XVI WORLD WINTER SERVICE AND ROAD RESILIENCE CONGRESS
CALGARY, CANADA - 7-11 FEBRUARY 2022

Session Report

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TECHNICAL SESSION R15.2, EXAMPLES OF ASSET MANAGEMENT PRACTICES THAT INCORPORATE RESILIENCE
MONDAY, FEBRUARY 7, 04:00 PM TO 05:30 PM

1. KEYWORDS

road asset management, asset management system, resilience, performance-based and data-driven approach, risk, performance and optimization, climate change adaptation, climate projections, BIM, heterogeneous data, data visualization.

2. PRESENTATION OF THE SESSION

The session presents examples of Asset Management business practices that incorporate resilience considerations in agencies with different levels of Asset Management maturity. The session discusses Asset Management decision processes that consider exogenous influences, such as climate change, and incorporate the requirements for resilience processes. The session illustrates the incorporation or resilience for managing (1) urban road system considering all stakeholders from a social, environmental, organizational and engineering perspective in Germany, (2) rural road system, which are critical for access, in Cameroon and (3) expressway infrastructure considering the full life cycle and all elements in China.

3. PROGRAMME OF THE SESSION

Session Chair: Gerardo FLINTSCH, Chair of PIARC TC 3.3, USA
Session Organiser: Gerardo FLINTSCH, Chair of PIARC TC 3.3, USA
Session Secretary: James SMITH, English Speaking Secretary of PIARC TC 3.3, Canada
Session Moderator: David HEIN, Member of PIARC TC 3.3, Canada

Person	Organization, Position…	Title of the presentation
Robert KAFALENOS	FHWA, USA	Integrating Climate Risks into Transportation Asset Management Planning & Practice
Markus STÖCKNER	Baden-Wuerttemberg Institute of Sustainable Mobility, Karlsruhe University of Applied Sciences, Germany	Asset Management and Resilience for Urban Pavements (IP0367)
Lei ZHANG	Henan Transport Investment Group CO., LTD, China	Study on Expressway Infrastructure Data Center with Full Life Cycle and all Elements (IP0306)

4. TECHNICAL FINDINGS AND DEBATE

Integrating Climate Risks into Transportation Asset Management Planning and Practices
Robert KAFALENOS (USA)

- The goal of the FHWA Sustainable Transportation and Resilience Team is to integrate considerations of resilience to climate change and extreme weather in transportation decision-making.
    - Planning (asset management plans, long-range transportation plans), Project Level (environmental processes, engineering, and design), and Operations and Maintenance (emergency relief, snow removal programs).
- Climate has already started to change, and it is impacting assets and expect to see a lot more in the future.
    - Global sea levels have risen 7+ inches in the 20th Century and expect to rise another 1-4 feet this Century.
    - Average US temperature could rise 3-11 °F this Century with more extreme high temperatures.
    - Heavy precipitation events are expected to intensify.
    - Extreme weather events are not new, but climate change impacts make them worse.
        - Droughts can lead to forest fires.
        - Rain leads to landslides.
- Integration process.
    - Assess the risk associated with extreme weather/climate change, and communicate/collaborate across departments (engineers, environmental specialists, and planners).
        - The data needed may already exist in another department.
        - Development of Risk Registers that include risks and mitigation strategies.
    - Develop hazard categories (gradual and sudden events). Assets will respond differently (not all are negative (i.e. decreased number of Freeze/Thaw cycles).
    - Importance of considering climate change resilience in life cycle planning (know strategies and scenarios).
        - Small incremental deterioration rate changes can add up over the asset's lifecycle and need to be included in life cycle resilience planning.
- Available FHWA resources (https://www.fhwa.dot.gov/environment/sustainability/resilience/).
    - Vulnerability Assessment and Adaption Framework, 3rd Edition (2017).
    - Asset management, Extreme Weather, and Proxy Indicators Pilot Program (2017-2019).
    - Guidance on Incorporating Risk Management into Transportation Asset Management Plans (2017).
    - Guidance on Using a Life Cycle Planning Process to Support Asset Management (2017).
    - Risk-Based Transportation Asset Management Reports: Building Resilience into Transportation Assets (2013).
    - AASHTO:NCHRP 25-25 (94) Integrating Extreme Weather into TAMPs (2015).
- FHWA CMIP Tool Helps with future climate projections (temperatures and precipitation).
- National Highway Institute (NHI) course development, Addressing Resilience in Highway Project Development and Preliminary Design. Key topics:
    - Addressing resilience in engineering decision-making.
    - Accessing and using climate projections.
    - Integrating resilience into project development.
- Six Pilot Programs focused on asset management, extreme weather and proxy indicators.
    - Arizona DOT, Kentucky Transportation Cabinet, Massachusetts DOT, Maryland SHA, New Jersey DOT, Texas DOT
- Additional resources are coming soon.
    - Addressing Resilience to Climate Change and Extreme Weather in Transportation Asset Management.
    - Geohazards, Extreme Events and Resilience Manual.

Asset Management and Resilience for Urban Pavement
Markus STOCKNER (Germany)

- Municipal road asset management is embedded into three operational systems QM (quality, environmental, health and safety), AM (asset management), and TIMM (Civil Engineering Infrastructure Management Munster).
- Implementing BIM as a tool.
    - Benefits (transparent information, optimized collaboration, improved communication, and coordinated maintenance management).
- The Decision-making process relies on data (strategic, tactical, and project) contained within a shared database.
    - Needs to capture stakeholder requirements, organizational objectives, operational and maintenance requirements, and deliverables operations and maintenance requirements.
    - Inspection and survey, maintenance planning, planning and tender, and construction.
- BIM Pilot Project.
    - Challenge was bringing together multiple databases with different technologies and semantics to develop the asset management algorithms.
- Process Example, Prediction of road condition and surface characteristics.
    - Basic assessment (quality control and verification of the data, error correction, calculation of condition assessment), forecast assessment (possible methods, tests for improved adjustment, and application recommendations), and conclusions.
- Future decisions are made based on. a three-stage process (structural evaluation, climate evaluation, object-related program) that involves prioritization of projects and construction with low BGS (bluegreenstreets) that minimize the climatic influences on water, natural environment, and temperature.

Study on Expressway Infrastructure Data Centre with Full Life Cycle and all Elements
Lei ZHANG (China)

- Management of expressway infrastructure requires large amounts of lifecycle data (construction, operations and maintenance, condition evaluation, GIS, traffic flow, level of service, …) for effective decision making.
- The challenge is that data standards are not uniform, difficult to share, and the quality of information services is low.
- The solution – development of a framework for intelligent high-speed information management as the core.
    - Development of new system integration where data flows freely between all areas and is supported by a unified application platform capable of maintaining and analyzing big data.
- Support of the platform required rapid digitization of expressway infrastructure through the use of BIM and vehicle laser scanning.
- The system's success is based on the technology and methods used by the platform to integrate multi-source heterogeneous data.
- Examples of ARCGIC data visualization platform used on the Beijing-Hong Kong-Macao Expressway in Henan Province.
    - Point location information.
        - Query information on routes, bridges, culverts, tunnels, toll stations, signs, pavement markings, emergency phone booths, etc.
        - Road condition detection evaluations.
    - Visualization application of 3D real data information.
        - Geometric dimension measurement of ancillary road facilities.
        - Video surveillance (real-time information and traffic camera video).

5. RECOMMENDATIONS FOR DECISION-MAKERS, FOR PIARC OR FOR INTERNATIONAL ORGANISATIONS

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6. PREPARATION OF THE SESSION

The session was planned by PIARC TC 3.3 Asset Management in response to the Call for Papers Topic 15: Resilience of Roads and Road Transport. Congress abstracts and papers were reviewed by volunteers of the TC.