maintenance of transport infrastructure.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

Main findings from the session can be summarised in the following recommendations:

1. The foresight session was accepted with a lot of interest and enthusiasm from the participants, which highlighted the importance of the initiative of PIARC and IENE cooperation. So, the PIARC – IENE cooperation must be pursued and further developed.
2. Crucial challenges that need to be addressed together in urgent and alerting status towards achieving sustainability on transport development are:
  - Achieving resiliency of infrastructure in resilient ecosystems.
  - Maintain the integrity of the ecosystems securing both the effectiveness of transport and ecological connectivity.
  - Implement the Mitigation Hierarchy assessing the level of reversibility of environmental impacts: when the level of reversibility is very low then avoid is the main choice, while when reversibility can be achieved in high or manageable level, mitigation or/and compensation can be decided.
3. Mapping and involving more stakeholders in international level is essential, especially on strengthening the cross-sectoral collaboration and breaking out the “professional silos”. Crucial target groups of stakeholders are:
  - Policy makers.
  - Banks and financiers.
  - International organization as Conventions or other Transport Organizations (e.g., UIC).

Developing legal, financial, and professional tools on mainstreaming biodiversity in transport sector is essential in all administrative levels (from internationally policy to local regional level) and geographical scales (from the international concerns of global changes to local practices of projects implementation), such as guidelines and standards of practical implementation of best practices.



Visual reminder: Foresight session 10 Engineers and Environmentalists teaming up for a more sustainable and biodiversity friendly mobility, Thursday October 5, 2023



# Foresight session 11

## A gender inclusive transport systém

**Transport, including roads, is not gender neutral- how we travel, when we travel and what transport mode we use differs between men and women. Road policy and strategy rarely recognizes the needs and priorities of all users. One reason for this is that women are underrepresented in the global transport workforce representing less than 20% of the global transport workforce.**

**This session explored the question What is (a) gender inclusive transport (system)? Speakers from different parts of the road and transport system provided examples and challenges regarding gender balance and equity in the transportation workforce as well as how gender considerations are and can be included in planning, design, construction and maintenance of transportation infrastructure. The first part of the session focused on gender balance and equity in transportation administrations and international transport agencies and in a second part speakers discussed the ways in which transport infrastructure is not gender neutral and what it means to incorporate a gender perspective in the planning, design, construction, maintenance of road transport. The session provided a variety of perspectives from around the world.**

### Foresight session 11

#### A GENDER INCLUSIVE TRANSPORT SYSTEM

#### TOPIC OF THE SESSION

Transport, including roads, is not gender neutral-how we travel, when we travel and what transport mode we use differs between men and women. Road policy and strategy rarely recognizes the needs and priorities of all users. One reason for this is that women are underrepresented in the global transport workforce representing less than 20% of the global transport workforce.

This session will explore the question What is (a) gender inclusive transport (system)? Speakers from different parts of the road and transport system will provide examples and challenges regarding gender balance and equity in the transportation workforce

as well as how gender considerations are and can be included in planning, design, construction and maintenance of transportation infrastructure. The first part of the session will focus on gender balance and equity in transportation administrations and international transport agencies and in a second part speakers will discuss the ways in which transport infrastructure is not gender neutral and what it means to incorporate a gender perspective in the planning, design, construction, maintenance of road transport. The session will provide a variety of perspectives from around the world.

#### TECHNICAL FINDINGS

Travel behaviour varies by gender, including elements such as trip purpose, distance, transportation mode, trip-chaining, and accompanied travel (e.g. with elderly or children/babies), and the number of stops are things to be considered. Women make up 15% of the transportation workforce, and currently gender stereotypes and job perception are barriers to attracting women to the transportation industry. Poor transport systems and services disproportionately affect women who cannot afford lost time, meaning an overall opportunity cost to society as women cannot access employment, education, and health. Women face a threat of gender-based violence and sexual violence, and have a higher likelihood of moderate and severe injuries in vehicle crashes (also affected pedestrians and cyclists) compared to men. Lack of transport is the greatest challenge to female labour force participation in developing countries, and female participation is reduced by approximately 16.5% due to this. In the UK, design of railway stations in a gender-responsive and inclusive way resulted in a return on investment of 2.4:1.

#### RECOMMENDATION FOR DECISION MAKERS

In order to overcome women joining the industry, consideration should be given to elements such as health and hygiene, personal safety, and sexual harassment. Women can be supported and retained by ensuring a positive work environment and culture, good work/life balance, training and career development, and focus to reduce the gender pay gap. Specific projects focussing on gender can have great rewards. For example, Asian Development

Bank (ABD)'s Rural Roads Improvement Project in Cambodia provided safe, cost effective and year round road access in remote agricultural areas. Women were able to access markets easier (better surfaces for wheeled carts) more quickly, with an increase in women's access to road construction jobs and a community-based road safety campaign. Road organisations should consider sanitary and hygiene facilities segregated by sex for women/men to improve women accessing jobs in the transport sector (e.g., truck drivers etc), as well as consideration for sex segregated facilities on public transport (e.g. women only train carriages or segregated bus areas), and anti-harassment signage in public transport stations. More widely, operators could consider reviewing travel routes and patterns of women, to accommodate routes that suit their needs.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

International organisations should consider gender-sensitive policies and regulations and provide capacity building and training projects to equip personnel. Data collection and analysis should be gender disaggregated to better understand the specific needs of women and men, and road infrastructure should be designed with this in mind. Women's participation should be promoted, via awareness raising of the importance of gender inclusion, mentorship programmes and consideration of community engagement. Gender checklists and toolkits can be used to review policies to ensure consideration of gender in policy design and implementation.



Visual reminder: Foresight session  
 11 A gender inclusive transport system,  
 Thursday October 5, 2023

# Foresight session 12

## Managing the energy transition: scaling up deployment of ev charging infrastructure

Strategies to set the world on a net-zero carbon trajectory look at electrification of transport as one of the key instruments to achieve this ambitious target. Many higher income countries have made major commitments to deploy Electric Vehicles (EVs) and the necessary charging infrastructure. How are road agencies addressing the technical, social, political, and economic issues related to such a major undertaking? For the low-and-middle income countries, the transition to electric mobility brings additional benefits in terms of air quality, last-mile connectivity, and dependency on imported fuel. EVs come at a cost premium, sometimes more than 70% compared to conventional vehicles, creating a financial hurdle for many consumers in developed and developing countries. A new World Bank report [The Economics of Electric Vehicles for Passenger Transportation](#), found that investing in electric vehicle charging infrastructure can be up to six times more effective at encouraging EV purchases than subsidies.

The session addressed the following questions:

- What's the business case for electric mobility and how does it articulate in different regions of the world?
- What's the role that charging infrastructure plays and can play in accelerating the transition to electric mobility?
- What actions can governments and financial institutions take to facilitate and scale-up equitable deployment?

### Foresight session 12

#### MANAGING THE ENERGY TRANSITION: SCALING UP DEPLOYMENT OF EV CHARGING INFRASTRUCTURE ENHANCING



Visual reminder: Foresight session 12 Managing the energy transition: scaling up deployment of ev charging infrastructure, Friday October 6, 2023

# Foresight session 13

## Stress tests tool to assess the resilience of road asset to climate change hazard

The provision of adequate service level is the key objective of work of road asset managers. That service level should be provided despite various hazards, including such coming from climate change. Is however the road asset resilient to these hazards? What are the tools available to road asset managers to understand the degree of road resilience?

This foresight session presented stress tests as tools for assessing the level of resilience of a selected road asset or road network to climate change hazard.

In this context, the session discussed road transport asset/network, observed impacts of climate change on road assets/networks, road asset/network service level and economically optimal level of risk. It also discussed costs and benefits associated with the managed road asset/network with and without intervention programme.

As far as stress tests are concerned, this foresight session clarified:

- How to define a stress test,
- What approach to use,
- How to define the asset/network and hazard representation for the stress test,
- How to deal with scenarios uncertainties, and
- How to perceive estimated risks and the appropriateness of the test.

The foresight session also simulated a stress test using qualitative approach. This provided a better understanding on what it takes for asset managers to carry out stress tests of their assets and/or networks.

## Foresight session 13

### STRESS TESTS TOOL TO ASSESS THE RESILIENCE OF ROAD ASSET TO CLIMATE CHANGE HAZARD

#### TOPIC OF THE SESSION

[Presentation of the issues that were presented, why they are important]

- **Impact of Climate Change on Road**

**Infrastructure:** Climate change, in particular through extreme weather events, affects road networks leading to numerous incidents which impact the service provided by the network. A number of examples were discussed.

- **Resilience of Road Assets:** The importance of assessing and improving the resilience of road infrastructure against climate-induced hazards was extensively discussed. This resilience is essential for maintaining safe and functional road networks and their service level despite environmental stressors.

- **Role of Stress Tests in Assessing Resilience:** Stress testing was presented as an essential tool for analyzing the resilience of road networks subject to climate change hazards. These tests help in identifying vulnerabilities and evaluating adaptation strategies.

- **Economic and Service Level Balancing:** There is a need to maintain road network service levels but it is important that is done at the economically optimal level. There is thus a need to fully understand the cost and benefit of adaptation versus costs on inaction and strike the optimal balance.

- **Development of Tools and Strategies:** Methodologies and tools to assist road asset managers in improving infrastructure resilience taking into account economically optimal level of service were discussed. This was done along with real-world case studies to demonstrate practical applications.

## TECHNICAL FINDINGS

[This can include key findings that have been confirmed and can be shared, as well as emerging issues that have been identified and will require more analysis.]

- The stress test framework developed by UNECE's group of experts has been confirmed as an effective guideline for infrastructure managers in setting up stress tests to assess the resilience of their systems. This framework is helpful for identifying vulnerabilities, assessing risks, and planning adaptation or risk reduction measures.
- The stress test case study that was conducted using expert opinion showed significant promise. This method showed to be practical, can be implemented within a reasonable timeframe, and provides infrastructure managers with a viable way to conduct stress tests. Even the relatively simple qualitative expert opinion-based stress tests could provide valuable insights into the resilience of the transport system of interest.
- Simulation-based stress tests have been found to offer a deeper, more thorough analysis of the system. They account for significant uncertainties in various system aspects, such as the occurrence of hazards, performance of assets and networks, and organizational factors. Should qualitative approaches not be sufficient, simulation-based approaches are essential for understanding the complex interplay between different variables in a road transport system and for making informed decisions about managing and mitigating risks associated with climate change.

## RECOMMENDATION FOR DECISION MAKERS

[This section is aimed at heads of road organisations. It should be focused on practical and confirmed recommendations.]

- Utilize the stress testing framework developed by UNECE as a guideline to set up and conduct stress tests. This approach helps in identifying vulnerabilities and facilitates the planning of appropriate adaptation and risk reduction measures to enhance the resilience of the system.
- Regularly perform stress tests on road infrastructure to continually assess and update the resilience status. Start by setting up qualitative stress tests based on expert opinions to assess the resilience of road networks. This approach is practical and less data demanding and can be implemented in a relatively short timeframe, while yielding valuable insights into the system's resilience. If a more in-depth analysis is required, then more

quantitative, simulation-based approaches can be implemented.

- Based on the outcomes of stress tests, develop and implement targeted adaptation and mitigation strategies to strengthen the resilience of road networks. This may include infrastructure improvements, policy changes, and emergency response plans.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

[This can include recommendations for future studies or future collaborations.]

- **Expand Research on Climate Resilience:** Encourage and fund research that focuses on improving the resilience of road infrastructure to climate change. This includes studying the long-term effects of extreme weather events and environmental changes on road materials, design, and maintenance practices.
- **Develop Global Standards for Stress Testing:** Work towards standardized global protocols and guidelines for stress testing road infrastructure. In this regard, promote the UNECE stress test framework. This will help in ensuring consistency and comparability in resilience assessments across different regions and countries.
- **Support Developing Nations:** Provide technical and financial support to developing countries and their road asset/networks managers to build their capacity in conducting stress tests and implementing adaptation measures. This can help in improving global resilience in road infrastructure.
- **Integrate Climate Resilience into Policy Making:** Continue promoting the integration of climate change resilience into policy making globally.



Visual reminder: Foresight session  
13 Stress tests tool to assess  
the resilience of road asset to climate  
change hazard, Friday October 6,  
2023



# Road Statistics Committee

**This session shows you outputs of activities of Road Statistics Committee during the work cycle from 2020 to 2023. The Committee has produced PIARC Databook of Roads and Road Transport 2020–2023. The Databook includes 10 road-related key indicators such as motorway length, the number of vehicles in use, road fatalities, road policies etc., which are selected from 7 main areas of roads and road transport to see whole pictures of the roads and road transport in the member countries. The session also has a panel discussion on road statistics/databook to explore more indicators to be involved and future development of the road statistics/databook.**

**The Main objectives of this Committee are to:**

- **Enable an international comparison of road statistics among the countries on the same definition and requirements, thereby allowing us to accurately gauge maturity of road and road transport of each country, and**
- **Provide statistical data as well as the outcome of their analysis for road administrations of member countries who conduct quantitative research on and make an objective assessment of actions based on such data analysis when formulating the road policies and measures.**

## TSRSC: PIARC Databook of Roads and Road Transport 2020–2023

### TOPIC OF THE SESSION

- I. Outline of PIARC Databook of Roads and Road Transport 2020–2023
- II. Road Statistics in Austria
- III. Road (Transport) Statistics in Germany
- IV. Road Statistics for Greece
- V. Road Statistics and Databook in Japan

### TECHNICAL FINDINGS

- In terms of the maturity level of development of Motorways, the concept that both population (P) and surface area (A) may impact on a required road length can be applied; length of Motorways divided by  $\sqrt{PA}$  is a hypothetical index with novelty.
- The number of Vehicles in Use as well as maturity of network of Motorways statistically correlates with the level of economic development.
- We should notice that the data provided by many countries concerns 2020 or 2021 in whose period COVID-19 rampant across the world should cause ATDDV(Annual Total Driving Distance of Vehicles)

to become smaller than normal by widespread hesitation and restriction of travel and drive. This trend also emerges when road fatalities and fuel consumption of vehicles are considered.

- In many countries, Investment exceeds Maintenance. However, Investment aimed at upgrade, structural reform, etc. of existing roads, instead of newly constructed roads might be interpreted as Maintenance. Then it would be necessary to distinguish Investment for new roads from that for existing roads which could be regarded as Maintenance.
- In many European countries, Diesel/Light oil is more dominant, and others consume more Gasoline/Petrol rather than the other fuel types.

### RECOMMENDATION FOR DECISION MAKERS

- By conducting a pseudo-quantitative analysis regarding Road Policies, we have discovered that the preferential item common to the most countries is Road Safety, and the 2<sup>nd</sup> most is Maintenance/Repairs and New Technology, followed by Construction, Multi-Modal and Modal shifts, and Environment.
- Statistical data can suggest the necessity of road investment and maintenance as well as their budget while appealing to the public with clarity and objectivity.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

- 10 indicators in total we have selected to see the whole picture of roads and road transport in the member countries can highlight essential and appealing aspects of international road statistics. They are presented so that they become internationally comparable. Especially a qualitative indicator focused on Road Policies seems interesting and informative, thereby suggesting current key interests of road administrations for us.
- We have somehow taken a conventional method of collecting data, by use of a spreadsheet as a questionnaire for each indicator, but it will be further streamlined and standardized if some innovative software tools are normally used. We recognize that there are already Microsoft Forms and Google Forms made available for free.
- In the next working cycle some more qualitative indicators can be added, focusing on Road Administration System, Road Technical Standards, Road-related Law System and so on, which may not be regarded as statistical data.
- It is hoped that more traditional quantitative/technical data (Transport Modal Share as one of the possible examples) will be incorporated into our output, but it depends on the number of dedicated workforce for this committee. It would be difficult to make it happen if there were only a small number of active members available likewise in this cycle.

- Also it is crucial to collaborate with the other TCs to further substantiate our own statistics. In this cycle we really appreciate generous support by TC4.2 Bridges to our output in which its own survey result has been effectively delivered.
- We have exchanged views with Asian Development Bank that produces Asian Transport Outlook (ATO) Database. Although we could not actively collaborate to produce any joint output in this cycle, we may be able to work together, thereby publishing something valuable for road administration in the following working cycle.

For the purpose of enabling a fair comparison between diverse statistical indicators, it is crucial to ensure their reliability. Thus the definition of each indicator should undergo careful scrutiny.



Visual reminder: Technical Session – Road Statistics Committee, Thursday October 5, 2023





# Special project session 1

## Social equity and social accessibility of the road sector

**It can be argued that the mission of road and transport authorities is to ensure that the provision of adequate transportation services to all citizens. All areas are usually not served equally: major urban areas benefit from public transport services, which are usually subsidized by local and/or national governments, whereas rural areas have to rely mostly on individual road transport. In general, transport expenditure of rural households is higher than households in big cities. This inequality was relatively well accepted since it was balanced by a lower housing expenditure in rural areas compared to urban ones.**

**The recent social development, forced by economic contingency, different growth trends and patterns, associated to the effects of the Covid-19 pandemic, have changed the overall picture of accessibility, mobility and core transport policies to answer new and old needs expressed by the stakeholders.**

**The session addressed a sub-set of the notions of equity, answering the question if all segments of the population are served fairly, and accessibility, answering the question of all geographic areas are accessible to all who need it both in HIC (High Income Countries) and LMIC (Low Middle Income Countries).**

# Special project session 2

## Carbon neutrality of the road sector

**Road transport is vital for society to function and, for the foreseeable future, is expected to remain the dominant mode of transport for people and goods. However, the construction, operation, maintenance and use of the highway infrastructure are responsible for large quantities of carbon emissions. Knowledge of the non-reversible, damaging consequences of climate change has resulted in global acceptance of the need to reduce carbon emissions in all sectors of human activity, including the highways sector. However, as efficient transport is vital to national economic growth, actions to reduce carbon emissions must not negatively impact the development and maintenance of high-quality road infrastructure, particularly for LMICs.**

**This session aimed to identify actions being undertaken as well as potential new options to progress towards carbon neutrality.**

### SPECIAL PROJECT SESSION 2 CARBON NEUTRALITY OF THE ROAD SECTOR

#### TOPIC OF THE SESSION

This session discussed actions being undertaken as well as potential new options to progress towards carbon neutrality. It built on the report recently published by PIARC and commissioned to ITEN/RDS, on the carbon neutrality of the road sector, available from this link:

<https://www.piarc.org/en/orderlibrary/39841en-Carbon%20Neutrality%20of%20The%20Road%20Sector>

Road transport is vital for society to function and, for the foreseeable future, is expected to remain the dominant mode of transport for people and goods. However, the construction, operation, maintenance and use of the highway infrastructure are

responsible for large quantities of carbon emissions. Knowledge of the non-reversible, damaging consequences of climate change has resulted in global acceptance of the need to reduce carbon emissions in all sectors of human activity, including the highways sector. However, as efficient transport is vital to national economic growth, actions to reduce carbon emissions must not negatively impact the development and maintenance of high-quality road infrastructure, particularly for LMICs.

#### TECHNICAL FINDINGS

##### Martin Lamb, Presentation of PIARC Report

Introduction to the partners and terms of reference of the report. High level overview of main areas where carbon emissions can be reduced and challenges for the future.

##### Gina Ahlstrom, The USA Perspective

This presentation provided the motivation and current direction in the United States for implementing low carbon transportation materials. An overview of current legislation, State of practice across the country, quantification of environmental impacts, and practical strategies for low carbon materials was presented.

In 2010 FHWA created a program focusing on sustainability for pavements and materials. This program provided practical strategies for considering context sensitive solutions for more sustainable pavements. In 2021 the United States published a report outlining long term strategies to reach net-zero greenhouse gas emission by 2050.

Since publication of this report, several pieces of legislation have been enacted that further provide more direction for implementation of strategies to reduce greenhouse gas emission in the transportation and building sector. In addition, several States within the country have passed their own Buy Clean

policies. An overview of quantification of environmental impacts was presented. Finally, practical strategies for implementing low carbon transportation materials for pavements were provided.

### **Tsutomu Yoshigi, Carbon Neutrality Strategy for Roads in Japan**

Japan has set a goal of achieving carbon neutrality in 2050, and by 2030 it will be necessary to reduce greenhouse gas emissions by 46% overall, and at least 35% in the road sector. For this reason, the Ministry of Land, Infrastructure, Transport and Tourism has compiled an interim strategy for promoting carbon neutrality on roads in September of this year. The strategy has four pillars:

- 1) Optimization of road traffic
- 2) Shift to low-carbon flow of people and goods
- 3) Greening road transportation
- 4) Low-carbonization of the entire road lifecycle

This interim report does not specifically set the amount of CO<sub>2</sub> reduction. In addition to actions directly involving road administrators, it is essential to collaborate with related organizations and explore co-creation areas with other fields in order to realize the strategy.

### **Robin Krutak, Austria's climate action framework for the road sector**

Austria has set the goal of reaching climate neutrality by 2040 in its government program. The 2030 Mobility Master Plan for Austria shows this way for the transport sector. We will succeed in attaining a climate-neutral transport sector with a "traffic transition" (avoiding, shifting and improving traffic) and an "energy transition" in transport (making improvements by phasing out fossil fuels and transitioning to 100 per cent renewable energy in the transport sector). Together, these two transitions make up the "mobility transition" that is needed to achieve our target mobility system by 2040.

Austria's Mobility Masterplan 2030 therefore identifies ways to avoid, shift and improve traffic and transport and significantly increase the share of eco-mobility in total transport – foot and bicycle traffic, public modes of transport, and shared mobility and making the ambitious switch to zero-emission vehicle technologies.

### **Antonio Muruais Rodriguez, Footprint calculation as a tool to decarbonization of a road administration**

If the goal is to achieve the carbon neutrality in the road sector, first we need to know carbon emissions for all activities that a road manager

has to do. This has to be done with a rigorous methodology so we can detect the main sources of carbon emissions. This is the basis to implement a decarbonization plan in a road organization as well as the instrument for the follow-up of carbon emissions reduction in the following years. The Spanish experience of carbon footprint calculation for the Road Directorate of the Ministry of Transportation, Mobility and Urban Agenda was shown in this presentation.

### **Dr Alfa Adib Ash Shiddiqi, Carbon Reduction initiatives by Indonesian Road Administrator: Promoting the utilization of Natural Asphalt**

Indonesia presented the objective to reach net zero emissions by 2060 during the UN Climate Change Conference (COP 26) in 2021. The Directorate General Of Highways has launched initiatives:

1. Establishing Indonesian Green Road concept
2. Utilization of material which has less carbon footprint
3. New Technology supporting carbon footprint reduction
4. Promoting utilization of Buton Asphalt (Indonesian natural asphalt/Asbuton) instead of petrol-based asphalt. The "asbuton" was presented in depth.

### **Dr Avishreshth (Avi) Singh, India's perspective**

The presentation focused on the frameworks, toolkits, and other measures being taken to transition to net zero in the Indian context.

### **Nancy Daubenberger, Carbon neutrality of the road sector- the Minnesota perspective**

Transportation is Minnesota's number one source of greenhouse gases, accounting for about a quarter of our state's emissions. Nancy Daubenberger (Commissioner of the Minnesota Department of Transportation) shared how Minnesota is looking to decarbonize the transportation sector and shift to cleaner transportation options. Commissioner Daubenberger shared goals the state has been advancing since 2007. She also described how new federal sustainable transportation program funding is helping Minnesota implement strategies to advance Minnesota's sustainable transportation goals.

## Fabio Pasquali, Knowledge-sharing on decarbonization issues in the national context of EU members

National policies for carbon neutrality policies in the road sector in Europe: evidence and lessons to learn National policies for the transport sector – focus on roads – have been set in all EU member states, following both the Paris Agreements and the EU policy lines. The presentation described the typical national approach to decarbonisation in the transport sector, with focus on Italy, France and Spain

### RECOMMENDATION FOR DECISION MAKERS

- Adopt all processes, techniques and materials that reduce the carbon footprint of road transport
- Conduct comprehensive cost – benefit analysis
- Analyse transport as a service and look for the
- Consider carbon offsetting as a possible option



### RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

- This continues to be an emerging and critical issue that should be a regular focus of PIARC and other organisations.
- Continue to share information and case studies for the benefit of all.
- Support Lower and Middle Income Countries in the development and usage of new approaches and techniques.



Visual reminder:  
Special project  
Session 2 –  
Carbon neutrality  
of the road sector,  
Wednesday, October 4,  
2023



# Special project session 3

## Interurban Cycling Infrastructure

Under the challenge of climate change, cycling has become a viable alternative to motorized transport. Both in LMICs and HICs with a growing market share of cycles and particularly e-cycles (bicycles assisted by electric batteries) and widespread adoption of bike-sharing system (PBS), cycling currently sees its revival as an attractive alternative or supplement not only for urban transport but also for longer routes. Providing the necessary cycling infrastructure, both for short and long-distance cycle journeys is key to this development. Cycling infrastructure such as segregated bicycle lanes on local highways or longer distance routes alongside motorways or strategic roads can play a crucial role.

A number of road and transport administrations are expanding their focus on biking.

This session offered a global view of the Interurban Cycling Infrastructure and featured an in-depth review of six case studies, with a light review of an additional 14 case studies. The case studies showcased exemplary projects and policies. There was a balance between low-income, middle-income, and high-income countries.

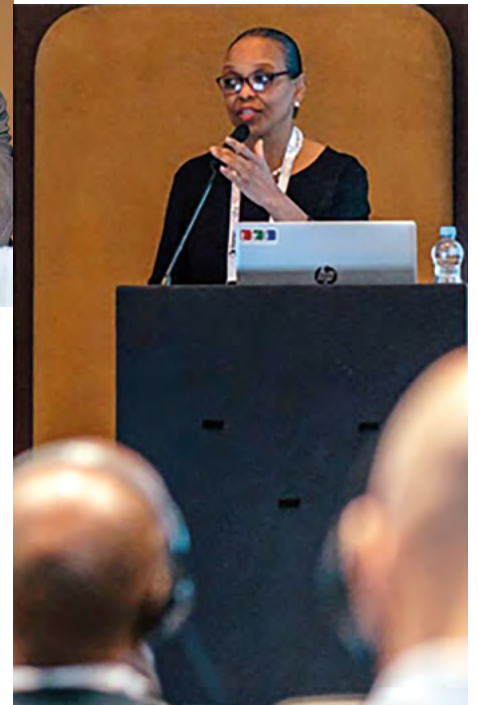


Visual reminder:  
Special project  
Session 3 –  
Interurban Cycling  
Infrastructure,  
Thursday,  
October 5, 2023

# Special project session 4

## Innovation policies

### in the road sector



**It can be argued that the transportation field has been on a continuous journey of innovations since historical times. The sector as a whole generates and requires innovation: cold-mix asphalt, intelligent transport systems, to name just two. Furthermore, some of the most recent innovations in transportation demonstrate that roads are a perfect vehicle for incorporating innovation: electric vehicles use roads, ride-hailing services use roads, etc.**

**This session addressed innovation processes at the organizational level in the road sector. What are some of the key noteworthy and best practices employed by road and transport administrations to encourage and sustain innovation processes at the organizational level?**

**What lessons on innovation can be learnt from other sectors which are applicable to road and transport agencies? What recommendations can be established and implemented at the organizational level?**

**PIARC commissioned TRL to prepare a report on those topics. Preliminary findings from the PIARC report were presented by TRL, and discussions held during the session will contribute to the final version of the report.**



Visual reminder: Special project Session 4 – Innovation policies in the road sector, Friday, October 6, 2023

# Strategic Direction Session 1 Road and road transport in a changed world

**This session addressed:**

- 1. Sustainable development of roads and road transport.**
- 2. Understanding, steering, and adapting to changing user needs.**
- 3. Disaster management.**

**The four Strategic Direction Sessions are high-level sessions presenting future-oriented approaches to key issues in the road sector. These sessions were based on national reports prepared by PIARC Member Countries, which capture national experiences and best practices.**

## Strategic Direction Session 1 ROAD AND ROAD TRANSPORT IN A CHANGED WORLD

Visual reminder: Strategic Direction Session 1 – Road and road transport in a changed world\_Wednesday October 4, 2023



# Strategic Direction Session 2 Mobility and Equity

This session explored how road transport can meet people's needs while promoting equity:

1. Transport decarbonization equity impact.
2. Improving air quality in megacities.
3. Impact of digital transformation and long-term effects of COVID.

The four Strategic Direction Sessions are high-level sessions presenting future-oriented approaches to key issues in the road sector. These sessions are based on national reports prepared by PIARC Member Countries, which capture national experiences and best practices.

## Strategic Direction Session 2 Mobility and Equity



Visual reminder: Strategic  
Direction Session 2 – Mobility  
and Equity, Wednesday  
October 4, 2023



# Strategic Direction

## Session 3

### New challenges and initiatives for improving safety and sustainability

This Strategic Direction Session was organised by PIARC's Strategic Theme Coordinator on Safety and Sustainability. National reports had been requested on "New challenges and initiatives for improving safety and sustainability" for the Strategic Direction Session 3. More specifically, two key subjects were selected. The first subject was "Creating safer road space and a vibrant community". The aim was to discuss roads that are designed to be safe and comfortable for all road users, regardless of age or physical ability. The second was "Realizing a greener society". The environmental impacts of road traffic are a common problem experienced by all countries in the process of economic growth, and there is no respite for decarbonising transportation, in particular.

Thirteen countries from around the world submitted national reports on their state-of-the-art measures. This session highlighted best practices by the PIARC member countries including the following:

- Road safety strategies with emphasis on the Safe System and Vision Zero approach
- Protecting vulnerable road users
- Traffic safety measures from a human factor perspective
- Strategies to strengthen sustainability and contribute to the decarbonisation of road transport.

## Strategic Direction Session 3 NEW CHALLENGES AND INITIATIVES FOR IMPROVING SAFETY AND SUSTAINABILITY

### TOPIC OF THE SESSION

Creating safer road space and a vibrant community

Realizing a greener society

### TECHNICAL FINDINGS

Many countries are adopting the Safe System and Vision Zero approaches to improve road safety. The Safe System approach is a holistic and comprehensive approach to road safety based on the recognition that humans make mistakes, and that the road system should be designed to accept these mistakes. Vision Zero is a road safety strategy that aims to eliminate all traffic fatalities and severe injuries. It is based on the principle that no loss of life or serious injury is acceptable on the roads. These approaches aim to create a road transport system that is free from death and serious injury by focusing on the design and operation of the transportation system rather than solely on preventing all collisions. The goal is to prevent deaths and mitigate serious injury in road traffic accidents.

Traffic safety measures from a human factor perspective focus on understanding and addressing the role of human behaviour in road accidents. These measures aim to improve road safety by taking into account the limitations and needs of road users and designing the road transport system in a way that is intuitive and easy to use.

Protecting vulnerable road users (VRUs) such as pedestrians, cyclists, and motorcyclists is a key priority for many countries in their road safety strategies. These road users are at a higher risk of being involved in accidents and sustaining serious injuries due to their lack of protection compared to vehicle occupants. Several countries have implemented measures to improve the safety of VRUs, including infrastructure improvements, education and awareness campaigns, and the use of technology.

Many countries are also implementing strategies to strengthen the sustainability of their road transport systems and contribute to the decarbonisation of road transport. These strategies aim to reduce the environmental impact of road transport and promote the use of cleaner and more sustainable modes of transportation.

Overall, countries are taking a comprehensive approach to improve road safety and sustainability, focusing on multiple pillars of action including infrastructure improvements, education and awareness campaigns, technology, and policy measures. These efforts aim to create a safer and more sustainable road transport system for all.

## RECOMMENDATIONS FOR DECISION MAKERS

It is recommended that road safety approaches such as Safe System and Vision Zero be adopted and implemented to achieve a road transport system that tolerates human errors and is free of fatalities and serious injuries.

To reduce the environmental impact of road transport and promote the use of sustainable mobility, we recommend that measures be pursued to improve energy efficiency and emissions, promote the use of low-carbon and renewable energy, and promote alternative modes of travel such as public transport and bicycles.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

It is recommended that activities such as information exchange and sharing of best practices among the PIARC member countries be continued and that materials such as guidelines and toolkits be developed and provided to support the dissemination and implementation of road safety approaches.

It is recommended that measures related to the sustainability of road transport system be actively promoted and that state-of-the-art measures such as the assessment and reduction of environmental impacts throughout the life cycle of road transport system be disseminated.

Visual reminder: Strategic Direction Session 3 – New challenges and initiatives for improving safety and sustainability, Tuesday October 3, 2023





# Strategic Direction Session 4

## From cradle to grave – improved life cycle management of road infrastructure in the course of digital transformation

**This Strategic Direction Session was organised by PIARC's TC 4.1 Chair and addressed the Strategic Theme on Resilient Infrastructure. It presented the best practices shared by PIARC member countries on the following issues:**

- **Digital Transformation**
- **Infrastructure Monitoring**
- **Asset Management**
- **BIM**

**Eight countries from around the world submitted national reports on their state-of-the-art measures. This session highlighted best practices by PIARC member countries.**

### Strategic Direction Session 4 Resilient infrastructure – New challenges AND initiatives For improving safety and sustainability

#### TOPIC OF THE SESSION

The presentations made were focussed on Improved Life Cycle Management of Road Infrastructure in the Course of Digital Transformation. It presented the best practices shared by PIARC member countries on the following issues:

1. Digital Transformation;
2. Infrastructure Monitoring;
3. Asset Management;
4. BIM.

Eight countries from around the world submitted National Reports on their state-of-the-art measures. This session highlighted best practices by PIARC member countries.

#### TECHNICAL FINDINGS

The technical findings reported below were drawn from the presentations on the best practices shared

by PIARC member countries to address the 4 sub-themes of the session. Here are some key insights and takeaways:

#### 4.1 Digital Transformation

- Many authorities are using digital technologies to manage local road assets, traffic activities, and enhance construction projects;
- Artificial Intelligence (AI) is being used to streamline asset management processes, and digital twins are being created to provide a holistic and accurate picture of assets. The use of intelligent sensors, drones, LiDAR, and connected vehicles is also mentioned as part of the data collection process for digital twins;
- Local authorities are also involved in trial of technologies viz. Connected and Automated Vehicles (CAV), AI, and the Internet of Things (IoT);

#### 4.2 Infrastructure Monitoring

- Digital Twin Models of the physical asset include information for constructing, maintaining and operating the infrastructure;
- The future of monitoring lies in integrated and automated systems that provide real-time data integrated in risk maps in a Geographical Information System (GIS). Technologies such as Lidar and satellite imagery are mentioned as supplements to traditional inspection systems. The importance of maintaining traditional systems while incorporating new technologies is also emphasized;
- Green technologies and IoT help enhance the sustainability of geotechnical assets and guarantee a harmonic development of their lifecycle;

#### 4.3 Asset Management

- Digital technologies aid in the management of road assets through systems drawing and new kinds of surveys;
- Many authorities are already using digital technologies for asset management systems viz. traffic modelling and BIM;
- Emphasis is being given to the use of digital technology in asset management.

## 4.4 BIM (Building Information Modelling)

- The term “Building” in BIM refers to the act of constructing information models which serve as digital twins of the physical assets, not just designing in 3D;
- These models provide the necessary information for constructing, maintaining, and operating infrastructure;
- BIM, along with Digital Twins, is being used to enhance construction projects. BIM is the future in designing, constructing, and maintaining infrastructure;

## RECOMMENDATION FOR DECISION MAKERS

Based on the information provided during the presentations, here are some general recommendations for decision-makers:

### 5.1 Digital Transformation

- Embrace digital technologies and explore the use of asset management systems, ITS, UTM traffic systems, traffic modelling, ATC, BIM, and Digital Twins to enhance road asset management and construction projects;
- Trial and implement innovative technologies like Connected and Automated Vehicles (CAV), AI, and the Internet of Things (IoT) to improve efficiency and effectiveness in managing and operating infrastructure;

### 5.2 Infrastructure Monitoring

- Incorporate digital twins of physical assets into infrastructure monitoring strategies;
- Utilize satellite register information and Lidar systems for monitoring displacements and other relevant data;
- Embrace green technologies and IoT to enhance the sustainability and lifecycle management of geotechnical assets;

### 5.3 Asset Management

- Leverage digital technologies in managing local road assets by implementing systems that utilize new survey methods and data-driven approaches;
- Consider adopting the updated Approach to Asset Management provided by National Highways in England or develop tailored asset management plans based on the specific needs and context;

## 5.4 BIM (Building Information Modelling)

- Emphasize the importance of BIM as a holistic approach that goes beyond 3D design and includes constructing information models that serve as digital twins;
- Recognize the value of BIM in providing necessary information for construction, maintenance, and operation of infrastructure;
- Encourage collaboration and integration of BIM and Digital Twin technologies to enhance construction projects and optimize asset management;

A large number of potentials and innovations were shown here with which road, earthwork and tunnel construction can be redesigned to be resilient, i.e. safe, permanent, sustainable and available. Some of these innovations are about to be standardized, while others still have a long way to go in terms of testing, validation and evaluation. . If implemented promptly, the creation of a resilient infrastructure is realistic. It is important for decision-makers to assess the specific requirements, challenges, and opportunities relevant to their context and consider tailoring these recommendations accordingly.

## RECOMMENDATIONS FOR PIARC AND INTERNATIONAL ORGANISATIONS

Here are detailed recommendations for PIARC and other international organizations on the four topics:

### 6.1 Digital Transformation

- Collaborate with member countries to exchange knowledge and best practices on the use of digital technologies in road asset management and construction projects;
- Develop guidelines and standards for the implementation of digital systems such as asset management systems, ITS, UTM traffic systems, traffic modeling, ATC, BIM, and Digital Twins;
- Facilitate knowledge sharing and capacity building through international conferences, seminars, and online platforms focused on digital transformation in the road sector;
- Encourage research and innovation in areas like connected and automated vehicles (CAV), artificial intelligence (AI), and the Internet of Things (IoT) to drive further advancements in the field.

### 6.2 Infrastructure Monitoring

- Promote the adoption of digital twin technology as a standard practice in infrastructure monitoring for improved asset management.

- Develop guidelines and methodologies for utilizing satellite registers and Lidar systems for effective monitoring of infrastructure displacements and other relevant data.
- Encourage the integration of green technologies and IoT in infrastructure monitoring practices to enhance sustainability and optimize asset lifecycle management.
- Establish a network of experts and research collaborations to develop innovative monitoring technologies and share insights among member countries.

### 6.3 Asset Management

- Provide guidance and resources on the implementation of digital technologies in asset management, including new survey methods and data-driven approaches.
- Develop standardized approaches, frameworks, and tools for asset management planning, based on best practices from different countries.
- Support capacity building efforts through training programs and knowledge-sharing events focused on asset management practices.

- Foster research and development in asset management systems to address evolving challenges and emerging technologies.

### 6.4 BIM (Building Information Modelling)

- Promote the adoption of BIM as a comprehensive approach to infrastructure development, construction, and maintenance globally.
- Develop international standards and guidelines for BIM implementation, including the creation and management of digital twins.
- Facilitate the exchange of BIM knowledge and experiences through international conferences, workshops, and online platforms.
- Encourage collaboration between governments, industry, and academia to advance research and innovation in BIM methodologies and tools.

These recommendations aim to enhance international collaboration, knowledge sharing, and standardization in the areas of digital transformation, infrastructure monitoring, asset management, and BIM, ultimately leading to improved efficiency, sustainability, and resilience in the road sector.



Visual reminder: Strategic Direction Session 4 – From cradle to grave – improved life cycle management of road infrastructure in the course of digital transformation, Tuesday October 3, 2023





# Slovakian Day

**09:15**

## Opening of the Slovak Day – ceremonial speeches

The CZECH&SLOVAK Pavilion hosted highly interesting and entertaining 'Slovak Day' – event, which began with ceremonial speeches and finished with the dancing and food tasting!

The Minister of Transport, Pavol Lančarič, warmly addressed the participants and expressed his gratitude for the opportunity to showcase Slovakia's professionalism at the WORLD ROAD CONGRESS. The event provided a great opportunity for Slovakia to increase its visibility and strengthen its relationships with other countries. The speaker openly acknowledged the participation of Slovak exhibitors at the accompanying exhibition and expressed his best wishes for the success of the event.

In his subsequent speech, Václav Mika, CEO of Slovakia Travel, diplomatically stated that his company was delighted to present Slovakia at the exhibition as an attractive tourist destination with a rich history, numerous cultural monuments, and beautiful natural scenery. The speaker thinks that some congress attendees might consider visiting Slovakia because it is nearby.

Martin Lunter, Chairman of the Banská Bystrica Self-Governing Region, spoke to the participants and stressed the importance of transportation, especially road infrastructure, for social and economic development. The speaker outlined the challenges facing the region and provided information on plans to develop road infrastructure, as well as ongoing or upcoming large infrastructure projects. They expressed gratitude for the opportunity to participate in the congress and learn from experts from around the world, gaining inspiration from new solutions and new cooperations.

At the end, the President of the Slovak Road Association Ján Šedivý addressed the participants, who on behalf of the organizers warmly welcomed everyone and stated that Slovakia is presenting itself at this WORLD ROAD CONGRESS in a historically unprecedented way. 2 national reports and 14 individual contributions were accepted. Slovakia was organizing a technical excursion entitled Bratislava Bridges and Bratislava Bypass. The Congress was attended by 138 experts from Slovakia (ranking 8<sup>th</sup> out of 119 participating countries worldwide).

He stated that as co-organisers of the congress they decided to present Slovakia even more actively as an advanced country in the field of motoring, a country with extremely interesting engineering works, remarkable research results of our experts and also a country interesting for tourism. This led to the decision to declare one day of the congress in the Czech and Slovak Pavilion as "Slovak Day".

**9:30–11:30**

## Block of Slovak lectures

### Peter Tvrdoň, Ministry of Transport of the Slovak Republic: Public-Private Partnership Projects in the Condition of Slovakia

From 9:30 to 11:30, delegates had the pleasure of attending a block of Slovak lectures.

The first lecture was given by Peter Tvrdoň from the Ministry of Transport of the Slovak Republic. The lecture focused on Public-Private Partnership (PPP) projects in Slovakia, covering the basic characteristics of PPP projects, different models, and types of projects according to payments.

The scheme of PPP projects was also described in detail. It is worth noting that in Slovakia, some sections of civil engineering constructions have been successfully implemented in the form of PPP projects.

Furthermore, potential new PPP projects that may be implemented in the near future were mentioned and clarified. For the first project, we have two possible scenarios: realistic and maximalistic. Both scenarios involve the reconstruction of bridges on class I roads. Slovakia will carefully consider the number of bridges and the amount of funds spent. The second project involves the construction of approximately 60 km of the R4 expressway in eastern Slovakia, up to the border with Poland. This section is part of the international corridor 'Via Carpathia'.



## **Vladimír Jacko, NDS, a. s:** **From Congress to Congress – 52 years of motorway construction in Slovakia**

The Director General of the National Motorway Company described in detail the major milestones and the history of motorway construction from the first plans to the present day, when there are 524 km of motorways and 242 km of expressways in Slovakia. He provided detailed information on the most important bridge structures, presenting their basic technical data and information on their construction dates. In the next part of his presentation, he focused on tunnels, giving an overview of them and focusing on the first motorway tunnel in Slovakia – Branisko.

Motorways are one of the most important engineering projects in Slovakia. Among the most technically interesting engineering works carried out in the recent period are, for example, the construction of the D1/D4 motorway junction, the D1 section Prešov West – Prešov South, the D3 section Žilina Strážov – Žilina Brodno, about which detailed information was provided in the presentation. Finally, a number of motorway constructions that have received important awards were mentioned namely.

## **Martin Chrappa, Doprastav, a. s.:** **Engineering Challenges in Bridge Construction in Slovakia**

Doprastav represented here by Martin Chrappa, the Commercial and Technical Director has successfully completed numerous engineering constructions in Slovakia, some of which have received prestigious domestic and international awards. A very interesting construction realized by this company was the intersection with a bridge on D1/D4 motorway. This project presented significant engineering challenges that were expertly overcome by Doprastav.

They are proud to say that they were able to complete the construction of the bridge's load-bearing concrete monolithic frame structure within the specified traffic restrictions of only 9 days for one direction of travel. Dedicated team worked hard to ensure that the construction process was seamless and did not cause any major disruptions to the flow of traffic. Compared to the original specification, the design underwent several changes. The insertion was preceded by a challenging operation to reroute traffic on D1, along with extensive

earthworks on the highway body. The Swiss company HEBETEC's Air Pad Sliding System technology was used for the insertion. The entire operation, including the reopening of traffic on the new bridge, lasted six days in one direction. The operation was carried out in January and February 2021. The paper presents detailed information on the tender conditions, design principles, technical solutions, preparation, organization of work, and implementation of the solution.

## **Jozef Fabian, SÚC PSK:** **Projekt Vysoke Tatry – Modernizácia cesty II/537 – Cesta Slobody/ Project Vysoke Tatry – Modernisation of Road II/537 – Road of Freedom**

The author of the paper, Jozef Fabian from SÚC PSK, has titled it 'Project Vysoke Tatry – Modernisation of Road II/537 – Road of Freedom'.

The paper outlines the preparation and implementation of an ambitious project aimed at reconstructing a road in the recreational and touristically interesting environment of the Tatra National Park. The project, which have been taken place between 2022 and 2024, is divided into seven sections with a total length of 43 km.

The construction aimed to address various issues such as the deteriorated condition of bridges, degraded condition of roadways, landslides, renewal of horizontal and vertical road markings, and the lack of technical equipment of the road. Moreover, the aim was to enhance the overall comfort for road users by constructing several new modern rest areas. The presentation provided detailed information on the works carried out within the individual sections.

In terms of environmental protection, we have established a collaborative effort to promote biodiversity conservation and reduce negative impacts on the environment. As part of this effort, we have implemented a tree-planting project, among other measures. The project's timing was exceptional, with construction work following strict schedules. It also involved coordinating multiple contractors and construction procedures, which required collaboration with various public and private entities.

## **Marián Hanták, Slovak Road Association: popularization and educational activities of SCS/ Popularization and Educational Activities of SR**

In his contribution he presented in general terms the activities of the Slovak Road Association. One of the main tasks is to organize professional events and to create a platform for the exchange of professional knowledge, the “flagships” being the annual Road Conference in the spring and the Slovak Road Builders Days in the autumn. To fulfil another task, which is to educate its membership, a non-accredited educational programme Road Construction and Economy has been created with a number of different forms of education and modules with a broad professional focus. Another important educational activity is the organisation of technical excursions at home and abroad to obtain information on extraordinary engineering works, technologies and technical solutions used in road transport and road construction.

In terms of popularising the road profession and road issues in general, a number of activities are being addressed. There is a long tradition of organising the Road Rodeo – a driving skills competition for drivers of winter maintenance vehicles to highlight the demanding work involved in winter road maintenance. With a focus on students, prizes are awarded for the best theses and dissertations. In order to generate interest in road issues and attract children and young people, the Slovak Road Association organised a Children’s Traffic University for children aged 10–15 years and Road Career Days for secondary school students with the aim of generating interest in studying at technical colleges. An interesting activity for laymen and professionals with no age limit is the organisation of a Bridge Model Competition aimed at building a model of a balsa truss bridge that can carry the greatest load.

## **Ján Čelko, ŽU Žilina: New Trends and Challenges in Transport Research**

In his contribution, Professor Ján Čelko, Rector from the University of Žilina highlighted the latest trends in transport research that present significant challenges for research teams in Slovakia. He presented these trends from the perspective of the University of Žilina, one of the most important universities in Slovakia, which is dedicated to research and development on both national and international levels.

The main focus of our exciting new research is on transportation issues. We are thrilled to share that the PIONEER Alliance is applying cutting-edge knowledge on the future of smart cities in 10 EU countries. Additionally, we have several other projects dedicated to the Urban Mobility Index, which carefully analyses the ecological impact of transportation development in European cities. The project concerning the front brake light has garnered significant attention in EU countries. It has undergone analysis and is currently awaiting a decision from the European Commission regarding its implementation.

The project not only focuses on results that are directly applicable to transport systems but also on new elements in electromobility and innovative components in vehicles that promote clean mobility. The project for the ‘factory of the future’ involves fully automated processes for the entire production cycle and is linked to their production processes. It has been prioritised for application in an automotive production plant.

The paper highlights the research and innovation capabilities of Slovak universities, which can achieve results in selected areas that are applicable both domestically and internationally.

## **In addition**

to the topics discussed earlier, the National Motorway Company shared their expertise and experience on Tunnels and Bridges. They also presented a solution for road infrastructure charging in Slovakia.

## **17:30 Social evening**

The day ended with a social evening at 17:30.

The conclusion of the ‘Slovak Day’ was preceded by a parade of traditional Slovak folk music and performers through the exhibition areas of the Congress Centre. This was followed by a social evening held in the Czech and Slovak Pavilions. During the social evening, visitors had the opportunity to watch a performance by the Terchovská music, which has been registered as an intangible cultural heritage by UNESCO. Moreover, visitors could enjoy and taste various Slovak specialities.



# National Pavilions & Partners & Exhibition

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The Local Organising Committee and the PIARC team would like to thank all the sponsors, all the partners from different countries, all the exhibitors and supporters!



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Chair  
of the Czech Road Society



**Václav Neuvirt**  
Head of the Local Organizing  
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of the ExCom of PIARC



**Nazir Alli**  
President  
of PIARC



**Luděk Sosna**  
1<sup>st</sup> Delegate  
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Minister of Transport  
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**Pavol Lančarič**  
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Chair of Slovak  
Road Association





THE CITY OF PRAGUE

## SPONSORS

### SUSTAINABLE PARTNER OF THE PROJECT

VÍTKOVICE STEEL



VÍTKOVICE STEEL helped us to achieve one of our goals; the transformation of our project into a to a sustainable congress. We have tried to be paperless, to put in place modern and digital solutions and to implement a zero waste policy.

### WIFI PARTNER

VIAKONTROL



ViaKontrol has been a long-term digital partner of the Czech Road Society and we are grateful that their support allows us to provide a high level of service to our guests.

### TECHNICAL VISITS PARTNERS

METROSTAV



Our working group has selected the most important constructions and innovative centres in the Czech Republic and Slovakia. I would like to thank Metrostav and Via Salis for their support and professionalism.

### CONGRESS BAGS

CAMEA



We have decided to cooperate with NGO Boruvka o. p. s. in this task. They focus on the education of children and for children and young people with physical disabilities. Thanks to the kind support of CAMEA and ARRB System the WORLD ROAD CONGRESS was to, in addition to the provided education and knowledge exchange, help also our community.

VIA SALIS



ARRB SYSTEM



### CONGRESS LANYARDS

STANTEC



The lanyards "are coming here" from Canada! I would like to thank Stantec for their support. They were the first confirmed sponsor of our Congress, fast and supportive!

## PHOTO CORNER PARTNER

CIUR



The Prague Congress Centre has an incredible view of historic Prague! Thanks to CIUR investment, every delegate can have a piece of this beauty back home now.

## COMMERCIAL WORKSHOPS

VARs



VDT TECHNOLOGY, A. S.



ŠKODA AUTO



The industry is bringing new technologies and approaches to the field. We strongly believe that the commercial workshops led by VDT Technology, VARs and ŠKODA, did enrich the program and stimulate new discussions.

## COMMERCIAL SYMPOSIUM

VIA SALIS



The financial aspects are becoming more complex and the differentiation of investment is crucial for road infrastructure. We are pleased that Via Salis Symposium was a big success.

## HIGH SCHOOLS PROGRAM & PARTNERS



## SOCIAL PROGRAM PARTNERS

SAUDI ARABIA



Roads General Authority We want to show the world, a part of good practice, a part of industry and science or innovations, as well as Czech and Slovak culture and cuisine. Let me thank our colleagues from Saudi Arabia – Roads Arabia – Roads General Authority for their support not only with their national pavilion but also with this important partnership.



Many thanks and gratitude to our partners for the school excursions; ROAD AND MOTORWAY DIRECTORATE of the Czech Republic, NATIONAL MOTORWAY COMPANY – SLOVAKIA HRDLIČKA, STRABAG AND ŠKODA.

Over 2000 students attended the congress thanks to our partners and their strong support!

# NATIONAL PARTNERS



AUSTRALIA



AUSTRIA



BENIN



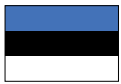
CANADA



CHINA



CZECH  
REPUBLIC



ESTONIA



FRANCE



GERMANY



HUNGARY



INDONESIA



ITALY



JAPAN



KAZACHSTAN



KOREA



LATVIA



LITHUANIA



MALAYSIA



MEXICO



MOROCCO



POLAND



QUÉBEC



SAN MARINO



SAUDI ARABIA



SENEGAL



SLOVAKIA



SLOVENIA



SOUTH AFRICA



SPAIN



SWITZERLAND



UNITED  
KINGDOM



USA

# COMMERCIAL PARTNERS

**AMMANN**

**aci** applied concepts, inc.

**ARKEMA**



**AF**  
L'Association Mondiale des Congrès de la Route  
The Permanent Members Association of Road Congresses



**BASF**  
We create chemistry

**budimex**

**CAMEA**



**CIUR**  
nature. technology. responsibility.



**Citilog**  
A TAGMASTER COMPANY



**CROSS**



**DOPUSTAW**

E&E  
CONGRESS

U.S. Department  
of Transportation  
**Federal Highway  
Administration**



**Fliegl**  
BAUKOM



**FORTA**  
ASPHALT FIBER  
STRONGER LASTING™

**FUTTEC**  
ADVANCED ROAD SURFACE SYSTEMS

**GDANSK UNIVERSITY  
OF TECHNOLOGY**

**GDDKiA**

**GD GEOTECHNIKA  
DUROVE s.r.o.**

**GREENWOOD ENGINEERING**

**HAENI**  
A Baumer Company

**HBH**  
projekt

**HEINTZMANN** Traffic Systems

**HOLCIM**

**HRDLIČKA**  
Holding

**ingevity**

**Intercomp**  
ADVANCED TRAFFIC SOLUTIONS

**K+S**

**KEMION**  
Innovative green chemistry

**KISTLER**  
measure. analyze. innovate.

**klimator**



**M-SILNICE**  
70 let  
1953 - 2023

**MBF**  
GROUP

**MEISER**  
Straßenausstattung

**Metrostav Group**

**MIT**  
CONSTRUCTION AND INFRASTRUCTURE

**NÁRODNÁ  
DIALENIČNÁ  
SPOLOČNOSŤ**

**NIRA**  
DYNAMICS

**OFO TECH**  
INNOVATIVE TECH SOLUTIONS

**ORIS** Materials  
Intelligence

**Palazzoli**  
SISTEMI ELETTRICI E LUCE D'AUTORE

**Pavemetrics**

**PIARC**

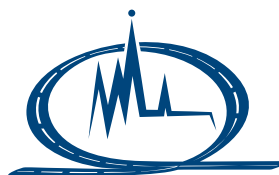
**PIARC  
France**  
ASSOCIATION MONDIALE DE LA ROUTE  
COMITÉ FRANÇAIS

**PIARC**  
Comitato Nazionale  
Italiano









XXVII<sup>TH</sup> WORLD  
ROAD CONGRESS  
PRAGUE 2023

## NATIONAL PAVILIONS

A record number of countries joined us in Prague with their national pavilions, bringing with them their experts, designers, contractors and investors to join dozens of companies, associations and schools.



## List of the National Pavilions

AUSTRIA	MEXICO
BENIN – ASSOCIATION OF AFRICAN ROAD MANAGERS AND PARTNERS (AGEPAR)	MOROCCO
CANADA	POLAND – GENERAL DIRECTORATE FOR NATIONAL ROADS AND MOTORWAYS
CANADA QUÉBEC	SAUDI ARABIA – ROADS GENERAL AUTHORITY
CEDR AND HOSTED COUNTRIES	SENEGAL – COMITÉ NATIONAL SÉNÉGAL
FRANCE	SLOVAKIA – NATIONAL MOTORWAY COMPANY
GERMANY	SLOVENIA
HUNGARY	SOUTH AFRICA
CHINA	SPAIN
INDONESIA	SWITZERLAND
ITALY – EDUCATIONAL LOUNGE	THE SOUTH AFRICAN ROADS PAVILION
ITALY + SAN MARINO	UNITED KINGDOM
JAPAN	USA
KAZAKHSTAN	
KOREA	
MALAYSIA	



**Martin Kupka**  
Minister of Transport  
of the Czech Republic



**Nazir Alli**  
President of PIARC

AND LAST BUT NOT LEAST OUR MORE THAN 1000 m<sup>2</sup> OF **THE CZECH & SLOVAKIAN PAVILION** where our industry, our innovative companies and the academia met the world!

# EXHIBITION

## SPONSORS

ARRB SYSTEMS  
CAMEA  
CIUR  
FUTTEC  
HRDLIČKA HOLDING

METROSTAV GROUP  
NATIONAL MOTORWAY  
COMPANY – SLOVAKIA  
ROAD AND MOTORWAY  
DIRECTORATE  
OF THE CZECH REPUBLIC

SAUDI ARABIA – ROADS  
GENERAL AUTHORITY  
STANTEC  
STRABAG  
ŠKODA AUTO  
THE CITY OF PRAGUE

VARS  
VDT TECHNOLOGY  
VIA SALIS  
VIAKONTROL  
VÍTKOVICE STEEL

## EXHIBITORS

8<sup>TH</sup> E&E CONGRESS  
BUDAPEST  
AMMANN  
APPLIED CONCEPTS INC /  
STALKER RADAR  
ARCELORMITTAL  
STELIGENCE®  
ARKEMA  
ARRB SYSTEMS  
ASSOCIATION OF AFRICAN  
ROAD MANAGERS  
AND PARTNERS (AGEPAR)  
AUSTRIA  
BASF  
BUDIMEX  
CAMEA  
CANADA / CANADA  
QUÉBEC  
CEDR  
CITIOLOG  
CIUR  
COLAS  
COMITÉ NATIONAL PIARC  
SÉNÉGAL  
CROSS  
CZECH-INVEST  
CZECH REPUBLIC AND ITS  
ROAD INFRASTRUCTURE  
BODIES  
CZECH ROAD SOCIETY  
CZECH&SLOVAKIAN  
PAVILION  
DIIF LLC  
DOPRASTAV  
EXCELLENCY  
IN THE CZECH REPUBLIC –  
CZECH UNIVERSITIES AND  
RESEARCH CENTERS  
FLIEGL

FONROCHE LIGHTNING  
FORTA  
FRANCE  
FUTTEC  
GDANSK UNIVERSITY  
OF TECHNOLOGY  
GEOTECHNIKA ĐUROVE  
GERMANY  
GREENWOOD  
ENGINEERING  
HAENNI INSTRUMENTS  
HBH PROJEKT  
HEINTZMANN TRAFFIC  
SYSTEMS  
HOLCIM  
HRADIL CZ  
HRDLIČKA HOLDING  
HUNGARY  
CHINA  
INGEVITY  
INTERCOMP SCALES  
ITALY  
ITALY,  
EDUCATIONAL LOUNGE  
JAPAN  
K+S MINERALS  
& AGRICULTURE  
KEMION OY  
KISTLER INSTRUMENTE AG  
KLIMATOR  
KOREA  
LIBERTY STEEL  
MALAYSIA  
MBF-GROUP  
MEISER  
STRASSEN AUSSTATTUNG  
GMBH  
METROSTAV GROUP

MEXICO  
MIT MESS-  
UND PRÜFTECHNIK GMBH  
MOROCCO  
MOSAIC51  
M-SILNICE  
NATIONAL MOTORWAY  
COMPANY, SLOVAKIA  
NIRA DYNAMICS AB  
OFO TECH SDN BHD  
ORIS  
PALAZOLLI  
PAVEMETRICS SYSTEMS  
PIARC PAVILION  
POLAND  
RATAELA  
REBLOC CONCRETE  
BARRIERS  
REDAELLI TECNA  
ROADS GENERAL  
AUTHORITY, SAUDI ARABIA  
ROADWAY SOLUTIONS  
S&P-KRUGER  
UNDERGROUND  
VENTILATION DIVISION  
SAFETY PRODUCT  
SARSYS-ASFT AB  
SELGEM  
SLOVAKIA TRAVEL  
SLOVAK ROAD  
ASSOCIATION  
SLOVENIA  
SMA ROAD SAFETY  
SPAIN  
SPOTLIGHT ON EUROPEAN  
STARTUPS – CZECH  
AND EUROPEAN  
START-UP COMPANIES

SPRINX  
STRABAG  
SUS – ROAD MAINTENANCE  
ASSOCIATION  
SWIETELSKY  
SWITZERLAND  
ŠKODA AUTO  
ŠKODA GROUP  
TENZO VÁHY  
TETRA CHEMICALS  
EUROPE AB  
TEUFELBERGER-REDAELLI  
THE CITY OF PRAGUE  
THE SOUTH AFRICAN  
ROADS PAVILION  
TRA 2024 CONFERENCE  
TYPISA-RAUROS  
UNITED KINGDOM  
UNITUM IT  
UNIVRSES  
USA  
VAISALA  
VANJEE TECHNOLOGY  
VARS  
VAS SERVIS  
VDT TECHNOLOGY  
VEACOM  
VIA SALIS  
VIAKONTROL  
VINCI CONSTRUCTION CS  
VÍTKOVICE STEEL  
VLČEK SOLUTION  
WESTWOOD  
KUNSTSTOFFTECHNIK  
XENOMATIX LIDAR  
ROADSCANNER  
ZITRON

# CZECH & SLOVAKIAN PAVILION

**WE ALL HOPE THAT YOU HAVE ENJOYED  
THE HOSPITALITY OF OUR PAVILION!**



**Martin Kupka**

Minister of Transport of the  
Czech Republic



**Radek Mátl**

General Director  
of the The Motorways and Road  
Administration



**Zbyněk Hořelica**

Director of SFDI



**Petr Mondschein**

Chair of the Czech Road Society



**Petr Lausman**

Chair of Road Contractors  
Association



**Ján Šedivý**

Chair of Slovak Road Association



**Pavol Lančarič**

Minister of Transport  
of the Slovak Republic



**Vladimír Jacko**

Chairman of the Board  
of Directors and Director General



AMMANN  
 BESIP  
 COLAS  
 CROSS  
 CZECH REPUBLIC  
 AND ITS ROAD INFRASTRUCTURE BODIES  
 CZECH-INVEST  
 CZECH ROAD SOCIETY  
 DOPRASTAV  
 FUTTEC  
 GEOTECHNIKA ŽUROVE  
 HBH PROJEKT  
 HRDLIČKA HOLDING  
 LIBERTY STEEL  
 METROSTAV GROUP  
 M-SILNICE  
 NATIONAL MOTORWAY COMPANY – SLOVAKIA

SLOVAKIA TRAVEL  
 SLOVAKIAN ROAD COMMUNITY  
 STRABAG  
 SUS – ROAD MAINTENANCE ASSOCIATION  
 SWIETELSKY  
 ŠKODA AUTO  
 ŠKODA GROUP  
 THE CITY OF PRAGUE  
 VARS  
 VAS SERVIS  
 VDT TECHNOLOGY  
 VEACOM  
 VIA SALIS  
 VINCI CONSTRUCTION CS  
 VÍTKOVICE STEEL  
 VLČEK SOLUTION



# HIGH SCHOOLS PROGRAM & PARTNERS

ONE OF THE MAIN STRATEGIC GOALS OF THE CZECH ROAD SOCIETY WAS THE INTEGRATION OF THE ACADEMIC FIELD INTO THE LEADING PROJECTS AND THE DEVELOPMENT OF COMMUNICATION WITH HIGH SCHOOLS FROM ALL REGIONS OF THE CZECH AND SLOVAK REPUBLICS.

WORLD ROAD CONGRESS IS PROVIDING A UNIQUE AND EXCELLENT PLATFORM FOR THIS TASK. WE ARE PROUD TO ANNOUNCE THAT OVER 2000 STUDENTS ATTENDED THE CONGRESS!

## CO-ORGANIZERS



## COMMERCIAL PARTNERS AND SUPPORTERS



## ACADEMIC PARTNERS

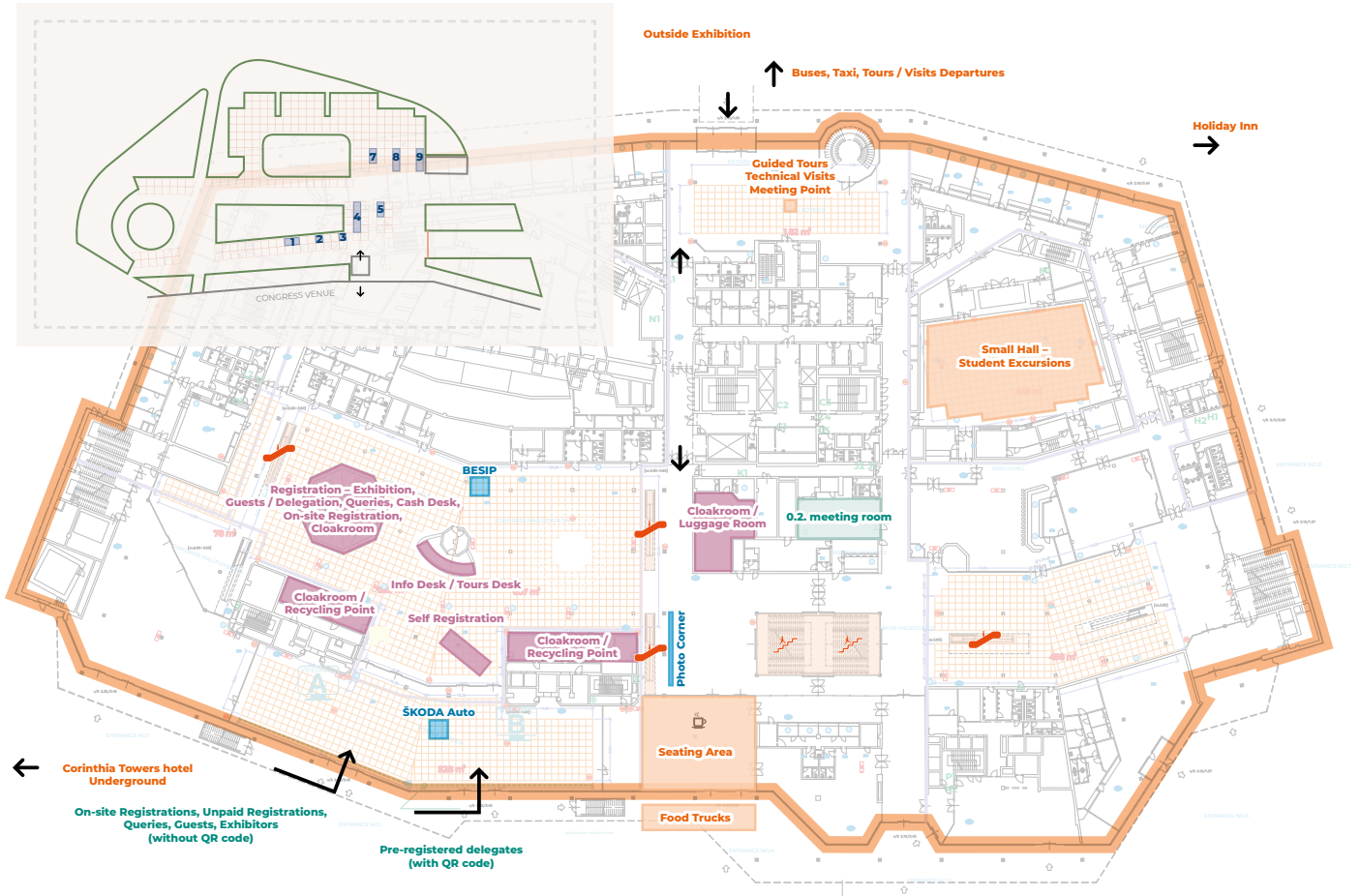


# SUPPORTERS AND MEDIA PARTNERS



# WORLD ROAD CONGRESS 2023 IN PRAGUE

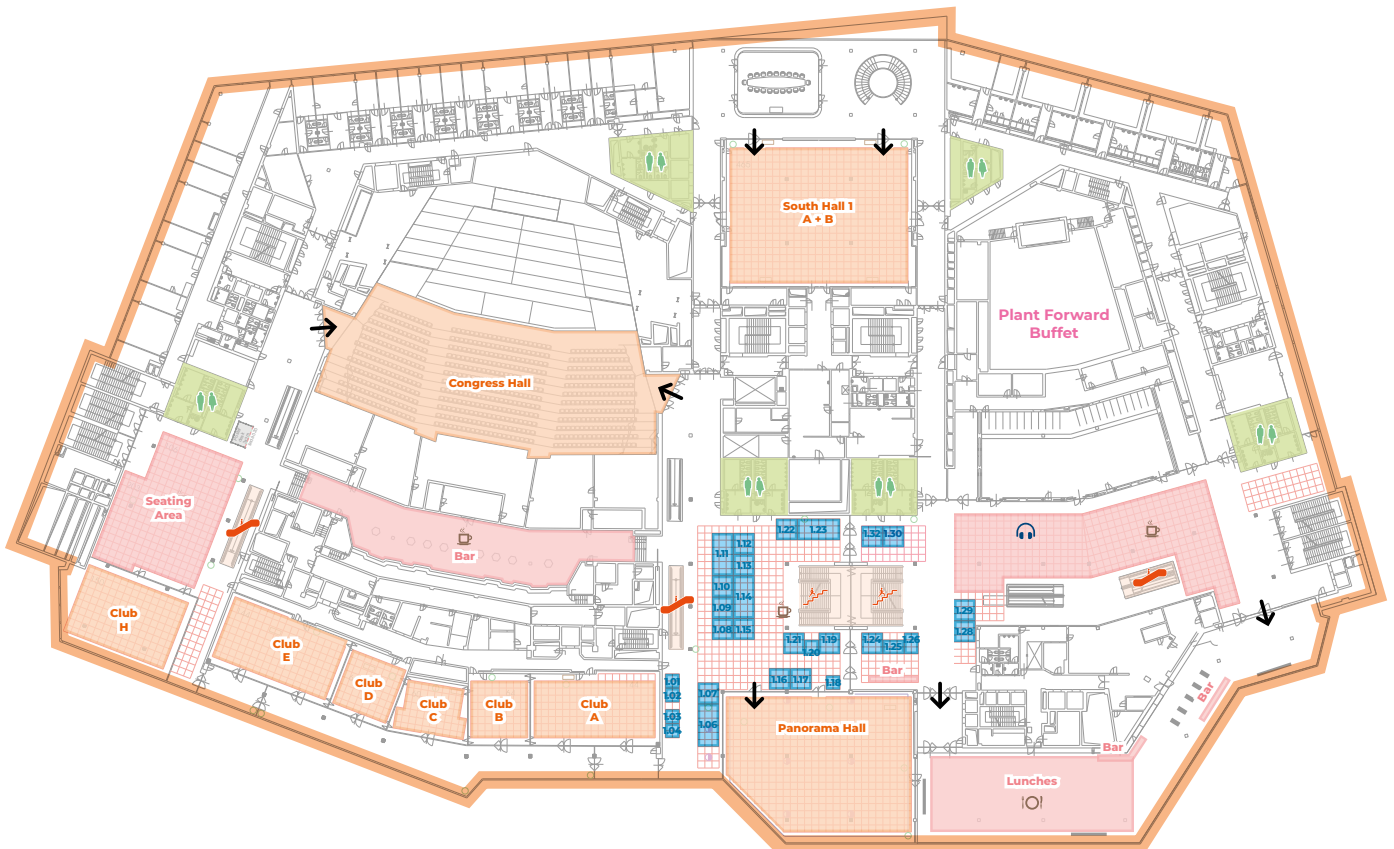
## EXHIBITION FLOOR / GROUND FLOOR



	N.
FLIEGL	8
FUTTEC	2
HRADIL	3
ROAD AND MOTORWAY DIRECTORATE OF THE CZECH REPUBLIC	4
ROAD AND MOTORWAY DIRECTORATE OF THE CZECH REPUBLIC	5
ROAD AND MOTORWAY DIRECTORATE OF THE CZECH REPUBLIC	7
VLČEK SOLUTION	1
ŽILINSKÁ UNIVERZITA	9

# WORLD ROAD CONGRESS 2023 IN PRAGUE EXHIBITION FLOOR

## 1<sup>st</sup> FLOOR



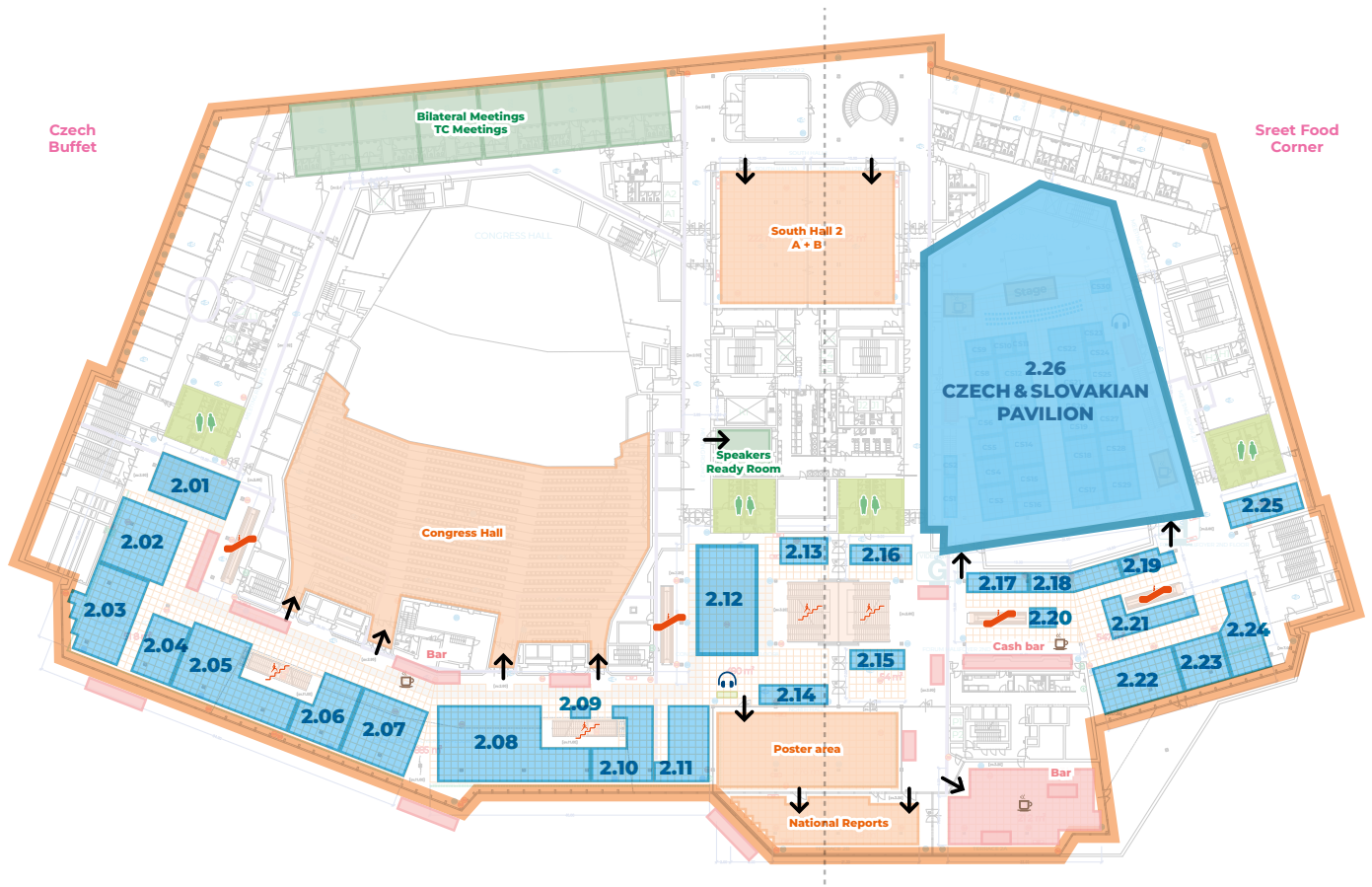
	N.		N.
8 <sup>TH</sup> E&E CONGRESS BUDAPEST	1.18	PALAZZOLI SPA ITALY	1.28
ARCELORMITTAL – STELIGENCE®	1.20	PAVEMETRICS SYSTEMS	1.08
ASASENSE	1.29	REBLOC CONCRETE BARRIERS	1.22
CITIOLOG	1.32	ROADS GENERAL AUTHORITY SAUDI ARABIA	1.19
DIIF LLC	1.02	S&P-KRUGER UNDERGROUND VENTILATION DIVISION	1.26
FLIEGL BAU- UND KOMMUNALTECHNIK GMBH	1.16	SARSYS-ASFT AB	1.04
FORTA	1.07	SMA ROAD SAFETY	1.23
GDANSK UNIVERSITY OF TECHNOLOGY	1.03	SPRINX	1.01
GREENWOOD ENGINEERING	1.21	TETRA CHEMICALS EUROPE	1.06
HRADIL CZ	1.23	VAISALA	1.11
INTERCOMP SCALES	1.24	VANJEE TECHNOLOGY	1.14
K+S MINERALS & AGRICULTURE	1.10	WESTWOOD KUNSTSTOFFTECHNIK GMBH	1.25
KISTLER INSTRUMENTE AG	1.17	ZITRÓN	1.09
KLIMATOR	1.15		
MEASURE	1.30		
OFO TECH SDN BHD	1.12		
ORIS	1.13		



# WORLD ROAD CONGRESS 2023 IN PRAGUE

## NATIONAL PAVILION FLOOR

### 2<sup>nd</sup> FLOOR



	N.
AUSTRIA PAVILION	2.02
BUDIMEX	2.19
CAMEA	2.15
CANADA PAVILION	2.24
CANADA QUÉBEC PAVILION	2.24
CHINA PAVILION	2.23
CIUR	2.18
CONFERENCE OF EUROPEAN DIRECTORS OF ROADS (CEDR)	2.13
CZECH-SLOVAKIAN PAVILION	2.26
FRANCE PAVILION	2.12
GERMANY PAVILION	2.03
HUNGARY PAVILION	2.20
ITALY EDUCATIONAL LOUNGE	2.25
ITALY PAVILION	2.07
JAPAN PAVILION	2.08
KOREA PAVILION	2.06
MALAYSIA PAVILION	2.14
MEXICO PAVILION	2.22
MOROCCO PAVILION	2.16

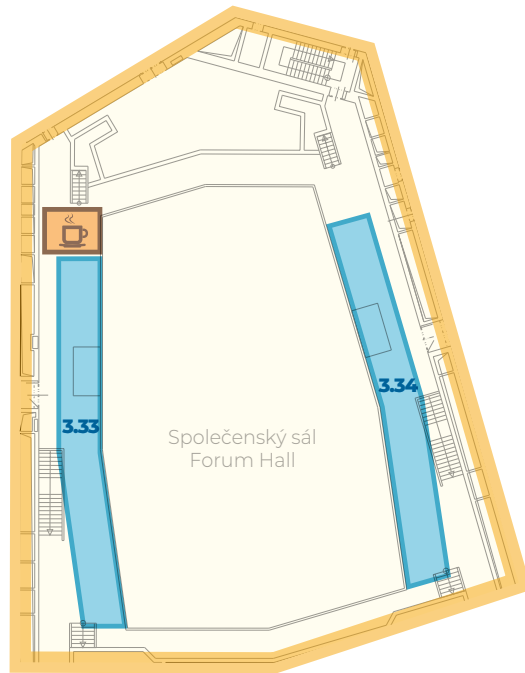
	N.
POLAND PAVILION	2.17
SAUDI ARABIA PAVILION	2.01
SLOVENIA PAVILION	2.10
SPAIN PAVILION	2.11
SWITZERLAND PAVILION	2.04
UNITED KINGDOM PAVILION	2.05
USA PAVILION	2.21
VIKONTROL	2.09

# WORLD ROAD CONGRESS 2023 IN PRAGUE CZECH & SLOVAKIAN PAVILION

## 2<sup>nd</sup> FLOOR



## 3<sup>rd</sup> FLOOR



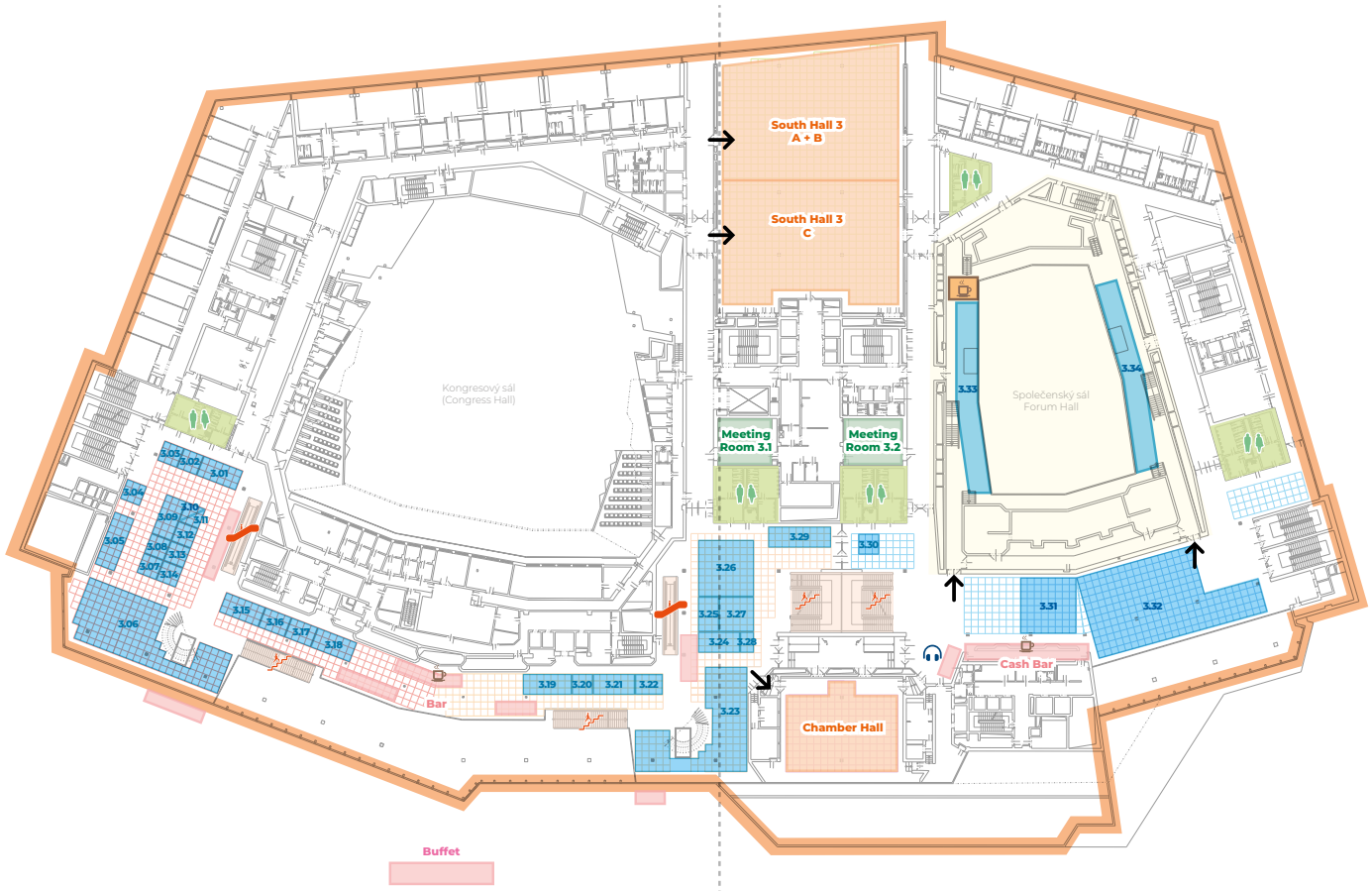
	N.
AMMANN	CS08
BESIP	CS13
CITY OF PRAGUE	CS30
COLAS	CS04
CROSS ZLÍN, A.S.	CS09
CZECH ROAD SOCIETY	CS01
DOPRASTAV	CS29
FUTTEC	CS27
GEOTECHNIKA ĐUROVE	CS14
HAENNI INSTRUMENTS	CS25
HBH PROJEKT	CS10
HRDLÍČKA HOLDING	CS23
LIBERTY STEEL	CS07
METROSTAV GROUP	CS17
MINISTRY OF TRANSPORTATION	CS13
M-SILNICE	CS16
NÁRODNÁ DIALNIČNÁ SPOLOČNOSŤ (NDS)	CS20
RATAELA	CS14
ROAD AND MOTORWAY DIRECTORATE OF THE CZECH REPUBLIC	CS13

	N.
SLOVAK ROAD ASSOCIATION	CS18
SLOVAKIA TRAVEL	CS19
STATE FUND FOR TRANSPORT INFRASTRUCTURE (SFDI)	CS13
STRABAG	CS06
SUS – ROAD MAINTENANCE ASSOCIATION	CS11
SWIETELSKY	CS05
ŠKODA AUTO	CS28
TRANSPORT RESEARCH CENTRE	CS13
VARS	CS22
VAS SERVICE	CS25
VDT TECHNOLOGY	CS15
VEACOM	CS24
VIA SALIS	CS21
VINCI CONSTRUCTION CS	CS03
VÍTKOVICE STEEL	CS12
VLČEK SOLUTION	CS02

	N.
EXCELLENCY IN THE CZECH REPUBLIC – CZECH UNIVERSITIES AND RESEARCH CENTERS	3.33
SPOTLIGHT ON EUROPEAN START-UPS – CZECH AND EUROPEAN START-UP COMPANIES	3.34

# WORLD ROAD CONGRESS 2023 IN PRAGUE EXHIBITION FLOOR

## 3<sup>rd</sup> FLOOR



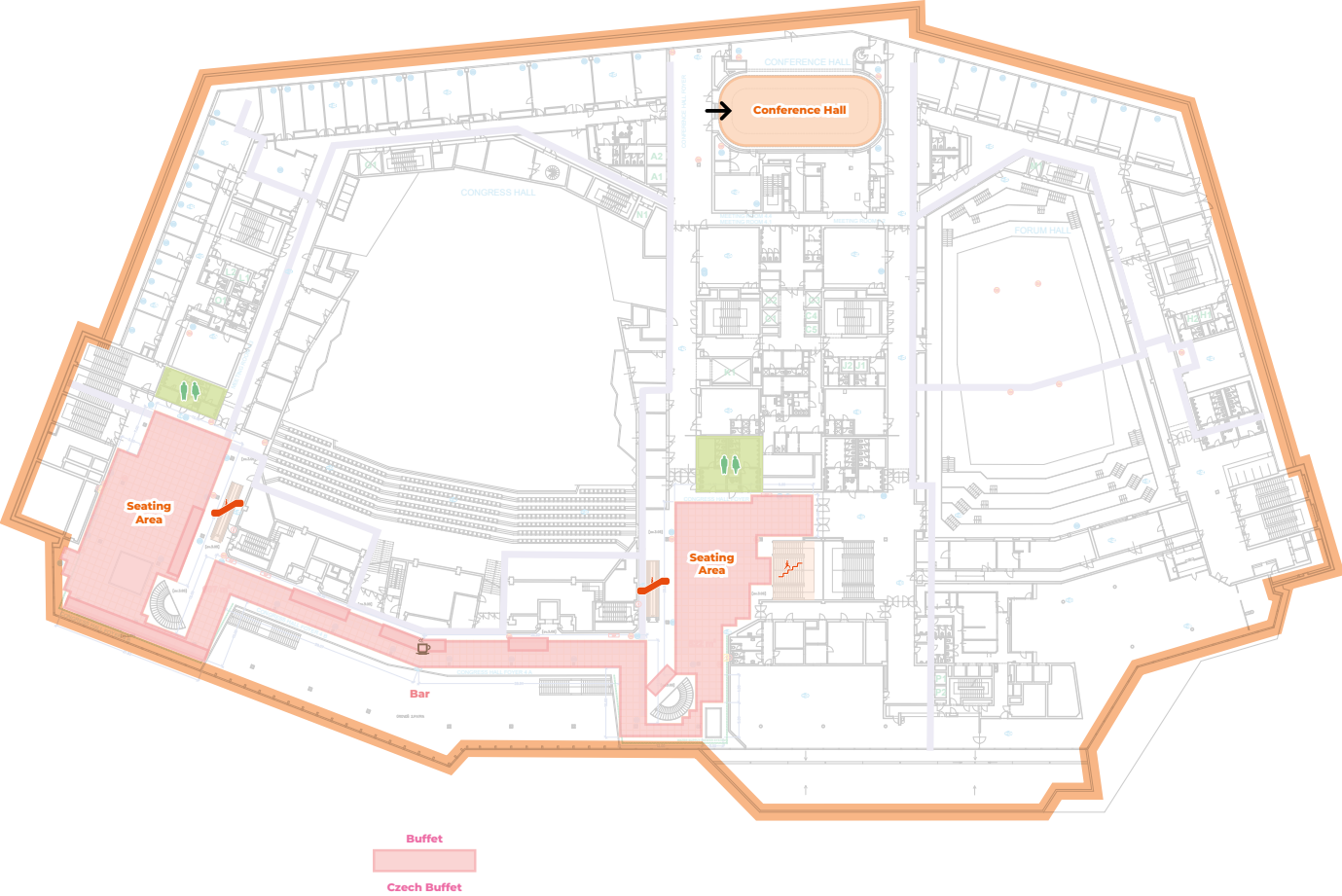
	N.
APPLIED CONCEPTS INC / STALKER RADAR	3.01
ARKEMA	3.09
ARRB SYSTEMS	3.21
BASF	3.22
BENIN PAVILION	3.08
CZECH-SLOVAKIAN PAVILION	3.31
CZECH-SLOVAKIAN PAVILION	3.32
EXCELLENCY IN THE CZECH REPUBLIC – CZECH UNIVERSITIES AND RESEARCH CENTERS	3.33
FONROCHE LIGHTING	3.27
HEINTZMANN TRAFFIC SYSTEMS	3.05
HOLCIM	3.29
INDONESIA PAVILION	3.25
INGEVITY	3.18
KAZAKHSTAN PAVILION	3.30
KEMION OY	3.17
MBF-GROUP	3.28
MEISER STRABENAUSSTATTUNG GMBH	3.19

	N.
MIT MESS- UND PRÜFTECHNIK GMBH	3.03
NÁRODNÁ DIALNIČNÁ SPOLOČNOSŤ (NDS)	3.26
NIRA DYNAMICS AB	3.02
PIARC PAVILION	3.23
RAUROS GROUP	3.15
ROADWAY SOLUTIONS	3.20
SAFETY PRODUCT	3.13
SELGEM	3.24
SÉNÉGAL PAVILION	3.07
SOUTH AFRICA PAVILION	3.06
SPOTLIGHT ON EUROPEAN START-UPS – CZECH AND EUROPEAN START-UP COMPANIES	3.34
TENZOVÁHY	3.10
TEUFELBERGER – REDAELLI	3.04
TRA 2024 CONFERENCE	3.16
UNITUM IT	3.11
UNIVRSES	3.12
XENOMATIX LIDAR ROADSCANNER	3.14

Street Food  
Ruffan

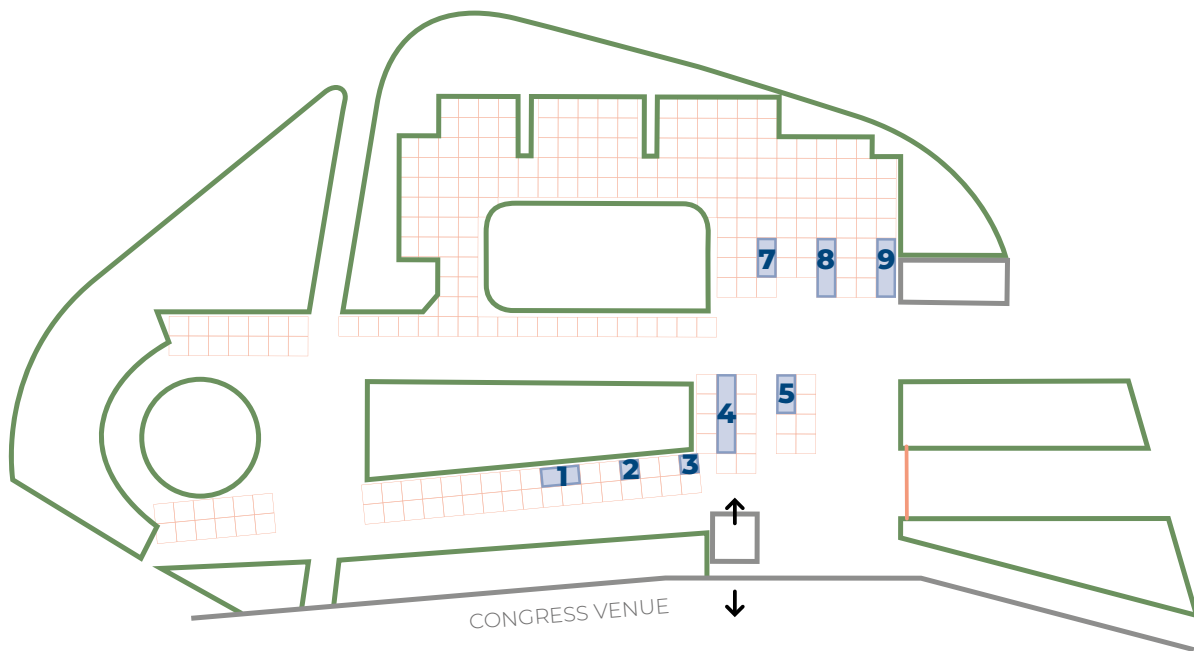
# WORLD ROAD CONGRESS 2023 IN PRAGUE EXHIBITION FLOOR

## 4<sup>th</sup> FLOOR



# WORLD ROAD CONGRESS 2023 IN PRAGUE

## OUTSIDE EXHIBITION AREA / PARKING



	N.
FLIEGL	8
FUTTEC	2
HRADIL	3
ROAD AND MOTORWAY DIRECTORATE OF THE CZECH REPUBLIC	4
ROAD AND MOTORWAY DIRECTORATE OF THE CZECH REPUBLIC	5
ROAD AND MOTORWAY DIRECTORATE OF THE CZECH REPUBLIC	7
VLČEK SOLUTION	1
ŽILINSKÁ UNIVERZITA	9



Each represents 3 × 3 metres

Weight limit 400 kg/sqm  
(spread footing not included  
in exhibition space rental  
and needs to be provided  
by the Exhibitor)

# Congress Awards

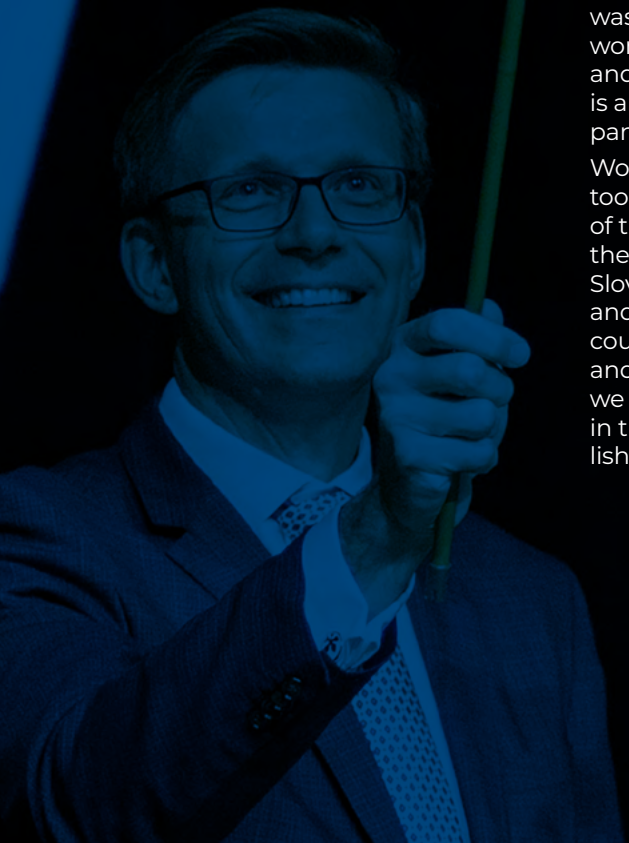
## Congress of the Year 2023

**The reason why –  
the motivation of our winning candidacy:**

The World Road Congress covers the full spectrum of transport infrastructure and the road economy and addresses all key topics – best practices, green deal, smart mobility, decarbonisation, resilience, recycling, financing, research, innovation, legislative frameworks, new technologies, gender, materials, etc. Governmental Government delegations from all over the world and delegates from 121 countries visited the Congress and shared their experiences. We hosted the project as Czechoslovakia.

The Congress was attended by 42 ministerial delegations, 20 embassies and was visited by 2000 high school and university students from the Czech Republic and the Slovak Republic (over 40 schools in total). The event was organized as a “paperless” event, communication was done completely through an app and the web. Two sheltered workshops were involved in the project, producing materials (bags and sustainable cups) and catering services (Silent Café). The congress is also professionally a great investment in the future – 17 start-up companies participated for free.

World Road Congress is an absolutely exceptional event, which took place with the support not only of ministries, but also of the Government of the Czech Republic and the Capital City, with the support of the academic community of the Czech Republic and Slovakia and with a record participation of students, companies, schools and Czechoslovak experts. The Czech Republic became only the fourth country in the world where the event took place for the second time and will probably never be held here again. For the first time in history, we managed to involve science, research, innovation and education in the Congress. Thanks to the project, the Czech Republic has established new international collaborations.



# Congress Awards

## Inspiration of the Year 2023

**The reason why –  
the motivation of our winning candidacy:**

**The World Road Congress  
had two exceptional aspects:**

- For the first time ever it was completely “paperless” and “re-use”
- The congress was digital, delegates navigated and communicated through an app and web interface, congress materials (bags etc.) were donated after use
- For the first time in history, 2000 students attended for free, from the Czech Republic and Slovakia
- The students had the opportunity to attend a specially organised conference with the participation of leading experts from the state administration, companies and the academy, they were introduced to the different branches and organisations of the state administration, they were able to tour the international exhibition and visit the national pavilions of 32 countries, meet with ten universities, 17 start-ups and 30 companies from the Czech Republic and Slovakia, experience the atmosphere of an international congress, taste cuisines from all over the world, participate in competitions, arrange temporary jobs and university projects, get acquainted with the construction project cycle and all the aspects that accompany it. The students were guided through the congress by members of the Czech Road Society Board.

**Technology and Strategy:**

- Using the app to communicate, to share materials, to arrange meetings
- use of video as a substitute for the daily congress newspaper
- Sponsor for sustainability – collecting used materials and tools and putting them back into circulation

**Social impact:**

- Network of 1200+ secondary schools created
- Regular communication with universities and secondary schools
- Student programme created with government support
- Sponsors of student activities enriched the program with donations and expertise
- Student participation in the congress completely free of charge for schools
- Participation of 10 universities from the Czech Republic and the Slovak Republic
- Investing in the future, reaching out to the young generation, introducing student projects to the world



XXVII<sup>TH</sup> WORLD  
ROAD CONGRESS  
PRAGUE 2023



# Photogallery







# Photogallery Gala Dinner











# Slovakian Day



