

Session Report

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**TECHNICAL SESSION: MANAGED RETREAT – DIFFICULT BUT NECESSARY
TUESDAY FEBRUARY 8, 17:45-18:45 CALGARY TIME**

1. KEYWORDS

Examples: managed retreat, climate change, resilience, adaptation, extreme weather, case studies

2. PRESENTATION OF THE SESSION (XX COPY THE SAME TEXT AS ON THE WEBSITE XX)

Transportation agencies across the world must address increasing impacts from climate change (e.g., sea level rise, land erosion, subsidence, pavement degradation) and extreme weather (e.g., flooding, landslides, wildfires, drought) and balance the costs and benefits of making assets more resilient. For some locations, the costs of maintaining individual assets are so high that transportation agencies may choose to stop maintaining the asset. The purposeful moving or abandoning assets due to current or future risks is known as managed retreat. Economics, politics, and system impacts all influence these decisions.

3. PROGRAMME OF THE SESSION

Session Chair: Tim Sexton, Assistant Commissioner, Minnesota Department of Transportation (US)

Session Organiser: Tim Sexton, Assistant Commissioner, Minnesota Department of Transportation (US)

Session Secretary: NA

Person	Organisation, Position...	Title of the presentation
Tim Sexton	Assistant Commissioner, Minnesota Department of Transportation, TC 1.4 (US)	Welcome – session overview
Caroline Evans	Principal Policy Advisor, National Transport Commission, Chair – TC 1.4 (Australia)	Welcome - TC 1.4
Katie Spidalieri	Senior Associate, Georgetown Climate Center (US)	Overview of Managed Retreat
Fraser Shilling	Road Ecology Center, University of California at Davis (US)	Managed Retreat Case Study: California, USA
Dr. Mark Henry Rubarenzya	Head of Research and Development, Uganda National Roads Authority, PIARC TC 1.4 (Uganda)	Managed Retreat: Stories from Uganda
Jeffrey Meek	Sustainability Coordinator, Minnesota Department of Transportation (US)	Managed Retreat Case Study: Minnesota, USA
Carlos Alfonso Lara Esparza	Director General, Mexican Institute of Transportation, PIARC First Delegate from Mexico (Mexico)	Managed Retreat Case Study: Mexico

4. TECHNICAL FINDINGS AND DEBATE

The first signs of significant climate change impacts have begun to appear, including increased frequency and intensity of storms, drought, and wildfire. Transportation and other infrastructure and populated areas are already experiencing disruption and in some cases relocation. Differential, but expanding exposure to impacts has led to intensified focus and discussion of the policy, technical and financial dimensions of becoming more resilient, as a society, for specific regions, and for exposed infrastructure.

Using a theoretic framework of resilience (defined here as maintaining an elastic and sustainable responses to change), the panel touched on examples of the types of issues that face policy makers and scientists at various scales. There is not yet a standard process or approach for performing a managed retreat analysis (to determine trade-offs, costs, etc.). However, common technical strategies include elevating infrastructure above excessive flooding (Uganda) and sea level rise (California), as well as horizontally removing from areas that will eventually be inundated or otherwise uninhabitable. There were also examples of infrastructure decisions in a managed retreat context such as flooding, erosion, saltwater intrusions; increasing maintenance needs and costs; transportation and land use; long-range planning and asset management; and community engagement. There are historical and recent examples of engineered and natural-system techniques that could be informative, but there are various challenges to applying them. While analysis of options and costs trade-offs is a critical initial step when considering managed retreat for a location, cost may not be the most important deciding factor and community input, detours, or route criticality during emergencies all play important roles in decisions around managed retreat-type solutions.

What is less clear is how to support what are often opportunistic responses with resilience strategies. These include local and state-scale land-use and ownership policies that are both culturally acceptable and responsive to inexorable change. A critical component is to meet the needs of the local community and to evaluate impacts on landowners, communities, cultural, environmental, construction and maintenance and shifts in equity. Policies inevitably must originate from and survive within political systems, which can be hazardous to their effectiveness. Over-arching both technical and policy responses is the financial cost and economic impacts of these responses. Can avoided future costs be used as a current benefit and balanced against adaptation costs? Can these adaptation costs be amortized and over what timeframe?

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

Managed retreat presents complex challenges related to managed retreat, including those below.

- Legal - administrative withdrawals must be controlled and are pose political and legal risks.
- Logistics - new locations represent difficulties like land costs and receiving capacity of new sites for people and business.
- Economic - for roads, constructing protective walls and dikes and enhanced maintenance is an adaptation option, but costs may be too high compared to abandoning and building a new alternative.
- Social – impacts to people using current infrastructure for mobility and access to goods and services.
- Organizational - road organizations have high demands for resources to rebuild the same affected infrastructure repeatedly and must focus investments on adapting or removing road sections vulnerable to different climate or geologic threats.
- Planning - governments must implement policies to avoid locating human settlements and infrastructure in high-risk areas. For example, establishing a safe distance away from flood zones and areas vulnerable to sea level rise.

A range of resilience strategies were identified that can be considered to address climate change impacts. These approaches can involve defending, accommodating, changing policy or practice and retreat (abandoning infrastructure, relocating infrastructure, or temporarily restricting use of infrastructure). The eventual costs of climate change impacts and adaptive responses are largely uncertain, but likely will be staggering. In comparison, investments in resilience science, technologies, policies, and financial experiments may be small in comparison. Civic science is looked to for answers but is rarely resourced

sufficiently to provide these answers. Similarly, municipal experiments may provide much of the material for understanding what is possible, but they are difficult to fund and rarely designed as scientific experiments. These gaps must be filled to provide strong scientific, policy and financial advice to local, national, and international governments and organizations.

Two primary responses would be useful in parallel: 1) open-ended experimentation with innovative approaches to resilience, ranging from living with water (canal cities) to municipal or ecological relocation; and 2) directed and structured investigations into waterproofing, fireproofing, and drought-proofing societies and the landscapes they rely upon, where proofing can mean adapting-to. For PIARC, we recommend understanding both how to adapt transportation infrastructure and to do it in ways that does not exacerbate climate change or reduce opportunities for future resilience. Devoting substantial portions of future conferences to these issues through invited and contributed sessions will encourage research in these directions.

Additional recommendations from the panel:

- Engage the local communities early and often. Present options and be clear about the trade-offs (not just costs)
- There is urgent need for demonstration projects to identify and share best practices and standards based on different local situations and scenarios
- More discussion and exploration of green vs grey infrastructure solutions can promote co-benefits including lower emissions, less impervious surface, and smaller ecological footprints

6. PREPARATION OF THE SESSION

This session was planned, designed, and organised as follows.

- The session was jointly proposed by AASHTO, TRB, FHWA and PIARC Technical Committee 1.4 Climate Change and Resilience of Road Networks. In particular, King Gee (AASHTO), William Anderson (TRB), Agnes Velez (FHWA) and Timothy Sexton and Caroline Evans (PIARC TC 1.4) led this effort.
- Tim Sexton coordinated the session.

Acknowledgement is given to all participants, attendees, and the following presenters:

Caroline Evans, Katie Spidalieri, Fraser Shilling, Dr Mark Henry Rubarenzya, Jeffrey Meek, Carlos Alfonso Lara Esparza, Nkululeko Leta, Thomas Bles, Fernando Mendoza, Tim Sexton