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Road Related Data and How to Use it

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VIRTUAL | VIRTUEL

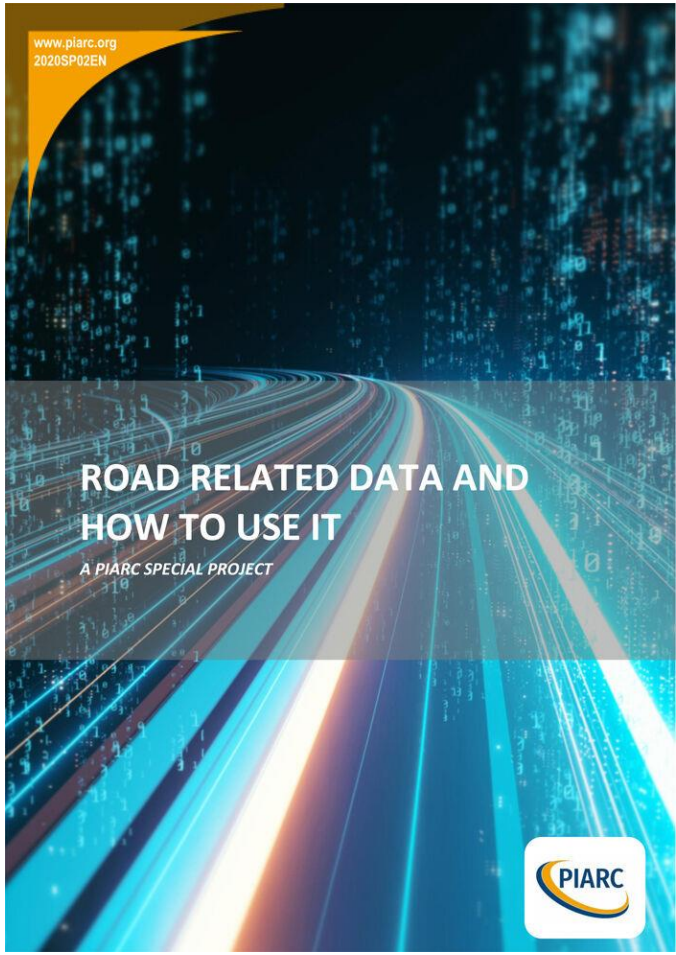
XVI WORLD WINTER SERVICE AND ROAD RESILIENCE CONGRESS
XVI[e] CONGRÈS MONDIAL DE LA VIABILITÉ HIVERNALE ET DE LA RÉSILIENCE ROUTIÈRE
XVI CONGRESO MUNDIAL DE VIALIDAD INVERNAL Y RESILIENCIA DE LA CARRETERA

PIARC Calgary Canada

Welcome and session introduction

PIARC Special Project mechanism

- PIARC Special Project mechanism aims to respond to **emerging issues** in the road sector within a limited time frame (12 months).
- Special Project on RRD was proposed by USA and it was actively supported by Germany and Portugal.
- The following PIARC Technical Committees were involved:
  - TC 1.1 Transport administrations performance.
  - TC 1.5 Disaster management.
  - TC 3.1 Road Safety.
  - TC 3.2 Winter service.
  - TC 3.3 Asset management.
- Selected external consultant: Atkins (UK).



Presentation Outline

- Project Background
- Literature Review
- Online Survey
- Business Model Analysis
- Conclusions and Recommendations
- Case studies – US, Netherlands, UK

Project Background

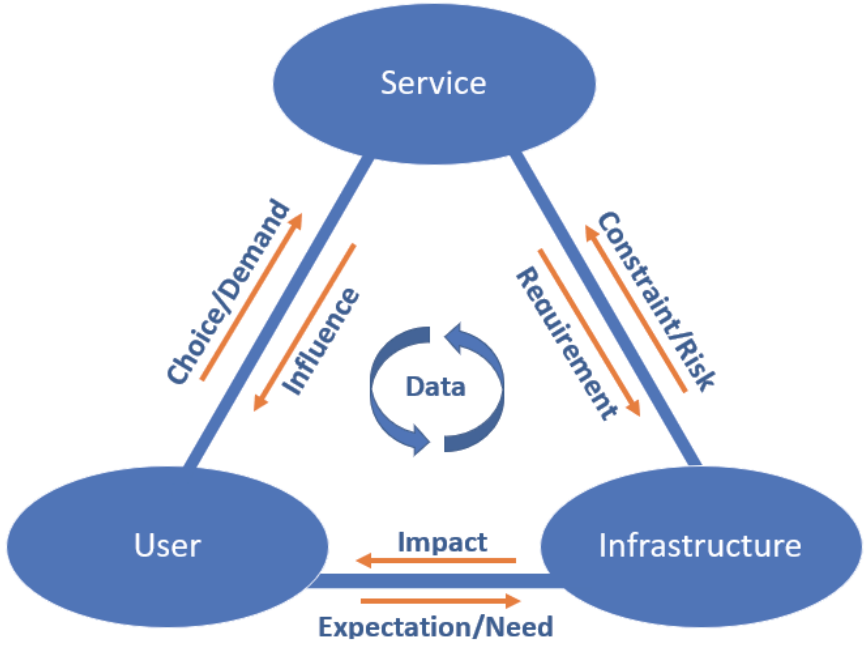
Project Background

The challenges

- Network demand and customer expectations
- Fast-moving data developments and limited clarity on how best to utilise data to improve services

Project objectives

- Provide an overview of existing, new and emerging state of the art
- Provide PIARC members with information and guidance to develop their approach of using data, and improve value of services



Literature Review

Literature Review

- **Aim** – review state of the art and Technology Readiness Levels
- **Output** – thematic review in the project report (100+ sources), from larger set of indexed resources (200+ sources)
- **Benefit** – learn from existing technical knowledge and use to inform local pilots, trials and applications

Road Condition and Maintenance

Traffic Data and Information and Intelligent Transport Systems (ITS)

Connected and Autonomous Vehicles (CAVs)

Social Media

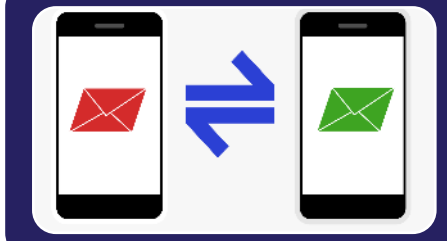
Road Safety

Disaster Management

Literature Review – Examples of Key Findings

Social Media

Potential source of information to road administrations as well as means of communication – emerging work



Smartphones

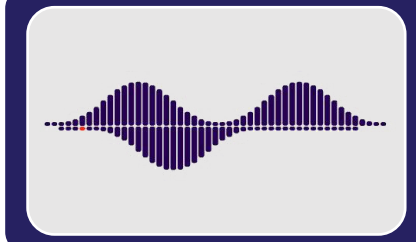
Continuous and efficient source of data, using ‘everyday technology’ – can either support existing data collection processes or fill gaps where coverage is not sufficient

CAVs

Increased alignment between needs of road infrastructure and the end user – benefits for road administration, vehicle suppliers and their mutual customers

Literature Review – Examples of Key Findings

Drones (UAVs)
Low-cost data collection method for asset condition and maintenance management



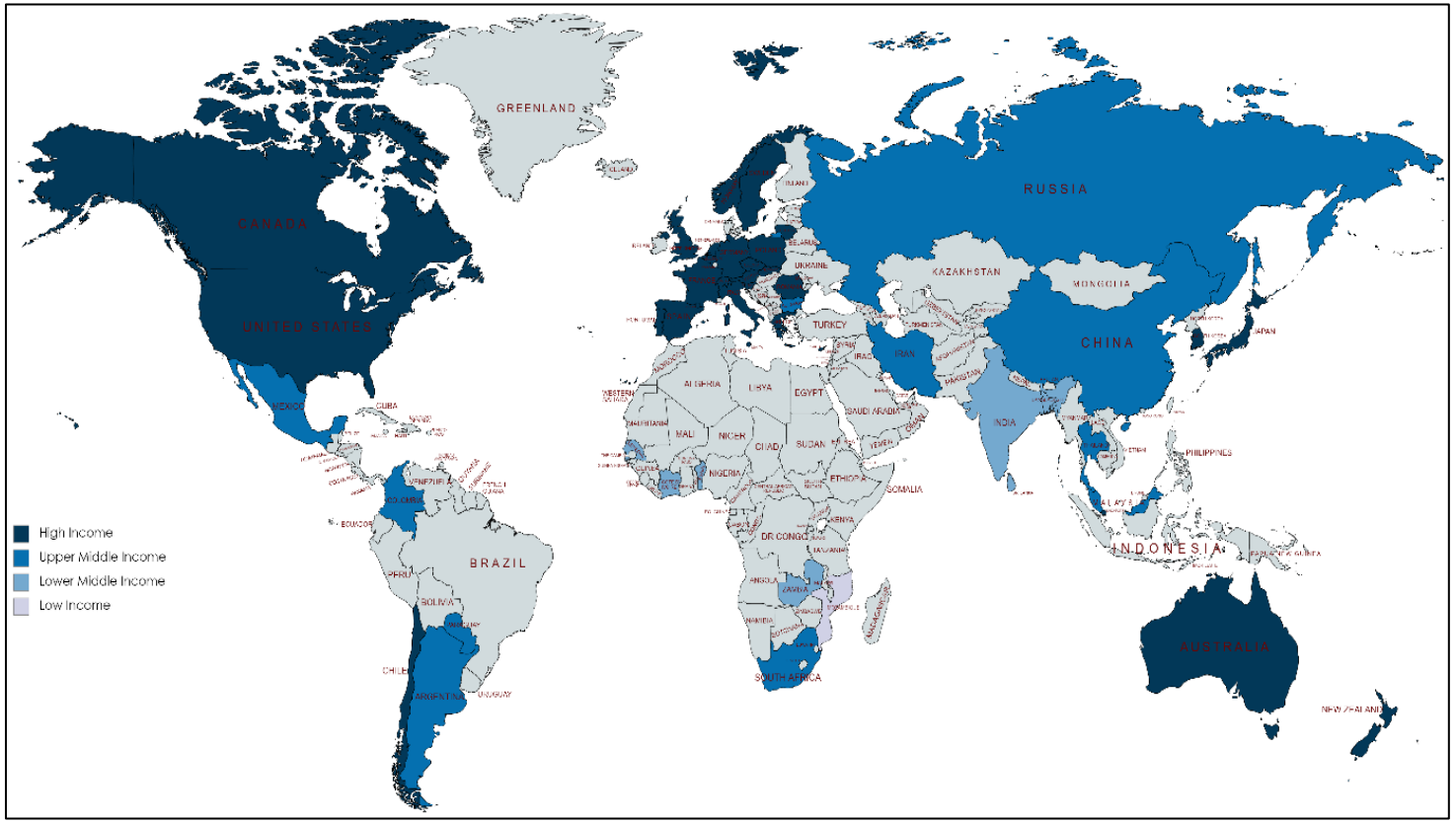
Acoustic Sensors
In-lab tests proved the feasibility of using an acoustic sensors to monitor the effect of traffic on the condition of the road pavement

Disaster management techniques (vehicles and sensors)
Combine data from vehicle tracking, sensors covering seismic location and intensity, ground and structural modelling, and simulation systems to identify sections of the road network for prioritised responses

Online Survey

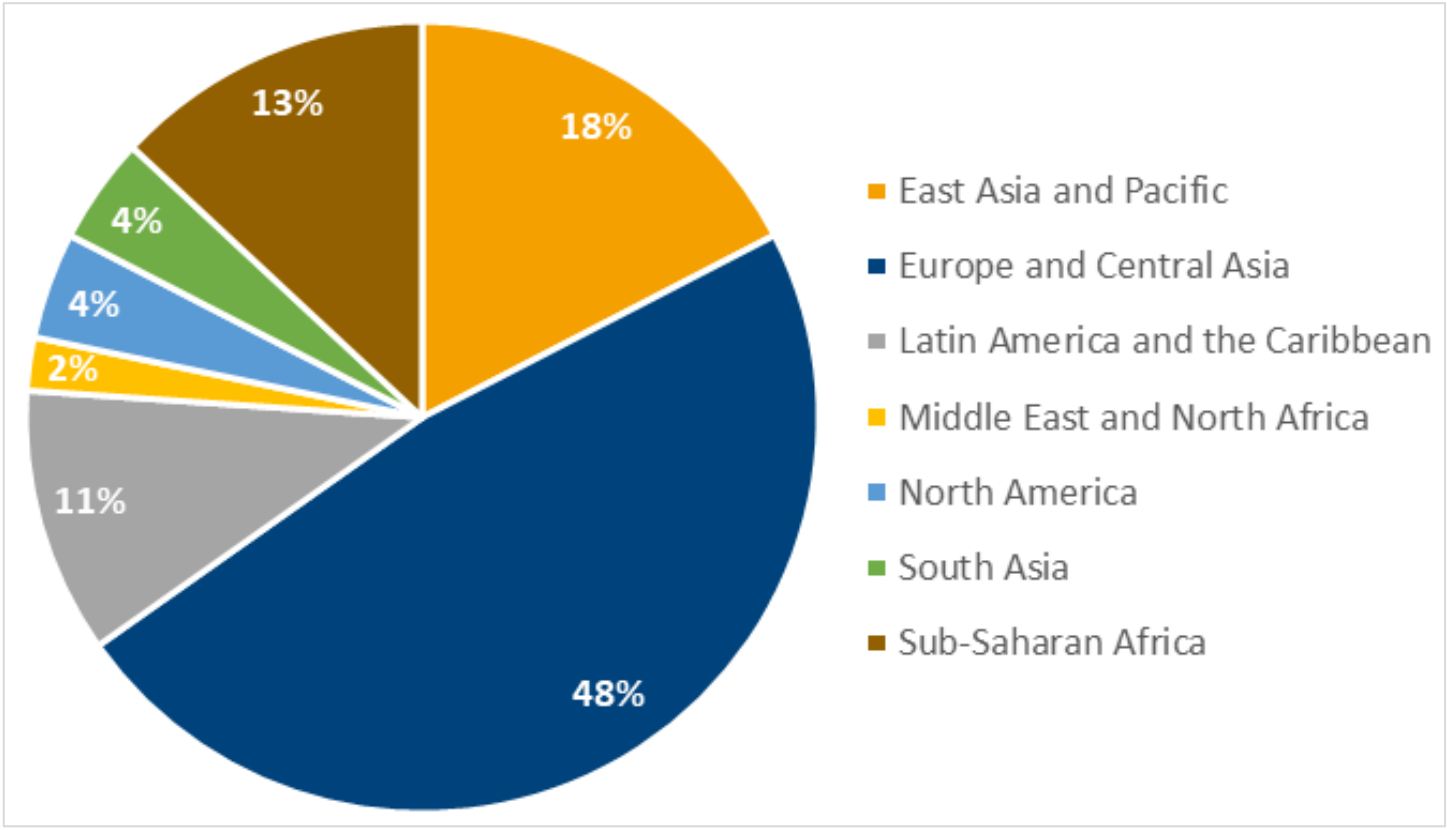
Online Survey

- **Aim** – explore data applications by road administrations within PIARC
- **Output** – extensive analysis of 80 responses from 46 countries, across all income levels
- **Benefit** – identify opportunities to introduce or improve applications of data across PIARC members

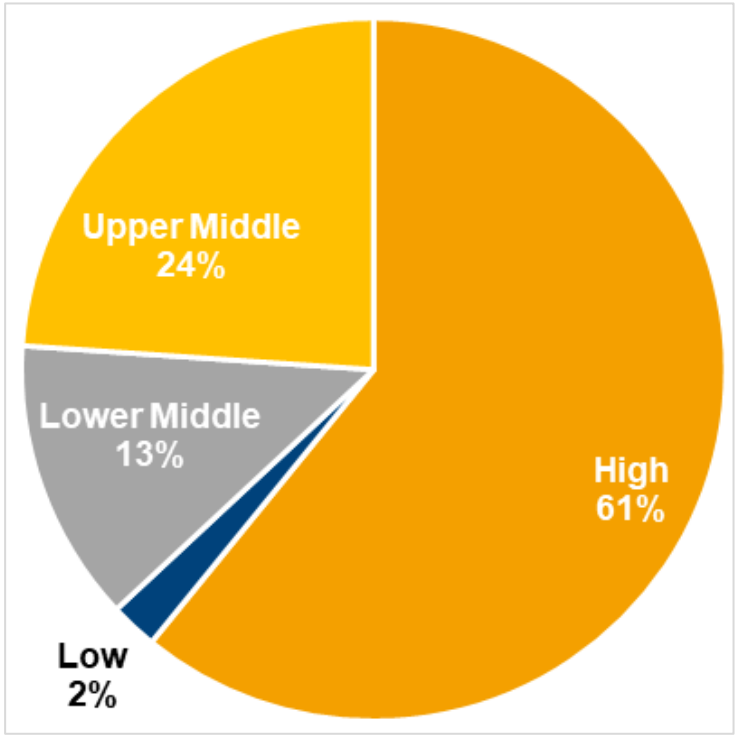


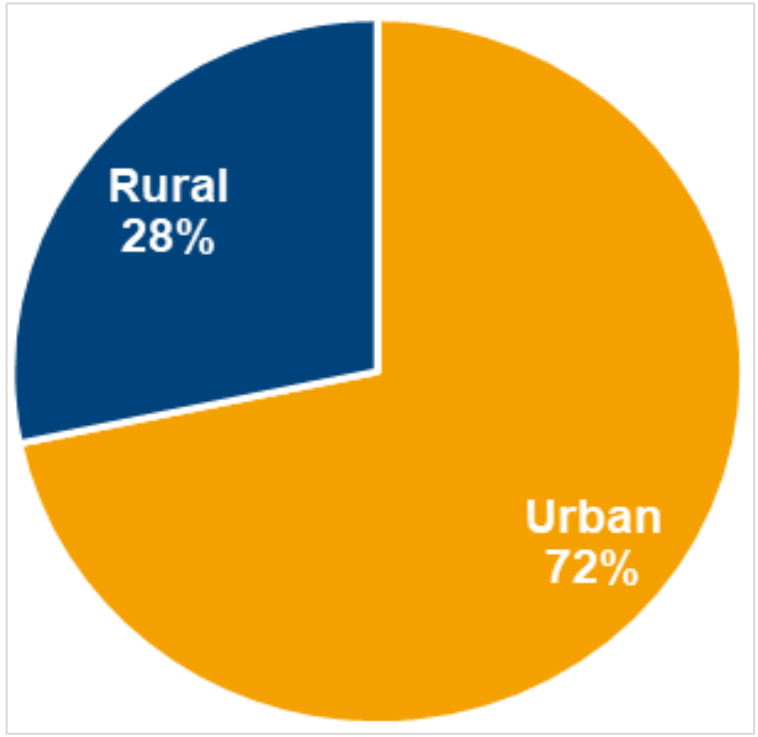
Online Survey – Geographical Regions Split

- **<u>46 countries</u>**
  - 80 organisations
  - 7 geographical regions



Online Survey – Income Levels and Urban/Rural Split





Online Survey

- 3 high-level themes
- 12 main questions
- 96 sub-questions

Online Survey – Examples of Key Findings

Artificial Intelligence (AI) in the UK

Viable automated road survey used as an alternative to other equipment to avoid human variability

Asset Management System (software) in Zambia

Use of HDM-4 system interface to prioritise road works and for asset lifecycle planning

Weather Sensors in China

Automatically detect weather information, road condition and visibility information

Business Model Analysis

Business Model Analysis

- **Aim** – development of structured guidance to develop / improve approaches to data
- **Output** – case studies, advice and recommendations
- **Benefit** – facilitate organisational change and encourage collaboration between road administrations and private sector

Business Model Analysis – Netherlands (HIC) Deep Dive

- Rijkswaterstaat, RAI Association and National Data Warehouse

Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

rai vereniging

ndw

National Road Traffic Data Portal

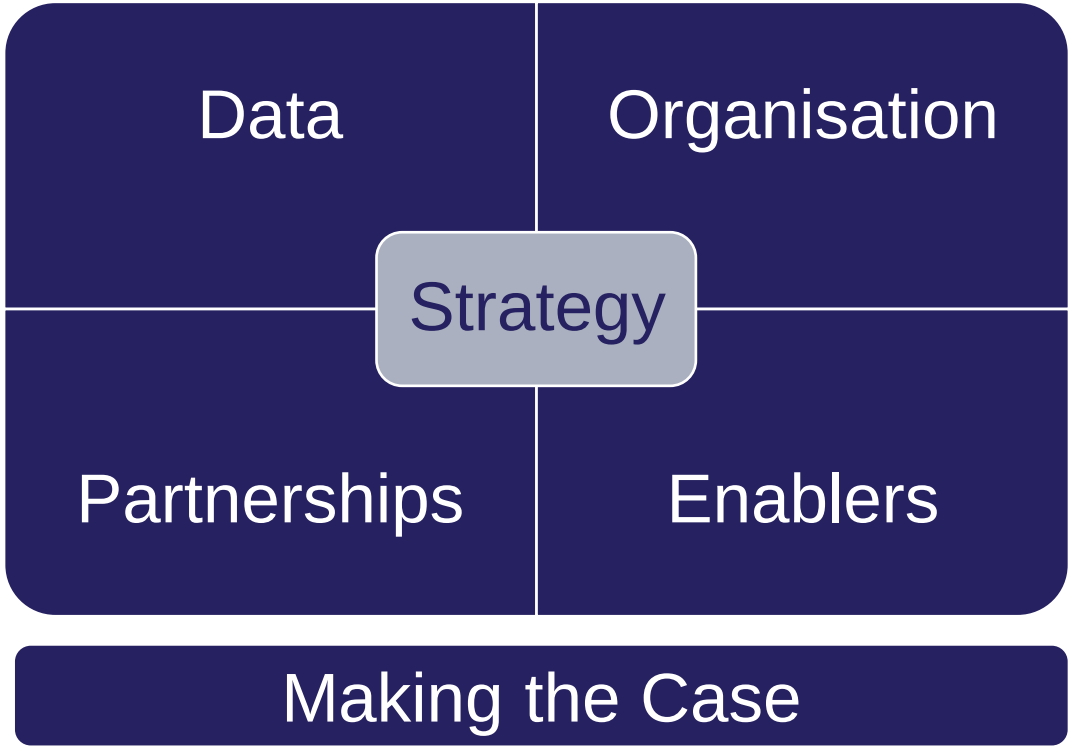
Business Model Analysis – South Africa (LMIC) Deep Dive

- SANRAL, ITS and Stellenbosch Smart Mobility Lab

Conclusions and Recommendations

Conclusions and Recommendations

- Set of **24 recommendations** covered in the report and presentation appendix
- Case studies for each theme, and examples of good practice



Conclusions and Recommendations

Strategy

Alignment between the high-level objectives of the organisation and the delivery of operations and services

- Use a strategic approach, both at organisation level and also in terms of data as a discipline
- Develop an action plan for data using SMART principles
- Collaborate with and learn from other administrations to provide stronger capability, share insights and manage risk

Data Sources

Careful selection and use of data is essential to support decision making and communication

- Data should be recognised and treated as a valuable asset to the road administration
- Review existing data and tools before investing in collecting new data or implementing new technology, and make better use where possible
- Consider access to existing external data before collecting more primary data

Conclusions and Recommendations

Organisation & Management

It is essential that resources are deployed in a way that will ensure sufficient capacity and capability are available for the required functions

- Understand the different organisational model options to deliver data functions and use the most appropriate
- Maintain a flexible approach to accessing staff resources
- Monitor performance and apply continuous improvement

Partnerships

Road administrations should not expect to deliver services on their own. They should make best use of partnerships with a range of potential organisations

- Engage with other road organisations to identify opportunities to develop partnership arrangements for the shared collection and use of data
- Understand the difference between information and data
- Recognise the opportunities and value that open data can provide

Conclusions and Recommendations

Enablers

Road administrations require a range of enablers to support the implementation of data-driven practices

- Demonstrate clear leadership both within the road administration and to the private sector
- Develop more than just data-orientated skills, but also behaviours and culture within the road administration
- Use the right tools to analyse data and communicate findings

Making the Case

Without a through case for investment, plans focused on data may face difficulties in being delivered

- Develop an investment case for data, and evaluate improvements and subsequent benefits
- Communicate in accessible language, with technical detail to support
- Consider pilot projects to demonstrate principles and secure interest

Conclusions and Recommendations – South Africa (SANRAL)

Strategy	Has data as a core part of the organisational strategy
Organisation	Collaborating with academia (Stellenbosch Smart Mobility Lab) to access innovation, skills and technology
Enablers	Set up the Technical Innovation Hub to develop graduates in the fields of electrical, electronic, mechatronic and computer engineering
Making the Case	Demonstrated benefits in responding to more incidents within the “golden hour” through better use of data, and saving more lives

Conclusions and Recommendations – Other

Partnerships	UK (Transport for London) generated annual economic benefits and savings of up to £130m a year for London through release of open data
Partnerships	Global work to analyse and visualise impacts of Covid-19 measures on mobility, using sources such as Google, Apple and TomTom
Enablers	European Data Portal provides free e-learning for open data skills in 16 modules and multiple languages
Making the Case	UK (DfT, ADEPT, Local Authorities) delivering “Live Lab” pilot projects to prove not just technical concepts but also partnering arrangements

Conclusions and Recommendations – PIARC (Next Steps)

- Share learning through PIARC networks
- Encourage road administrations to consider common data specifications and engage with global initiatives
- Promote greater focus on topics that were less common in the research, for example sustainability and inclusivity
- Support the development of new skills within the sector

Conclusions and Recommendations – PIARC Members

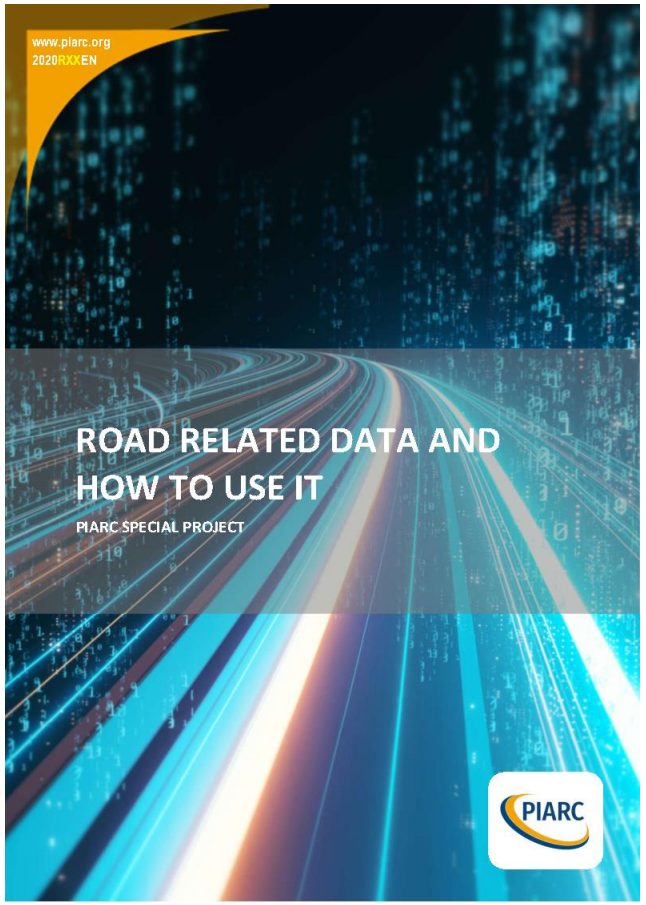
- Next steps regarding use of the report

Read – Executive Summary as minimum, plus areas / topics of major interest to your road administration

Share – Identify leaders within the road administration, review in more detail

Think – Think about data as a fundamental aspect of road services, now and in the future

Act – Develop an action plan, implement the recommendations, collaborate



Case study from FHWA, USA

Case study from Netherlands

Case study from Netherlands

Stakeholders

Rijkwaterstaat (RWS): responsible for maintaining and improving the Netherlands' trunk road network.

RAI Association: representing the vehicle industry in the Netherlands with a strong focus on the mobility sector.

National Data Warehouse (NDW): the national access point for traffic data in the Netherlands.

National Data Warehouse became in 2020 National Road Traffic Data Portal (Nationaal Dataportaal Wegverkeer)

Case study from Netherlands

Strategy

Rijkswaterstaat Data Strategy 2020
(annual and longer-term objectives)

5 main objectives:

- Vision and strategy
- Data, information and presentation
- People and organisation
- Process, management, control and finance
- Architecture and infrastructure

Addressing key issues:

- Organisation of data.
- Breaking silo mentalities.
- Ownership and constraints to exchange

Supported by a set of principles and conditions

Case study from Netherlands

RWS Strategy - Principles

1. **Ownership of data** – all data has an owner who is responsible and accountable for quality. Principle: “if the object is yours, the data is also yours”.
2. **Apply data conventions & standards** – if there are none, best practices from RWS is used. Principle “apply or explain”.
3. **Core registrations with mandatory use** – core records are kept for key data to work processes.
4. **Collect once and use multiple times** – make it available, use what is available elsewhere.
5. **Data management in one place** – the chain from collecting, managing, to providing and presenting data takes place in a standardized manner for all data flows.

RWS Strategy - Conditions

1. **Safeguarding data craftsmanship** – it is essential that this is safeguarded throughout the chain.
2. **Data is integrated in work processes** – according to unambiguously agreed quality requirements.
3. **Make strategic choices** – priorities are then set for confirmation by the Board.
4. **One central data platform** – available internally and externally.
5. **Combining expertise** – to apply new data technology and quickly achieve the added value of innovations.

Case study from Netherlands

National RT Data Portal Strategy

- **Responsibilities:** Collecting, processing & sharing data.
- **Objective:** provide quality data.
- **Public owned data**.
- **Private data purchases**: OEMs, Google, TomTom, HERE…

Case study from Netherlands – Initial analysis

RWS Lessons learned

- Data **ambiguity**: source and process.
- Unclear data **definitions:** different interpretations.
- **Manual transfers**: source of errors.
- Systems **synchronised** at different times: misalignments.
- **Discrepancies** in asset registrations between different registration systems.

RWS Solutions found

Data standards for

- Data creation, storage, management and access.
- National and international consultation.

Data Car Wash

- Achieving a uniform, standardised data production process.
- Working principle: “demonstrate, participate, do it yourself”.

Case study from Netherlands

Data Sources

Careful selection and use of data is essential to support decision making and communication

- Data should be recognised and treated as a valuable asset to the road administration
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CAVs and sensors in LGVs – RWS + RAI

- Data which is important for a vehicle might be for the road.
- Example of NIRA Dynamics: friction in winter service.
- Challenge: data ownerships and access.

Traditional approaches to data: loops.

Unconventional sources: smart phones, social networks, Strava… for real time operations and users' preferences.

Smart infrastructure: WIM, fiber glass sensors for congestion…

Case study from Netherlands - Coordination

Organisation & Management

NDW

- More efficient to have a single organisation collecting the data and sharing it for the benefit of the roads sector
- Responsible for processing, fusing and publishing data
- In-house capability plus private data science companies.
- RWS access to data scientists at NDW

Partnerships

Rijkswaterstaat and RAI Vereniging as part of Data Task Force

- Very different perspectives and priorities, but they partner for data sharing
- Lessons learned around data standardisation and volumes of data

Case study from Netherlands - Coordination

Regulation

Road safety

- European regulations related to Safety-Related Traffic Information (SRTI) (No 886/2013), sharing of safety critical data is mandated.
- Pilots are being trialed across 5 nations with multiple OEMs and contexts.
- www.dataforroadsafety.eu

Purchasing data

NDW

- Public data source, purchasing of private data & combination of data.
- Sharing data to stimulate developments: avoiding school zones at open and closure of the schools.
- Agreements to share raw data: responsibilities vs. open data.

Case study from Netherlands

Enablers

Challenges around recruitment, plus behaviours / culture across organisations – theme within data strategy to grow maturity:

- Collaboration (internal and external)
- Knowledge and craftsmanship
- Communication and culture

Making the Case

The concept of connected vehicles suffered from political and commercial issues, until first pilot was run in 2016:

- Limited scale and technological advances, but major and lasting impact on key stakeholders
- Created much greater awareness with politicians
- Shaped a vision for what could be achieved in future
- Convinced OEMs of benefits to their customers to provide a win-win situation

Case study from UK

Case study from UK

Background:

- Connect Plus (CP) and Connect Plus Services (CPS) are working with National Highways to create better journeys for road users via the £6bn 30-year Design, Build, Finance and Operate (DBFO) contract for the M25, one of Europe's busiest motorways and key arterial link routes.
- CPS is trialing different surface treatments and conducting traditional monitoring to understand the durability of these treatments.
- CPS also wanted to understand road user perception in relation to these options and thus preferred treatments(s) from a customer perspective – in line with the National Highways customer imperative.
- Atkins with support from Accent were commissioned by CPS to undertake this research.

Case study from UK

Methodology:

- Sampling:
  - 19 participants x min 4 journeys
  - Range of journey types, vehicle types, vehicle age
- Pre-Data Collection and Set Up
- ‘In the Moment’ Data Collection
- Post Experience Review
- Analysis
- Reporting

Case study from UK

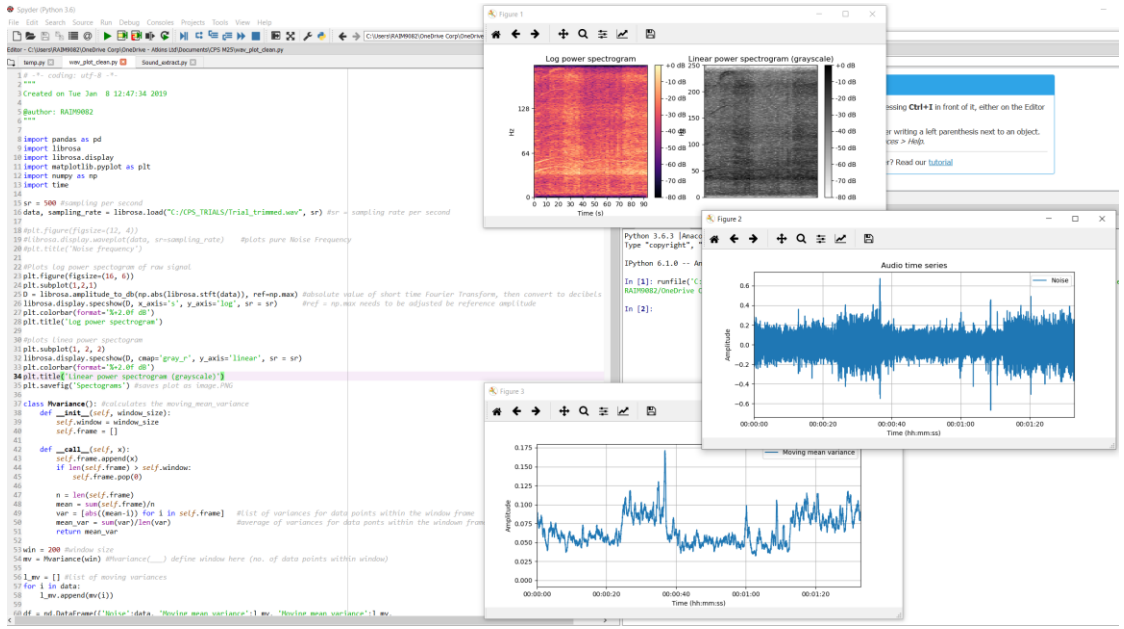
Data collected:

- Dashcam footage – internal and external footage
- Dashcam audio – converted from the dashcam footage
- Road roughness measurement – captured via smartphone app (Road Lab Pro)
- Heart rate monitoring – captured via fitness tracker to identify points of stress or trends in physical response
- Location and speed measurement – captured and cross-checked across devices
- Post-journey interview – provided a qualitative account of the customer's perception of the journey

Case study from UK

Data processing and analysis:

- A range of digital tools were carefully selected:
  - Feature Manipulation Engine (successfully used on other road projects)
  - Racerender (from the motorsport sector)
  - Bespoke Python code (developed by the team for audio analysis)
- Automated, repeatable and traceable processes for handling the data were developed to ensure quality and consistency while managing significant volumes of data across multiple sources, formats and types.



Case study from UK

Data analysis:

- Combining datasets in visual format allowed an in-depth analysis of the different variables and a spike analysis of the roughness, heart rate and changes in in-car noise.
- This highlighted correlations and trends across the data types / different surface treatments.
- The output of this analysis was combined with the qualitative research to understand the road users' perception from an overall perspective
- Data collected through the trials was validated against traditional monitoring data – close alignment of trends for noise captured in-car and also via more specialist external measurement.

Case study from UK

Case study from UK

Outcomes:

- Project findings used to inform a more customer-focused approach to managing road assets, national policy decisions and operational interventions throughout the lifecycle of the M25.
- Methodology identified subtle changes which may have been missed through more traditional research methods.
- Visualisation of data provided a powerful tool to support analysis and communicate findings to stakeholders.
- Recognition via industry awards:
  - Institute of Asset Management – Customer Service Award Winner 2020
  - Highways Awards – Steve Berry Highways Innovation Award Winner 2021