

World Class Transport: Transport and Resilient Cities – A Review of Current Developments

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The Storyline

Cities

Resilience

Lifelines

Transport

Risk

Sustainability

Smarter, Safer, Stronger



Some Context



By 2050 over 70% of the World's population will live in Cities (c.f. 1913 10%)

Losses of life have decreased from Natural Disasters but....capital losses have exceeded \$2.5 trillion since 2000

Some Context



Direct disaster losses are 50% higher than reported figures

Kobe port before the earthquake in 2005 was 6th busiest port in the world; By 2010 it had fallen to 47th despite massive investment.

Toyota lost \$1.2B in product revenue after the 2011 earthquake & tsunami

Resilience – of What?

Cities - Global trends:

- Growing
- Interconnected
- Increasingly dependent on infrastructure
- Exposed to natural hazards & climate change

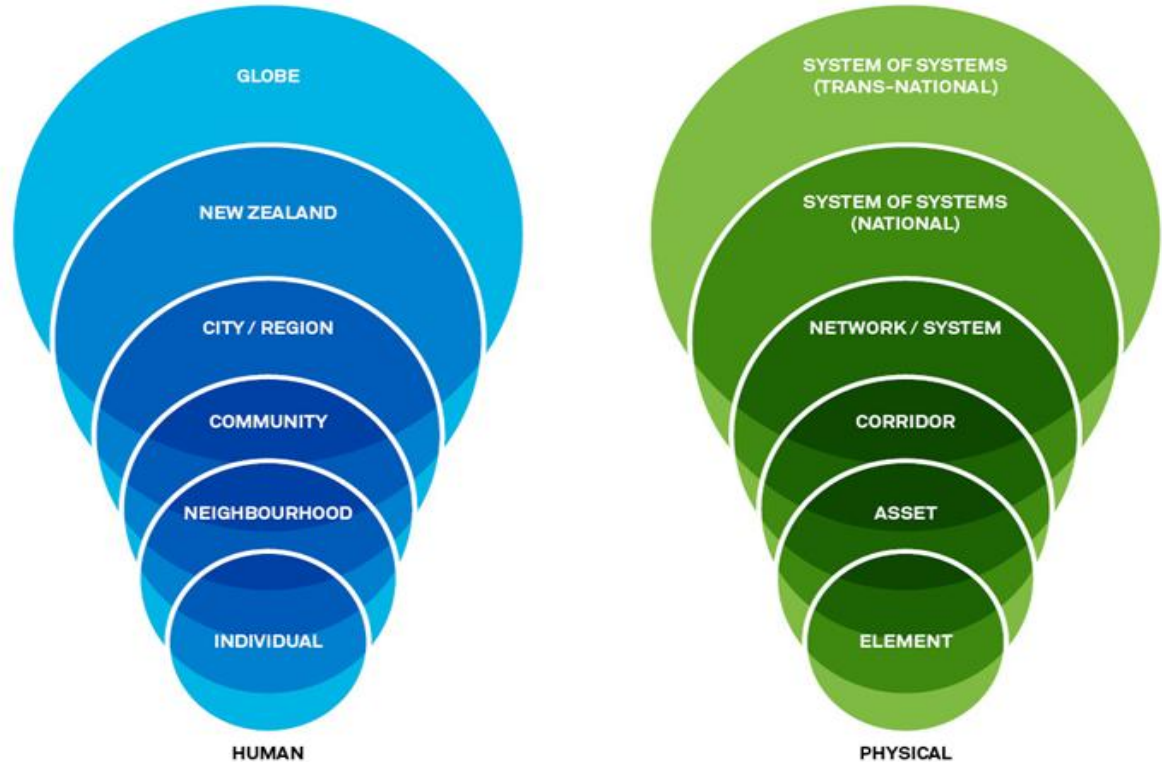


Resilient cities are safer, more attractive to investors and new residents, and more able to recover quickly and with less loss of life and assets in the event of crises. UNISDR

Resilience – of What?

Is it human?

Is it physical?



Resilience must exist at multiple levels

Resilience – of What?

Infrastructure – YES

Transport:

- Roads & highways
- Walking & Cycling
- Public transport / transit
- Aviation
- Marine



Resilience – To What?



Resilience – What is it?

National Infrastructure Plan:

The concept of resilience is wider than natural disasters and covers the capacity of public, private and civic sectors to withstand disruption, absorb disturbance, act effectively in a crisis, adapt to changing conditions, including climate change, and grow over time.

Resilience (100 Resilient Cities)



The ability of a **city** to **maintain essential functions** and to **evolve and emerge stronger** in the face of **acute shocks** and **chronic stresses**.

Rockefeller 100 Resilient Cities

Growing urbanization is reshaping the modern world

- Our future is increasingly urban: By 2050, more than 75% of the world will live in urban areas
 - Our future is increasingly interconnected: What happens in cities impacts everyone else, everywhere

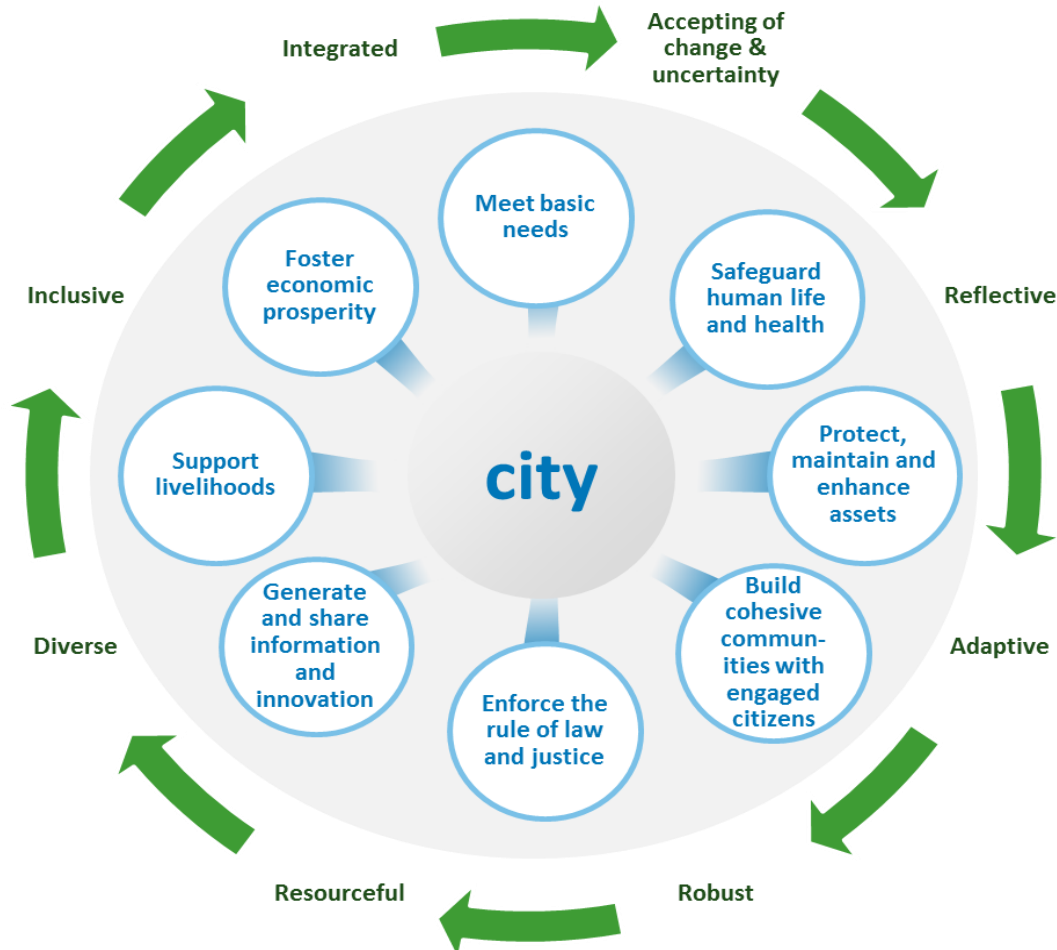
The resilience of cities is essential to our global vitality

- Cities must be able to prepare for, adapt to, and quickly rebound from shocks and stresses

100 Resilient Cities was pioneered by the Rockefeller Foundation to catalyze city resilience by:

- Working closely with 100 member cities from around the world
- Partnering with local government, civil society, and private stakeholders
- Helping member cities to develop and implement resilience strategies
- Elevating the understanding and significance of resilience

Essential Functions of Cities



Qualities associated with Urban Resilience

**Accepting of
uncertainty and
change**

Expects a wide
range of
unpredictable
outcomes

Reflective

Learns from past
experiences

Adaptive

Changes based on
new evidence

Robust

Is organized &
transparently
managed

Resourceful

Develops efficient
and redundant
systems

Diverse

Maintains flexibility
with varying
options across
systems

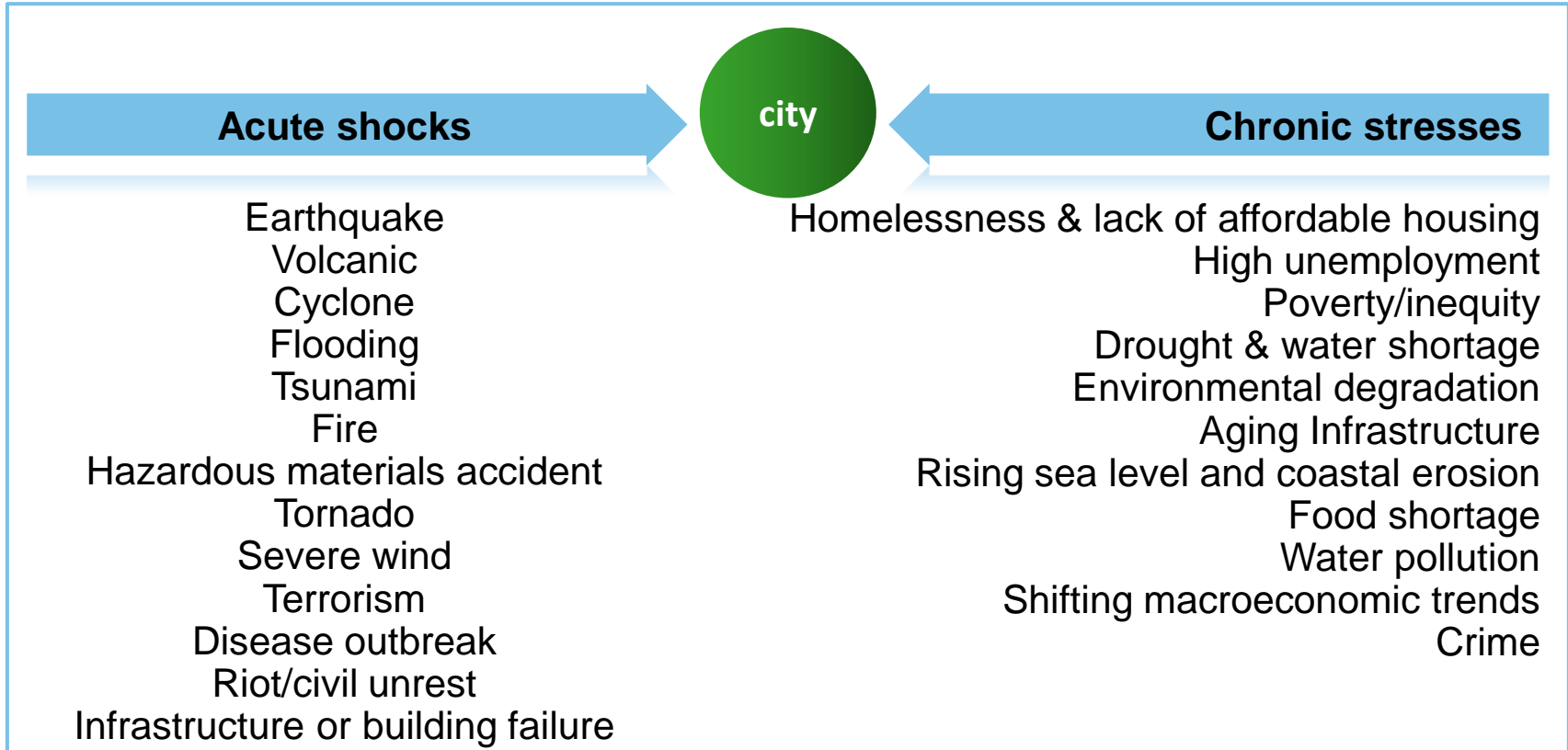
Inclusive

Covers wide range
of people and
places

Integrated

Collaborates
effectively across
systems

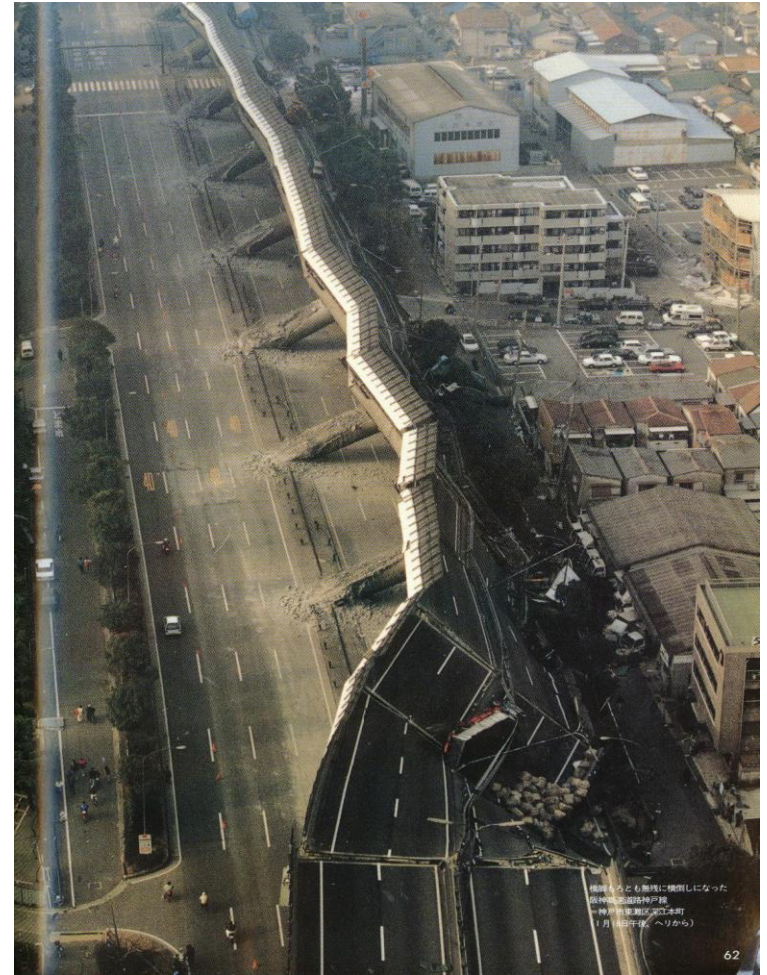
A city's ability to maintain essential functions is threatened by both acute shocks and chronic stresses



What can happen if Transport Systems fail?

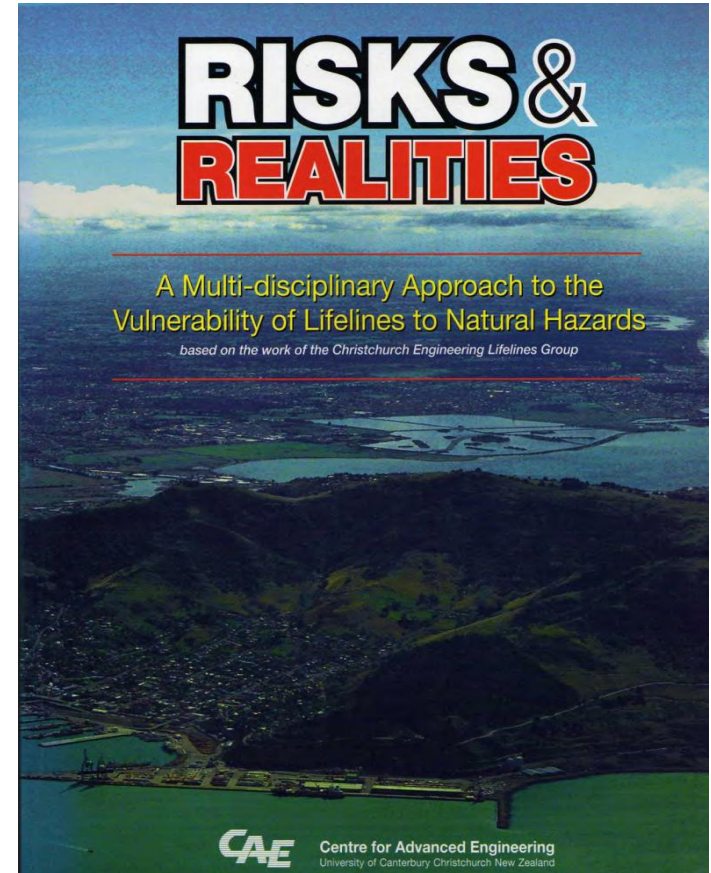
Kobe Earthquake Case Study

- Although in Japan – possibility of earthquake there was discounted
- Major impact on transport infrastructure, linkage to Port
- Resulted in dislocation of people, loss of export / import business, employment, etc
- Long term loss of Port position from 6th to 47th



Local Transport Context

- Critical assets identified 20 years ago in R&R, e.g.:
 - Bridges
 - Tunnels – road and rail
 - Priority roads
 - Port
 - Airport
- EQ strengthening carried out
- New bridges designed over-code

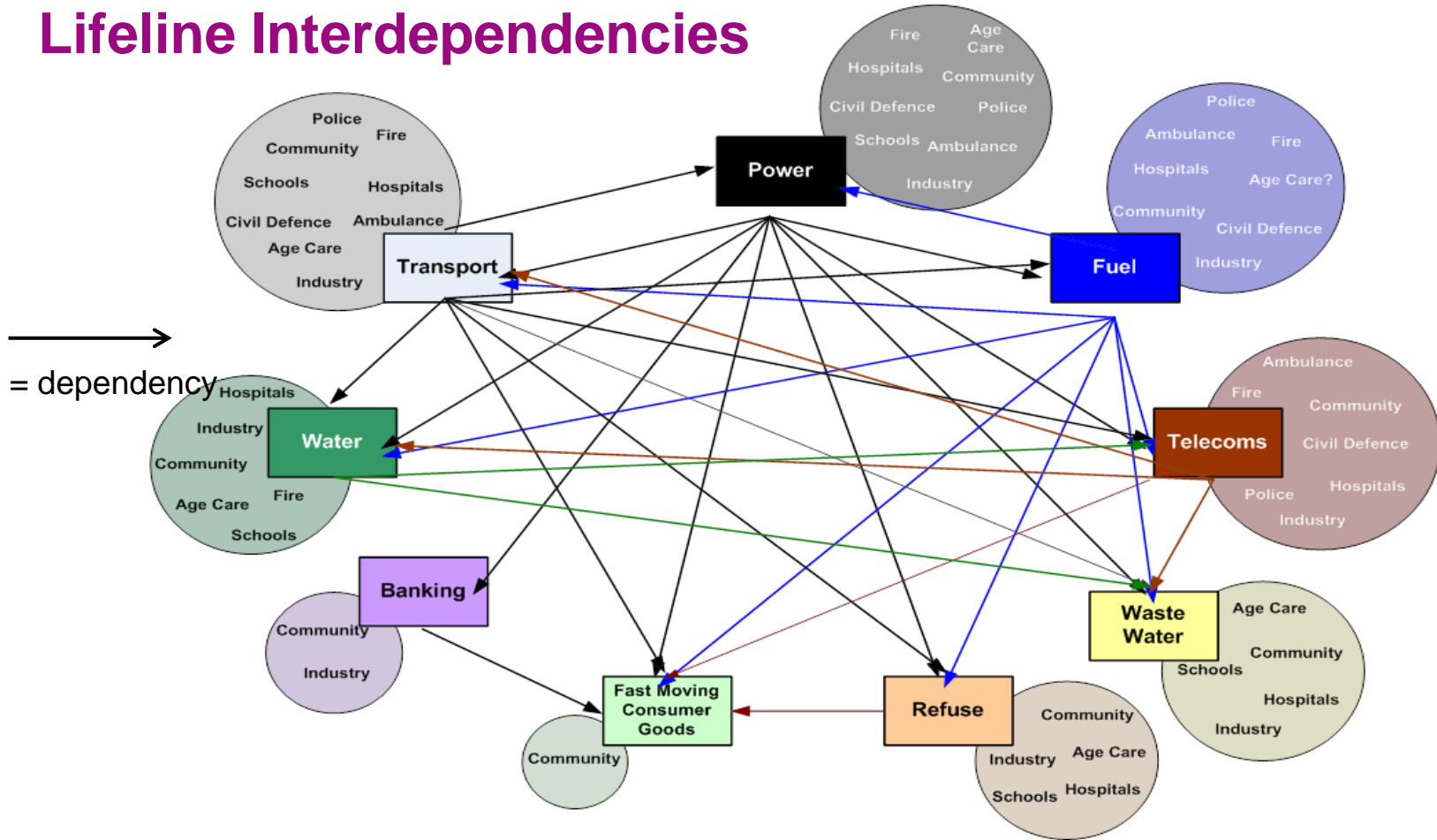


Lifeline Utilities

- Electricity Networks
- Telecommunications
- Broadcasting
- Petroleum Distributors
- Gas Suppliers
- Water Supply
- Wastewater
- Stormwater
- Transportation



Lifeline Interdependencies



Pretty much everybody depends on **Transport**, **Power** and **Fuel**

Are Risk and Resilience Different?

Is Resilience just an outcome of good risk management?



Risk	Resilience
Mitigate failure through probability and consequence analysis of known hazards.	Minimise the consequences of failure no matter what the cause or extent or likelihood of the hazard may be.
Incrementally modify existing designs in response to emerging hazards.	Adapt to changing conditions, allowing controlled failure ('safe-to-fail') to reduce the possibility of broader loss.

Source: Park (2013) and Snowden (2011)

How is Resilience Different?

*“Moving from a system designed for **robustness** to one that supports **resilience** represents a significant strategic shift.....*

*.....A resilient system accepts that **failure is inevitable** and focuses instead on early discovery and fast recovery from failure”.*

David Snowden (founder of Cognitive Edge, a research network focusing on complexity theory in sensemaking)



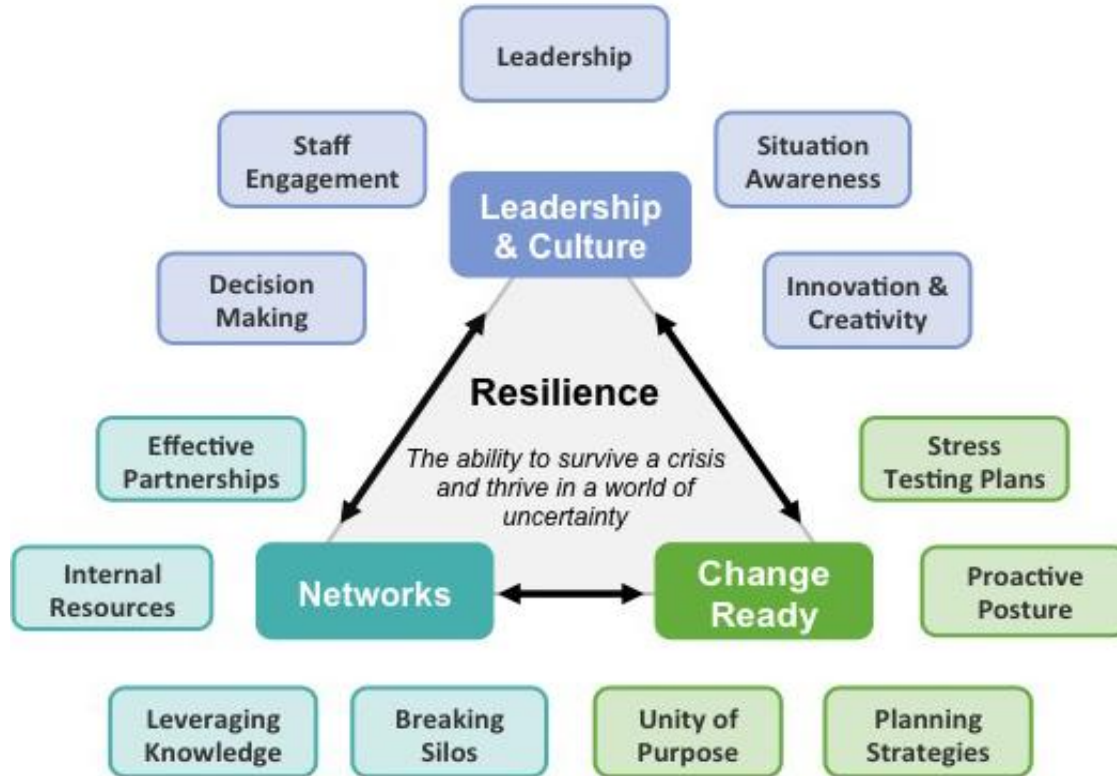
Current Developments

- National Infrastructure Plan 2015 update
- Resilient Organisations - Resilience Benchmark Tool
- NZTA State Highways Resilience Framework (Research Report 546)
- NZTA Network Resilience Prioritisation Framework – GNS
- MERIT – Economics of Resilient Infrastructure
- Regional Lifelines Groups

National Infrastructure Unit Key Themes

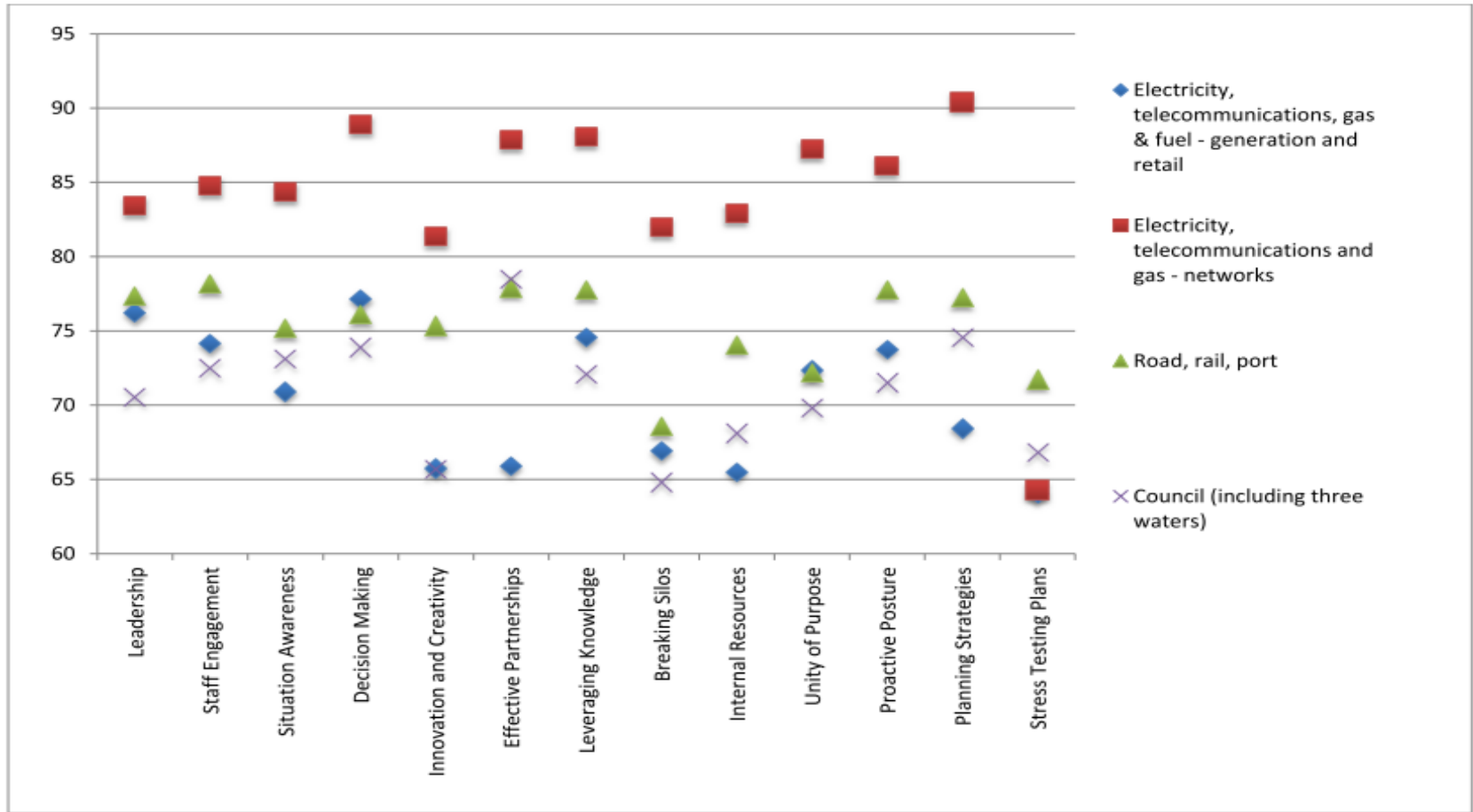
<p>Vision: Changing patterns of demand. Technology impact. Relationship to economic growth. Community expectations and levels of service.</p>	<p>Economy: Relationship to economic growth. Drivers and opportunities of regional growth. Links and impact on other economic priorities and policies.</p>	<p>Regional integration and collaboration: Regional collaboration – vision, planning, investment. Integration of land use planning and infrastructure – especially transport.</p>
<p>Data and asset management Data quality , consistency and transparency. Asset management maturity. Understanding and measuring network performance. Informed decision making.</p>	<p>Resilience: Understanding of criticality and key pinchpoints/bottlenecks. Climate change and adaptation. Supply chains and security. Levels of service.</p>	<p>Decision making: Data/informed decision making. Optimisation of networks. Cross sector coordination/prioritisation. Auckland investment. Governance and management. Procurement opportunities Useful “tools” to drive conversations.</p>
<p>Demand Management: Improving asset utilisation. Understanding of decisions makers and communities. Levels of service.</p>	<p>Regulations/standards: Consideration of cost implications. Clarity on roles and responsibilities. Future proofing. Inconsistencies across planning legislation. Levels of service.</p>	<p>Funding: Affordability and investment certainty. Alternative sources of funding. Cross-sector prioritisation. Pipeline and visibility.</p>

Characteristics of Resilient Organisations



From Resilient Organisations (Seville et al)

Benchmarking Resilience



NZTA State Highways Resilience Framework

Transport infrastructure is recognised as a critical element to healthy economies and stable communities

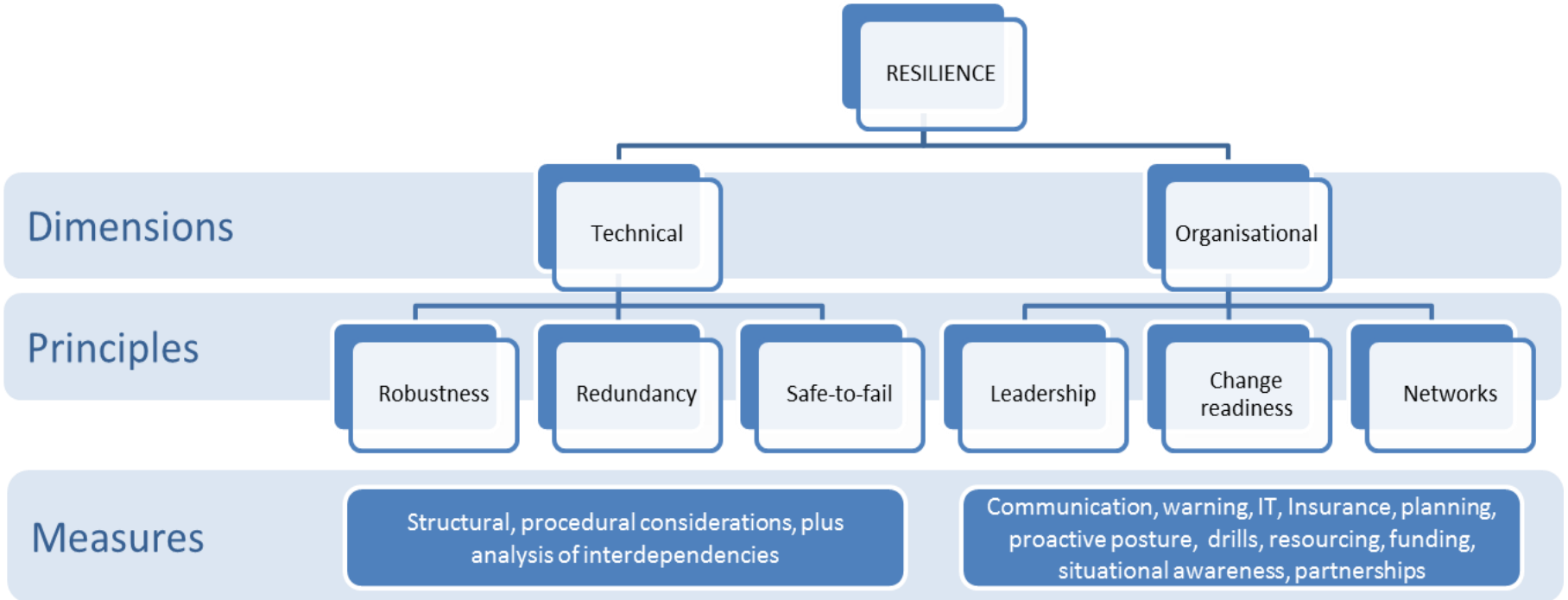
Technical and Organisational Resilience



Technical / Asset	The ability of the physical system(s) to perform to an acceptable/desired level of service when subject to a hazard event.
Organisational	The capacity of an organisation to make decisions & take actions to plan, manage & respond to a hazard event.

NZTA
Research
Report TAR
12/07

NZTA State Highways Resilience Framework



MERIT – Economics of Resilient Infrastructure

Tool will model economic consequences of infrastructure failure, leading into business response and recovery options:

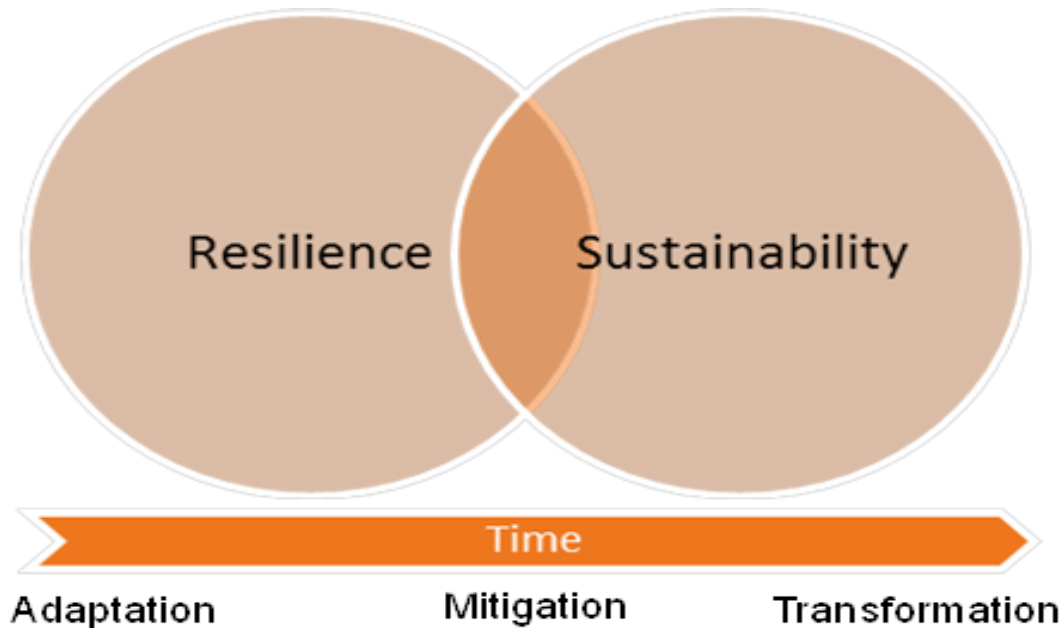
- Quantify economic implications to natural hazards and infrastructure-only events
- Explore alternative post disaster recovery strategies

Two infrastructure disruption case studies for Canterbury:

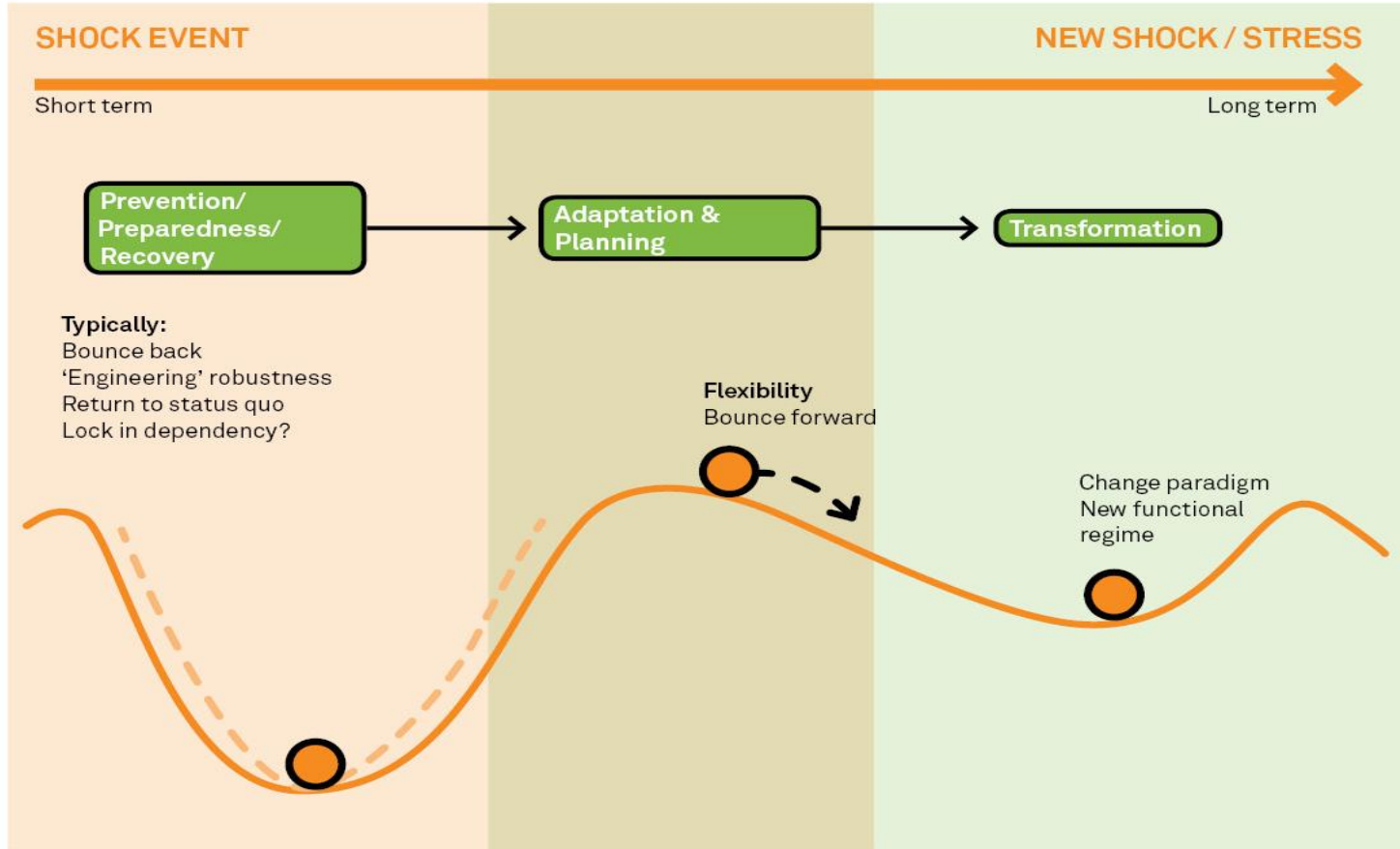
- Disruption of access to Lyttelton Port
- Alpine Fault Scenario

Resilience and Sustainability


The sustainability of a system is a measure of its lifespan. Resilience is one measure of the potential sustainability of a system; so, resilience is to sustainability what, say, blood pressure is to health. Since resilience is a component of sustainability, the opportunity should exist to do both things simultaneously (McRoberts 2010).



Resilience – Bounce Forward



Case Study: Van, Turkey



Strong? Yes

Safe? Yes

Smart? ???

- Toyota facility in Turkey after 2011 7.1 magnitude earthquake
- Engineered to withstand strong earthquakes and seismic shocks
- Immediate surrounding infrastructure hardened such as roads
- Modern systems and plant designed to improve economic opportunity

Smarter, Safer, Stronger Transport?

How about us. Are we creating a resilient transport future?



Smarter, Safer, Stronger Transport?

Smarter – our organisations, our thinking, our use of technology, our systems, our priorities, our understanding of what transport depends on and what depends on it

Safer – for users, customers and communities in the face of known and unknown shocks and stresses; are we “safe to fail”?

Stronger – our infrastructure must be robust and fit for purpose, our organisations must be able to cope and adapt in the face of adversity

Our cities and way of life will increasingly rely on transport systems and their ability to adapt to change. Our physical networks and our organisations must meet the resilience challenge.

Thank You

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