Smart Transportation Alliance

Key Challenges for the Smart Transportation Infrastructures of the Future

Assessment of Results of Perception's Survey

DISCUSSION PAPER 1/2019

January 2019

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1. Introduction

Between April and October 2018 four on-line surveys were carried out to investigate the expert community's perceptions on the key topics covered by the STA Technical Committees:

- Smart Mobility;
- Smart Safety& Security;
- Smart Sustainability;
- Smart Financing.

The aim was to get an indication about the general orientation on the different domains of the Smart Transport Infrastructures of the Future in order to identify current weaknesses and priorities of intervention.

Each survey was led by the Chairman of the related Technical Committee (TC), namely: Dr. Elena Dr Elena de la Peña (TC1 on Smart Mobility), Mr Wolf P. Zeplin (TC2 on Smart Safety and Security), Mr César Bartolomé (TC3 on Smart Sustainability), and Prof. José Manuel Vassallo (TC4 on Smart Financing).

Surveys have been conducted by submitting specific online questionnaires through 'SurveyMonkey' web tool, collecting globally 371 answers. In particular, the following four waves were conducted:

- Survey on Smart Mobility (April 2018): 107 respondents;
- Survey on Smart Safety and Infrastructures (June 2018): 69 respondents;
- Survey on Smart Sustainability (September 2018): 84 respondents;
- Survey on Smart Financing (October 2018): 111 respondents.

Sections 2-5 of the present Discussion Paper synthesise the outcomes of the different surveys while section 6 provides some conclusions.

Annex 1 contains the main graphs resulting from the surveys.

2. Smart Mobility

The survey has analysed the expert's perceptions on Smart Mobility issues critical to secure actual deployment of a new generation of transportation infrastructures. The following topics have been addressed:

- Infrastructure characteristics;
- Transition from 'bricks' infrastructures to Smart infrastructures;
- Infrastructure adaptation to connected/automated cars;
- Legal, financial and budgetary systems suitability.

The 107 answers collected highlight the following:

- Almost 60% of respondents think that high-quality service and improvement of mobility are **key features** for considering an infrastructure 'smart'; on the contrary, less than 30% of the respondents believe that resilience or the provision of added value are key attributes of a Smart Infrastructure.
- 68% of the participants consider that there had been no or minor advances in the **creation of Smart Infrastructures**.
- With regards to the **adaptation of roads** to connected or automated vehicles, 61% of the respondents consider that such transition is not so advanced. In addition, the respondents consider as relevant in this context the adaptation of both urban roads and inter-urban networks.
- Almost 96% of the participants consider that **making infrastructure and transport smart** will be cost-effective in the long run.
- The overall perception also highlights that the **legal, financial and budgetary systems** still require a higher level of adaptation in order to accommodate the deployment of Smart Infrastructures. More specifically, 79% of the respondents consider the current legal system not at all or slightly adapted to this evolution, while 79% perceive the financial and budgetary systems not adapted at all or only slightly adapted.

According to the results, in the next future the civil construction and transport services sectors should work increasingly together in the definition of a viable model for the Smart Mobility of the 21st century, considering road networks (interurban, urban and rural) as a unique system interconnected with other transport networks.

3. Smart Safety & Security

The survey has investigated the expert's perceptions on challenges and opportunities faced by a new generation of safer and more secure transportation infrastructures, focusing on the following topics:

- Perception of infrastructures' safety and security for the different transport modes;
- Actions to increase safety and security;
- Actions to reduce road mortality and injury rates;
- R&D activities.

The 69 answers highlight that:

- Airports are perceived as **safe or very safe** by 95% of the respondents. Railways and ports follow with respectively 92% and 86% of respondents. However, 55% of them declare road infrastructures as not very safe.
- In terms of **security** a similar pattern shows that airports are perceived secure or very secure by 89% of the respondents. Ports and Railways follow with respectively 71% and 73% of respondents. Again, 52% of them declare roads as not very secure.
- On a ranking scale 1-5, **safer design** of infrastructure is considered to be the action that has the most potential of reducing transportation mortality and injury rates. This is followed by the modernisation of existing infrastructures, their maintenance, safety monitoring (e.g. data collection), and finally the standardisation of safety devices and equipment.
- The majority of respondents also believe that safety-related actions should mainly be taken on **interurban networks** (61%) and to a lesser extent on urban Networks (30%). Rural networks are not considered a priority, with only 9% of choices.
- 87% of the respondents agree with the statement that solutions acting directly on infrastructure allow a rapid implementation and have immediate **social benefits**.
- For 70% of the participants, the contribution of **European Standardisation (CEN)** to safer devices and equipment is considered effective or very effective, while 30% consider it not so effective.
- Security issues appear more relevant for **passenger transport** (93%) compared to freight transport (86%).
- In terms of actions with more potential to increase security, on a ranking scale 1-4, respondents have indicated **infrastructure-based systems** (e.g sensors) as the most effective. This is followed by adequate resilience planning, cyber-security and, lastly, police enforcement measures.
- 48% of respondents believe **funding for safety and security** should be increased at national level and 41% at European level; the rest (11%) point out at the local level.
- 80% of the participants believe that **infrastructure R&D** should address both safety and security issues. However, R&D efforts in safety are perceived relatively more important (18%) compared to security (3%).

According to these results, STA considers that transportation accidents remain an on-going challenge across developed and less-developed countries. According to the stakeholders consulted, the design of transportation infrastructure is primordial to reduce the number of fatalities and injuries; overall, modernisation of existing infrastructures is perceived as more effective than their maintenance.

4. Smart Sustainability

The survey has investigated the expert's perceptions on current and future hurdles and challenges for transport sustainability, addressing the following topics:

- Sustainability of the different transport modes;
- Most relevant transport and infrastructures' variables affecting sustainability;
- Most relevant infrastructures' elements in relation to sustainability;
- Sustainability in urban mobility.

The questionnaire has not specified any area of sustainability, with the specific objective of leaving the respondents to deal with the general concept. The 84 answers collected highlight that:

- 87% consider that **making infrastructure sustainable** is affordable.
- Roads and planes are perceived as the **less sustainable**, with a 50% of respondents considering roads not or only slightly sustainable, and even a higher 57% for planes. Railways are perceived as the **most sustainable** mode with a 56% voting as fairly or very sustainable.
- Around 80% of respondents think that the **sustainability performance** of all transport modes (roads, planes, railways, ships, urban mobility) is improvable through different measures.
- Results are quite mixed regarding that is the most important factor for achieving sustainable transport, measured in a ranking scale 1-5. Yet 50% choose **Reducing Carbon Foot Print** as the most important factor, while 38% think that reducing non-users disturbance is the less important factor.
- Talking about **mobility sustainability**, the most relevant variables are vehicles (57%) and fuels (51%).
- **Durability** is the most relevant variable for infrastructure to be sustainable, with 47%, followed by Impacts During Operation, with 45%.
- Again, very mixed results about which elements are relevant for infrastructure to be sustainable. One third of respondents consider that **structures** (tunnels, bridges or terminals) would be the most relevant.
- For 63% of the respondents the **correlation between sustainable and smart** is high or very high.
- In the scope of **Urban Mobility**, Public Transport (63%) and Users Behaviour (46%) are regarded as the most relevant elements.
- Compared with **10 years ago**, all dimensions related to sustainability are perceived in general between slightly and fairly sustainable, for at least a 60% of the answers.

In addressing sustainability, most respondents believe that both infrastructures and mobility can be made more sustainable, and the transport modes, improved. For infrastructures, attention should be put to their durability and their 'smart' nature. For mobility an improvement in the environmental impact, especially for roads and air modes should be pursued.

5. Smart Financing

The survey has investigated the expert's perceptions on smart financing issues connected to the infrastructures of the future, focusing on the following topics:

- Cost effectiveness and users' awareness about cost;
- Infrastructure financing in the different project phases;
- Private participation in financing;
- Critical aspects in Public Private Partnerships (PPPs).

The 111 collected answers highlights that:

- Over half of the respondents (65%) believe that the **European infrastructures and transport services** are not cost-effective.
- 45% of the respondents are of the opinion that users are aware or partially aware of the r**eal cost** of transport services and infrastructure facilities, whereas 55% of the respondents declare the users are unaware, suggesting that people do not hold the right perception of the resources needed for providing transportation infrastructures.
- Results are extremely even when asked about the most challenging issue in **infrastructure financing**, suggesting that respondents believe that financing is equally challenging in each phase. Nevertheless, maintenance received the highest score.
- When asked about which actors should play a more **active role** in the future of infrastructure financing, the European Union ranked 1st (30%), followed by National Governments (25%).
- When asked about the most **suitable funding mechanism** for each transport mode, tolls and fares appear to be the most suitable option for roads, railways and airports infrastructures, while the taxation option is chosen for railways and urban transport.
- Results show that respondents tend to favour the **participation of the private sector financing**, in particular for air and maritime transport, while a weaker interest is registered in relation to urban mobility infrastructures.
- Respondents think that both public and private shareholders should bear the **risks** when it comes to design, construction, demand, availability, operation and financial risks, while 65% of the respondents think that public sector should be mostly responsible when it comes to legislative risks.
- Contract design and risk distribution were seen to be the most critical aspects for the success of **PPP contract** (67% chose it as most or second most critical aspect), whereas infrastructure reversion was seen as the least important (66% thinking it would be the least or second to last important aspect).
- When asked about **liberalisation**, there is a general appreciation of the liberalisation process in all transport modes. Nevertheless, such preference is less pronounced in the road sector.

The survey clearly highlights that cost-effectiveness of transport infrastructures and services needs to be improved, even by eventually increasing the user's awareness about costs. In infrastructure provision, the financing of maintenance activities is critical. Although European and National Institutions should continue playing a significant role, the participation of the private sector in financing needs to be further fostered. In this respect it is fundamental to provide efficient PPP schemes, with particular attention to contract design and the optimal allocation of risks between public and private actors.

6. Conclusions

The perception surveys have allowed identifying the most relevant aspects and issues to be addressed in order to advance infrastructures and mobility towards smarter performances. The following table synthesises the main indications in the different areas investigated.

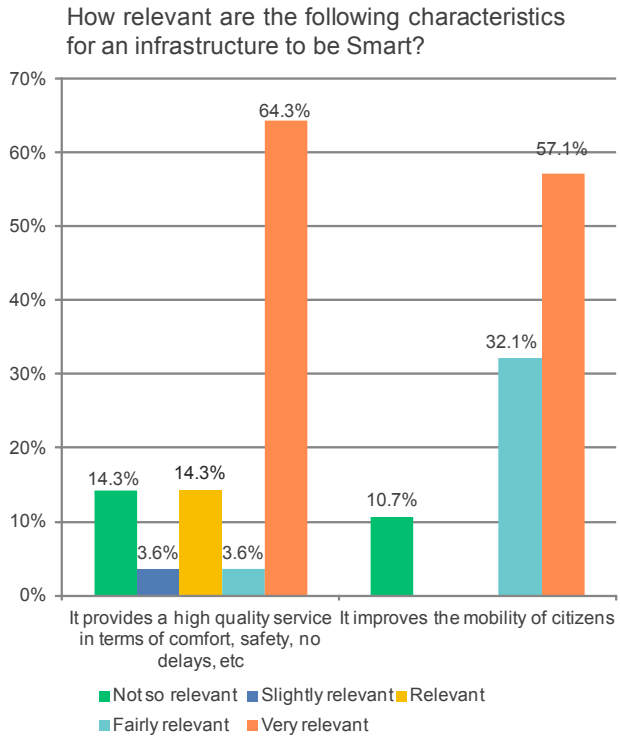
Table 1 Smart Infrastructures and Mobility priorities

Area	Indication
Smart Mobility	- Road networks should constitute a unique system interconnected with other transport networks.
Smart Infrastructures	- Road safety needs to be further improved through a safer design. - Modernisation of existing infrastructure should be considered more effective than normal maintenance,
Smart Sustainability	- Attention should be paid to the durability of the infrastructures -For mobility it should be improved the environmental impact of road and air modes.
Smart Financing	- Users' awareness about costs should be increased - Maintenance should receive suitable financing - The participation of private sector in financing should be further fostered - In PPP schemes is crucial to pay attention to the contract design and reach an optimal allocation of risks between public and private subjects.

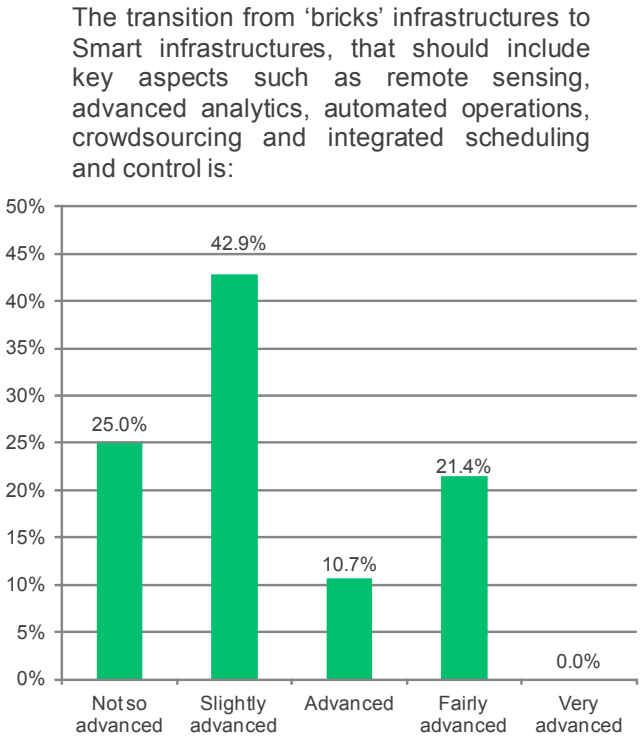
ANNEX 1 - Perceptions' survey main graphs

Survey on Smart Mobility

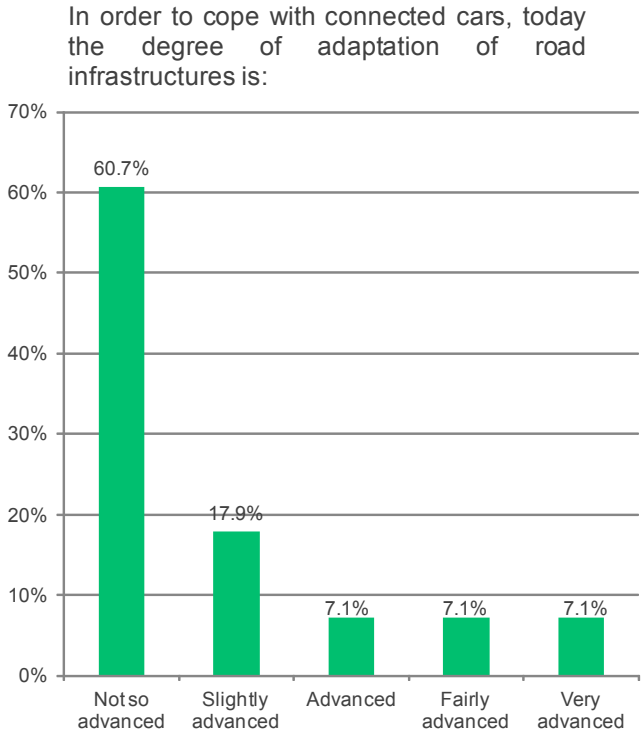
Infrastructure characteristics



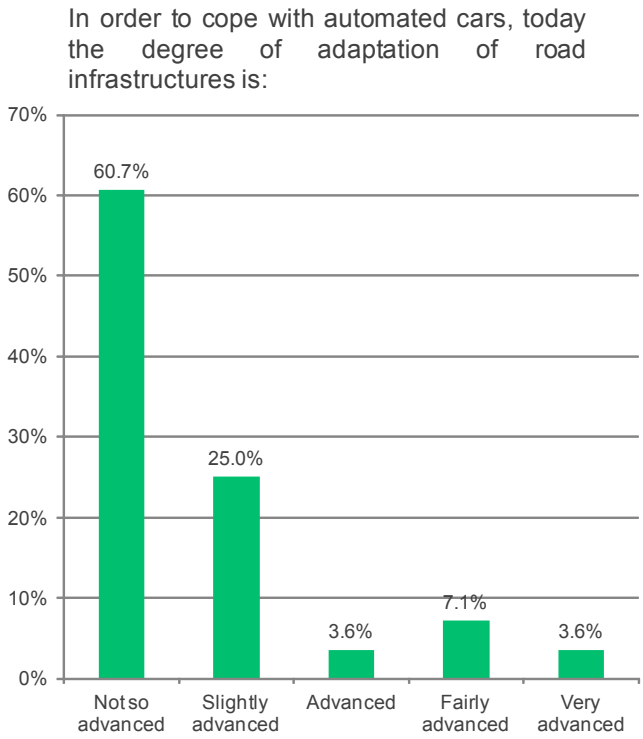
Infrastructure transition



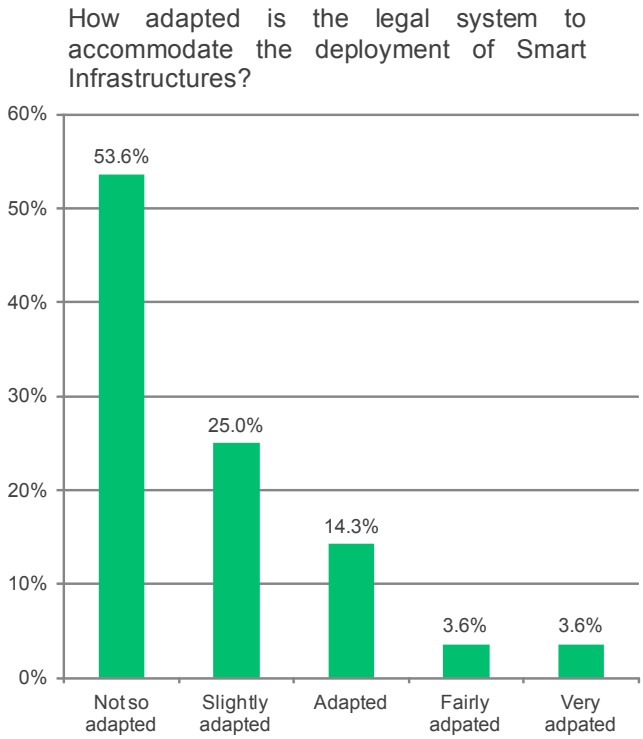
Infrastructure adaptation to connected cars



Infrastructure adaptation to automated cars

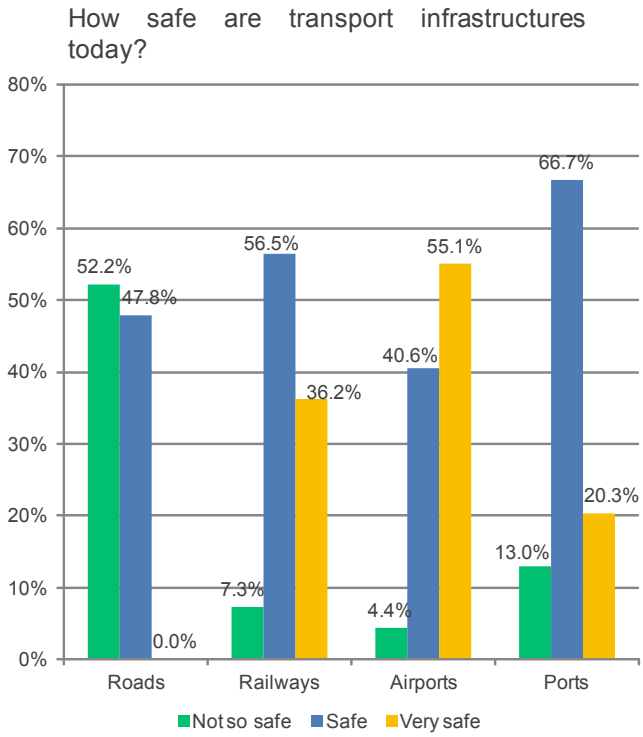


Legal system

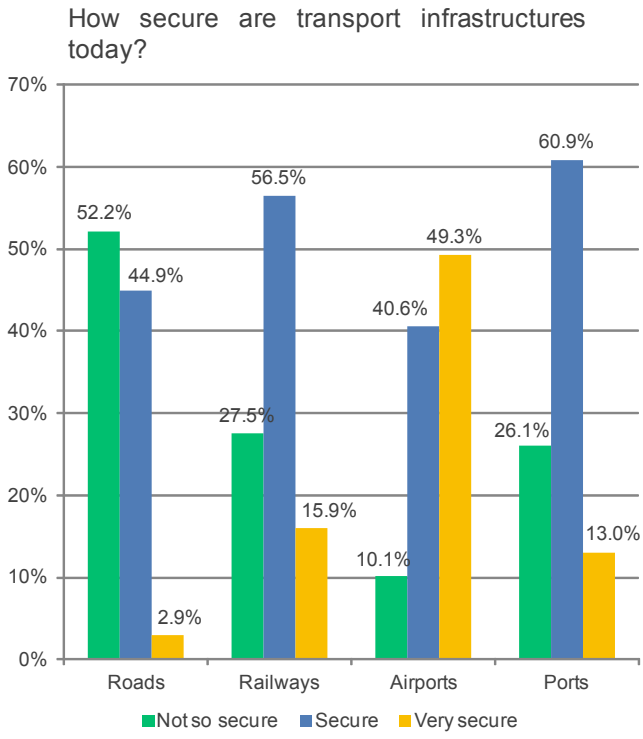


Survey on Smart Safety & Security

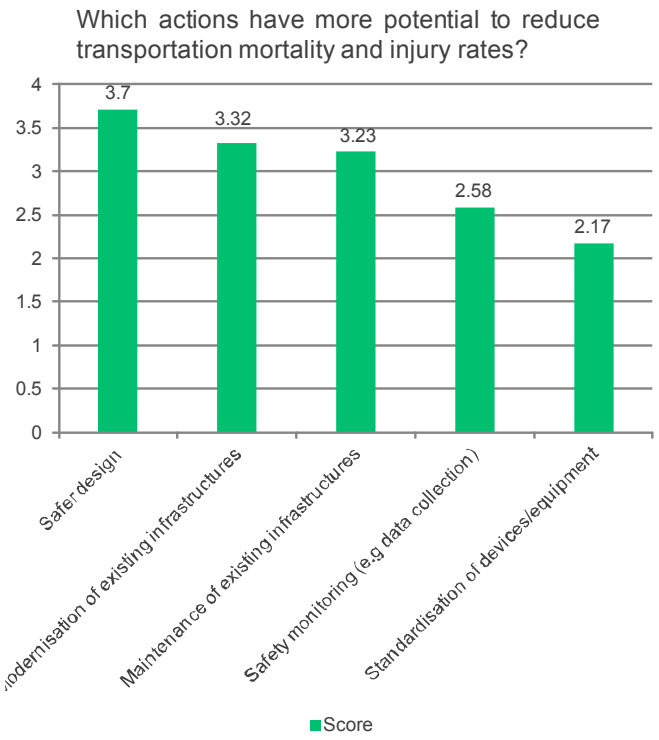
Infrastructures' perceived safety



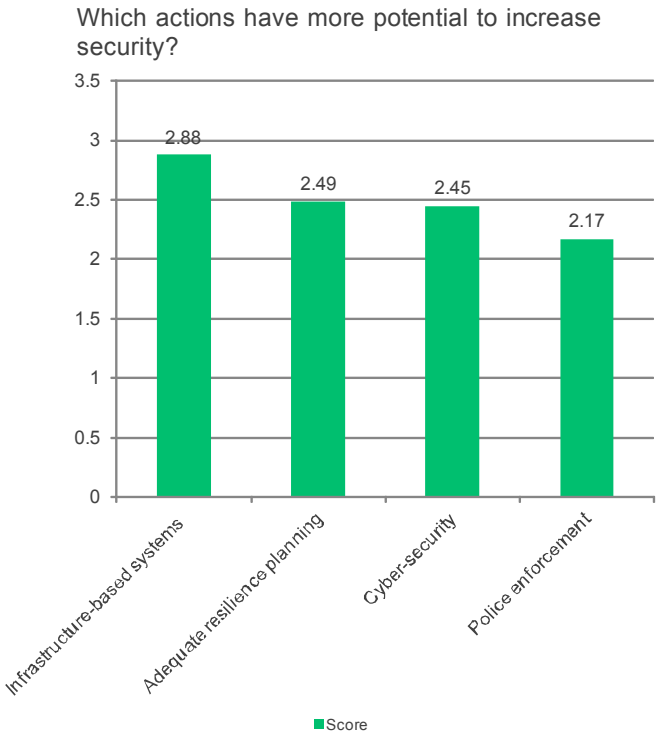
Infrastructures' perceived security



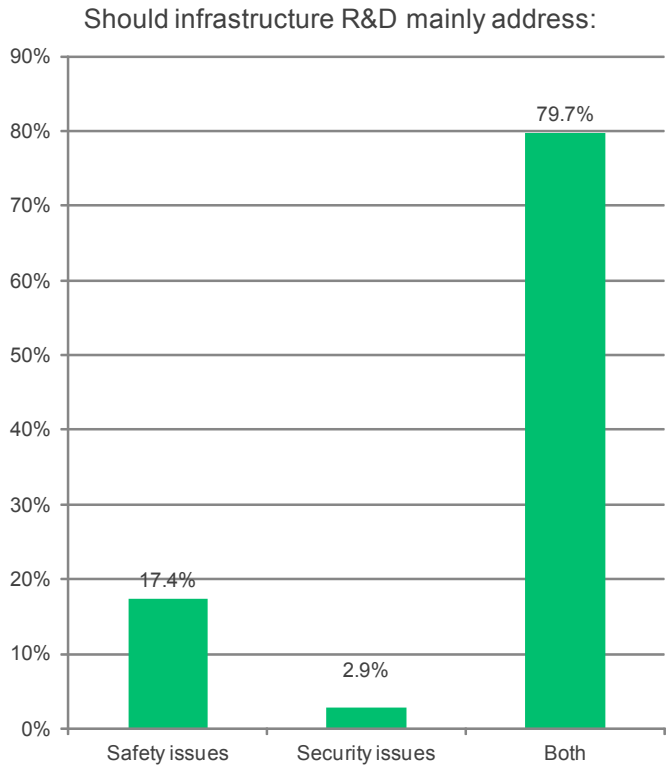
Actions to improve safety



Actions to improve security

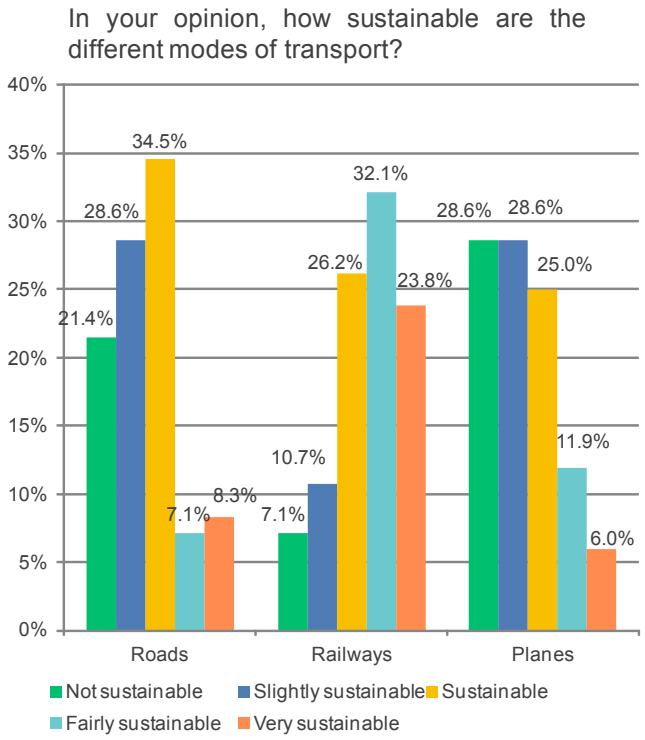


R&D activities

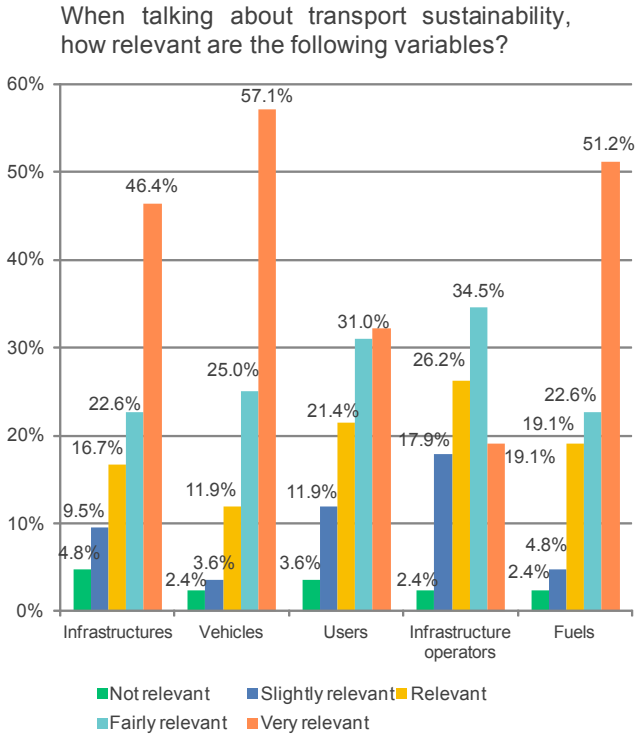


Survey on Smart Sustainability

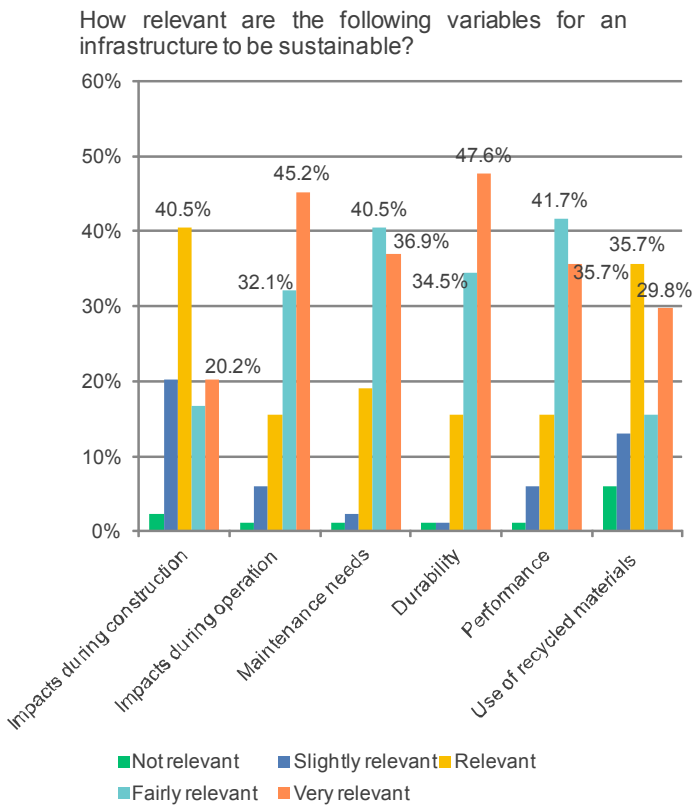
Sustainability of the different transport modes



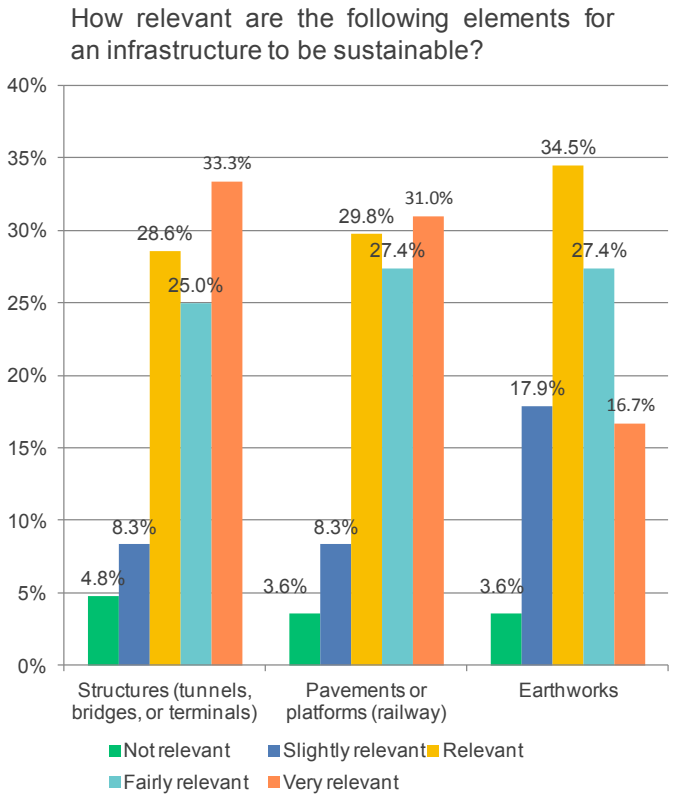
Transport sustainability variables



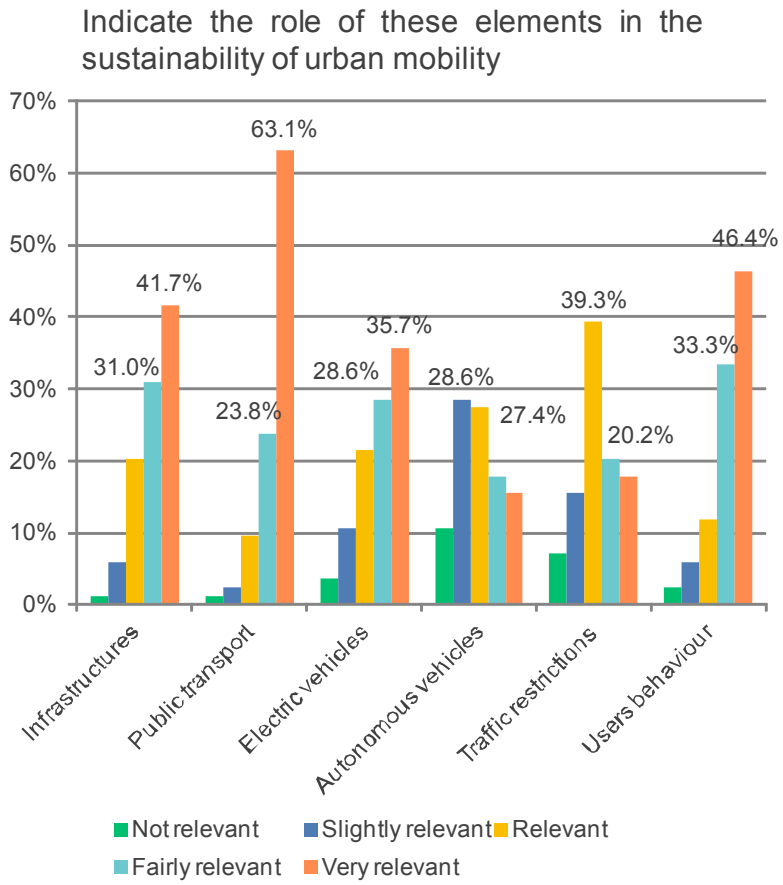
Infrastructure sustainability variables



Infrastructure sustainability elements

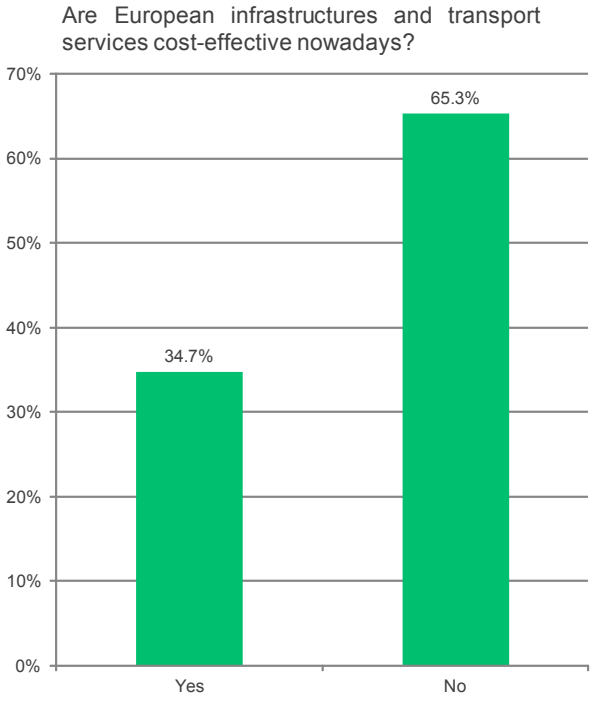


Urban mobility sustainability

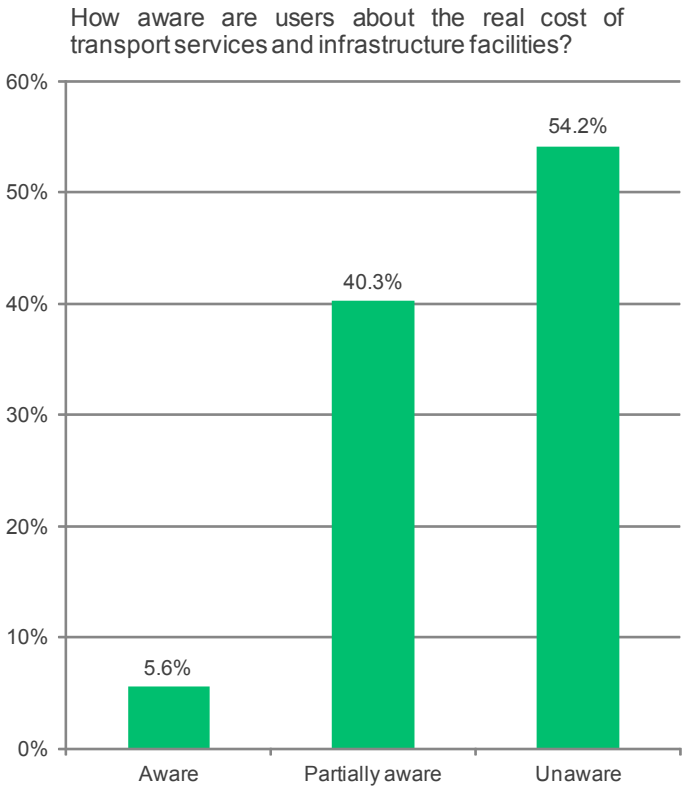


Survey on Smart Financing

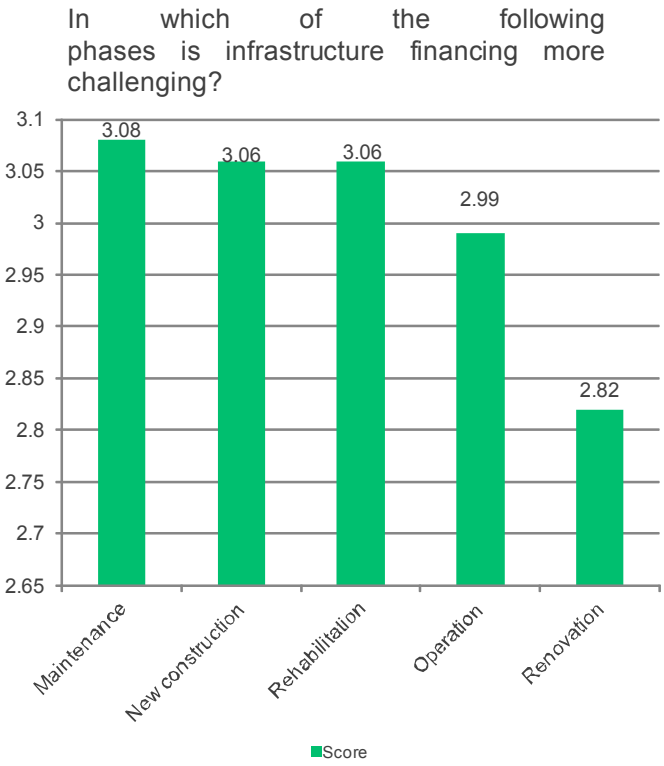
Infrastructure cost-effectiveness



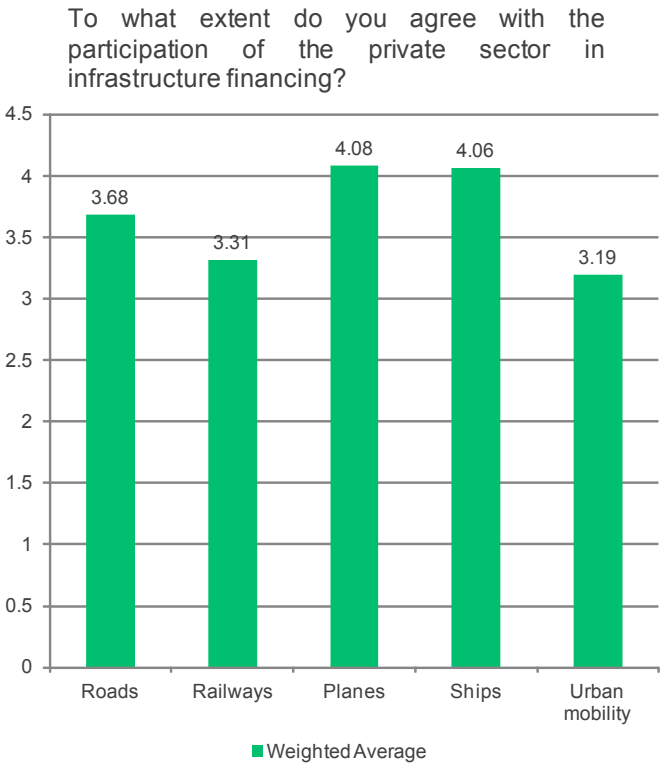
Users' awareness



Infrastructure financing



Private participation in financing



PP's critical aspects