Enhancing resilience: from city to asset scale

Understanding Risk Balkans, Belgrade

19 September 2018

Welcome to our session

Outline

14:00 Welcome and introduction

Presentations

1) City Resilience Index – Sachin Bhoite
2) Resilience of an infrastructure system – Áine Ní Bhreasail
3) Corridor X – Aleksandar Bajovic
4) The Resilience Shift – Savina Carluccio

Live polling – www.sli.do

Open Q&A and panel discussion

Interactive feedback session

15:30 Close

Informative

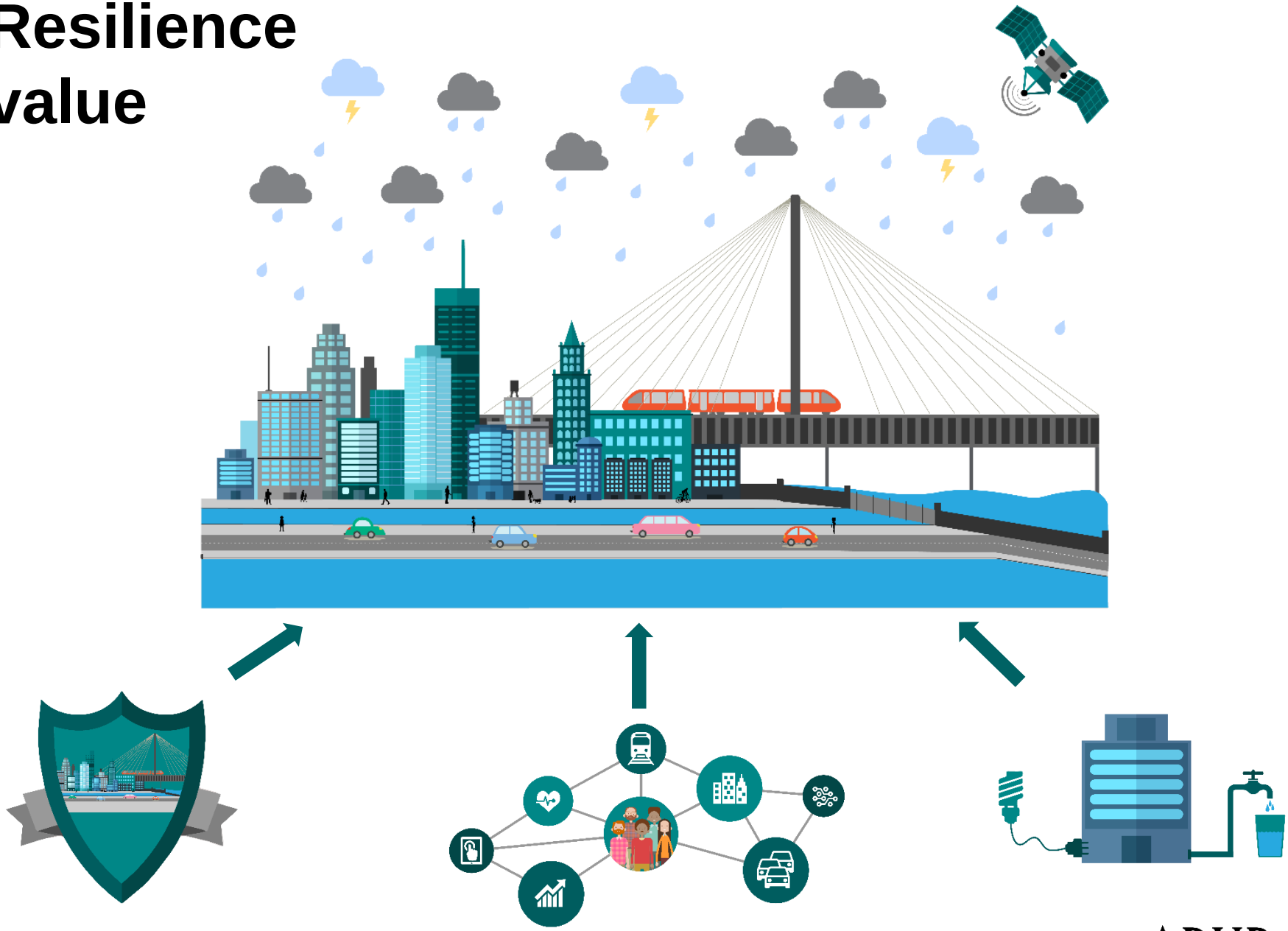
A shift from theory to practice

Thought provoking

Reflective


short term
known
asset scale
prepare
static equilibrium
long term
unknown
whole system
recover/adapt
dynamic equilibrium
Risk
Resilience

Resilience value



THE RESILIENCE SHIFT

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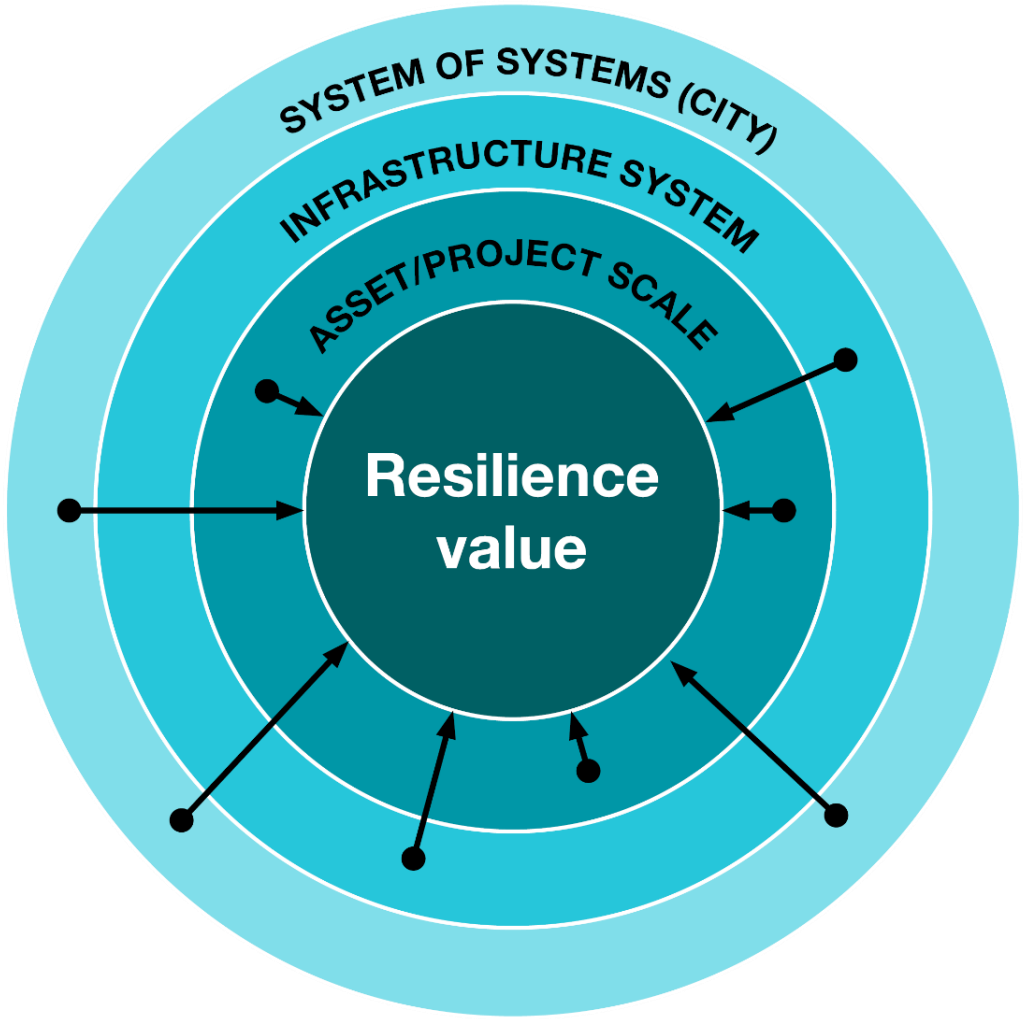
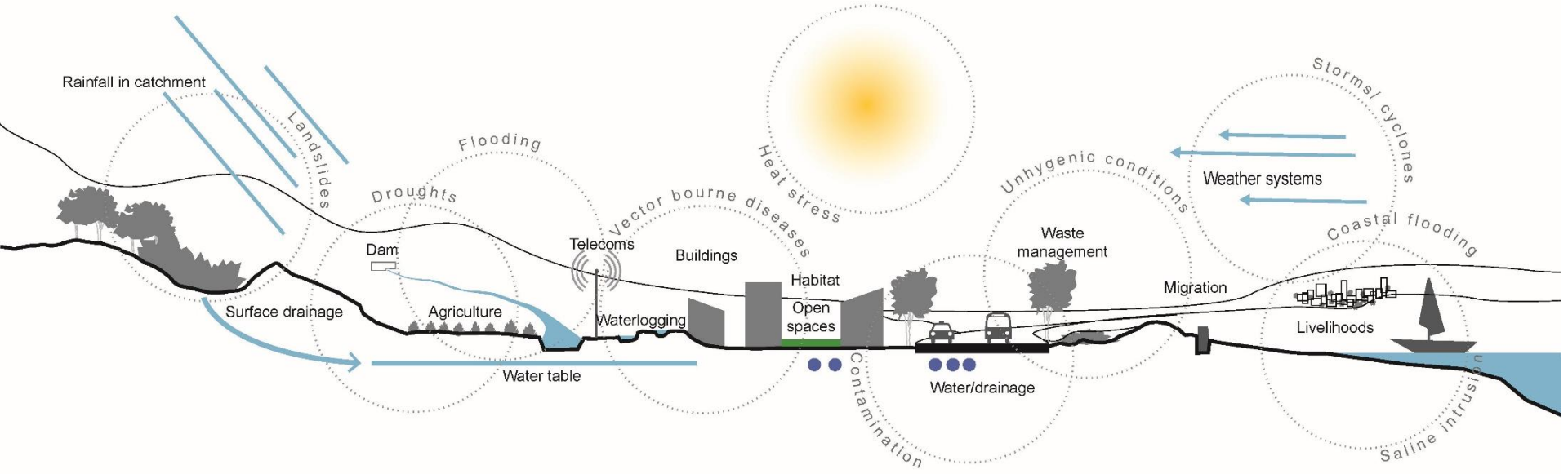

SYSTEM OF SYSTEMS (CITY)
INFRASTRUCTURE SYSTEM
ASSET/PROJECT SCALE
Resilience value

CITY RESILIENCE INDEX

Sachin Bhoite, Arup

Understanding Risk Balkans
Belgrade, 19 September 2018

Cities rely on a complex web of institutions, infrastructure and information



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Cascading failure & mutual support within systems

Haiti

New Orleans

The Challenge for CRI

Making city resilience

- Tangible
- Practical
- Globally applicable








CITY RESILIENCE INDEX

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Research

27 Cities; 150 Sources of Literature

CITY RESILIENCE INDEX

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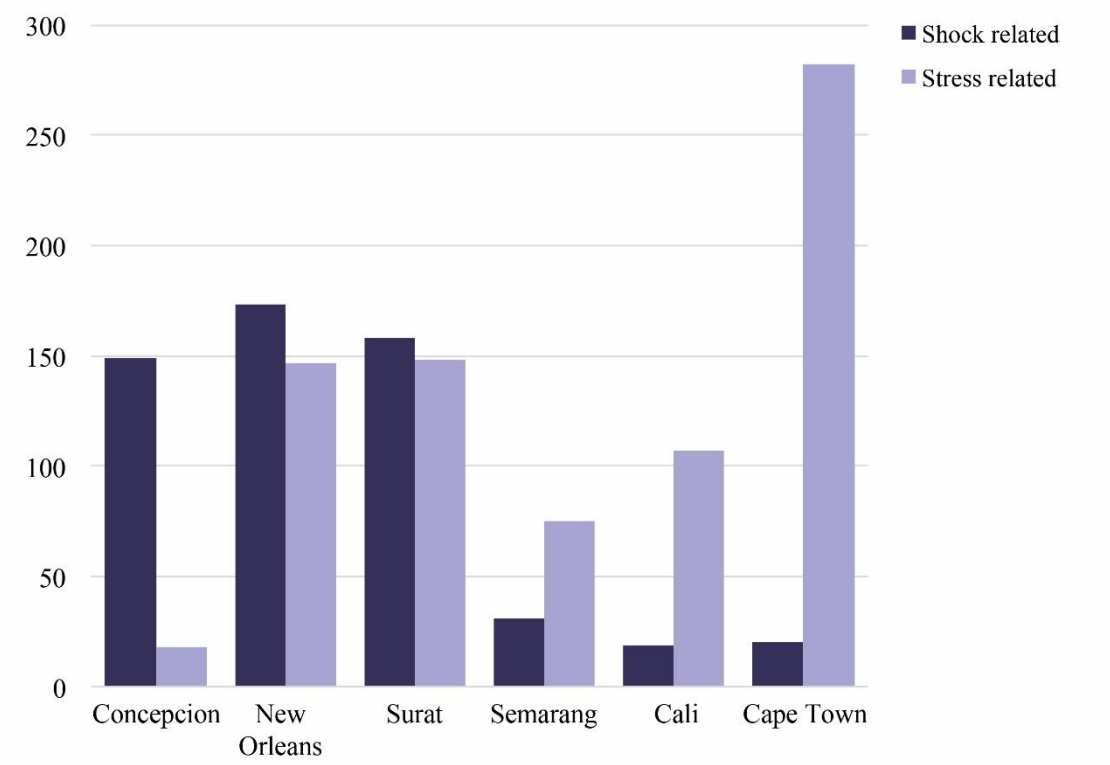
Research

27 Cities; 150 Sources of Literature

Although profile of shocks and stresses was very different…

1500+ factors



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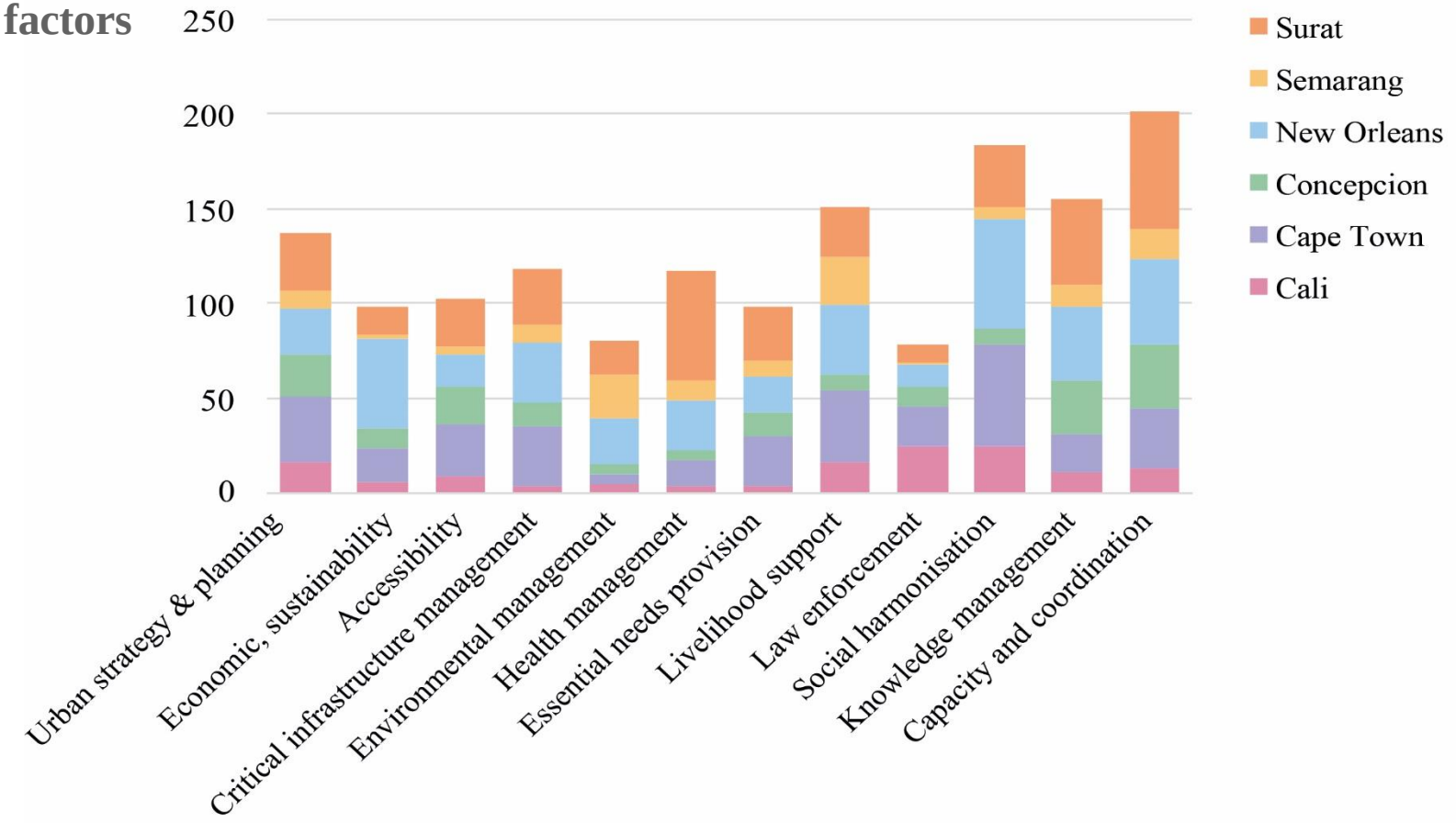
Research

27 Cities; 150 Sources of Literature

Similar themes emerged across cities

1500+ factors



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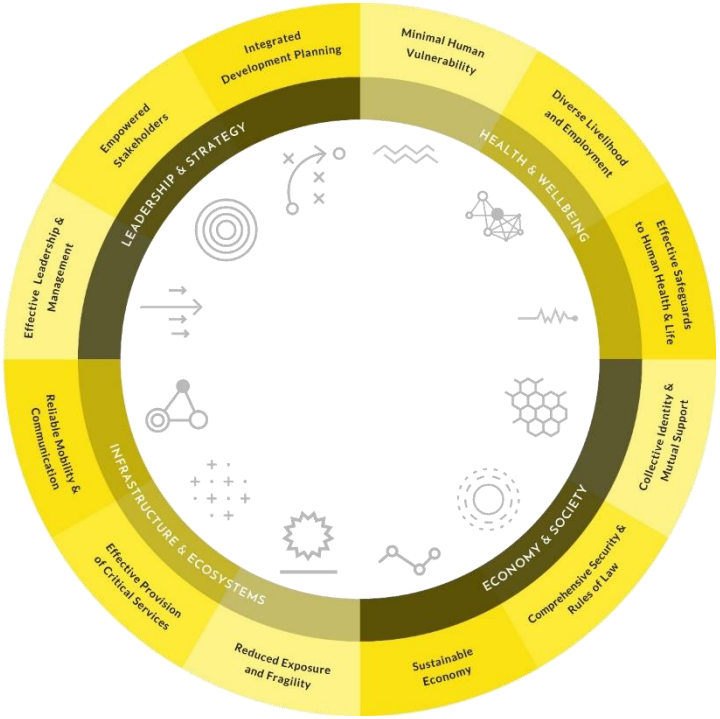
City Resilience Index
How and what to measure



Health & Wellbeing

People: the health and well-being of everyone living and working in the city.

Economy & Society

Organisation: the systems within the society and economy that enable urban populations to live peacefully and act collectively.

Infrastructure & Environment

Place: the quality of physical infrastructure and ecosystems that protect, provide and connect us.

Leadership & Strategy

Knowledge: appropriate leadership and strategy, enabling the city to learn from the past and take timely action.

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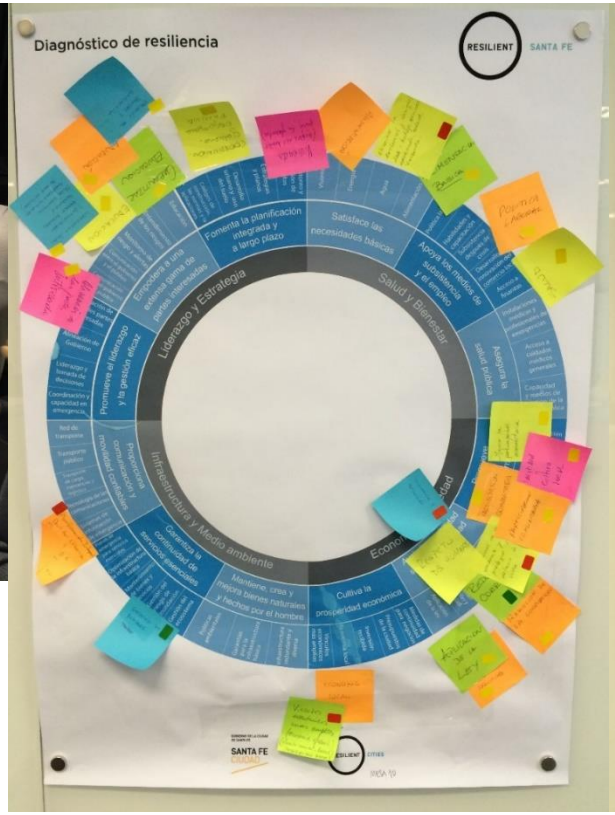
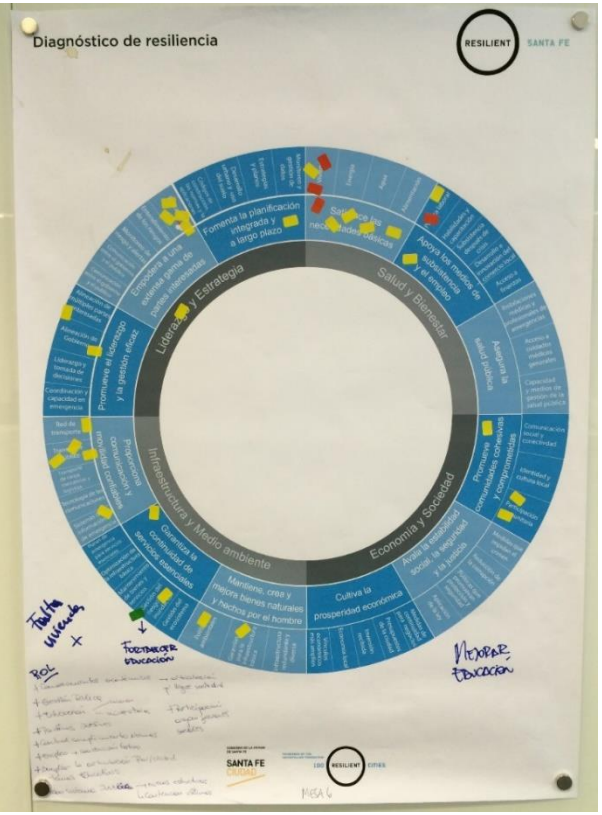
Research

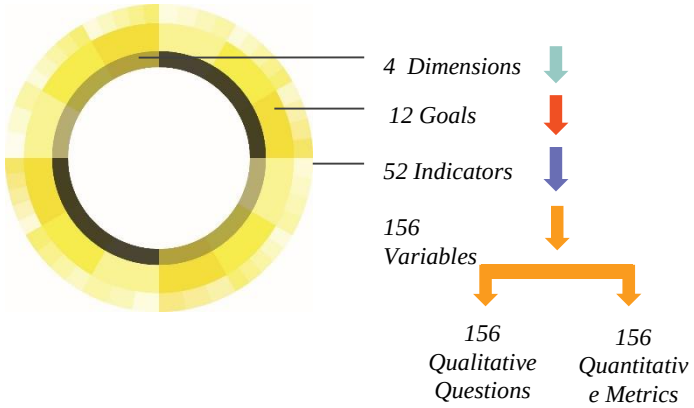
27 Cities; 150 Sources of Literature

Understanding Resilience at a City Scale (100RC Santa Fe)



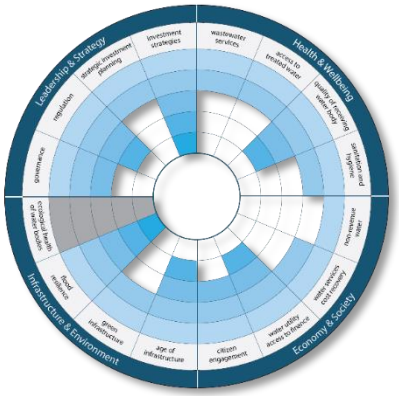


Applications

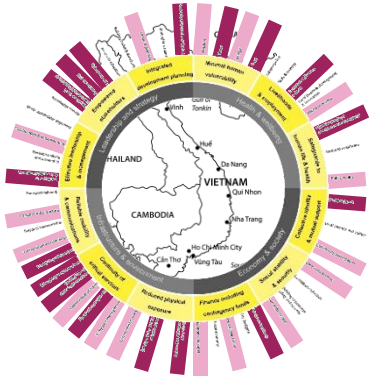


Basis and tools for measurement

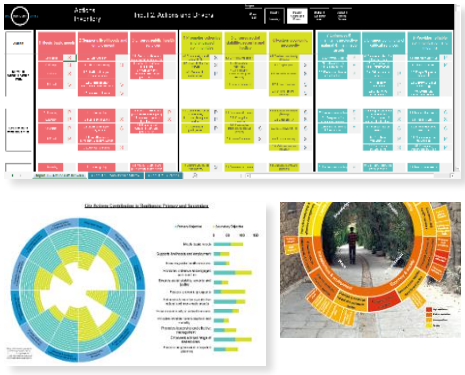
Child-centred Urban Resilience Framework



Water systems resilience framework



Vietnam CRI



Tools and processes

Communication and capacity

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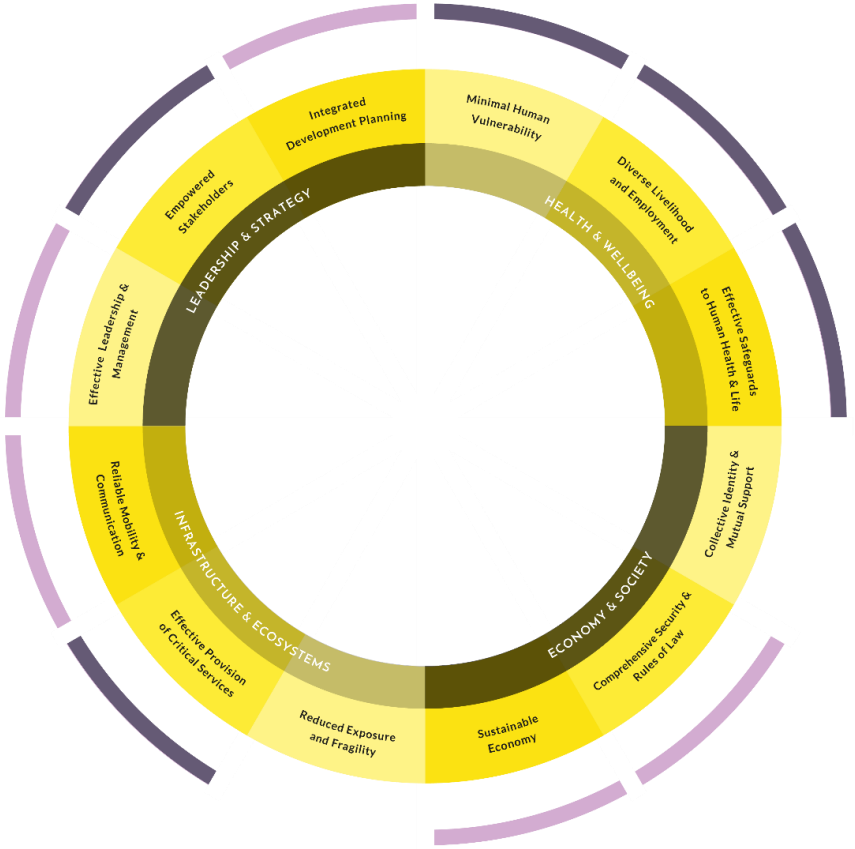
Sustainable Development Goals



Thematic overlap with goals

Substantial thematic overlap

Some thematic overlap

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Value

Feedback from cities:

- Informs / supports integrated planning and investment decisions
- Communicates knowledge about resilience concepts and actions
- Enables monitoring / measurement
- Builds credibility
- Empowers stakeholder engagement

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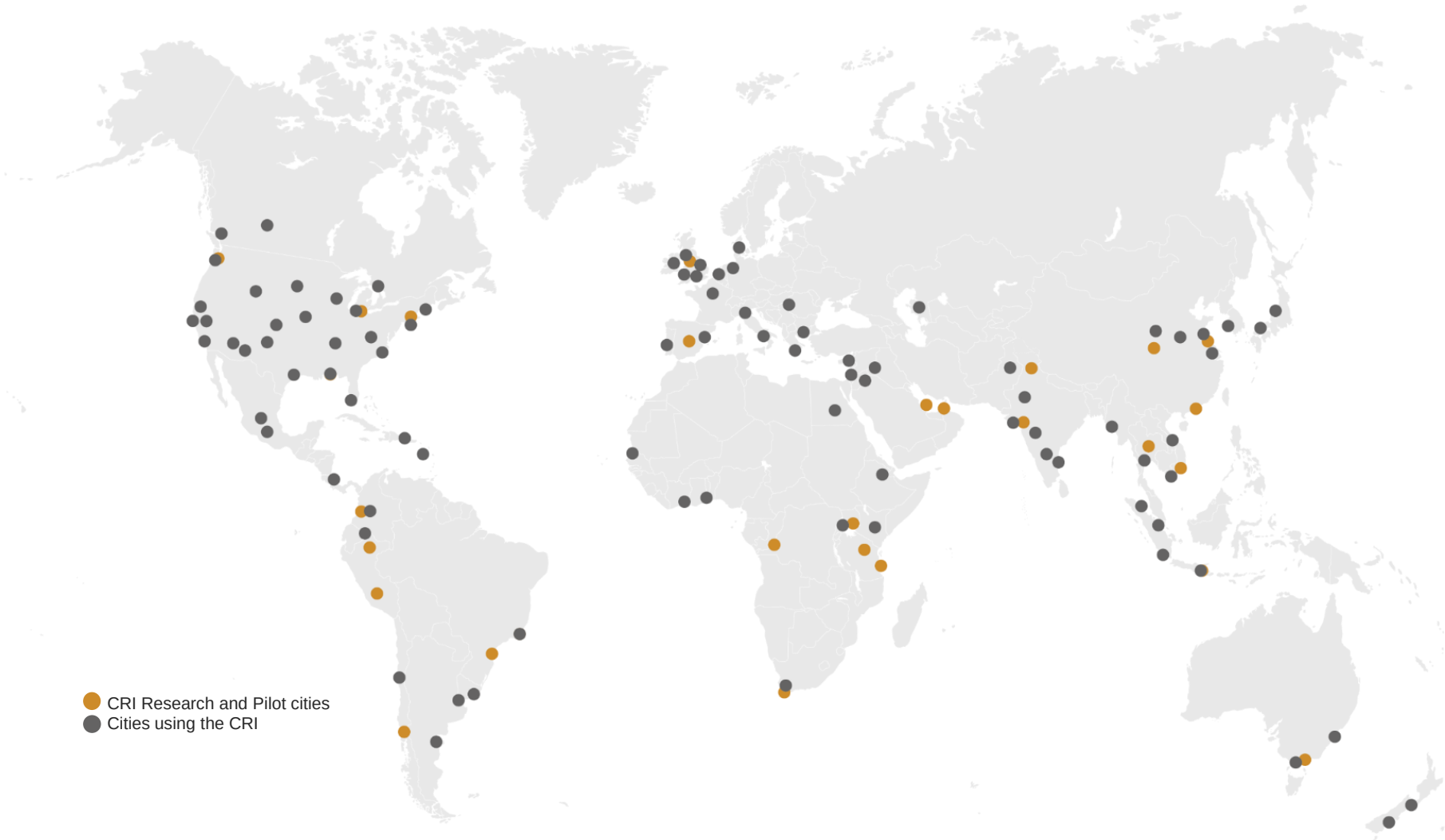
www.cityresilienceindex.org



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Resilience of an infrastructure system

Áine Ní Bhreasail
Senior Engineer
Arup

Understanding Risk Balkans
19th September 2018

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Acknowledgements

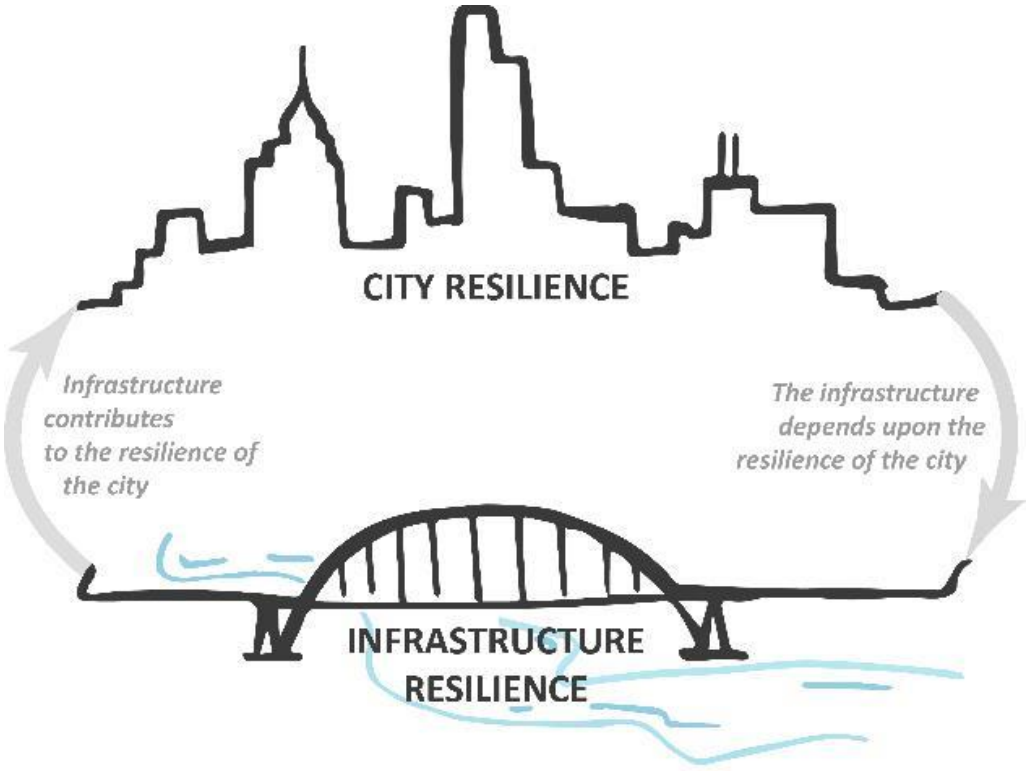
- Urban Rail Development Handbook
- World Bank Team: particularly the main Handbook authors Joanna Moody, Daniel Pulido, Georges Darido, Ramon Munoz-Raskin
- The chapter sponsor: the Global Facility for Disaster Reduction and Recovery (GFDRR)

- Images: © Yaacov Dagan/Alamy, MTA New York via Wikimedia Commons, Shutterstock, Roy Garner/Alamy, ymphotos/Shutterstock

City and infrastructure resilience

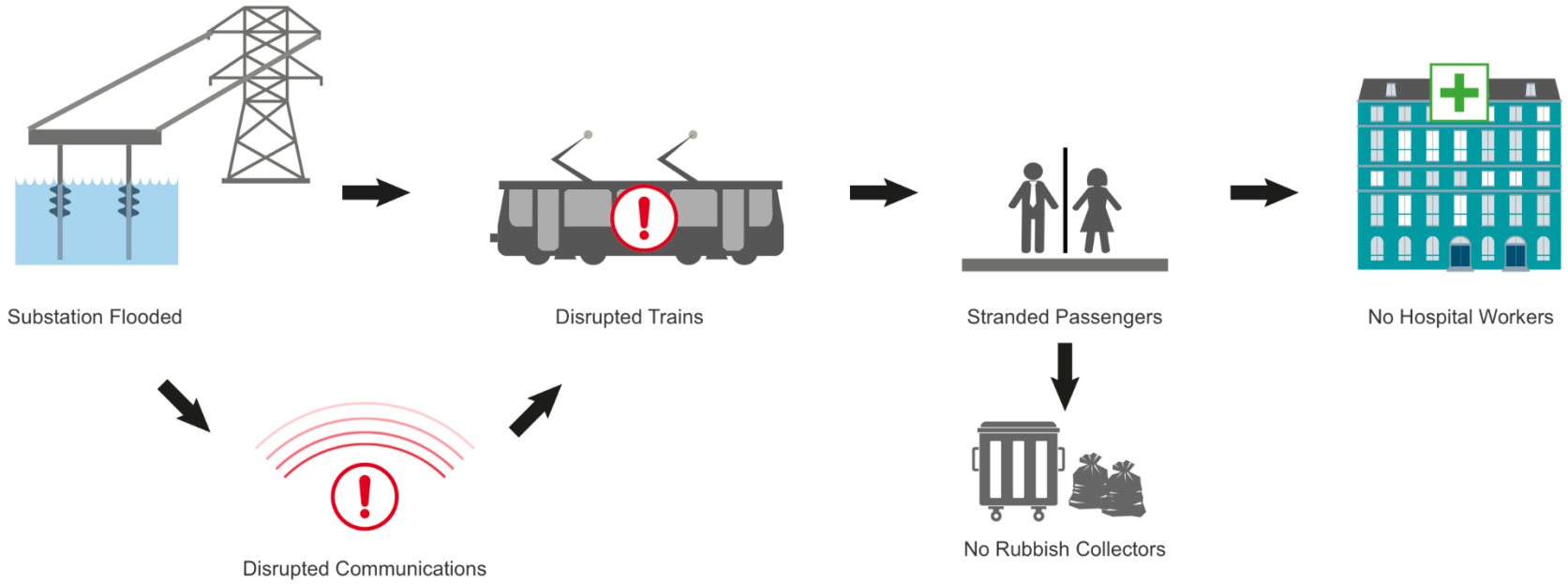
Resilient infrastructure is essential for the safety, well-being, sustainability, and economic prosperity of cities

(Transformation through infrastructure, World Bank 2012)



Resilience between systems

Each infrastructure system has interdependencies on other systems

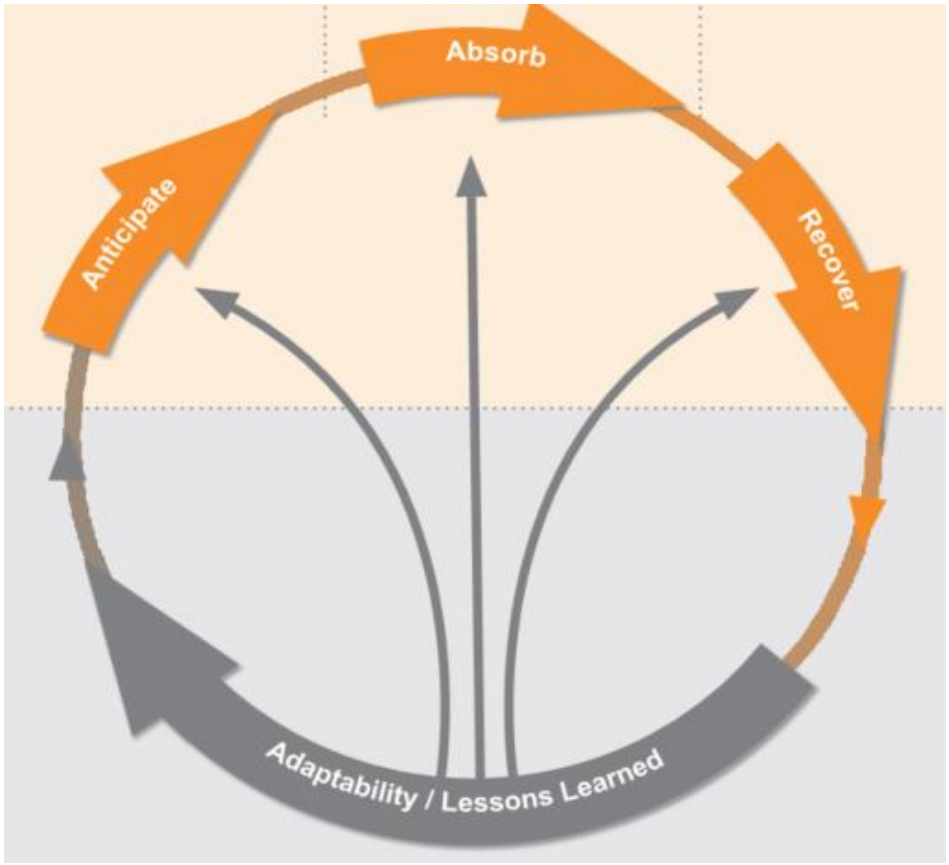


from Urban Rail Development Handbook, World Bank

Resilience within systems

Each system also needs to consider its own resilience

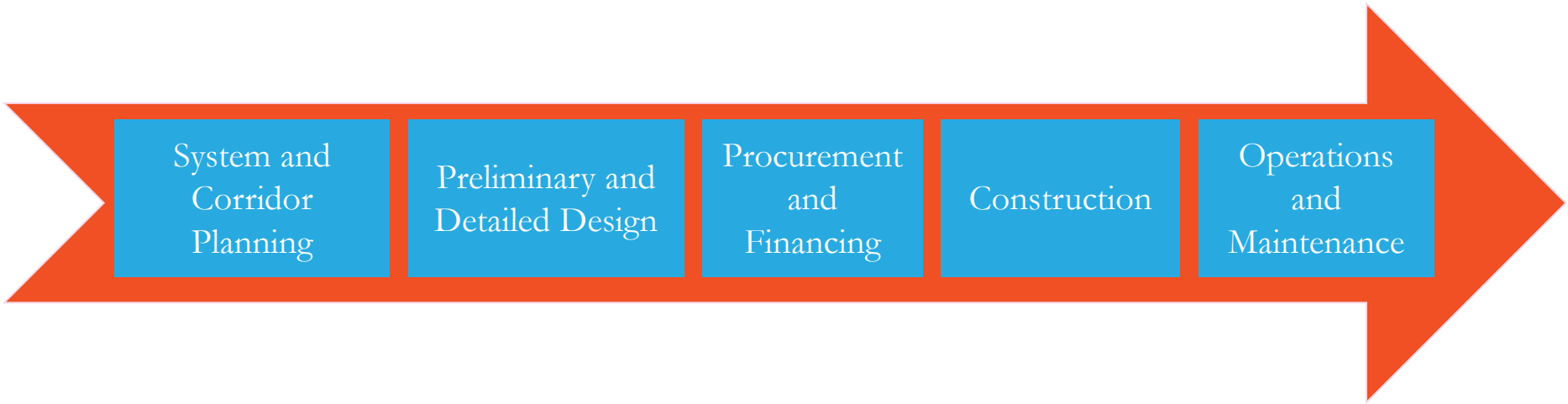
Event focussed



Post-event

from Urban Rail Development Handbook, World Bank

Resilience of a railway system



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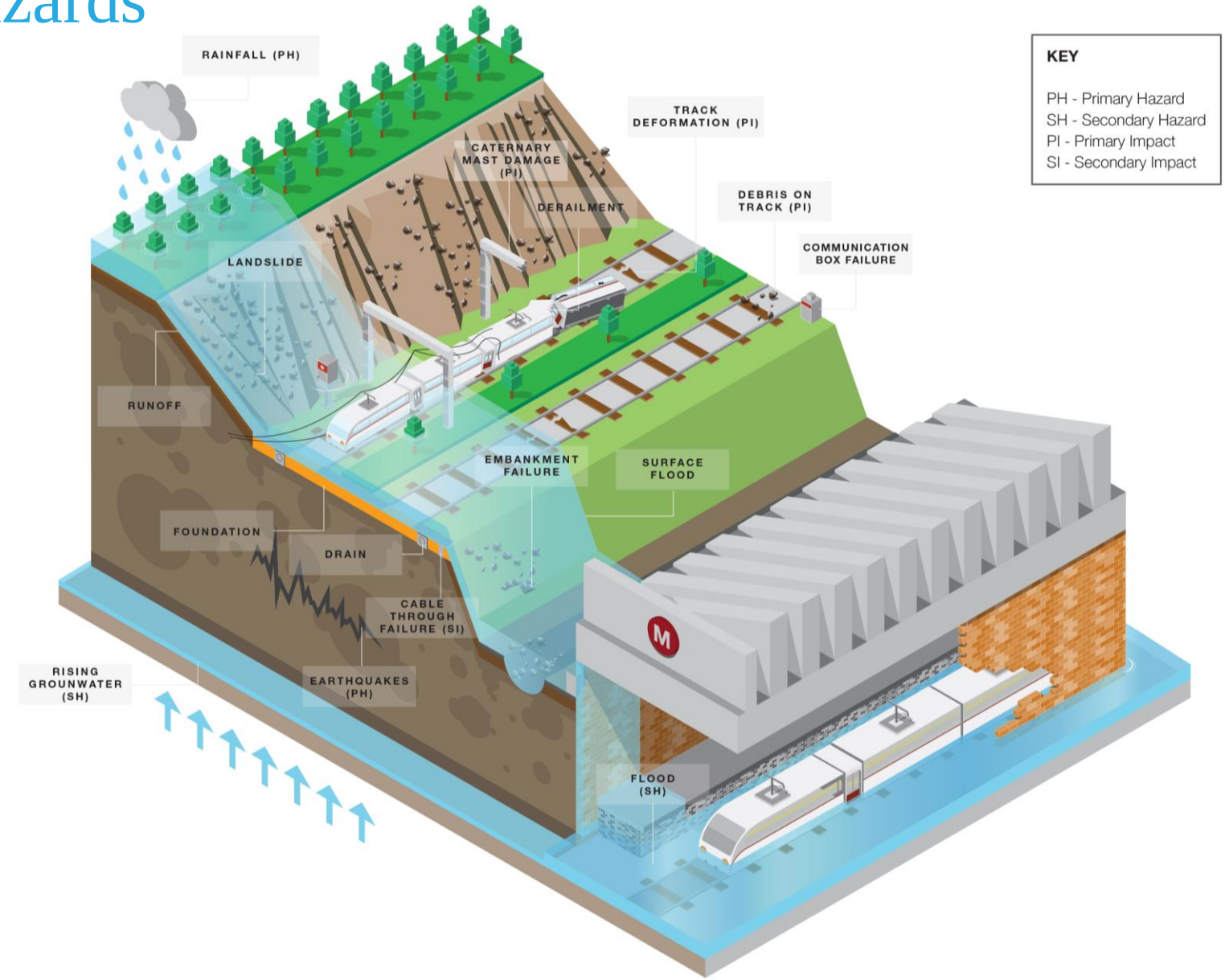
Hazards



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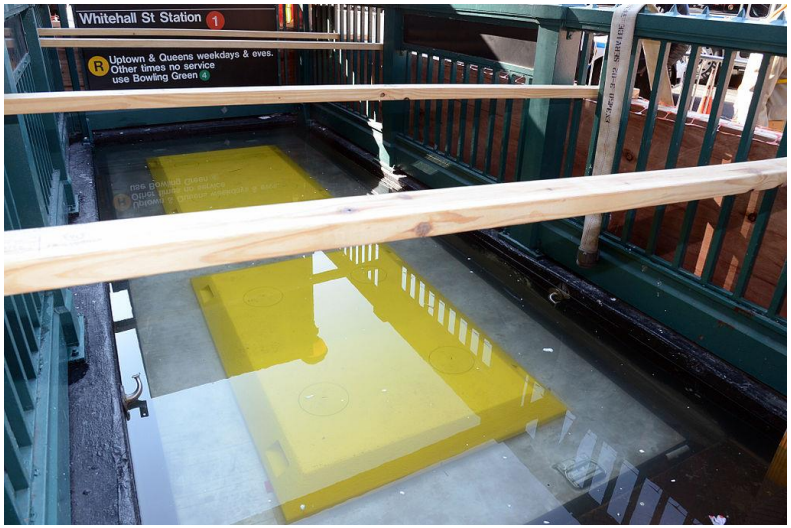
Case study – New York

- Super Storm Sandy in 2012
- Adaptations for climate change had been undertaken
- Current plans may not be sufficient
- The Metropolitan Transportation Authority created a Climate Adaptation Task Force

Temporary Flood Mitigation Measures at a New York Subway Station in 2012



Removable Subway Stairs Flood Control Cover in New York in 2013

Case study - Bangkok

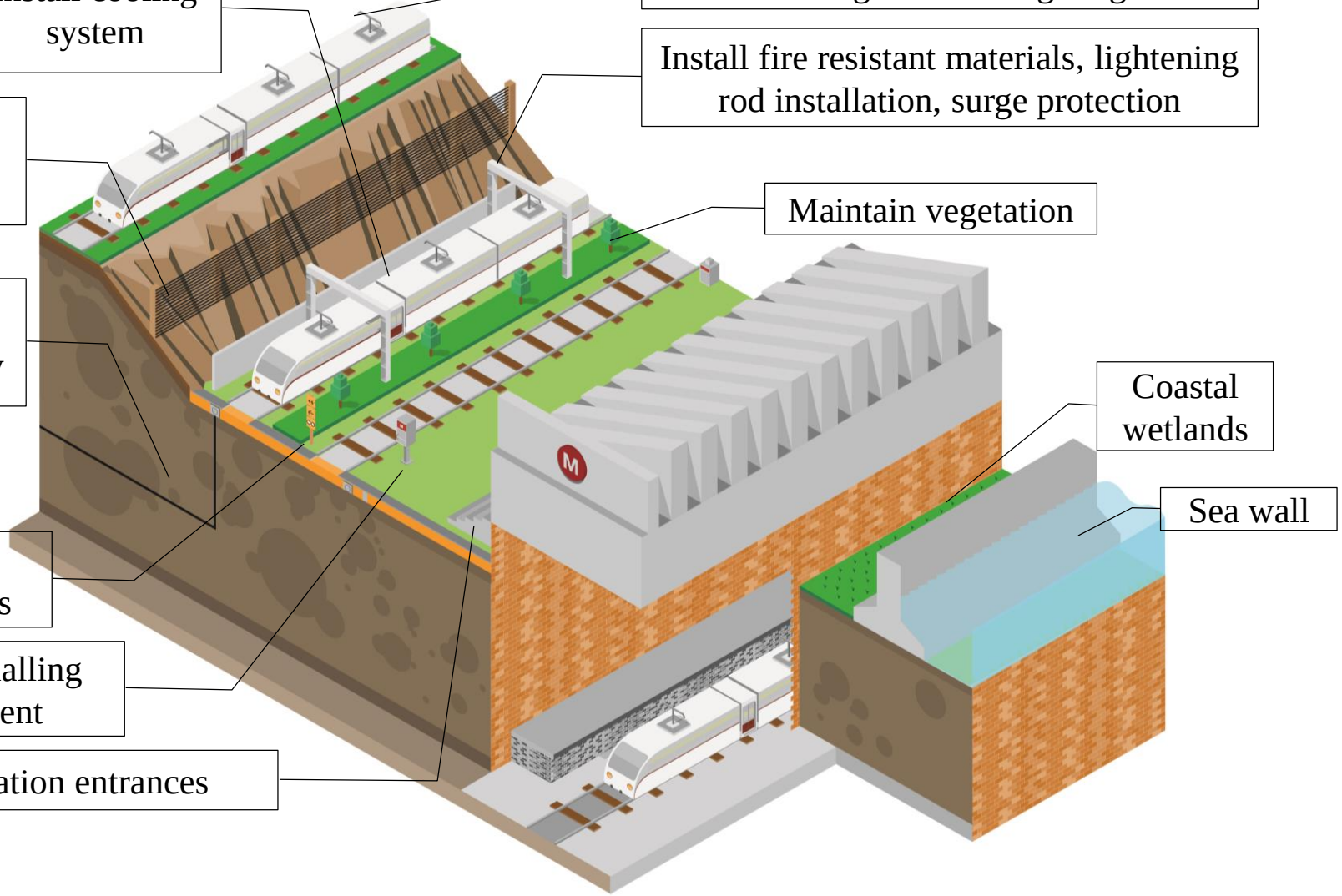
- In 2011, Thailand experienced severe monsoons with 14 million people affected and more than 800 deaths
- Bangkok's urban subway and aboveground Skytrain services remained operational
- Station entrance design credited with this resilience
- But resilience must be considered within the wider urban context

Case study – Istanbul, Turkey

- Turkey is subject to devastating earthquakes
- Istanbul Metro Marmaray Tunnel only 16 km from an active fault
- The design of the tunnel includes
  - Grout injection to minimize liquefaction effects
  - A flexible tunnel that would not fracture under powerful ground shaking
  - Installation of flood wall gates

Workers in the Marmaray Tunnel, designed to be resistant to the large earthquakes expected in Istanbul, Turkey

Mitigation measures



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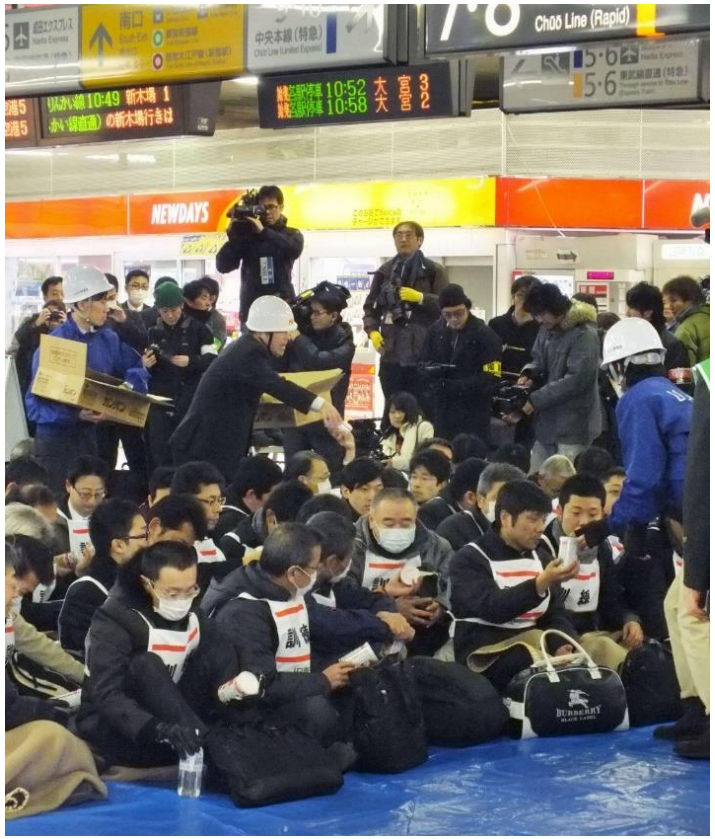
Non-structural measures

- Early warning systems
- Response plans including evacuation
- Monitoring of hazards
- Communication and coordination with disaster management teams
- Capacity building



Participants in a drill testing the emergency shelter capabilities of train stations following an earthquake: Tokyo, Japan

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Thank you

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Resilience value aspect for Corridor 10 Highway Project, Serbia

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About the Project

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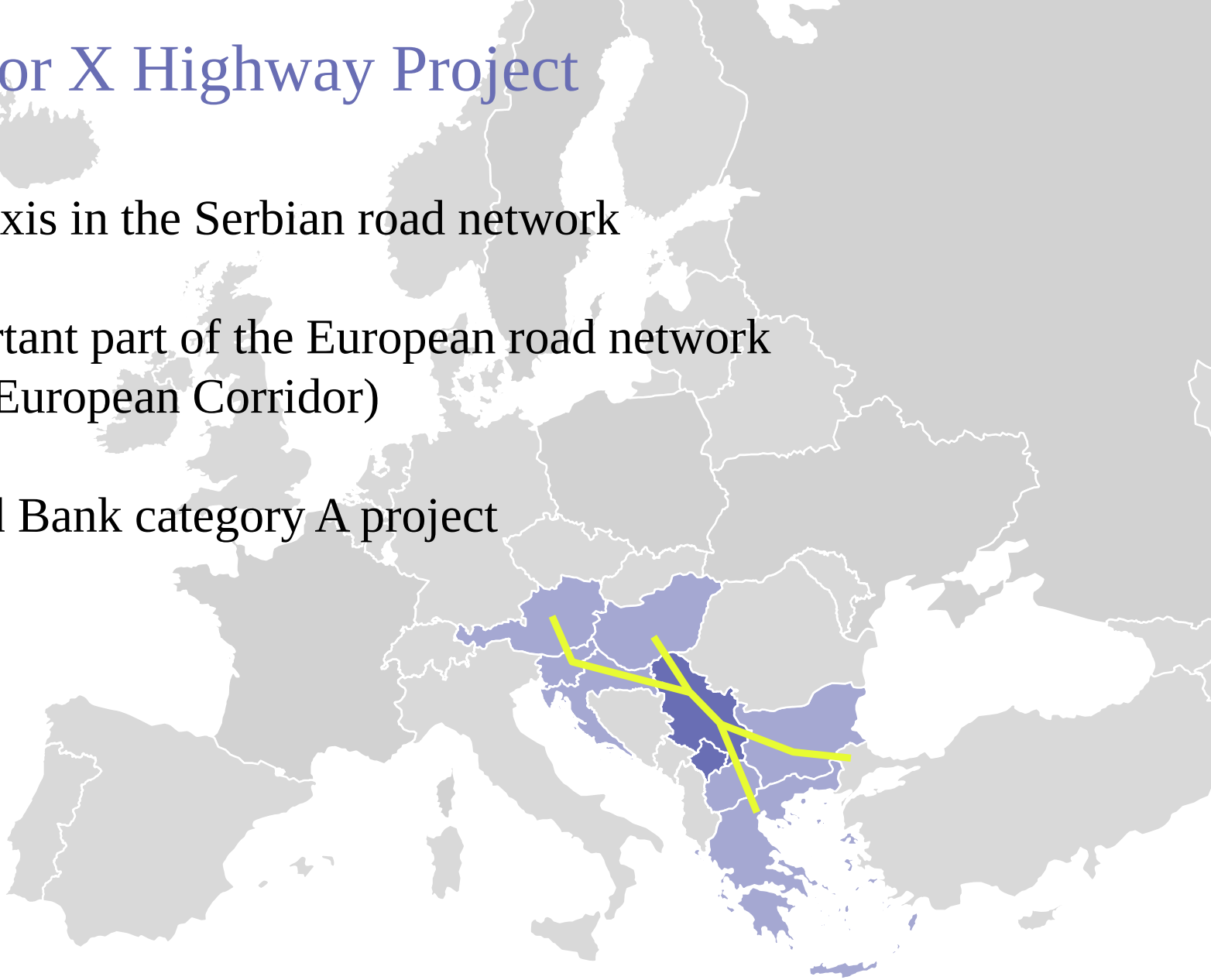
Corridor X Highway Project

- Key axis in the Serbian road network
- Important part of the European road network (Pan-European Corridor)
- World Bank category A project



Key numbers and facts

17 Million m^3	=	**7 000**
of excavated material		Olympic Swimming Pools
1,5 Million m3	=	**300**
of concrete		Avala Towers
82,500 t	=	**12**
of steel		Eiffel Towers
13,5 Million m2	=	**45 Runways**
of laid asphalt		of Belgrade Airport

Our Role

- We are Environmental Management Plan Supervision Consultant (EMPSC) to the Client Client - Koridori Srbije
- Addressing Social Impacts of the Project and the implementation of Social Safeguards
- Environment, Health and Safety Management of the Project
- We advise/suggest the Client, the Engineer and the Contractor about actions and measures to be taken

Why we do it?

- The need to preserve ecosystems and ecosystem services to enhance the ability to adapt.
- Additionally, the synergy of ecosystem preservation with socio-ecological resilience and sustainability.
- The maintenance of ecosystems and ecosystem health is imperative for the resilience of human societies

Challenges and obstacles

As the climate changes and countries suffer more frequent extreme weather events, that resilience of infrastructure even during construction becomes crucial.

Flooding in May 2014 and December 2017 occurred on site, interrupting the works and services and affecting the local communities. It took a lot of time for the works to be fully restored.

Thank you for your attention!

The Resilience Shift
Making resilience tangible, practical and relevant

Savina Carluccio, Arup | The Resilience Shift Project Lead

Understanding Risk Balkans,
Belgrade, 19 September 2018

What is the Resilience Shift?

A global initiative to catalyse **resilience** within and between key **critical infrastructure** sectors.

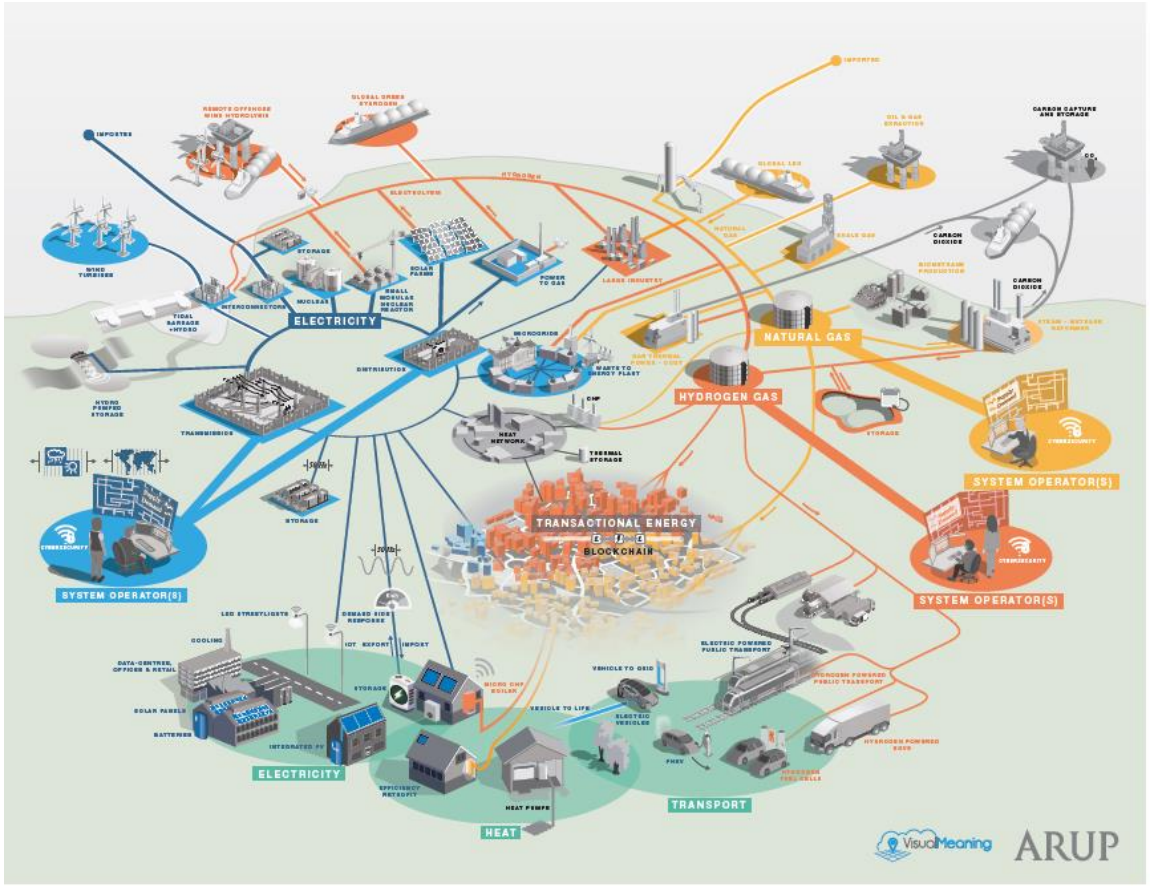
We want to **re-orient professional decision-making practice** from a focus on physical infrastructure as an asset to infrastructure as part of a system that provide services **under both ordinary and extraordinary circumstances**.

Our vision

Morandi Bridge Collapse, Genoa (Italy).

Engineered structures and infrastructure will be not only safer but better.

Decisions made along the value chain will account for how critical infrastructure contributes to the resilience of the larger socio-technical-ecological system.



Energy Systems 2035, www.arup.com

Critical infrastructure will be planned, designed, delivered and operated to serve communities (protect, connect, provide) under ordinary and extraordinary circumstances.

Making resilience tangible, relevant and practical

The value is created by equipping professionals and decision makers with the tools, approaches, technology, and educational practices needed to put **resilience into practice.**

What to do differently on Monday morning?

One of our projects is about identifying **frameworks, tools and approaches** that **enhance the resilience of critical infrastructure** and assessing them from the perspective of the **value they deliver.**

A value chain approach to resilience of critical infrastructure

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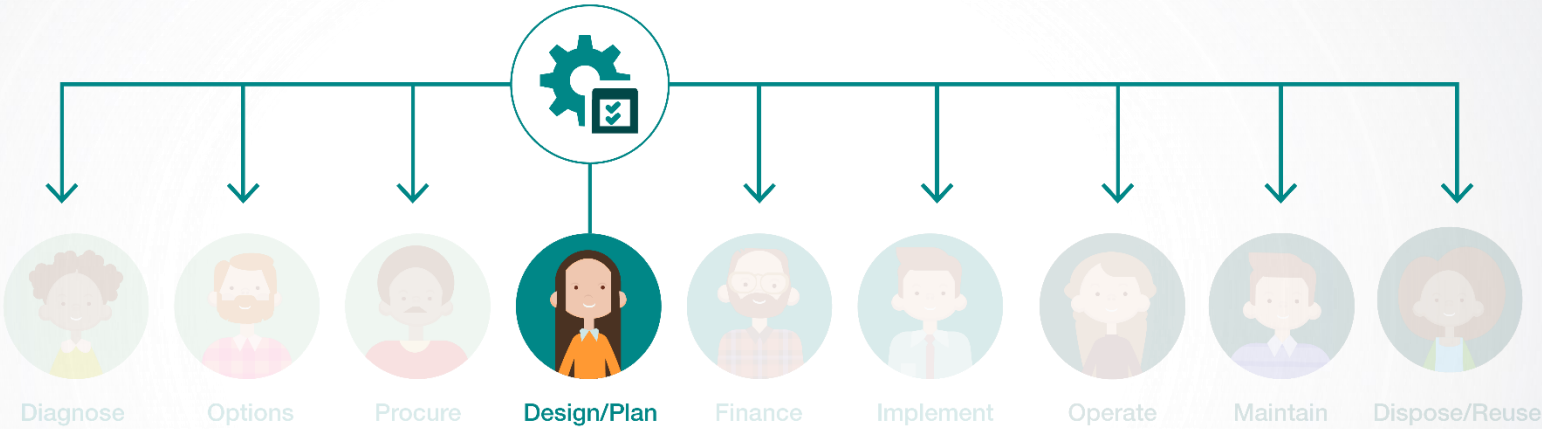
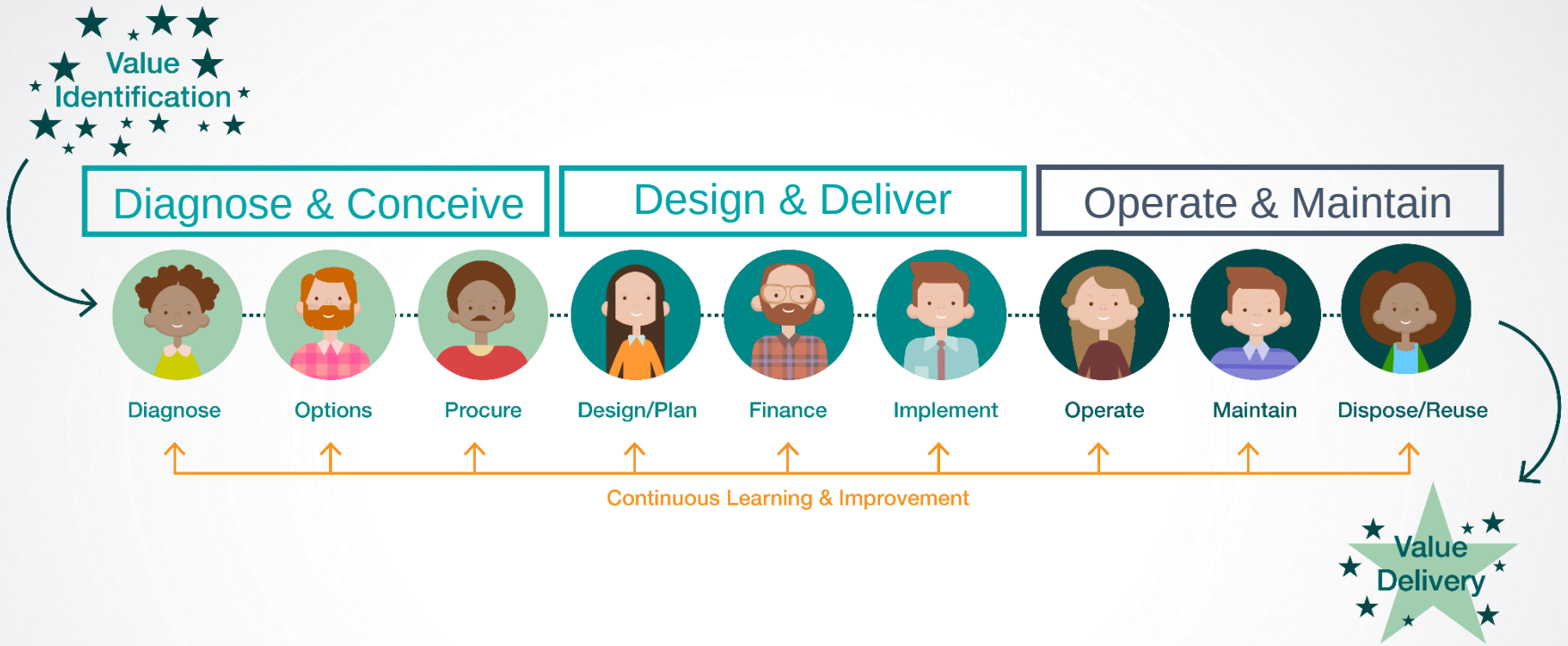

Diagnose
Options
Procure
Design/Plan
Finance
Implement
Operate
Maintain
Dispose/Reuse


Value Identification
Diagnose & Conceive
Design & Deliver
Operate & Maintain
Diagnose
Options
Procure
Design/Plan
Finance
Implement
Operate
Maintain
Dispose/Reuse
Continuous Learning & Improvement
Value Delivery

Thank you

Find out more and subscribe to our **newsletter** at **resilienceshift.org**

Twitter @resilienceshift and **Linkedin** The Resilience Shift

Live polling

Instructions

You will need a device connected to the internet

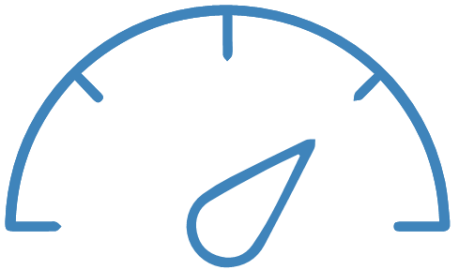
1. Type www.sli.do in your browser
2. Enter event code **R518**
3. Join the survey!

Q & A and panel discussion

Interactive feedback session

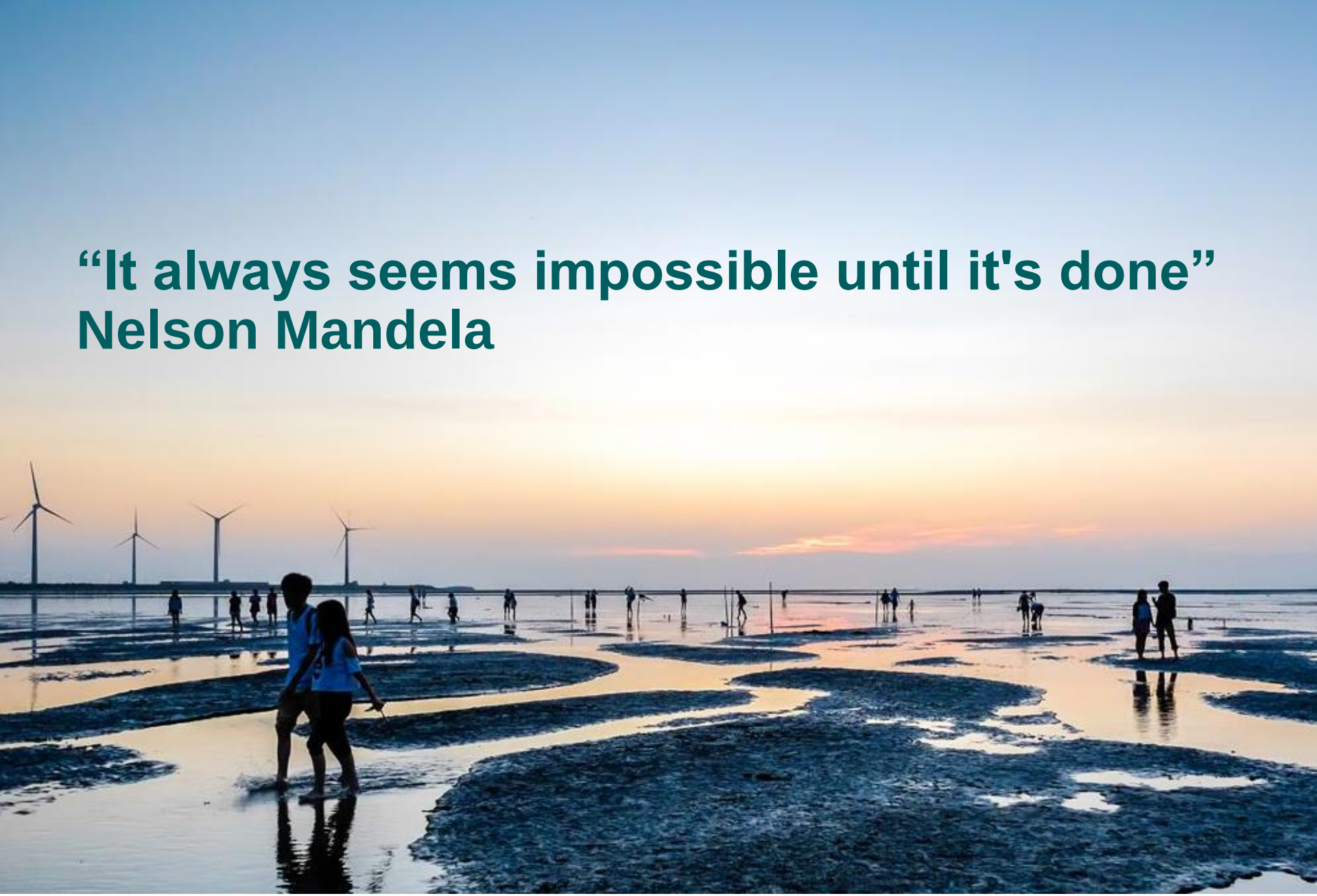
Feedback card session - Instructions

- What are your challenges in enhancing resilience in your day job?
- What is needed to move the resilience needle from theory to practice?
- What tools and approaches do you currently use/would you need to enhance resilience?



1. Answer feedback card (2-3 mins)
2. Share answers with to your neighbour (2-3 mins)
3. Key insights from the audience

“It always seems impossible until it's done”
Nelson Mandela



Thank you!

Enhancing resilience: from city to asset scale

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