IMPLEMENTATION LAB AT COP 27

Engineering the vision for climate-resilient transport

16 November 2022

Organised by:
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WITH THANKS TO…

Speakers
Caroline Evans, PIARC World Road Association
John Dora, Royal Academy of Engineering Visiting Professor at the University of Birmingham and Director at Climate Sense
Lucie Anderton, UIC International Union of Railways

Moderators
Andy Deacon, Global Covenant of Mayors for Climate & Energy (GCoM)
Marcia Toledo, UNFCCC Climate Champions
Mark Hanford, Institution of Civil Engineers (ICE)
Savina Carluccio, International Coalition for Sustainable Infrastructure (ICSI)

Roundtable Participants
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Anusha Shah, Arcadis/ICE
Bryn Lindblad, Climate Revolve
Dr. Mona Anand, Coalition for Disaster Resilient Infrastructure (CDRI)
Dr. Priti Parikh, UCL/ICE
Eduardo Kantz, Port of Acu/PRUMO
Gregor Robertson, GCoM
Matt Kennedy, Arup/International Road Federation
Marco Serena, Private Infrastructure Development Group (PIDG)
Mohamed Hegazy, Transport for Cairo/Climate Champions Team
Pawan Mulukutla, World Resources International India
Robert Spencer, AECOM/FIDIC
Rod Braun, Conservation International
Shravani Sharma, Climate Champions Youth Fellow
Tebebu Terefe, Ethio-Djibouti Railways
Tom Lewis, WSP
Wei-Shiuen Ng, UN ESCAP
Transport infrastructure systems play a pivotal role in supporting society through provision of essential connectivity services to end-users, alongside enabling economic growth. To be able to deal with an increasingly complex and interconnected world and uncertain future, transport systems need to be more sustainable and resilient.

The COP27 Transport Implementation Lab held on 16 November 2022 aimed to explore how the adaptation and resilience breakthrough can be operationalised, through knowledge-sharing, discussion and collaboration.

Participants discussed available solutions and actions needed to deliver on the adaptation and resilience breakthrough, and critically explored the feasibility of the target, including resolutions to barriers.

**Framing Question**

*How can the transport sector accelerate the implementation of climate resilient transport infrastructure?*

**Adaptation and resilience breakthrough**

‘Transport infrastructure is resilient to climate hazards through adoption of new technology, design and materials.’

A range of diverse voices and a powerful mix of experts were in the physical and virtual room. Attendees heard from representatives of the global engineering community, including from the private sector, professional associations, academia, and key transport industry bodies, alongside representatives from the policymaker and the investor communities. The event saw input from twenty-two organisations such as Airports Council International Europe, the International Union of Railways, World Road Association, Ethio-Djibouti Railways, Coalition for Disaster Resilient Infrastructure (CDRI) and many more.

The event is available to watch here: [https://unfccc.int/global-climate-action-at-cop-27](https://unfccc.int/global-climate-action-at-cop-27)
TOGETHER FOR IMPLEMENTATION

The first half of the session consisted of three best practice showcase presentations from leading global transport industry bodies.

Rail Sector Showcase

Lucie Anderton, UIC (International Union of Railways) Head of Sustainable Development Unit

Rail use must grow by at least 40% by 2030 if we are to reach the Paris Agreement goal. It is essential that the service is reliable. Functioning transport systems are essential to transform cities to become less congested, safer and healthier places to live, better connect people to businesses and opportunities.

Featured case study: In Eastern Germany in 2002, regional flash floods and long-lasting intensive superregional rainfalls affected all modes of transport infrastructure except air. A range of strategies were used such as the improvement of water retention capacity, mobile flood barriers and warning systems. Furthermore, the bursting of two dams in Vienna led to flooding of an important railway. The resulting emergency construction of new railway infrastructure taught that a detailed communication system between all affected stakeholders and detailed reaction plans is highly recommended, and signalling systems need to be elevated on pillars/outside flood zones.

Road Sector Showcase

Caroline Evans, PIARC (World Road Association) Chair Technical Committee 1.4

The Road Sector is facing challenges such as floods and roadside inundation, droughts, erosion, sea level rise, salinity impacts on pavements, thermal expansion, landslides and many more. All of this causes traffic disruptions – challenging for both societal safety and economy. In especially vulnerable areas, rural accessibility can be compromised regularly, creating both direct and indirect adverse effects on communities and socio-economic development.

Featured case studies: PIARC presented a case of geospatial analysis of climate change in road infrastructure in Mexico, where GIS-methodology and hazard mapping was used to identify sections of the road network exposed to climate threats. ReCAP also developed guidelines for a holistic approach to sustainable adaptation and resilience for rural road infrastructure in Africa. This included regional guidance on the development of climate-resilient road infrastructure and the development of a Climate Adaptation handbook (2019) providing a 5-stage methodology to support resilience and adaptation building in the roads sector.
TOGETHER FOR IMPLEMENTATION

Guidance and standards

John Dora, Royal Academy of Engineering Visiting Professor at the University of Birmingham and Director at Climate Sense

Standards and guidance play a key role, especially when mandated. They can bring benefits and value as recognised best practice, and provide a politically neutral source of guidance. Some key standards are:

- Adopted into infrastructure lifecycle – ISO 55000 Asset Management
- ISO 14090 Adaptation to climate change
- BS 8361 on adaptation pathways

Many technical specifications need modifying to cover future resilience. For example, the Structural Eurocodes (EN 199x series) and other ENs, as the weather loadings are based in the past. Case studies show how highways and rail are changing their own guidelines! Engineers must:

- Promote good practice
- Adopt or modify standards that look to future hazards
- Think redundancy and whole life value – not lowest first costs
- Think systemic impacts
- Think sustainability and net zero
Building climate resilience in transport systems

Key points made in discussion:

Investment in resilience infrastructure is difficult to obtain and infrastructure development is slowing down due to debt overhang, especially in Africa.

There is a need for gender-inclusive transport and safer cities. 64% of women in the UK feel unsafe in public spaces. A big part of public spaces is public transportation, and safety is affected by elements such as poor street lighting, bus stop and train station design.

Solutions for climate resilient transport

Key points made in discussion:

Data, digitalization, and new technologies are available, which can go hand in hand with the promotion of innovation across systems, processes, and people.

For example, through modal shift with rail electrification, new renewable power, digitalization, and ever-increasing energy efficiency, 460Mt GHG emissions will be avoided by 2050. Another example is that social inequity in ‘heat islands’ in places such as LA (underinvested neighbourhoods without green spaces) could be assisted through new technology like cool reflective road surfaces.

“Through various projects, the United Nations Economic and Social Commission for Asia and the Pacific found that countries need a communication mechanism to ensure that the exchange of relevant information and data are available in real time for effective and efficient regional cooperation.”

Wei-Shiuen Ng, Economic Affairs Officer Transport Division

“Cities are taking important actions to accelerate sustainable infrastructure improvements. Deployment of electric vehicles and charging, investing in walking, cycling and public transit, and using sustainable materials when building infrastructure will support our path to liveable green cities and propel us towards resilience and decarbonisation.”

Gregor Robertson, Global Ambassador, Global Covenant of Mayors for Climate and Energy
Taking action

Poverty makes people more vulnerable, and forces transportation professionals to address short-term needs often at the expense of long-term resilience.

How do we make existing infrastructure systems invest in their own resilience in the long-term? How do we attract investors? We need political exchange on climate risks. The Sharm el-Sheikh Adaptation Agenda seeks to answer these questions.

“Knowledge is a huge missing piece in transport infrastructure, and it is hard to see what already exists. The CDRI lexicon project is trying to understand what is meant by resilience and systems approaches, aiming to develop a common understanding. Collaboration is key, and CDRI have 31 member countries, and work with many UN and government bodies”

Dr. Mona Anand, Director for Research and Knowledge Management

“It is the best time to make holistic interventions where youth and other vulnerable groups are included and acknowledged for their voices against climate change, to ensure long-term positive behaviour change for transport.”

Shravani Sharma, Climate Champions Youth Fellow
The COP27 Transport Implementation Lab event has initiated a powerful call to action: to mobilise the global engineering community - including key transport industry bodies, the private sector, professional associations, academia, and civil society - to work together with representatives from the policymaker and investor communities on the target for climate resilient transport systems by COP28.

Three main objectives for climate action to support the achievement of the milestones in 2030 Breakthrough and adaptation and resilience outcome targets:

1. **Development of the outcome target through collaboration with stakeholders and other initiatives**
   The multi-modal, multi-stakeholder alliance/coalition convened at this event will continue to work on the Resilience and Adaptation Outcome Target for climate resilient transport systems, to be presented at COP28. Work will progress under three key themes: (1) Building climate resilience in transport systems; (2) Solutions for climate resilient transport; and (3) Collaboration, partnerships, and capacity building. Key to this objective will be alignment and collaboration with other stakeholders and thematic areas.

2. **Best practice dissemination and continued stock take and progress reporting**
   The stock take and outputs from the workshop will be disseminated. Sessions on climate resilient transport will be convened during UN Climate Weeks and other convenings such as the ICE Brunel International Lecture Series to keep on building the repository of best practices, better understanding regional challenges and local capacity gaps. Progress will also be reported through the Race to Resilience.

3. **Mainstreaming resilience through deep collaboration**
   Any work going forward will focus on integrating resilience and adaption with mitigation. In addition, synergies and dependencies of this Resilience and Adaptation Outcome with outcomes for other sectors will be identified and exploited. This can only be achieved through deep collaboration with other thematic areas and initiatives.
Many initiatives and solutions are already being implemented in the transport sector. The COP27 Transport Implementation Lab has undertaken an important stock take, recording 50+ resources, case studies and initiatives from across all transport modes, with examples from both developed and emerging economies.

- Guidance, tools and approaches
- Case studies
- Collaborative initiatives
GUIDANCE TOOLS AND APPROACHES

Cross-sector
Infrastructure Pathways

Infrastructure pathways is a new multi stakeholder initiative developed by the International Coalition for Sustainable Infrastructure (ICSI), led by the resilience shift and in partnership with Arup. The project brings together existing guidance from a range of sources to provide a line of sight across the entire project lifecycle and help infrastructure practitioners embed climate resilience within their respective areas of influence.

Link to resource

U.S. Climate Resilience Toolkit - Transport

The safety, reliability, and sustainability of transportation infrastructure in U.S. cities is threatened by a range of climate change impacts. Cities can build resilience by bolstering existing infrastructure and planning ahead for new conditions in the coming decades.

Link to resource
Digital technologies can enhance climate resilience of critical infrastructure

The operability and functionality of critical infrastructure are continuously challenged by multiple stressors, increasing demands and ageing, whilst their interconnectedness and dependencies pose additional challenges. Emerging and disruptive digital technologies have the potential to enhance climate resilience of critical infrastructure, by providing rapid and accurate assessment of asset condition and support decision-making and adaptation. 

Link to resource

Enhancing the Resilience of Urban Transport in Asian Cities after COVID-19: Synthesis of Academic Study Results and General Recommendations

This Study Report discusses how Asian cities might reconfigure the mobility trends and offers a series of recommendations for enhancing the resilience of urban transport systems in the short, medium term and long term in Asian cities.

Link to resource
State of Knowledge Report: Adaptation for Transport Resilience to Climate Change (AfTR-CC) for LICs in Africa and South Asia

This report explores the current state of knowledge of climate change adaptation for transport infrastructure resilience in low-income countries (LICs) in Africa and South Asia. The project combined primary and secondary data to characterise the current interest, challenges and barriers pertinent to improving the resilience of transport to climate change in these countries.

Link to resource

Resilience Toolbox

Resilience tools can be useful for a wide range of practitioners but it can be hard to find the right tool for the job. The Resilience Shift has assessed a wide range of tools, which are listed below, mapped by the resilience value they add at different stages of the infrastructure lifecycle. More information about the project can be found here.

Link to resource
GUIDANCE, TOOLS AND APPROACHES

United Kingdom’s Cross-Sector Resilience Study

Over recent years, major floods and the UK’s worst power cut for a decade have had significant impacts on families and businesses. For maintaining a resilient system, a proactive approach is needed. The National Infrastructure Commission has undertaken a study and developed a framework that can be used to better deliver the resilience of the UK’s energy, water, digital, road and rail infrastructure. 

Link to resource
GUIDANCE TOOLS AND APPROACHES

Rail
GUIDANCE, TOOLS AND APPROACHES

Tomorrow’s Railway and Climate Change Adaptation

Global warming is changing the planet and will have implications for Britain’s railways. This project provides the rail industry with the information necessary to make the railway more resilient to climate change.

Link to resource

Building a resilient railway: UIC RailAdapt project

The UIC initiative ‘RailAdapt’ has been designed to provide UIC members with a strategic framework to build long-term resilience. RailAdapt brings rail and other experts together to share good practice and develop guidance on optimizing cost effective resilience, prioritising resilience activity, sourcing funding for the investment and making connections with funders (e.g. development banks).

Link to resource
GUIDANCE, TOOLS AND APPROACHES

Resilience Shift Primer: Rail. An industry guide to enhancing resilience

This primer is a brief document introducing the elementary principles of resilience relevant to the rail sector and is part of a body of knowledge, tools and approaches that the Resilience Shift is producing, funding, and curating, intended to help those responsible for the financing, planning, design, delivery, operation and maintenance of critical infrastructure systems to shift practice.

The Urban Rail Development Handbook

This Handbook provides experiential advice to tackle the technical, institutional, and financial challenges faced by decision makers considering urban rail projects. It brings together the expertise of World Bank staff and the input of numerous specialists to synthesize international 'good practices'. The material presented is intended as an honest-broker guide to maximize the impact and manage the challenges of urban rail systems in cities in both developed and developing countries.
GUIDANCE TOOLS AND APPROACHES

Road
GUIDANCE, TOOLS AND APPROACHES

Resilience Shift Primer: Roads. An industry guide to enhancing resilience

This primer is a brief document introducing the elementary principles of resilience relevant to the roads sector and is part of a body of knowledge, tools and approaches that the Resilience Shift is producing, funding, and curating, intended to help those responsible for the financing, planning, design, delivery, operation and maintenance of critical infrastructure systems to shift practice.

[Link to resource]

Bioengineering for Green Infrastructure

This publication explains how bioengineering can be successfully applied to improve different forms of infrastructure while providing various socioeconomic and ecosystem benefits. It introduces the concept of bioengineering, discusses its engineering functions and other benefits, and gives examples of bioengineering techniques that are appropriate in the Southeast Asia context. The publication also provides practical guidance for planning, designing, and implementing bioengineering initiatives.

[Link to resource]
GUIDANCE, TOOLS AND APPROACHES

PIARC International Climate Change Adaptation Framework for Road Infrastructure

This Framework aims to guide road authorities through the process of increasing the resilience of their networks and assets and is intended to be of practical use for road owners and managers in high and lower middle-income countries. The Framework comprised 4 main elements with a series of international case studies.

This Framework is currently being updated and will be available in 2023.

Link to resource

PIARC Adaptation Methodologies and Strategies to Increase the Resilience of Roads to Climate Change

This report aims to undertake a state-of-the-art case study analysis of adaptation strategies to increase the resilience of road infrastructure at the policy, strategic, system level and project specific levels.

It provides the methodological detail to support the PIARC International Climate Change Adaptation Framework for Road Infrastructure. It refers to state-of-the-art case studies examples and is based on 59 collected and classified case studies that were analysed and classified.

Link to resource
GUIDANCE, TOOLS AND APPROACHES

Refinement of PIARC’s International Climate Change Adaptation Framework for Road Infrastructure

This report follows up on the implementation of the PIARC International Climate Change Adaptation Framework for Road Infrastructure. It identifies the refinements required for the next update of the Framework (to be completed in 2023). Major ideas for the refinement of the Framework are presented in this report: separating the methodology aspect from the structural aspect, restructuring to achieve easier applicability and opening possibilities for adding new knowledge.

Link to resource

COVID-19: Initial Impacts and Responses to the Pandemic from Road and Transport Agencies

This report sets out impacts of, and responses to, COVID-19 from the roads and transport sector in the early stages of the pandemic; highlights lessons learnt and recommendations which may be relevant to the remaining period of the pandemic or to subsequent crises which may arise on an equivalent scale; briefly touched on some of the key issues which may be relevant to economic and social recovery from the pandemic in the coming months and years; and sets out possible lessons which might be considered. The key conclusions and recommendations of the Report as the pandemic continues into 2021 highlight the strategic and essential value of road transport, and acknowledge that road and transport organisations have demonstrated their speed of reaction and adaptability.

Link to resource
**GUIDANCE, TOOLS AND APPROACHES**

Delivering a Sustainable, Safe and more Resilient Upgrade on the A380 Route in Uzbekistan

ORIS, the first digital materials platform for sustainable roads, is working with the Asian Development Bank’s program on the A380 route upgrade project in Uzbekistan. This road project is among the Asian Development Bank’s strategic investments with the route being one of the major trade routes in Central Asia and part of the road networks connecting the Caucasian region to Eastern Asia. The A380 also connects the Southern and Western part of Uzbekistan to its neighbouring country, Kazakhstan.

[Link to resource](#)

ReCAP Programme library (hosted by IRF)

The ReCAP Rural Access Library represents an integral part of the Partnership’s knowledge dissemination strategy. You will find knowledge and research generated by ReCAP, AFCAP and SEACAP in this library. The library is free to access for anyone interested to find out more about rural access in Africa and Asia; you do not need a password or login.

[Link to resource](#)
GUIDANCE, TOOLS AND APPROACHES

Global Transport Knowledge Partnership Knowledge Centre (hosted by IRF)

The global Transport Knowledge Partnership (gTKP) is a platform for making effective use of the best available transport knowledge and facilitating strong participation from developing and transition countries. The new gTKP website is now open for instant access to the latest and best road safety knowledge.

Link to resource

LA 114 Climate

This document sets out the requirements for assessing and reporting the effects of climate on highways (climate change resilience and adaptation), and the effect on climate of greenhouse gas from construction, operation and maintenance projects.

Link to resource
GUIDANCE, TOOLS AND APPROACHES

ReCAP Climate Adaptation Handbook and Guidelines for Africa

Climate in Africa is changing and the most immediate impact is from extreme climate events such as drought, floods, storms and cyclones. Knowledge on how this will adversely affect African Governments’ roads and transport is weak and there is no common guidance on how to best deal with climate effects at present and in the coming years.

Link to resource

Climate-Resilient Transport – A Policy Guide

This policy guide provides background and context on the problem and practical steps to develop, prepare and implement adaptation plans for transport resilience to climate change. Its information is based on findings in a recent State of Knowledge report on Adaptation for Transport Resilience in Low-Income Countries in Africa and South Asia, and as such, it is targeted at policymakers in these regions.

Link to resource
GUIDANCE TOOLS AND APPROACHES

Aviation
Climate change risks for European Aviation

The report assesses how existing weather trends have impacted aviation in recent years, factoring in climate change impacts that are emerging faster than expected. It forecasts growing disruption both on the ground and in the air: airports and their surrounding transport infrastructure face a rising risk of flash flooding and rising sea levels, while flight operations are set to be increasingly delayed by violent storms that will increase delays, raise fuel burn and lead to higher emissions.

Link to resource

Climate resilient airports

This paper provides a high-level overview of the issues climate change may bring for airports, as well as some strategies on how to anticipate and prepare for contingencies. This paper is not intended to capture every single aspect regarding climate change and aviation, but will instead stay focused on airport resilience.

Link to resource
GUIDANCE TOOLS AND APPROACHES

Shipping
Climate Risk and Ports: A Practical Guide on Strengthening Resilience

This guide helps port developers and operators create an action plan to build resilience and reduce the adverse consequences of climate-related events in and around port facilities. It provides information and analysis to better understand the climate context of a project, develop a risk assessment, formulate adaptation measures, and establish monitoring and evaluation procedures.

Link to resource

Climate change and ports Impacts and adaptation strategies

The risks to port operations and infrastructure from climate change are increasing. This paper explores some of the impacts for the UK ports sector and looks at adaptation strategies to counter them.

Link to resource
Facilitating Sustainable and Resilient Port Development to Support Sustainable Maritime Connectivity in Asia and the Pacific

The project was designed to enable countries and other stakeholders to discuss sustainable and resilient port development in relation to sustainable maritime connectivity, to share decarbonized shipping policies in the ESCAP region and review regional and national strategies for sustainable and resilient port development and decarbonized shipping in Asia and the Pacific. Recommendations and policy guidelines to establish a priority policy agenda for improving the sustainability and resilience of port infrastructure were developed. National strategies were also identified in a follow-up study.

Link to resource

COVID-19 Recovery Guidelines for Resilient and Sustainable International Road Freight Transport Connectivity in ASEAN

The COVID-19 Recovery Guidelines for Resilient and Sustainable International Road Freight Transport Connectivity in ASEAN was developed by the ASEAN Transport Facilitation Working Group (TFWG) with joint assistance from the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and the International Transport Forum (ITF). The Guidelines were designed to support ASEAN Member States in establishing their regional and national transport connectivity recovery plans with a focus on resilience and sustainability, as well as developing regional COVID-19 recovery guidelines on cross-border road freight transport.

Link to resource
SOLUTIONS/CASE STUDIES

Cross-sector
Communicating the uncertainty of sea level rises: analysing future climate change impacts

Arup developed a sea-level rise insights tool to explore how uncertainty over future sea level rises can be captured in the economic decision process. The science surrounding climate change is hugely complex and uncertain, and the tool is designed to help improve and inform key decision-making around flood risk management and resilience.

[Link to resource]

Port Lands Flood Protection & Enabling Infrastructure, Roads and Parks, Toronto, Ontario, Canada

This $1.15B (CAD) government-backed mandate will confer flood protection on 240 hectares of urban waterfront, improving and protecting Toronto’s Port Lands by naturalizing the mouth of the Don river, set into a formerly industrial district. WSP has implemented a treatment train approach to managing stormwater in the newly created precinct, involving stormwater retention and detention through passive irrigation of street trees, bioswales and subsurface soil volumes, and urban rain gardens, which will connect with a stormwater quality treatment facility, and provide protection from rising lake levels.

[Port Lands Flood Protection]
Designing for holistic resilience with REDi

As climate change–related threats to the built environment, such as extreme weather and natural disasters, increase in severity and frequency, there is an imperative to design today for their potential impacts tomorrow. Arup's Resilience-Based Design Initiative (REDi) guidelines offer beyond-code provisions for enabling the resilience of building during and immediately following climate threats.

Link to resource

ARUP

Designing bridges for future resilience, Solomon Island and Vanuatu, Pacific Islands

This project investigated use of modular bridges to meet the Pacific region’s infrastructure needs and enhance resilience. The project also included performance monitoring of a pilot project in Solomon Islands and Vanuatu. Modular bridges comprise pre-cast concrete or prefabricated steel bridge sections, ideal for short, single-span bridge crossings between ten and 20 metres. Their standardised components can be rapidly assembled and easily replaced if damaged in a natural disaster.

Link to resource

ARUP
Making transportation climate resilient in Freetown, Sierra Leone

The government of Sierra Leone worked to gain a better understanding of the roads’ vulnerability to floods and landslides and how climate change would affect the patterns and characteristics of those events. Through the collection of data on public mobility on formal and informal transport systems they were able to identify interventions to enhance the resilience of transport systems. Mobile applications such as the RoadLabPro were used to map 4,038 km of formal and informal transportation systems, flooded areas and the locations of critical road infrastructures, such as drainage and culverts. This information, together with climate change projections for rainfall and sea level rise resulted in the first comprehensive climate risk-informed transport map of Freetown. This will support decision making on everything from infrastructure and policies to journey planning.

Use of low-carbon materials

Calcined clay is naturally available worldwide, making it one of the most scalable solutions for delivering low-carbon cement globally. It is also a good substitute for slag and fly ash, which are becoming more scarce, so that we can continue to produce low-carbon and high-performance cement. Developing such proprietary green technologies is part of our plan to build a net-zero future.

Our first calcined clay cement was launched in the French market in July 2021 as part of our ECOPlanet range. Produced from locally sourced materials at the La Malle plant using proprietary technology, this ECOPlanet variant emits 34% less CO2 per ton of cement (compared to the local market standard).

Link to resource
SuM4All Catalogue of Policy Measures 2.0 Towards Sustainable Mobility

The Catalogue of Policy Measures (CPM) compiles all the policy instruments available to country decisionmakers to achieve sustainable mobility. Since 2017, this concept is an emerging standard that the international transport community has increasingly accepted to refer to the ambition in transport and the movement of people and goods. Note that the concept covers all passenger and freight market segments, considering each segment via modes of transportation.

Link to resource
Link to resource

Multiple partners
SOLUTIONS/CASE STUDIES

Rail
INFRA.wetter – Weather Warning and Information System for Railway Infrastructure, Austria

INFRA.wetter is a railroad-specific warning system, which combines weather monitoring and forecasting with alert capabilities. It provides early warning of meteorological hazards which have the potential of causing large-scale disruption of railroad traffic in the country. In addition, it provides individualized, route-specific public warning approximately 1,500 OBB employees using multiple communications pathways (text messages, voice messages, fax, and email).

New York MTA Flood Protection and Resilience, NYC, USA

This project is aimed to restore New York City’s subway system to pre Sandy conditions and protect it against future storms. Innovative flood resiliency designs are being implemented for subway stations, tunnels, bus depots, etc. Solutions include vent covers, floodproof doors, watertight manholes, conduit seals.

Link to resource
Network Rail’s Weather Resilience and Climate Change Adaptation Plans, UK

Network Rail’s 30 year Environmental Sustainability Strategy aims to deliver ‘a reliable railway that is resilient to climate change’ and provides the framework for achieving a sustainable railway ‘serving the nation with the cleanest, greenest mass transport’. This lays out the key principles and actions we will take to embed weather resilience and climate change adaptation risk assessment and action into our decision-making processes across the business. Actions range from research, policies, guidance and standards through to solution design, construction and operation. The action in our routes is guided and monitored through individual Route Weather Resilience and Climate Change Adaptation Plans and our progress as a whole can be seen in our third Adaptation Report to government.

Link to resource - Climate Change Adaptation
Link to resource - Weather Resilience & climate change impact assessment guidance
Link to resource - Climate Change Projections guidance

Strategic Regional rail Infrastructure Flood Risk Assessment, Hong Kong, China

This study supported the development of a long-term resilience investment strategy, through the use of catchment-level hydraulic modelling and a holistic risk assessment framework to understand and classify flood risk. The risk assessment framework incorporates both quantitative (flood predictions) and qualitative (GIS assessments) attributes, integrated to ensure a robust and consistent assessment of hazard at any level. Use of bespoke InfoWorks ICM themes to directly compare flood results, enabling extensive geographical visualisation of the impacts of climate change on risk.
SOLUTIONS/CASE STUDIES

Road
National Rural Transport Strategy in Mali

The objective of the National Rural Transport Strategy is that “50% of villages will be located within 2 km of a road that remains passable year-round. The program includes the construction of 1,000 km of unpaved roads per year, the maintenance of 200 km of commercial routes per year, the development of a Rural Road Master Plan. Project design incorporates a whole community approach. From a technical point of view, the project incorporates a wide range of interventions intended to improve water drainage and protect unpaved roads from erosion.

Link to resource

Road Rehabilitation and Safety Project, Serbia

This Serbian pilot project assessed existing and potential natural hazards, available demographic and socioeconomic data, in order to identify critical locations in terms of service provision and economic activity and consequently identify priority road network/links that are vulnerable to climate driven risks. Output from the task was a series of hazard maps for different climate scenarios. These hazards include landslides, rockfalls, floods, flash floods, optionally also, wildfires and snow fall.

Link to resource

ARUP
Flood Emergency Reconstruction and Resilience Project, Pakistan

The Asian Development Bank is working with Pakistan to rebuild and upgrade roads, bridges and other infrastructure damaged by the devastating September 2014 floods, which displaced over 2.5 million people. The project is rebuilding infrastructure to disaster-resilient standards in the worst-hit areas of Punjab Province and the districts of Haveli, Kotli and Poonch. This project has used bioengineering to stabilize slopes.

Link to resource - Pakistan project

Transportation Climate Change Adaptation Project, Norway

Based on “Climate in Norway 2100”, a report developed by the Norwegian Climate Center, the Norwegian Climate Center, the Norwegian Public Roads Administration (NRPA) undertook a major research project to assess the risk to their network and identify mitigation measures for existing and new roads.

Climate in Norway 2100: warmer and wetter
Rion-Antirrion Bridge (Harilaos Trikoupis Bridge), Greece

The Greek ports of Patra and Igoumenitsa were the principal maritime transportation modes linking Greece to other European Union countries. The bridge was built to connect Peloponnese with mainland Greece and therefore enhance the country’s connection to Italy and the remainder of the European Union through these two ports. Prior to the construction of the bridge, it took 45 minutes to cross the strait using ferry boats (excluding loading and unloading time). The bridge aimed to reduce that time to below 5 minutes.

Link to resource

Te Ahu a Turanga Highway Stormwater Design, Manawatū - Tararua, New Zealand

This complex, 11.5-kilometer roading infrastructure project provides a key regional connection between Tararua and Manawatū. The 4-lane highway includes 6 bridge structures and traverses a challenging, steep topography with high rainfall, and flooding and erosion issues. WSP, as part of the wider Alliance, is leading the stormwater and hydraulic design, which treads lightly on the environment and incorporate cultural considerations, and includes 40 culverts, 6 wetlands and 8 wetland swales, 5 kilometers of constructed streams, 9 kilometers of network drainage pipes and 20 kilometers of open channels and drains.

Link to resource
Florida Keys Sea Level Rise Pilot Project, Monroe County, Florida

As climate change–related threats to the built environment, such as extreme weather and natural disasters, increase in severity and frequency, there is an imperative to design today for their potential impacts tomorrow. Arup’s Resilience-Based Design Initiative (REDi) guidelines offer beyond-code provisions for enabling the resilience of building during and immediately following climate threats. 

Link to resource

Green-Gray Solution to Protect the Ciénaga Grande de Santa Marta (CGSM) in Colombia

Working with local partners (Tras La Perla, INVEMAR, and Uniandes), Conservation International developed a design to widen the highway while also improving the hydrologic connection between the marsh and the ocean and restoring and protecting the mangroves and sand dunes of the region. The presented alternative would not only result in a highway capable of fulfilling the requirements of increased traffic but also bring additional benefits to people and nature. 

Link to resource
Roads and Bridges Management and Maintenance Program, Mozambique

This World Bank funded programme has improved coverage and conditions of roads and bridges in the territory; strengthened the institutional capacity to manage and administer the road sector; established financing mechanisms for road maintenance; promoted the use of local resources in road construction and management; and improved road transport safety. The programme resulted in the percentage of roads in good or fair condition increasing to 72%, the percentage of the rural population living within 2 km of an all-season road increased to 29.3% and beneficiaries from rural communities were 4.66 million.

Link to resource

Gravity – Smart Campus

UK destination for international business - targeting transport decarbonisation through gigfactory.

- 1.1m m² of Advanced manufacturing and associated uses, up to 750 dwellings – Clean & Inclusive Growth.
- Collaborative approach (developer, planning and highway authorities) LDO approval to achieve this.
- New appraisal methodology – assessed wide range of potential futures (over 100 scenarios) – identified a range of acceptable (low carbon) futures.
- Collaborative monitor and manage approach agreed – target multi agency investment plans into a low carbon sustainable transport solution.

Link to resource
Climate resilient sustainable road pavement surfacing

18-month CRISPS multi-disciplinary research project aims to demonstrate the technical and economic suitability of three global best-practice road surfacing technologies for the range of traffic and environmental conditions of high volume roads that typically currently occur in LICs and those that are predicted to occur in the future. The technologies evaluated are Modified Epoxy Chip Seals (MECS), Modified Epoxy Asphalt Surfaces (MEAS) and Fibre Mastic Asphalt (FMA) respectively. Link to resource

Multiple partners
COLLABORATIVE INITIATIVES
Resilience4Ports

The Maritime Resilience Breakthroughs Lab: Resilience4Ports is the first Innovation Lab launched by Resilience Rising, tapping into its global, multi-sector consortium of policy makers, engineers, businesses, financiers, and infrastructure owners and operators and supporting achieving the UN Climate Change High Level Champions’ 2030 Maritime Resilience Breakthroughs.

The program aims to mobilize a critical mass to create the scale and momentum necessary to break through the industry’s barriers to resilience.

Climate Emergency Action Planning: Guidance for Asset Owning Organisations

The IAM is committed to support Members, governments and other decision-making bodies by leading action in our community and sharing good practice, with the aim of embedding an asset management approach in climate action plans.

Link to resource
Climate Emergency Group: Women’s Engineering Society

The WES CEG aims are:
• To provide a platform for knowledge sharing for engineers from a variety of disciplines to guarantee alignment across sectors and
• To share experiences, develop understanding and expertise, to better influence the delivery of sustainable solutions, Net Zero Carbon and the UN SDGs.

This multi-sector, multi-discipline group uses the SDG framework to facilitate a programme of events and webinars. It was founded by head judge Sally Sudworth following the WE50 Sustainability awards in 2020. Link to resource

IRF Partners with World Bank on Resilient Transport

Recognizing the need to improve the management of transport assets and to plan for growing risks, in the face of a changing climate, the World Bank partnered with IRF to develop a freely accessible, self-paced online training program which provides strategic, experiential, and practical knowledge on how to integrate climate and disaster risk considerations in the management of transport assets specially adapted to the needs of Small Island Developing States. Link to resource