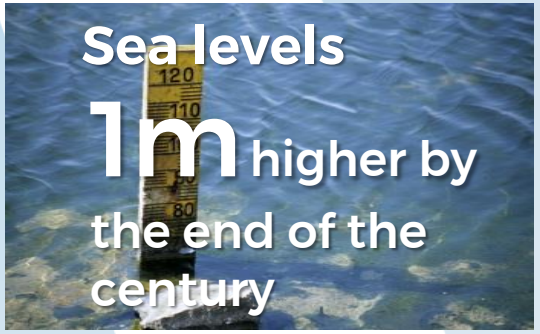
Future Ready

11/04/2019

Chris Gibney, Business Development Director

Climate



Society

Technology

Resources

- Disruptive changes to our work
- Using current codes and techniques won't work
- Risks to infrastructure & services
- Opportunities
- A piecemeal approach will fail
- What to do? The challenge is overwhelming!

1. Future Ready Case Studies

AYLESBURY ESTATE, LONDON
DESIGNED READY FOR FUTURE TEMPERATURES

THE PROJECT

Aylesbury Estate is a large 1960's residential estate in Southwark, central London. It's home to 2700 families, including affordable and commercial homes. WSP | Parsons Brinckerhoff is part of the design team commissioned by Notting Hill Housing Association to advise on the refurbishment of the estate.

WHAT FUTURE TREND(S) DID WE INCLUDE OVER CURRENT CODE?

The main trend we considered was future higher temperatures in London – especially considering the future risk that homes would overheat.

HOW DID WE CONSIDER THESE TRENDS?

modelled temperatures today and also into the future as part of our design of the ... Key things we considered included:

RRINGTON BRIDGE STREET REGENERATION –
DY FOR A FUTURE ENERGY CENTRE

OJECT

Bridge Street Redevelopment is a £100m urban regeneration project in the town. The project sees the demolition of an old shopping centre, temporary f the town's market and the construction of a new shopping centre, cinema, 1200 space car park and new market building.

ons Brinckerhoff provide multi disciplinary design and support for the project

TURE TREND(S) DID WE INCL...

A STRONG FUTURE READY SUST
FOR CROSSRAIL 2, LONDON

THE PROJECT

Crossrail 2 is a proposed new railway serving London and the wider South E the National Rail networks in Surrey and Hertfordshire via new tunnels and Wimbledon, Tottenham Hale and New Southgate, linking in with London Un Overground, Crossrail 1, national and international rail services.

WSP | Parsons Brinckerhoff was appointed to develop the sustainability s

WHAT FUTURE TREND(S) DID WE INCLUDE OVER CUR

- Climate change leading to increased temperatures and precipitation
- Increase in energy costs by 40% in real terms by 2040.
- Increase in technology assisted lifestyles
- Closer links between environment, health and well being
- A trend towards reduced crime, but increase risk of terror
- Increased focus on buildings as multi-use service 'hubs'.

HOW DID WE CONSIDER THESE TRENDS?

Using these principles, we worked with Transport for London to vis the coming century – what's the future of London's climate, what L city, how technology will change. We then used this to assess th has over these trends, or how the project might be affected by ther

HOW WAS OUR FINAL APPROACH BETTER?

The strategy takes a long-term view of the potential scenarios in 2020 and 2031 (respectively when construction and operatio factors that can be planned or forecasted at this stage.

HOLES BAY, POOLE HARBOUR:
COASTAL MANAGEMENT FOR NETWORK RAIL

THE PROJECT

The railway running across Holes Bay is a critical piece of infrastructure connecting Poole to the west of England. The historic coastal embankment was in a poor condition, suffering from scour, degradation and increased wave exposure. Network Rail commissioned us to investigate options to prolong its life. After successful feasibility & planning, it is now being implemented by the framework contractor, Osborne.

WHAT FUTURE TREND(S) DID WE INCLUDE OVER CURRENT CODE?

- Climate change leading to sea level rise
- Vegetation die back of the saltmarsh on the foreshore across southern England
- Increased scour of the embankment toe caused by both trends.
- Uncertainty over future of both trends requiring a flexible approach which could be easily adapted in the future.

HOW DID WE CONSIDER THESE TRENDS?

We worked with Network Rail to use the latest design models and also actively sought the views of numerous stakeholders across the bay. We worked to include a mix of hard and soft engineering approaches and created opportunities to bring in additional funding sources by delivering a multi-functional project.

HOW WAS OUR FINAL APPROACH BETTER?

It would have been easy to take the published guidance on sea level rise and design a defence to accommodate this. However this wouldn't have given Network Rail best value and jeopardised wider benefits to biodiversity and flexibility.

Our approach used a mix of hard and soft engineering – making it much quicker and cheaper to build and giving the flexibility for Network Rail to be able to adapt the design in 30 years' time; when sea level and vegetation trends are better understood.

This work was more than a 'standard' approach: ☒ YES ☐ NO

Our outcome was more than a 'standard' outcome that competitors would recommend: ☒ YES ☐ NO

THE OUTCOME

Phase 1 of the scheme has now been built. Our more future ready and sensitive approach:

- Avoided extensive consenting and permitting, delivering the benefit up to five years ahead of 'traditional' approaches
- Was around 50% less expensive to build
- The project has attracted a DEFRA climate change grant as a showcase project
- The team's approach has been praised by Network Rail and Osborne.

CONTACT FOR MORE INFORMATION

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December 2015

...ON NEIGHBOURHOOD –
...APPROACHES FOR CLEANER AIR

...and invest in innovative ...and transform the urban realm –

...neering concepts Hackney, ...n borough' bid for this funding

...centres

...d street furniture which can support this

...king and cycling

...TRENDS?

...develop a series of practical proposals to ...ed the core of the Boroughs' application to ...fer.

...ACH BETTER?

...nate zones to serve as test beds for a range of ... examples of the new and emerging technologies

...s – linked to areas of high footfall and cycling ...pooling deliveries at the edge of the low emission ...ing the last mile deliveries with a single, low emission

...icle charging infrastructure – using new technologies such

This work was more than a 'standard' approach: ☒ YES ☐ NO

Our outcome was more than a 'standard' outcome that competitors would recommend: ☒ YES ☐ NO

...n Spring 2016.
...esults of the competition in Autumn 2016, with target implementation ...19.

...RE INFORMATION

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CONFIDENTIALITY

This case study can be referenced and shared internally within our business. Please don't use this externally without reference to the author though.

BRINGING ELECTRIC VEHICLE CAR CLUBS TO LOND

THE PROJECT

Vehicles are a major cause of both bad air quality and greenhouse gas emissions in London. The Mayor's strategy places a considerable emphasis on a transition to electric car clubs as part of the solution. London is already host to the second largest car club in the world, after New York. Transport for London's (TfL's) targets are to increase membership to 1m members and 50% Ultra Low Emission Vehicle (ULEV) fleet by 2025

We were commissioned by TfL to understand the attitude of key organisations – from the car clubs to Boroughs, to an electric future and the barriers to be overcome to deliver TfL's aspirations on car clubs and electric vehicles.

WHAT FUTURE TREND(S) DID WE INCLUDE OVER CURRENT CODE?

- Increasing awareness of city air quality as a key issue to be addressed
- Changing vehicle technology, reducing costs of electric vehicles
- The growth of the sharing economy.

HOW DID WE CONSIDER THESE TRENDS?

We ran a series of workshops and one to one interviews with London's car clubs, and public authorities involved in delivery of electric vehicles and car clubs. This information, coupled with our expertise identified the key opportunities and challenges for the much wider update of electric vehicles in London, with clear recommendations.

HOW WAS OUR FINAL APPROACH BETTER?

Our research provided a clear view of industry and public sector bodies to the scope for delivering electric car clubs on mass, and recommendations on how to deliver a future ready city. Key conclusions were:

- All operators anticipate that ULEV vehicles will have a major part to play in their future fleets, although precisely how much depends on their business model.
- A strong desire for consistent provision of common, fast charging points across the city, with fair pricing structures.
- Including a requirement for car club bays in new development as a key way to grow membership
- A need to keep borough provision of charging points in line with forecast growth of electric cars.

This work was more than a 'standard' approach: ☒ YES ☐ NO

Our outcome was more than a 'standard' outcome that competitors would recommend: ☒ YES ☐ NO

THE OUTCOME

Our study provides Transport for London with a clear, practical overview of current attitudes to ...r clubs and electric vehicles, with clear insights on what the barriers to uptake are likely to be, ...d how to overcome these.

...NTACT FOR MORE INFORMATION

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CONFIDENTIALITY

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...trends included ...future costs of carbon, ...igher mains energy costs, ...wer renewable energy generation costs; and ...erging renewable technologies that will become more cost effective over the ...ing decades. ...so recognised that a flagship British landmark should be at the cutting edge of ...technologies, while maintaining the palace's unique heritage

...WE CONSIDER THESE TRENDS?

...has covered various options for upgrading the heating . This has considered: ...design brief for the project ...need to keep fuel capital costs low ...ler equipment life for boilers ...further work to the main rooms to a minimum while having flexibility to ...ace heating and hot water systems.

...AL APPROACH BETTER?

...n a number of potential solutions to the Buckingham Palace team – ...ecide between lowest first capital cost, zero carbon leadership today ...ade to a next generation low carbon system at a later date. ...r approach maintains a gas fired combined heat and power ...water source heat pumps in our options. Our design makes it ...ady for use, at the same time as the CHP, or to have the ...once the costs have come down. ...ptions meaning there will be no impact on rooms and

...'traditional' design just based around lowest first capital ...hanged at a later date as technolog... ...reed options ho...

This work was more than a 'standard' approach: ☒ YES ☐ NO

Our outcome was more than a 'standard' outcome that competitors would recommend: ☒ YES ☐ NO

2. Future Ready Checklist

This document gives built environment professionals a simple, practical checklist of 40 key trends which could affect the robustness and viability of development in the United Kingdom by 2030.
The document accompanies 'The Built Environment in 2030' – a white paper produced by WSP, and other partners in Business in the Community's Future Insights project.

We know, of course, that some of our forecasts will prove wrong, and other trends will emerge that we don't know about today – that is the challenge of forecast. However the issues and the case studies we've included from across our industry, show both the opportunity for business leaders and how – together – our industry can respond to create a built environment ready for the future.

HOW TO USE THIS CHECKLIST

1. **Work** through the checklist with your design team to review how Future Ready your designs are. Which areas are most important?
2. **Identify** whether there are design changes you could include now which could make your scheme more ready.
3. **Track** the actions and leaders for each using the checklist.

ABOUT THE PROJECT

Project Name

Design Life	
When will the project be complete?	
What is the overall design life?	Years
What are the design lives of key work packages?	Years
1.	Years
2.	Years
3.	Years
4.	Years

1. DEMOGRAPHY

– A larger, older population
– More connected but lonely

	Relevance (High/Medium/ Low/None)	Action Taken
1.1 UK population is forecast to grow from 65m in 2014 to 74m in 2039.[1]	✓	
1.2 By mid-2039, more than 1 in 12 of the population is projected to be aged 80 or over.[2]	✓	
1.3 One person households are the largest area of growth in the United Kingdom.	✓	
1.4 Homeworking online shopping and the decline of the pub means there's less reason or need to get out of the house.	✓	
1.5 Technology lets people 'work' everywhere, not just the office.	✓	

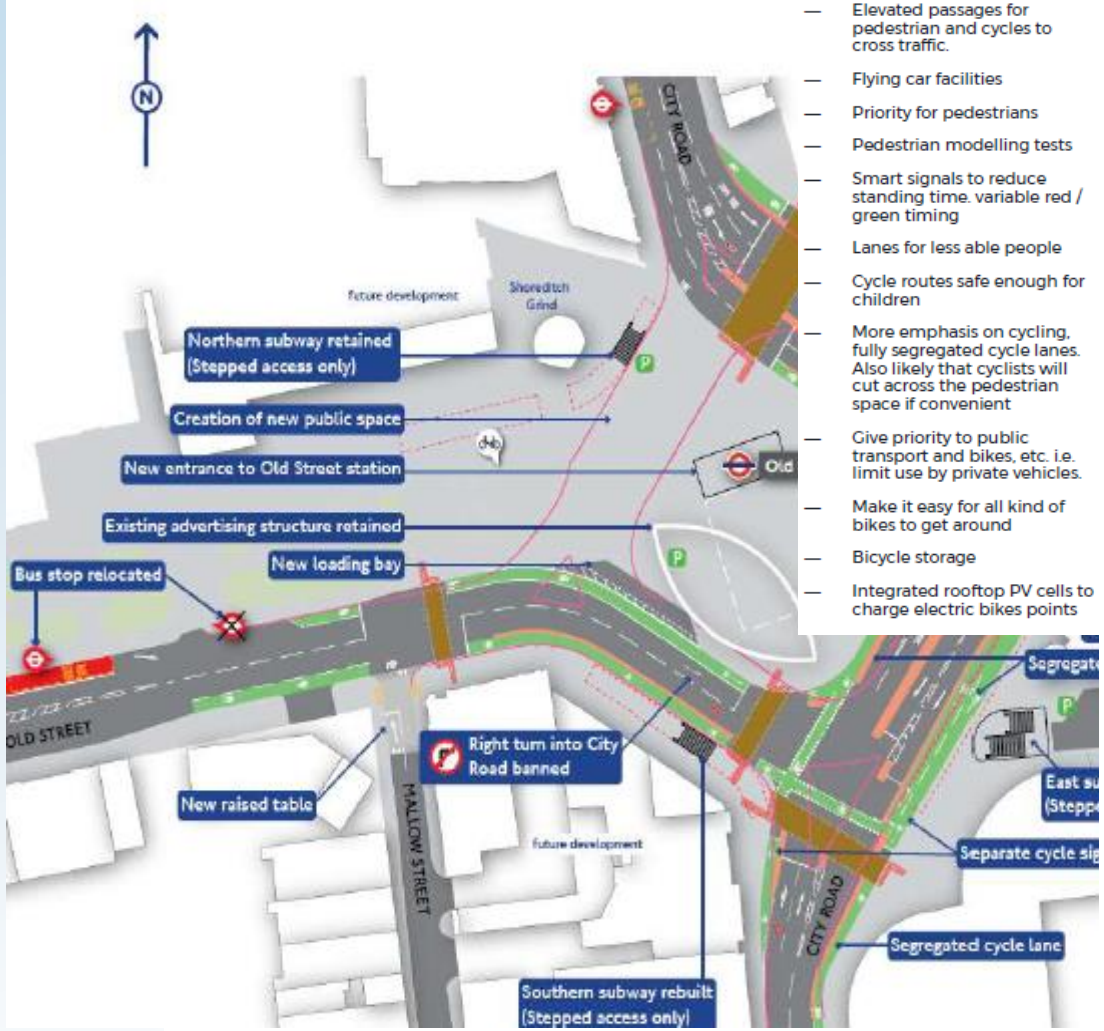
2. CLIMATE CHANGE

– Wetter
– Hotter
– Longer dry spells
– Windier

	Relevance (High/Medium/ Low/None)	Action Taken
2.1 It will rain more heavily, causing local surface water and river flooding. 5-10% heavier from 1990 by 2010/39, 20% heavier by 2040/59 and 20-40% heavier by 2060/2115.[3]	✓	
2.2 Dryer summers, causing droughts and ground shrinkage.	✓	
2.3 Local watertable changes could mean that soakaways don't work as designed.	✓	
2.4 Global sea levels could be between 12 and 76 cm higher than today by the end of the century	✓	
2.5 Peak temperatures in towns and cities could be up to 6°c hotter than today by 2050.	✓	
2.6 Fewer very cold days.	✓	
2.7 Peak gusts could be stronger, although long range projections are not categoric.	✓	
2.8 'Multi hazard' events could become more frequent (storms bringing wind, rain and flooding).	✓	

[1] https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2015-10-29
[3] Source Environment Agency 2016

3. Future Ready Innovation labs



Workshop 1: How could we make a road scheme like Old Street Roundabout more future ready? Participants' suggestions – page 1

Movement

- Disability access
- Elevated passages for pedestrian and cycles to cross traffic.
- Flying car facilities
- Priority for pedestrians
- Pedestrian modelling tests
- Smart signals to reduce standing time. variable red / green timing
- Lanes for less able people
- Cycle routes safe enough for children
- More emphasis on cycling, fully segregated cycle lanes. Also likely that cyclists will cut across the pedestrian space if convenient
- Give priority to public transport and bikes, etc. i.e. limit use by private vehicles.
- Make it easy for all kind of bikes to get around
- Bicycle storage
- Integrated rooftop PV cells to charge electric bikes points
- Electric bike charging
- e-bike availability in 'Boris bikes', ability to hire pedal only or electrically assisted
- Shared cycle paths through
- Sharing private bicycles

Activity

- 4G Football 5-a-side on top of the Clerestory structure
- Boules
- Café in the area
- Charging points
- Include space for recreation e.g. a skating rink in winter
- Co-working space
- Drone delivery or collection facility
- events space
- Mini stage areas for street performers
- Need a big screen opposite the tiered seating
- Outdoor evening cinema or stage to attract people at night
- Outdoor gym
- Outdoor sport facilities street furniture
- Park with café in the middle?
- Recreation space?
- Recreational facilities like table tennis or air hockey
- Public toilet facilities
- Shower/changing/locker facilities for active travellers I.e. cycle, run, walk
- Better interchange between buses and tube or other modes of transport
- Sponsored seat names

Connectivity

- 5G access
- Electric charging points, WiFi. Big screen TV for seating area
- Free WiFi
- Charging points iPhone etc.
- Wifi charging points.
- USB charging points powered by static bicycles
- Communication facilities like WiFi access?
- Informational city. Screens showing data like pollution levels, temperature, noise...

Workshop 2: Taking account of the constraints, how could we make Old Street Roundabout more future ready? Here are participants' suggestions

- 4G Football 5-a-side pitch on top of the Clerestory Structure
- completely segregated bi-directional cycle lanes to save on space

Connectivity

- WiFi and charging points located within and around the seating areas
- Acoustic screens attempting to separate traffic from public as much as possible

Community

- Combat loneliness with free hugs station
- contact local community groups

Environment

- Ensure planting is interesting all year and easy to maintain
- More green and trees in front of the sloped seating area to give stress relieving effect to people sitting. Also use clear acoustic screens
- More planting in seating area
- More green areas for shade and water retention. A water source like a fountain or similar for cooling of air
- More green spaces and more water
- Put a roof on the seating area. For use all year round
- Reduce access to vehicular traffic.
- Suggest relaxing LU standards but not to compromise safety.

Safety

- Replace bollards with security planters
- Trees as traffic barriers (counter terrorism)
- Trees to replace bollards

Flexibility

- Consider how uses of all buildings and public realm areas could change
- LU seem to be actively discouraging innovative thinking or new technology so worth exploring in turn
- how rigid each constraint has to be
- Strengthening works to the station?

Energy

- Focus on renewable energy generation measures - PV roof panels, piezoelectric footways, wind? - & sell back to grid
- Put a green roof or solar cells on all buildings
- Solar powered street lighting
- Solar roadways, solar panels in the pavement
- Use of helical wind turbines. Utilising wind turbulence from surrounding multi-story structures.

Safety

- Electric vehicle charging had other funding streams, likewise electric bikes
- feed in tariffs from PV to provide income to offset budget restraints
- FRP strengthening - light weight and easy to install

Value

- Get sponsorship for future technologies
- request more money?
- Reuse of existing materials where possible
- Sponsored seat branding
- Sustainable materials for paving - recycled stone/plastic etc.
- TfL look for future ready funding streams - monopolize the drone market in London?
- There are other roof options like "Olivine" that are lightweight, sustainable and carbon reducing.
- Use lightweight materials over existing structures
- Focus on other areas of the UK, not just London
- in-situ carriageway recycling

4. Future Ready R&D

Gain a wider and deeper evidence base for strategy

Engage technical staff in cutting-edge projects

Engage clients and partners in research

Exchange R&D benefits across global operations

Promote WSP as a global hub for technical excellence

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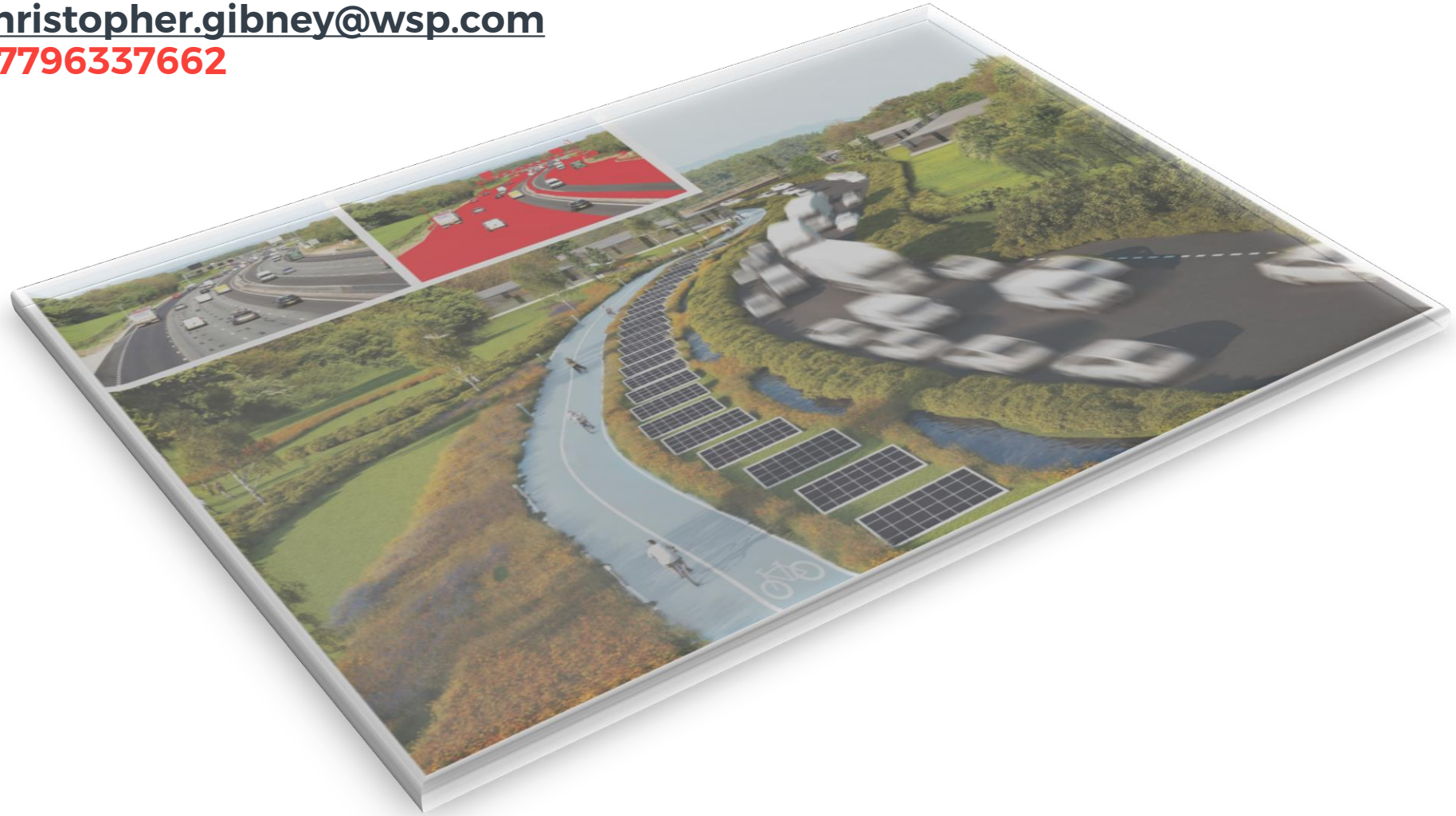
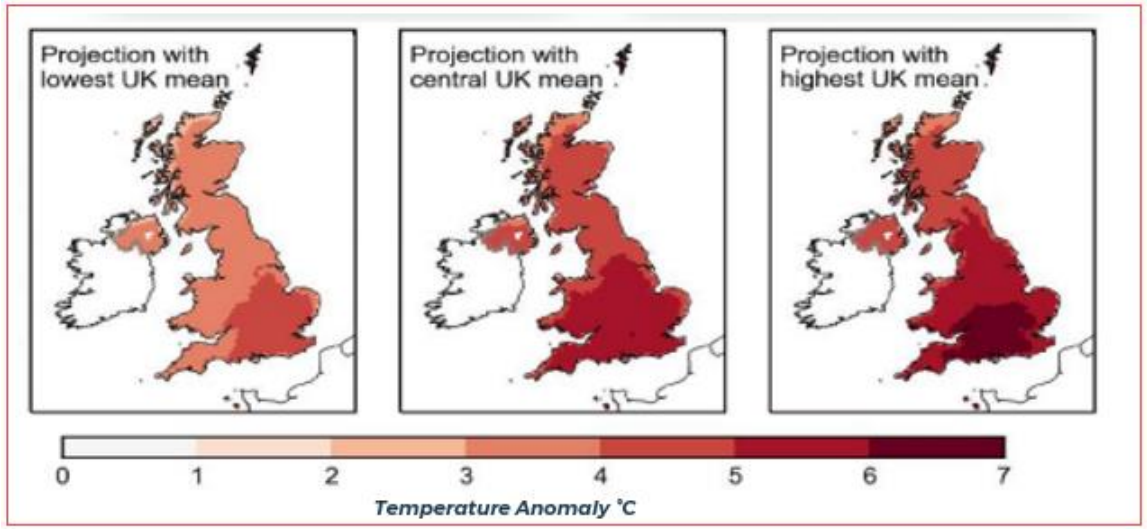
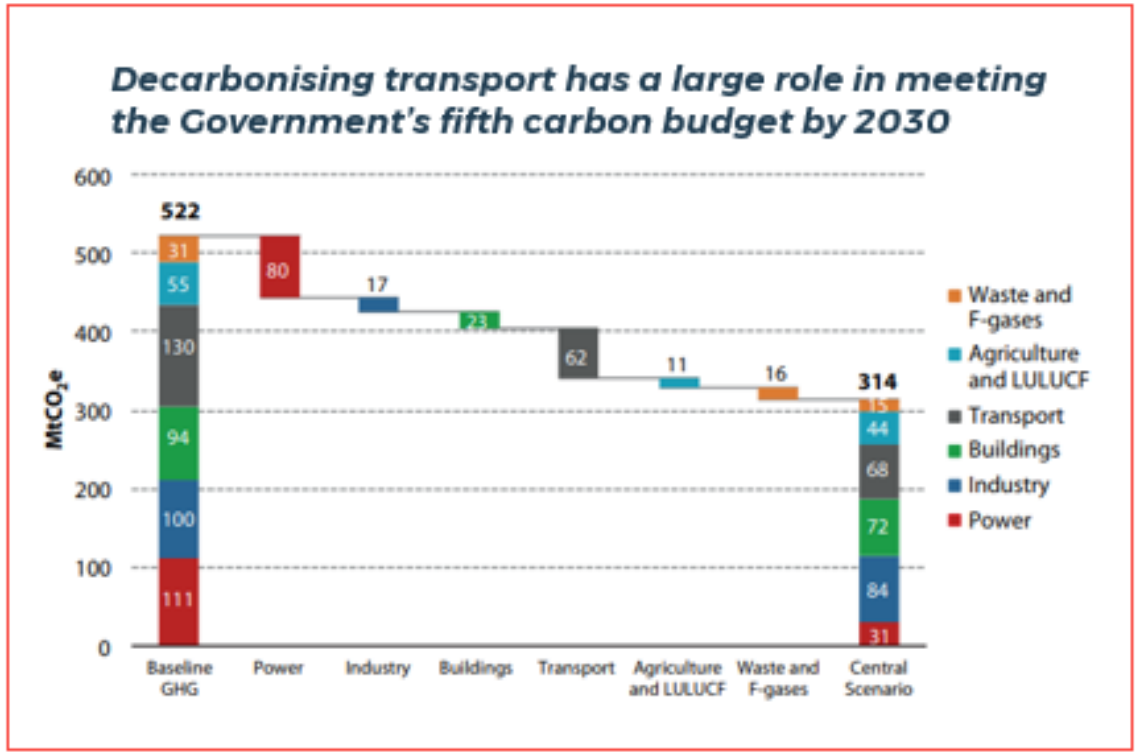
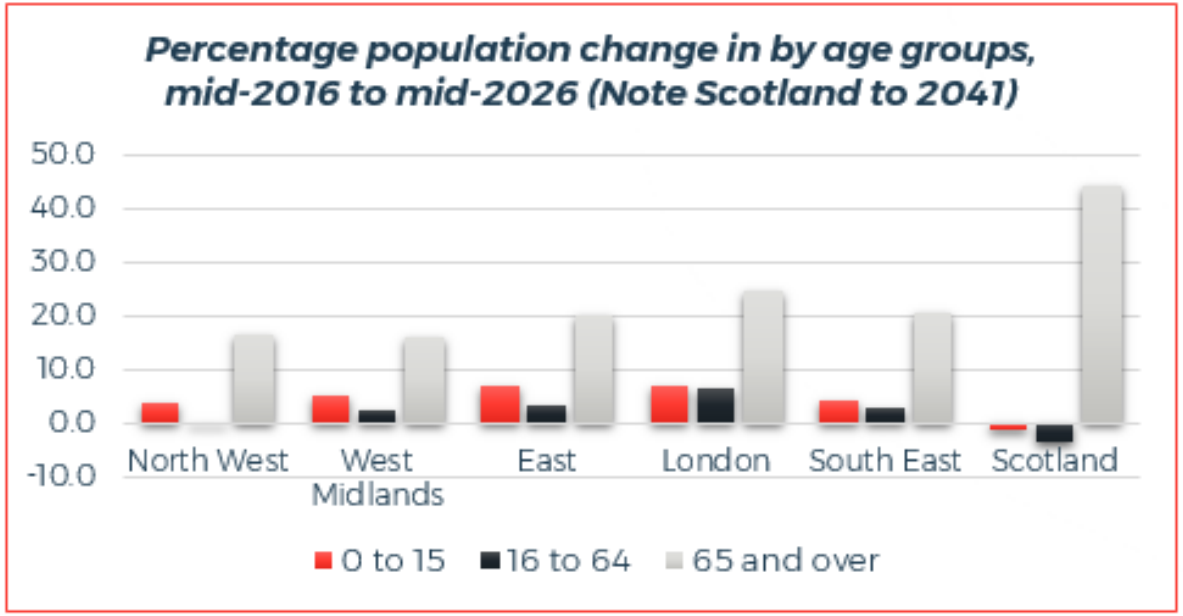
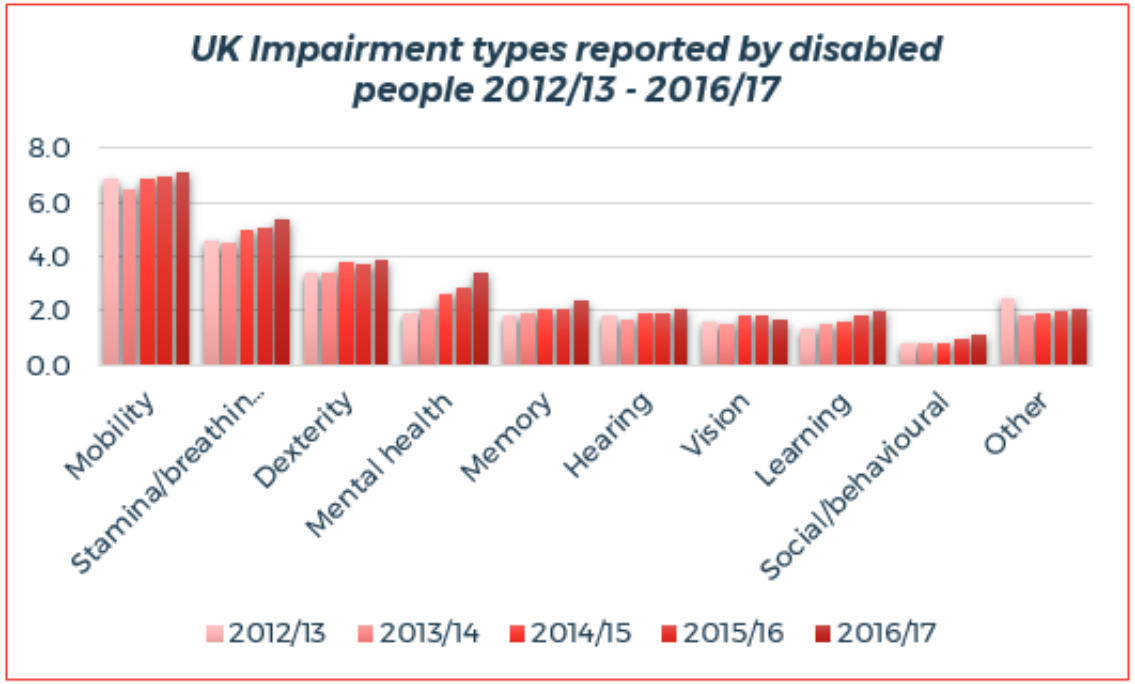


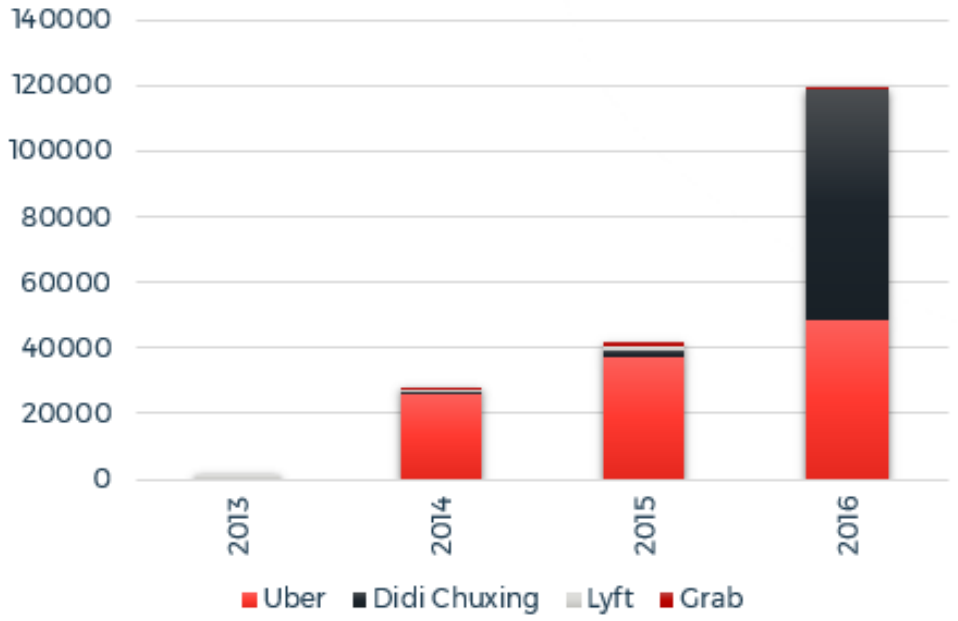

Projection with lowest UK mean
Projection with central UK mean
Projection with highest UK mean
0
1
2
3
4
5
6
7
Temperature Anomaly °C


Decarbonising transport has a large role in meeting the Government's fifth carbon budget by 2030
600
500
400
300
200
100
0
MtCO2e
522
31
55
130
94
100
111
80
17
23
62
11
16
314
15
44
68
72
84
31
Baseline GHG
Power
Industry
Buildings
Transport
Agriculture and LULUCF
Waste and F-gases
Central Scenario
Waste and F-gases
Agriculture and LULUCF
Transport
Buildings
Industry
Power


Percentage population change in by age groups, mid-2016 to mid-2026 (Note Scotland to 2041)
50.0
40.0
30.0
20.0
10.0
0.0
-10.0
North West
West Midlands
East
London
South East
Scotland
0 to 15
16 to 64
65 and over

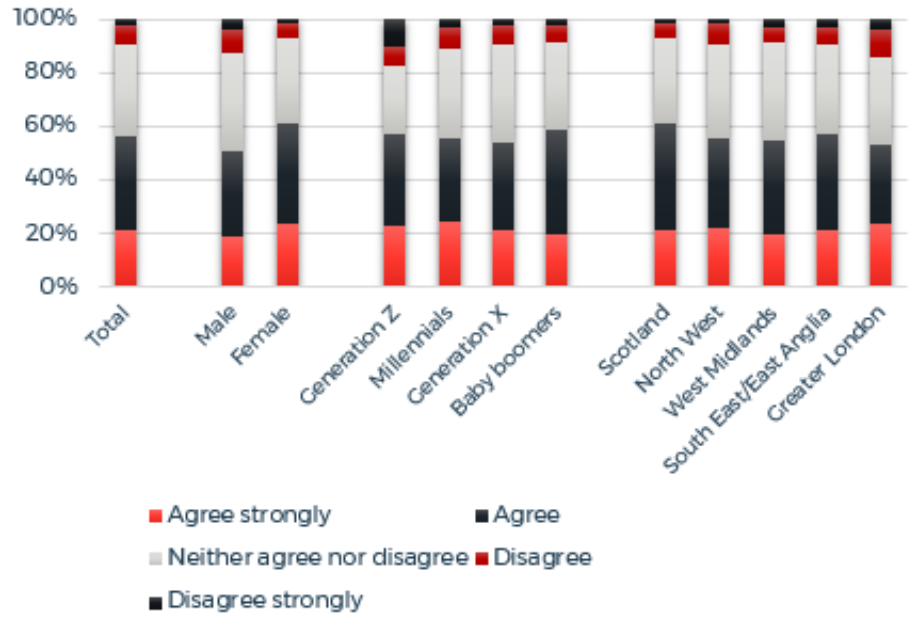

UK Impairment types reported by disabled people 2012/13 - 2016/17
8.0
6.0
4.0
2.0
0.0
Mobility
Stamina/breathin...
Dexterity
Mental health
Memory
Hearing
Vision
Learning
Social/behavioural
Other
2012/13
2013/14
2014/15
2015/16
2016/17

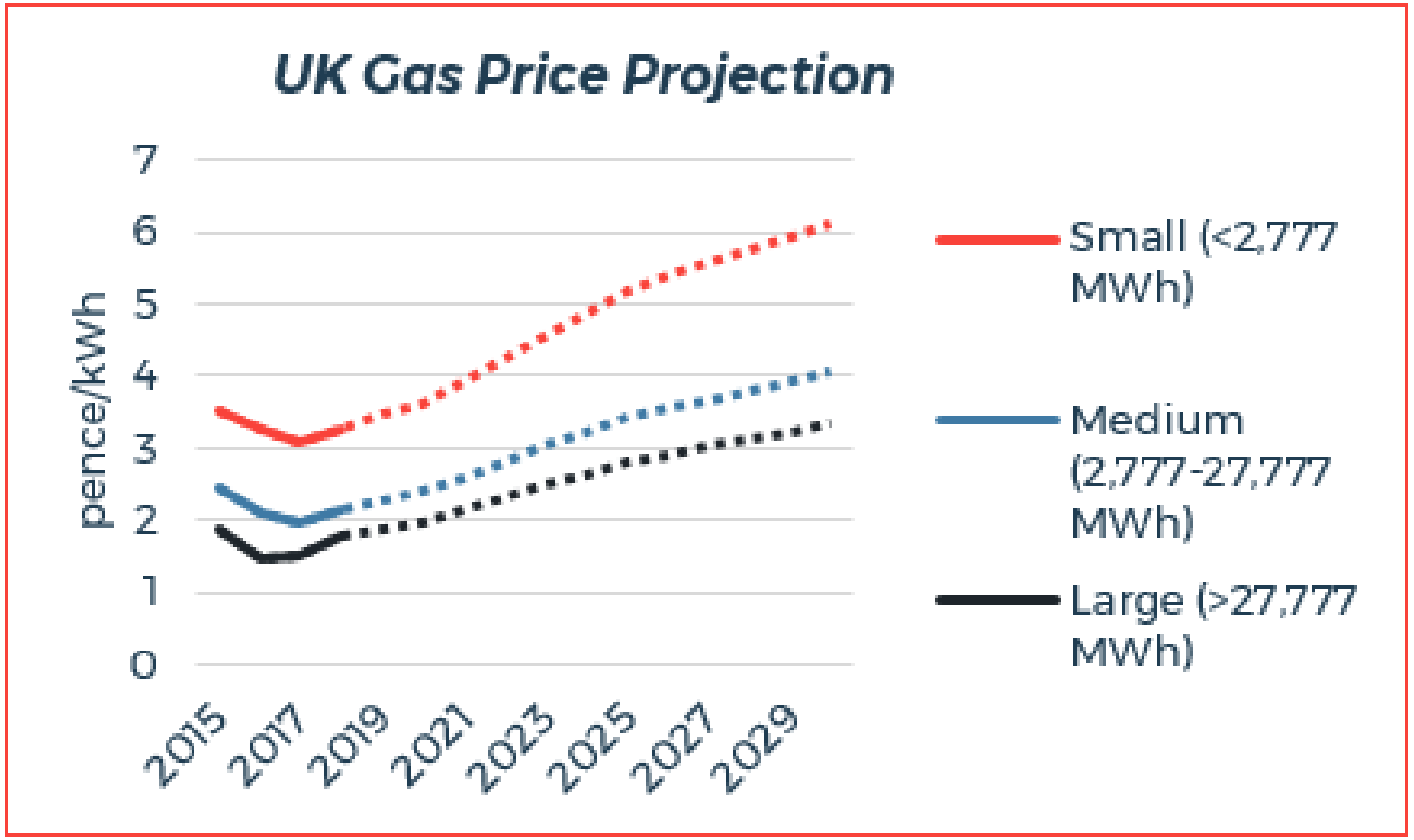
Growth in disclosed funding for top ride sharing companies in millions



Belief that "Companies should prioritise human employment over automation."

"How strongly do you agree or disagree with the following statements?" Companies should prioritise employing humans over robots/automated services even if it means they have to charge higher prices




UK Gas Price Projection
pence/kWh
7
6
5
4
3
2
1
0
2015
2017
2019
2021
2023
2025
2027
2029
Small (<2,777 MWh)
Medium (2,777-27,777 MWh)
Large (>27,777 MWh)

Road Resilience Readiness – A Contractor's View

CIHT – Transport Sector Resilience in a Changing World

Mark Ellerington – 11 April 2019

Building our future

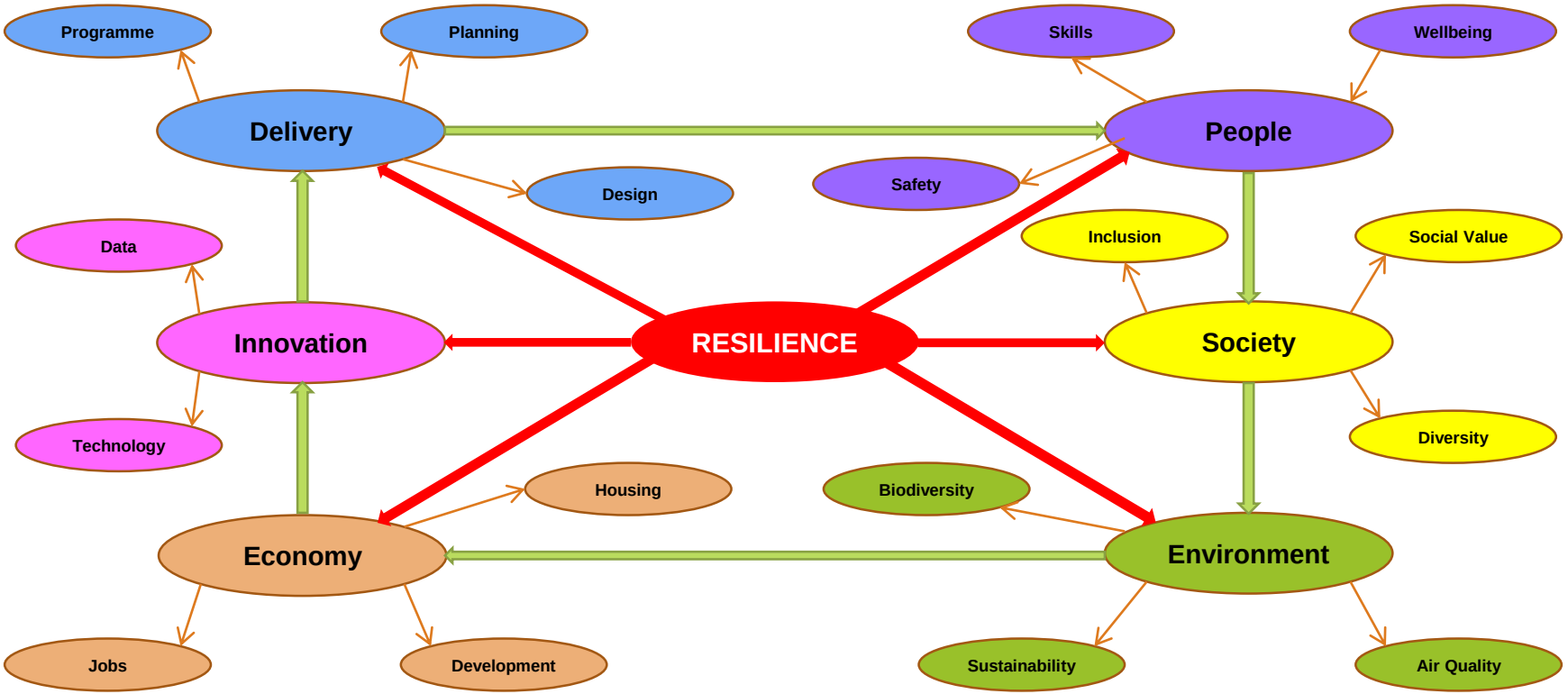
We are
proud
ambitious
collaborative

Be resilient, how?

- Asset Management
- Effective Delivery
- Circular Economy

Tarmac. Building our future

Resilience Model?

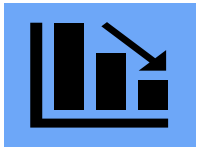


Strategic Resilience through Asset Management

A SHARED CHALLENGE

Under Investment

Maintenance Backlog



Budget Cut Priorities

Self-assessment

Network Data

Interpretation and Recommendation

Strategic Resilience through Asset Management

MAKE DATA KING

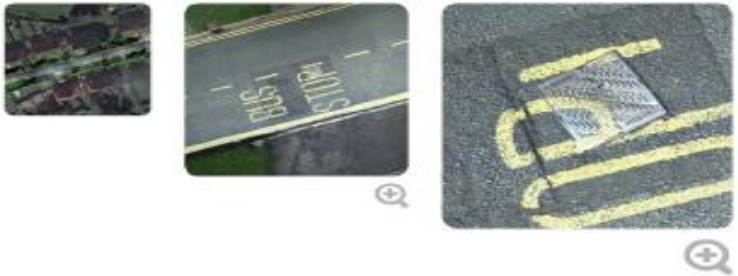
Good data must underpin any approach to effective asset management.

With improved knowledge you can make evidence based decisions.

RISK BASED DETERIORATION MODELLING, USING PROBABILITY AND REGRESSION ANALYSIS

- HIGHWAY VIEW, LOCAL & OTHER DATA INPUT
- SCENARIOS CREATED
- OPTIMISATION MODELLING
- SCHEMES PROPOSED

NETWORK CONDITION IN HD



HIGHWAY VIEW

VISUAL CONDITION SURVEY BASED ON HD IMAGING, DELIVERING A CONDITION MAP AND ENVIRONMENTAL VIEW

- ROADS, FOOTPATHS, STREET FURNITURE, INVENTORY etc
- DEFECTS IDENTIFIED
- CONDITION GRADED
- INTEGRATE INTO EXISTING ASSET SYSTEMS

Strategic Resilience through Asset Management

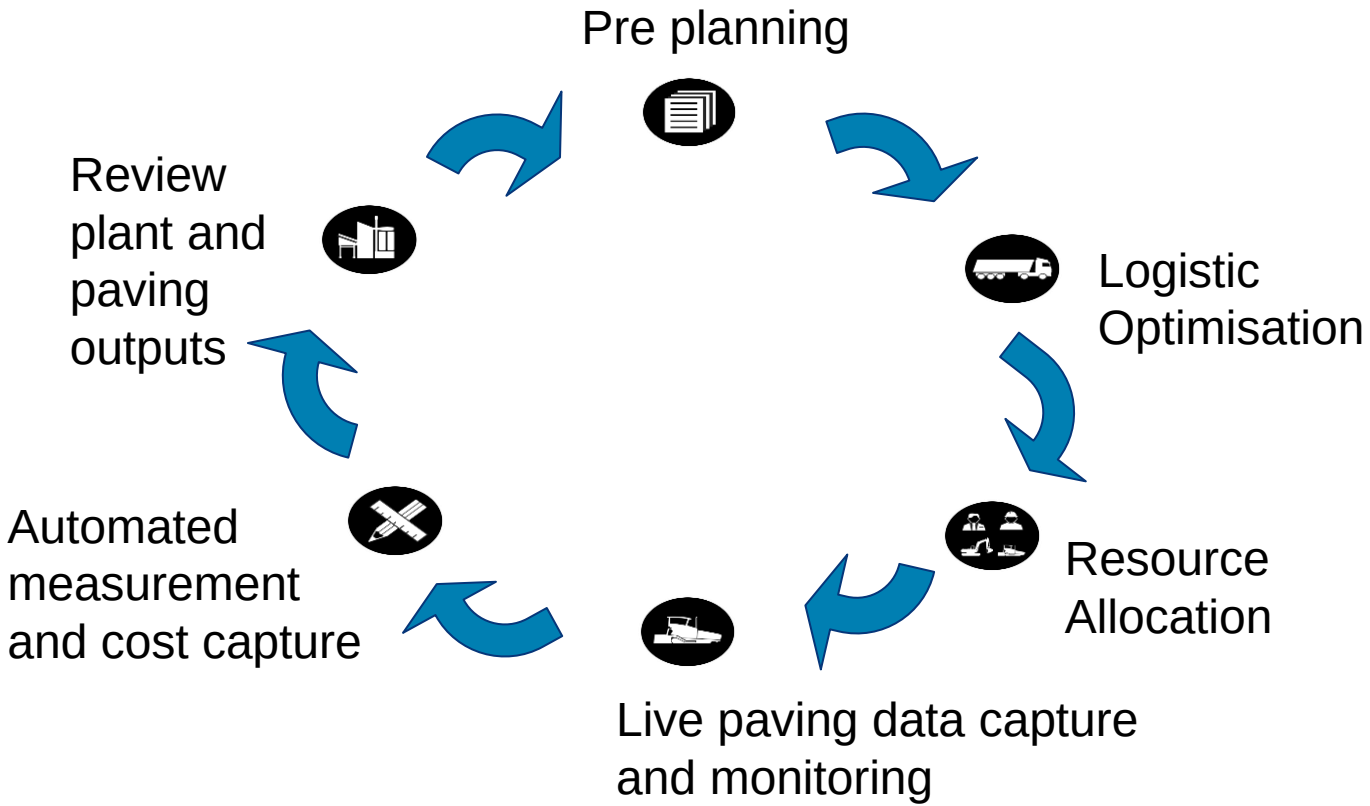
SELECT THE RIGHT PARTNERS

- Articulate visually to members and the public
- Supports funding submissions including Band 3 status (o/s London)
- Technology moving quickly to provide affordable survey and asset grading solutions…
- SCANNER…limited shelf-life?
- **SXSW - https://youtu.be/LdmzQ6jzuk4**
- **Savannah - https://youtu.be/xr3JQ2ogoVk**
- **Detroit – https://youtu.be/oTg4D3rDPGw**
- **CEO - https://youtu.be/6jK7U2E1Iio**




Tactical Resilience through Effective Delivery

Tactical Resilience through Effective Delivery



Tactical Resilience through Effective Delivery

ENHANCED SAFETY, QUALITY AND PERFORMANCE THROUGH SYSTEMISATION

Resource allocation and link to Timesheet / Cost Sheet / Daily records to reduce paperwork

Live laying data for supervisor to monitor progress

Live delivery tracking via EPOD interface direct into BPO cockpit

Reconciliation for laid volume versus target volume

Instant data records from previous days' activities including site photos and BIM data

Future Resilience through creating a Circular Economy

Stage 1
- Consider the imperative for change (Aug-Sep '16)

Stage 2
- Develop a long/short list of possibilities (Oct-Nov '16)

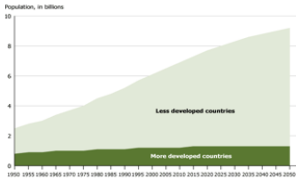
Stage 3
- 3a (Nov-Dec '16) Review and rank longlist
- 3b (Jan-Mar '17) Initial appraisal of 'long shortlist'
- 3c (Mar-May '17) Test the business case for the shortlist.

Stage 4
- Agree next steps and implementation plan (June/July '17)

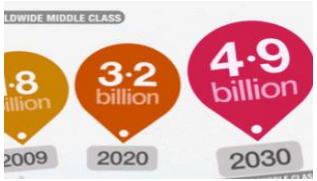
- **Steering Group led process to consider Circular Economy business opportunities**
- **6 key opportunities identified and tested against key 'assumptions for success'**
- **Clear accountability, time and governance is now necessary to deliver these projects**

Future Resilience through creating a Circular Economy – The Drivers

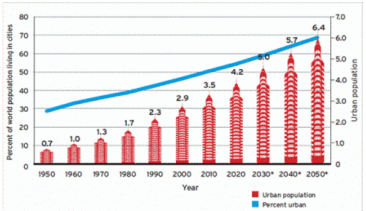
Growing population



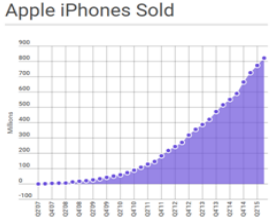
Rise of the middle class



Urbanisation & intensification

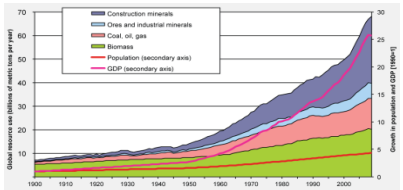


Technology & digitisation



Increasing demand for resources

Peak oil & critical Raw materials



Resource use

If the world consumed resources at the rate we do in the UK we would need 3 planets

Political instability

Future Resilience through creating a Circular Economy – The Need

Reducing cost & gaining planning consents

Managing increasing regulation

Winning more business

Driving innovation through collaboration

"If it wasn't for Tarmac, we couldn't have got to where we are today."

"Closed loop innovation is going to drive the next generation of business growth."

Sir Ian Cheshire, Kingfisher

"Cat® Remanufactured Parts – same as new performance at fraction of cost with reduced environmental impact."

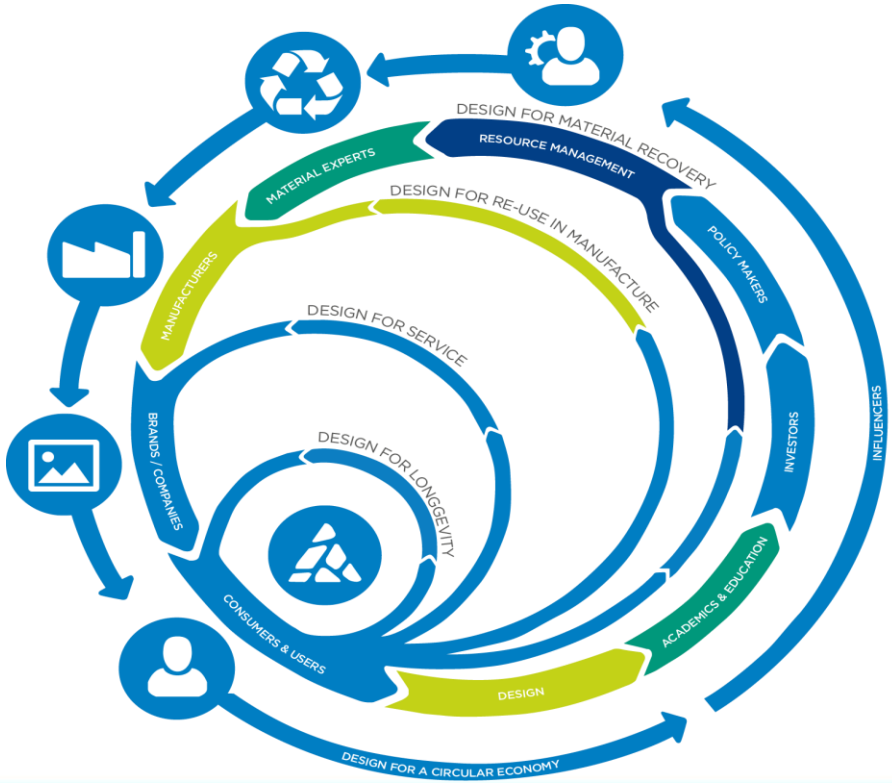
Caterpillar

"The core challenge for the global economy is to decouple economic growth from resource constraints."

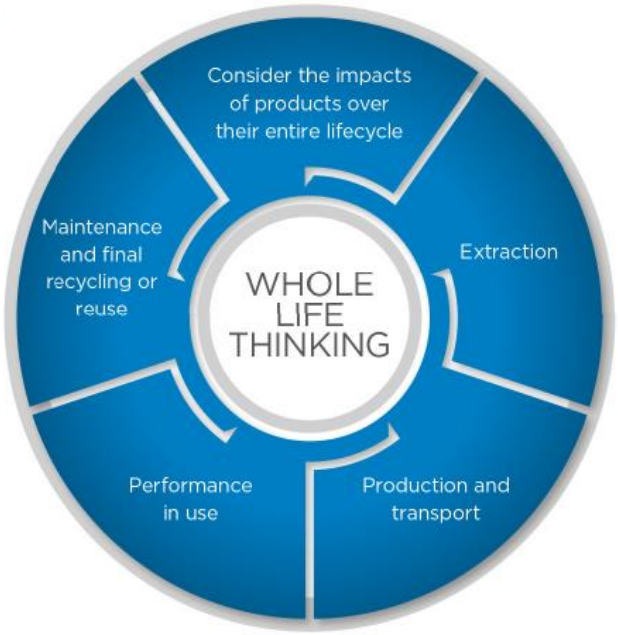
Peter Lacy, Accenture

Future Resilience through creating a Circular Economy – More than just Recycling

- Design for longevity
- Design for service
- Design for reuse in manufacture
- Design for material recovery



Future Resilience through creating a Circular Economy – Lots of Opportunity



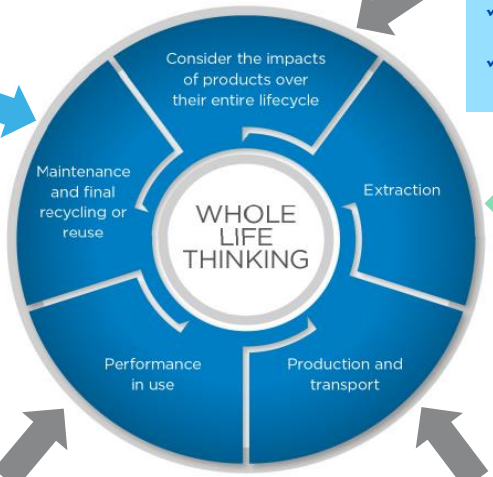
Six opportunities shortlisted from a longlist of 50+

Opportunity	Business Unit
Long-life road specifications and service models	Contracting
Retaining RAP within Tarmac through data sharing & coordination	A&A, L&R
Circular Economy demonstration with Water co.	Business Development
Glass-based lightweight aggregate	TBP
Reduced material concrete solutions	Readymix
Modular foundations for buildings and structures	Construction Solutions

Future Resilience through creating a Circular Economy - Highways Specific

Pavement and Material Design
- ✓ Long life solutions (Ultigrip, Ultilayer) backed by guarantees
- ✓ Low waste designs (Ultifoam, concrete milling)
- ✓ Combined uses – making the most of road surfaces

Routine Maintenance
- ✓ Early intervention with better data capture, investigation
- ✓ Using smartphones to detect potholes
- ✓ BIM , GIS and GPS to record laying conditions
- ✓ Re-use of planings, prioritising PSV65+



Re-Purposing
- ✓ Reduced reliance on scarce virgin materials
- ✓ Increased use of RAP in base, binder and wearing courses

Contract Delivery
- ✓ Higher precision service, producing longer lasting surfacing
- ✓ Data driven for predictive maintenance
- ✓ On-site material reuse
- ✓ Stock management, reusing highway components across sites

Integrated Service Model
- ✓ Use of rail heads and marine wharfs
- ✓ Collaborative arrangements with competitors
- ✓ Best-in-class fleet – FORS Gold, electric, etc.

Future Resilience through creating a Circular Economy – Highways Examples

UltiFoam - https://www.youtube.com/watch?v=tTNVQj2msbc

UltiPatch SiteMix - https://www.youtube.com/watch?v=duqUw6cIYlM

UltiFastPath - https://www.youtube.com/watch?v=iDgQd2HlOHU


TARMAC
A CRH COMPANY

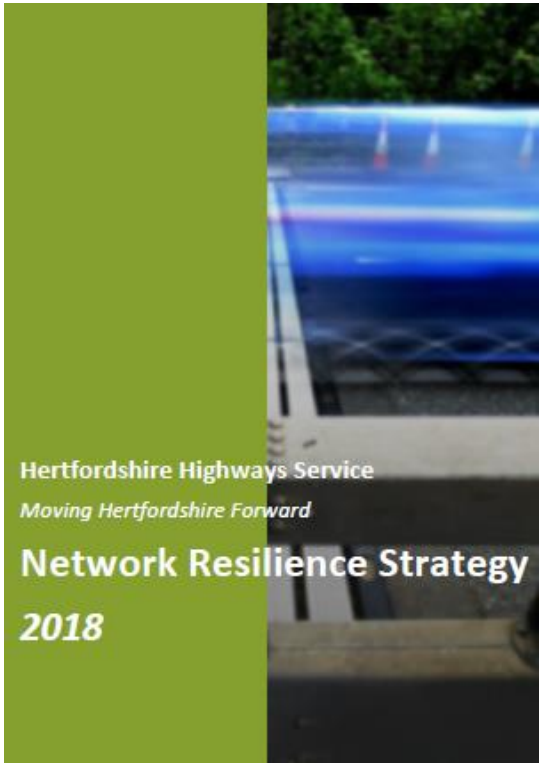
Hertfordshire's Network Resilience Strategy

Chris Allen-Smith

Head of Profession, Asset Management

Hertfordshire County Council Network Resilience Strategy

- Why is it important?
- What are the potential issues?
- What are we doing?
- What are we considering?
- What are others doing?



Why is it important?

- Social and economic well-being
- Access to key facilities and services
  - Emergency services
  - Transport interchanges
  - Utilities
- DfT Incentive Funding/WMHI CoP/LTP4/TMA

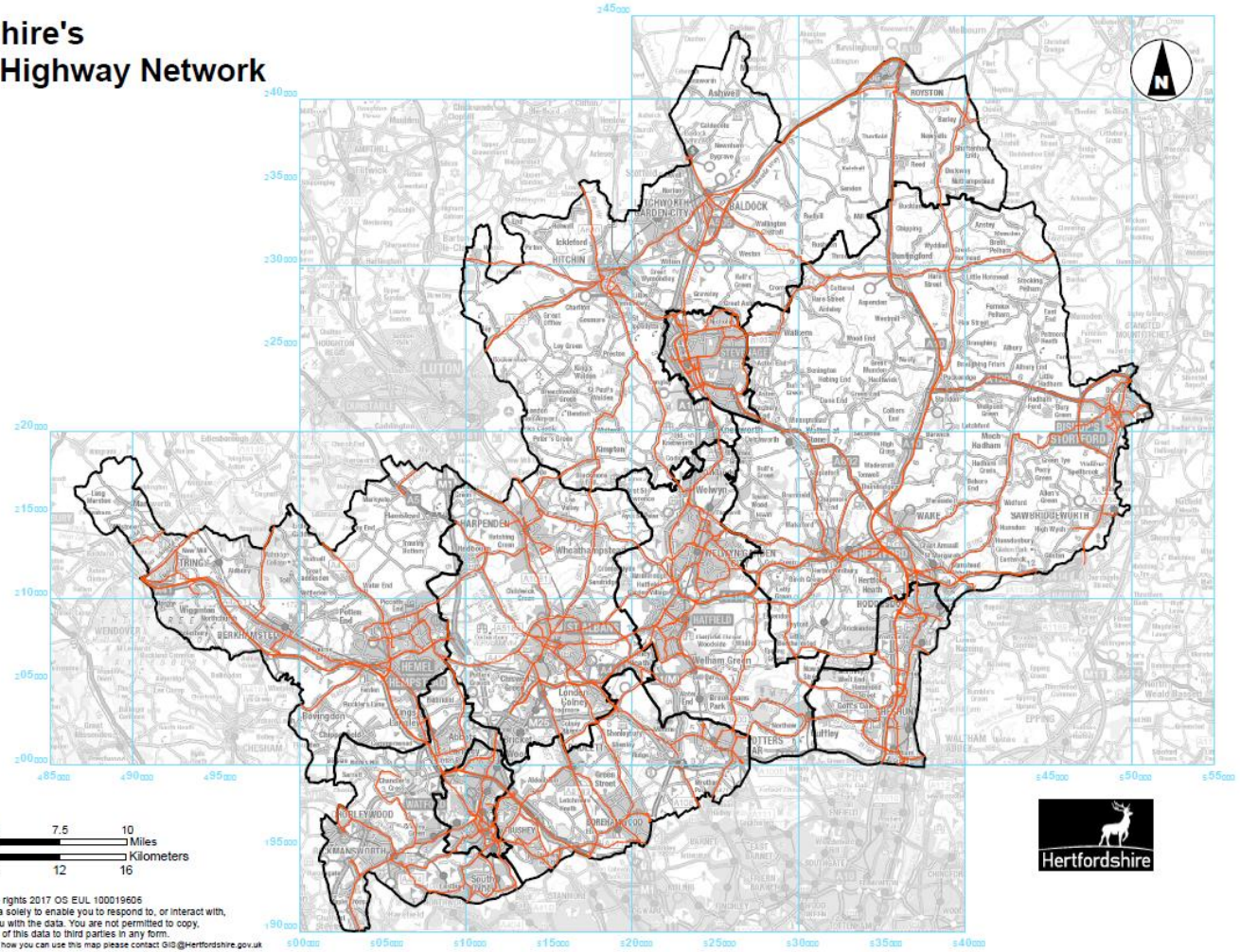
What are the potential issues?

What can we do?

Strategic Goals

1	We respond efficiently and effectively to unplanned events	
2	We plan and coordinate works on the network	
3	We adopt Asset Management principles to plan and deliver effective maintenance regimes	
4	We continue to improve the resilience of existing assets	
5	We ensure that new infrastructure is designed and built to be resilient	

Hertfordshire's Resilient Highway Network



Hertfordshire

Hertfordshire

Responses to unplanned events

What we do already:

- We have the ITCC/Incident management Protocol/Defect Management Approach/Critical Asset Inspections

Development Initiatives:

- We will review our inspection regimes for un-tensioned safety barriers

Plan and Coordinate Works on the Network

What we do already:

- Network Management Strategy/Network Hierarchy/Traffic Sensitive Network/Works Permitting and Licencing/Winter Service Plan…

Development Initiatives:

- ‘Workathon’ approach on critical parts of the network
- Review of Network Hierarchy

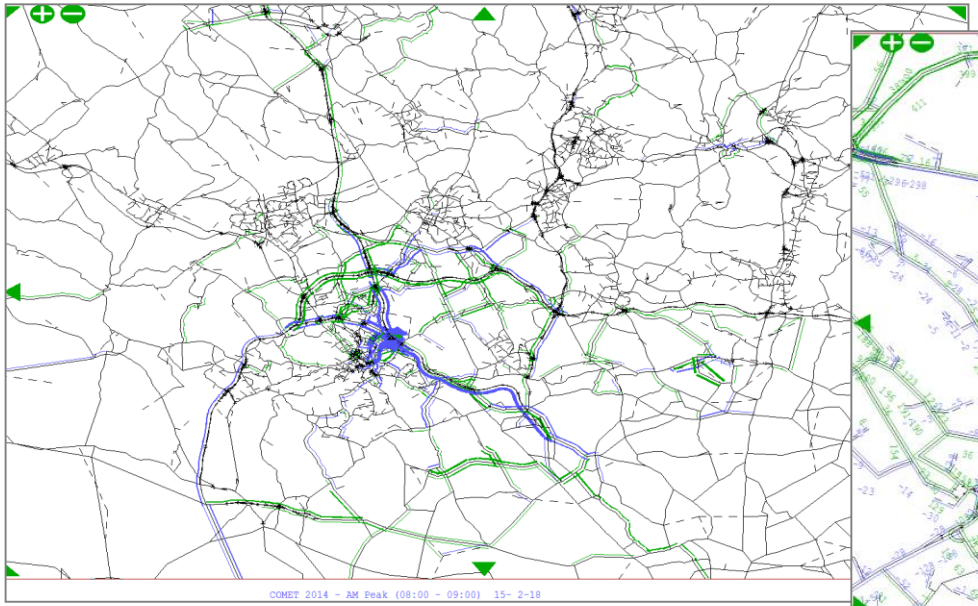
- ‘Workathon’ approach at strategic intersections
- Model the impacts of worse case scenarios using COMET
- Coordinate works within a single window
- Highways England, Utilities, Highway Authority – all asset owners

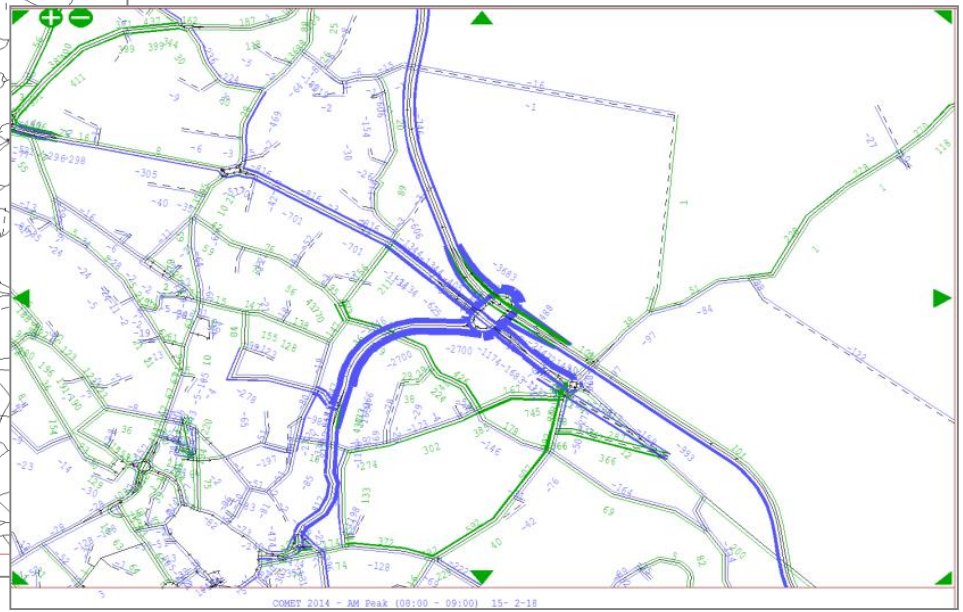
Berrygrove M1J5/A41/A4008

- Averaged flows AAWD
- M1 – 147,000
- A41 – 33,000
- A4008 – 31,000

Hertfordshire

COMET Modelling





Adopt AM Principles to plan and deliver effective maintenance regimes

What we do already:

- Pavement Management Strategy/Cyclical gully cleansing programme/Local Flood Risk Management Strategy

Development Initiatives:

- Proactive tree management

Improve existing assets

What we do already:

- Sign de-cluttering

Development Initiatives:

Narrow Verge/Central Reserve hardening. Concrete VRS

Reducing maintenance requirements - Larger gullies

Drainage Asset Inventory

VMS Signs – review locations

More durable road markings/studs
London Colney Rbt 2011

London Colney Rbt 2012

London Colney Rbt 2016

The Plough Rbt 2008

The Plough Rbt 2009

The Plough Rbt 2012

The Plough Rbt 2014

The Plough Rbt 2017

- Cross-over points on dual carriageways
- Slow growing grass species
- Self cleansing sign faces
- Installing spare ducts during major works

Ensuring new infrastructure is designed to be resilient

What we do already:

- Roads in Herts Design Guide/Asset Inventory

Development Initiatives:

- Utilities plant placed in verges
- Review of Roads in Herts to incorporate lessons learnt from Major Projects schemes

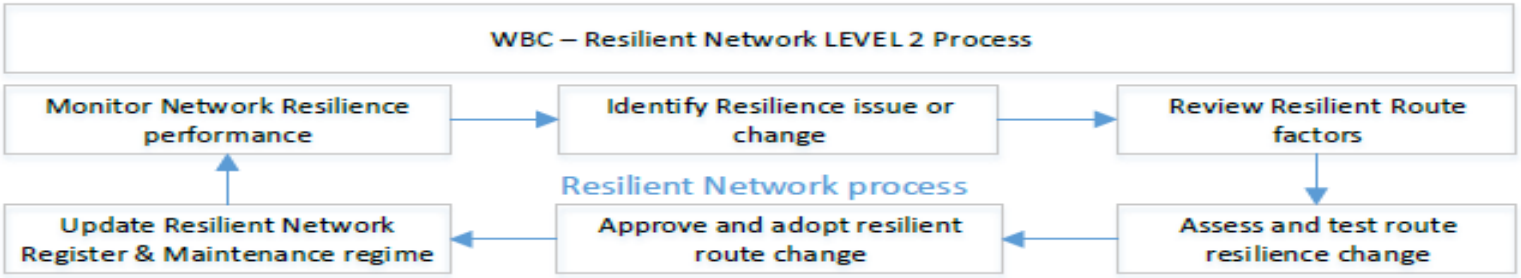
Other Approaches

- Strategic role in formulating transport strategy and policy for the West Midlands, delivering an integrated transport system, incorporating strategic highways, freight, rail, bus and rapid transit networks

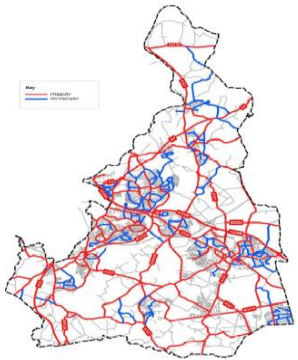
- Network Resilience
  - Manage congestion and keep West Midlands moving – **Congestion Management Plan**
  - **Key Route Network** part of an integrated transport system
  - Encourage users **to re-time**, **re-mode** and **re-route** journeys to avoid disruption

Congestion Management Plan

- Improve capacity – both road and public transport
- Improve efficiency – more reliable
- Manage demand – encouraging users to plan ahead, change journeys



The development of a resilient network strategy will identify the critical highway network, focusing on risk management with networks defined, and aligning strategic maintenance in the areas of winter maintenance, highway drainage and carriageway maintenance. A sister document, the WBC Flood Strategy, focuses on flood management in the borough.



thank you


Hertfordshire

Building a railway fit for the future

CIHT – Transport sector resilience in a changing world
David Quincey
11th April 2019

Flooding and erosion


Maidenhead


Bridge Scour
Lamington Viaduct Feb 2016


Cowley Bridge

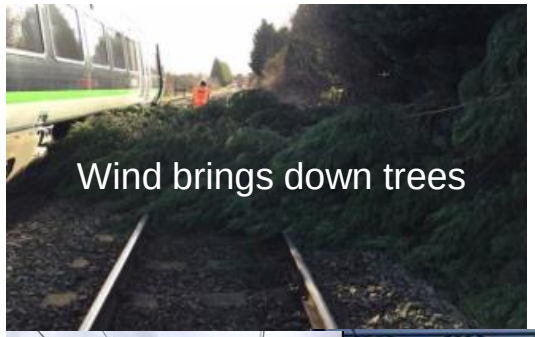

Wave damage at Shakespeare Beach Folkestone Dec 2015


Somerset Levels

Dawlish 2014

- February 2014
- Rail access to South West England blocked for two months
- Capital cost at least £63 and disruption payments of £28m.
- Cost to Cornwall's economy? Estimates range from £1m/day - £1bn in total?

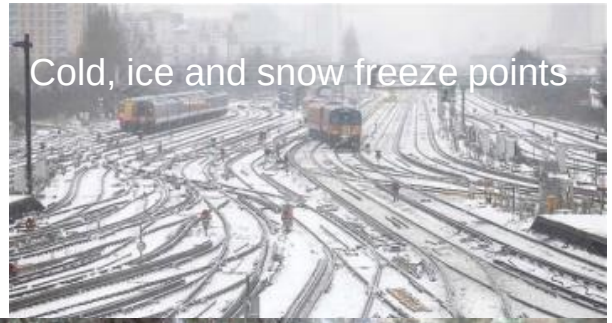
Wind, heavy rain and lightning

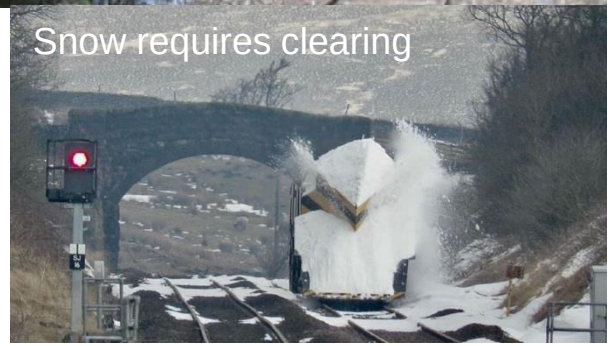


Watford 2016

- September 2016
- Landslide caused by runoff from 3rd party land blocks Watford Tunnel
- One train was derailed and then struck a glancing blow" by passing train.
- Both trains were damaged, but none.
- 384 people, no serious injuries.

Temperatures



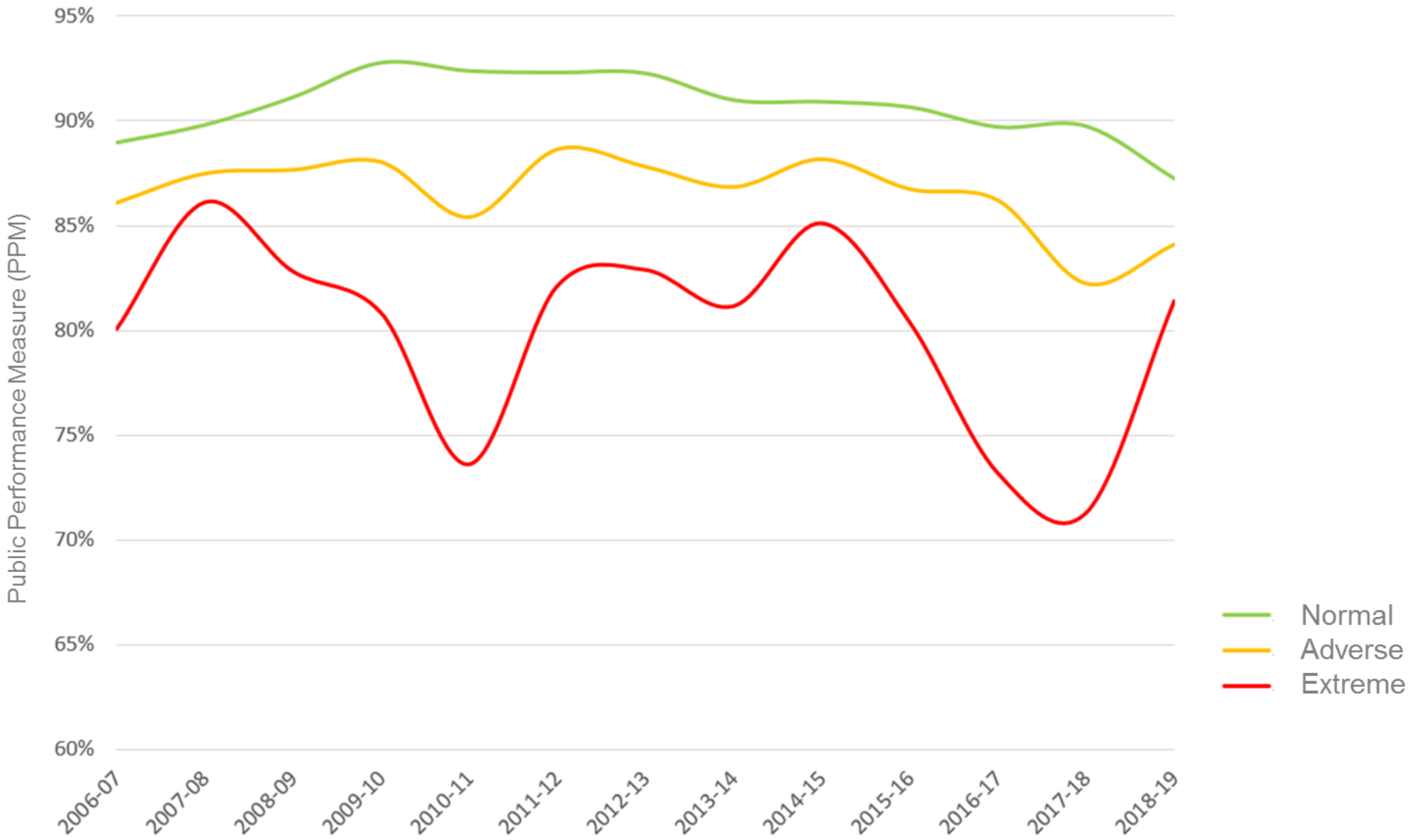


Heatwave 2018

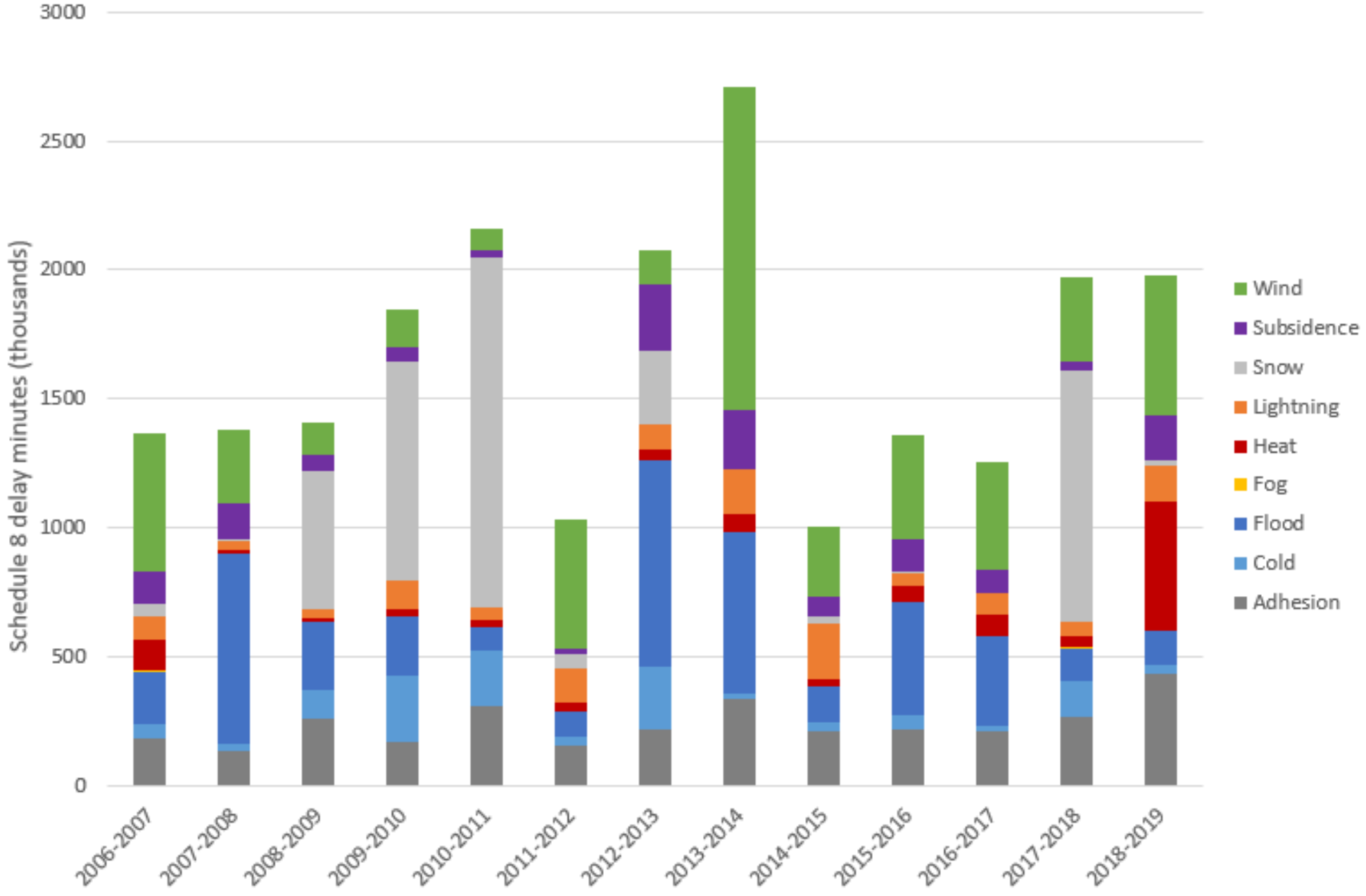
- The 2018 heatwave caused an overall 40-50% increase in asset failure rates
- In April – June this was as high as 80%
- PPM fell by 4.2% due to asset failures and heat speeds
- Heat-related disruption payments were over £35-40m
- Service affecting failures forecast to be ~4% worse than target for year.

Current weather impact on performance

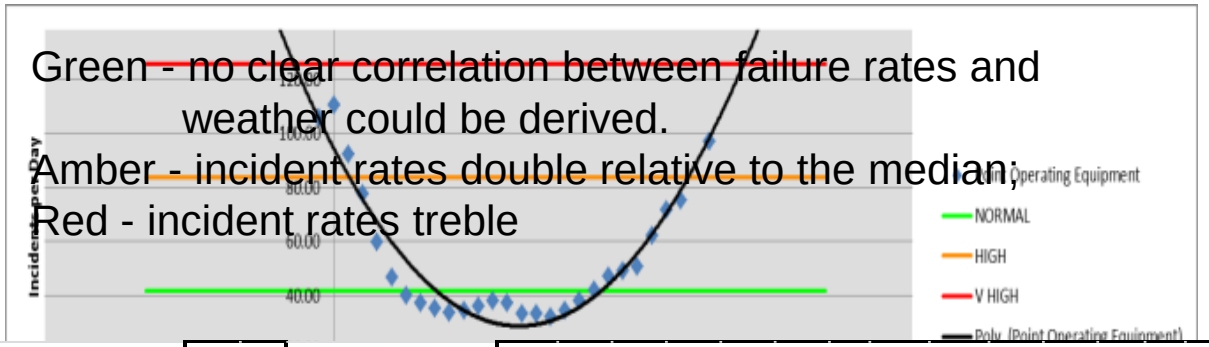
2-3% performance drop on adverse weather days



Schedule 8 Delay Minutes 2006 - 2019



Understanding the risks



Green - no clear correlation between failure rates and weather could be derived.
Amber - incident rates double relative to the median;
Red - incident rates treble

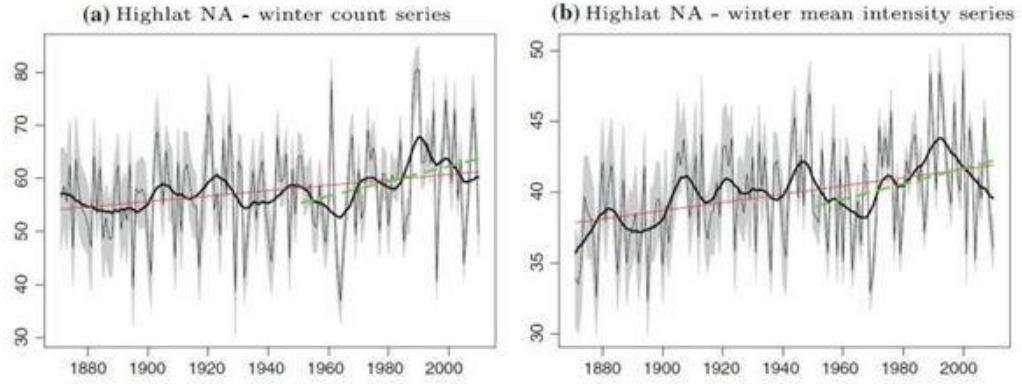
- Weather impact data collected
- 12 year data set of Schedule 8 data
- Analysis of failure curves for assets
- Identification of failure thresholds

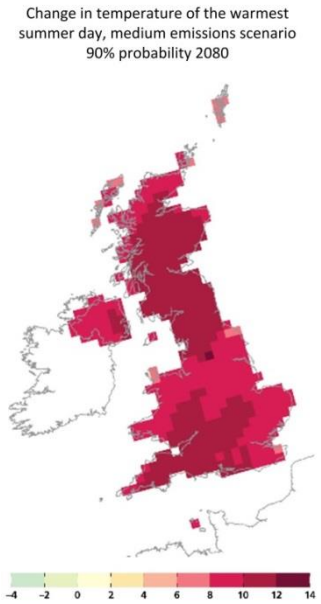
	Buildings		E&P				Signalling														Telecoms										SE&PT		Track			Earthworks
Weather	Property	Structures	3rd Rail	OLE	Signalling Power	Traction Power	ATP	AWS	Axle Counter	HABD	Interlocking	Level Crossing	Miscellaneous	Monitor	POE	Remote Control	Signallling	Signalling Control	Staff Protection	TPWS	Track Circuit	Unknown	Cable	Concentrator	DOO	Miscellaneous	PABX	PETS	Power	Radio	SCADA	SISS	Telephone	Transmission	Voice Recorder	Cable Route	Lineside Equipment	S&C	Track	Sign	All
Daily Maximum	>22		>29	>24	>27	>21	>20	>25	>24	>25	>24	>31			>24	>22	>27	>27		>22	>21			>25	>21	>26		>25	>24	>27	>22		>29	>29	>29		>34		>25		
(^{O}C)	>27			>30		>24	>21	>31	>30	>30	>30				>29	>27				>27	>26			>30	>25					>34	>27								>29		
Daily Minimum				<-10						<-12		<-15			<-5			<-7																			<-0			
(^{O}C)				<-15											<-10																							<-3			
Diurnal Cycle	>13					>12	>10	>14		>13	>14				>13	>13		>14		>14	>13	>12			>13						>14										
(^{O}C)						>16	>11	>18		>16					>16						>16																				
3 Hour Rainfall		>9	>11		>8																>7			>12														>7		>2	
(mm)		>12			>13																>10																		>12		>4	
Daily Rainfall		>29			>46									>24							>38																		>44		>11	
(mm)		>37												>32							>60																		>66		>16	
15 day Rainfall														>112																											>68	
(mm)														>137																											>102	
Hourly Max Wind Gust				>49	>48	>59			>61			>54		>49							>49								>69										>50		>39	
(mph)				>53	>57	>71			>67			>67		>57							>54																		>57		>46	
Daily Max Gust				>59	>70							>96		>55							>62								>76										>64		>42	
(mph)				>66										>61							>72								>84										>76		>49	
Daily Max				>40	>41							>44									>37																		>40		>25	
Windspeed (mph)																					>44																		>51		>29	

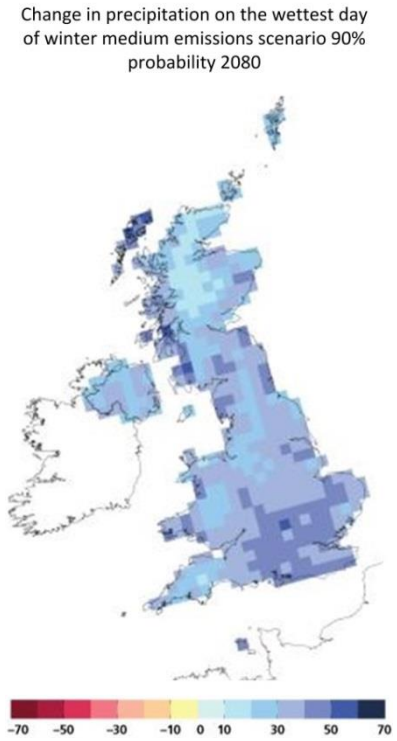
Future impacts

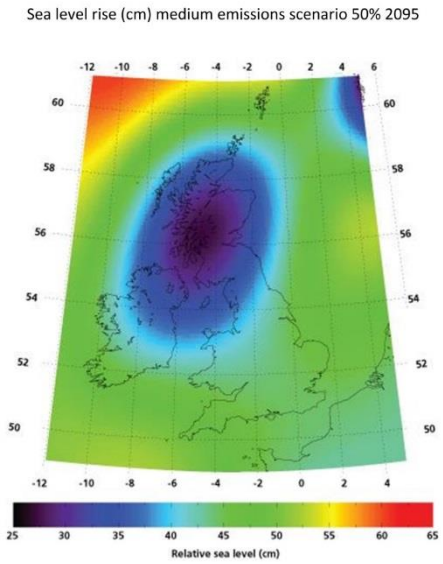
- Summer and winter temperatures will rise
- Total rainfall will stay similar, but summer decreases and winter increases
- Storm frequency and intensity will increase
- Wind and lightning will show increases
- Sea level will rise
- Etc……

- The challenges for Network Rail will increase
- Without an appropriate response so will the impacts









WRCCA Strategic Objectives

A railway that is safe and more resilient to the effects of weather, now and in the future

Infrastructure able to withstand the impact of future weather conditions

Rapid recovery from the impacts of adverse and extreme events

STRATEGIC OUTCOMES

Improved performance and safety during adverse and extreme weather conditions

Financial savings through reduced compensation payments and repair costs

Enhanced reputation and trust in the railway's ability to manage weather events.

Pillars of Resilience

WRCCA CP5 activities

Integrate climate change into business as usual	Strategic Action and Investment	Analysis and Reporting	Streamline operational weather management
• GRIP - Climate Risk Assessment Guidance (linked to ESR) • Agree plan to integrate CC into Asset policies and standards • Sustainable Procurement • Investment Process (developing)	• WRCCA Strategy (2017) • Update Route WRCCA Plans • Enhanced engagement with Government and Regulators • ERR Update	• Define CP6 analysis requirements • Periodic reporting of Sch8 and PPM • Asset sensitivities and thresholds • Flood risk and adaptation cost • TRaCCA • Climate change projections analysis	• Update NR/L2/OPS/021 and modules managing assets in adverse and extreme weather • Seasonal planning audit • Seasonal reviews (working best for Autumn via AWG) • Business Continuity Management

WRCCA in CP6

Integrate climate change into business as usual

- CC Projections and Frequencies Guidance (incl update to UKCP18))
- Update Asset policies and standards
- Pilot Projects to support GRIP climate risk assessment process
- Additional activities as identified by business

Strategic Action and Investment

- Clear, robust plans for resilience improvements (Routes and Assets)
- Implement action plans for CP6
- Long term WRCCA strategy (incl Govt's expected level of service)
- Embed climate change within SBPs in CP7 and beyond

Analysis and Reporting

- R&D Projects: *WRCCA Vulnerability and Prioritisation* and *Real Cost of WRCCA*
- Understand interdependencies within NR and wider UK infrastructure systems
- Resilience metrics
- Adaptation Report to Defra 2021

Streamline operational weather management

- Expand NTF Adhesion Working Group to all seasons
- Audit of Seasonal Preparedness
- Activities as identified in collaboration with Operational Weather Management Team and business
- BC Plans for more critical assets

CIHT Resilience Seminar
11th April 2019
Disaster Management: An International Perspective

Current PIARC work on managing disasters and disaster information (TCE.3)

James ELLIOTT
(Leader of WG1)

Contents

- Disaster management context
- Work of the TCE3 committee
- Disaster management research scope
  - Disaster information management
  - Disaster management with the public
- Synthesis of findings from:
  - International survey
  - Case studies
- Early conclusions

Disaster management context

Disaster can be defined as “a crisis situation that far exceeds the capabilities” - Quarantelli, 1985

- Disasters cause wide spread damage which far exceed an organisation’s ability to recover
- Disaster management can therefore be explained a series of activities and techniques to try to improve an organisation’s or society’s capability.

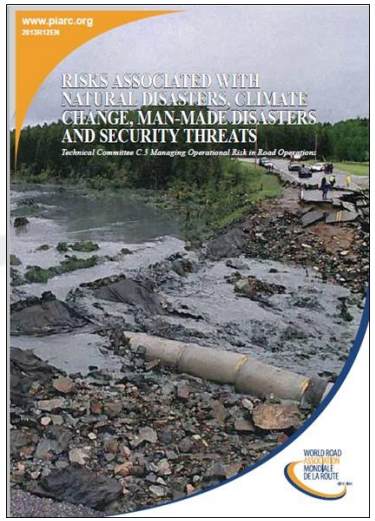
https://www.drc.udel.edu/news/Pages/quarantelli.aspx

Enrico Quarantelli

(1924 to 2017)

- Carried out pioneering work in disaster sociology
- Founded the US Disaster Research Center (DRC)
- The DRC has generated important social and behavioural science research on disaster
- The DRC holds decades of qualitative and quantitative research data, and a library of more than 70,000 publications

History of PIARC risk & resilience research

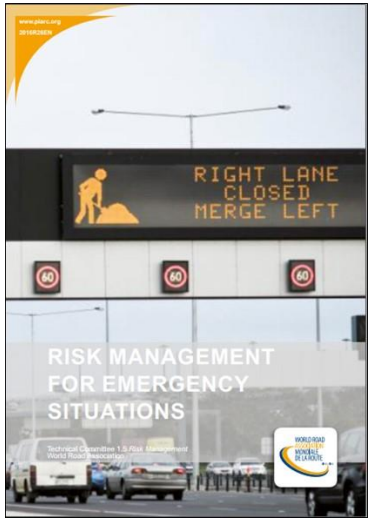


2008-2011 cycle

- Identified the strategies for reducing and mitigating risks from natural and man-made disasters and security threats

2008-2011 cycle

- Identified the factors affecting social reaction to risks in road related activities



2012-205 cycle

- Provided advice for management of emergency situations and coordination between different authorities
- Included combined and large hazards

Current risk & resilience work of the TCE.3 committee

Current “Disaster Management” has focussed on:

- Two key areas of current disaster management activities
- Collecting best practice case studies
- Identifying management techniques to mitigate disasters
- Sharing knowledge with developing road organisations

TCE.3 Working Groups:

- 1 - Disaster Information Management
  - Information management
  - Disaster management with the public
- 2 - Management of Major Disasters
  - Road authority vulnerability
  - Disaster monitoring
  - Emergency operations
  - Education and training
- Web Manual on Disaster Management

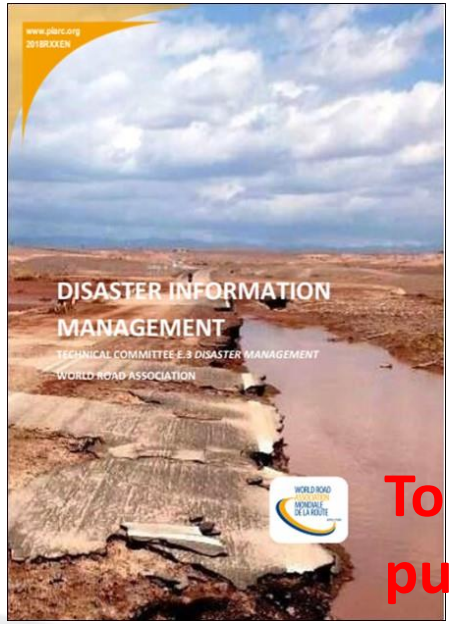
Next steps

Report preparation and publication

- Report to be published by PIARC in Q1 2019
- Online Disaster Management manual
- Seventh TCE3 committee meeting (joint with AASHTO) in San Diego 7-10 May 2019

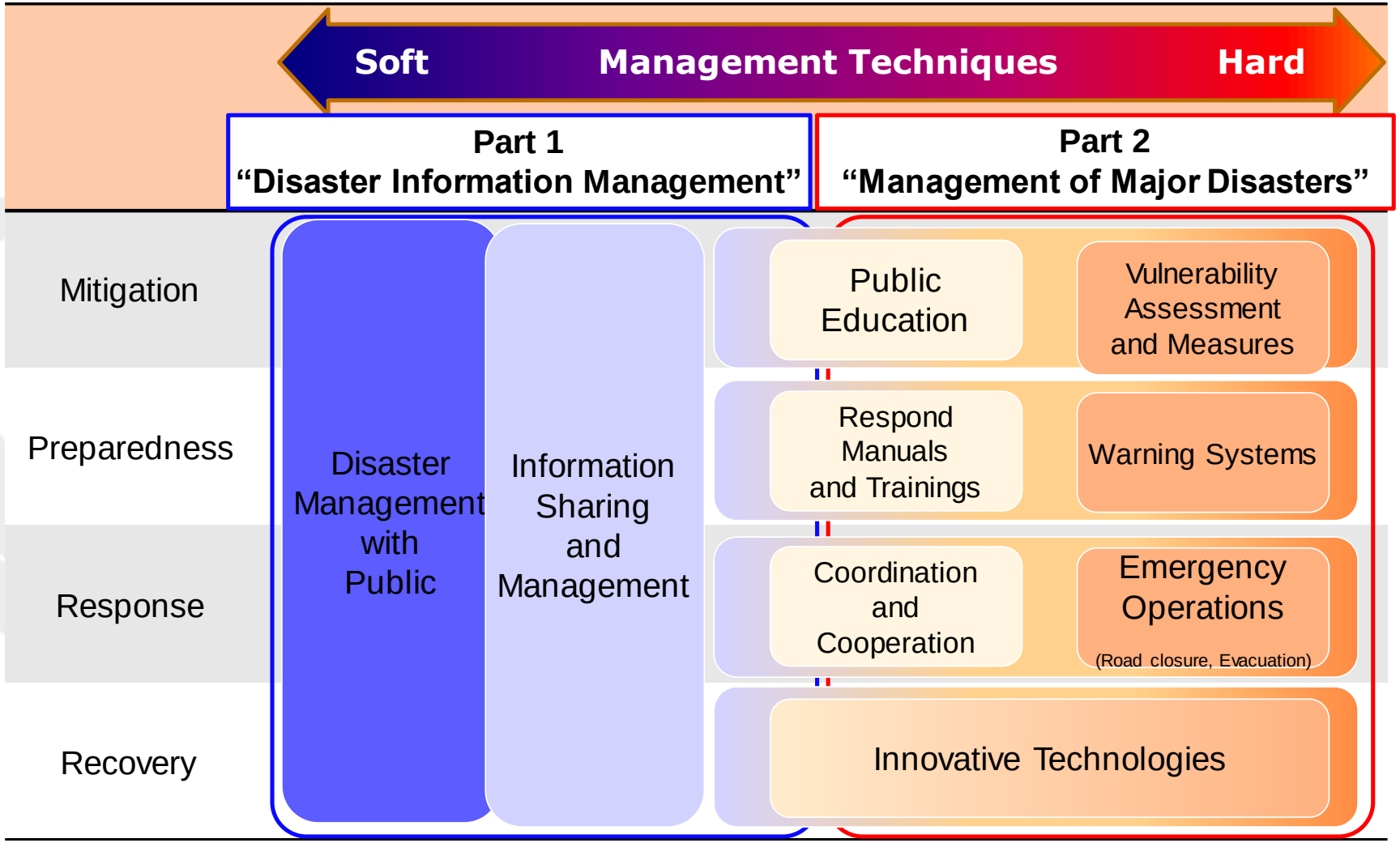
Dissemination

- 26th World Road Congress in Abu Dhabi 6 to 10 October 2019



To be published soon

Disaster management research scope



Part 1: Disaster information management

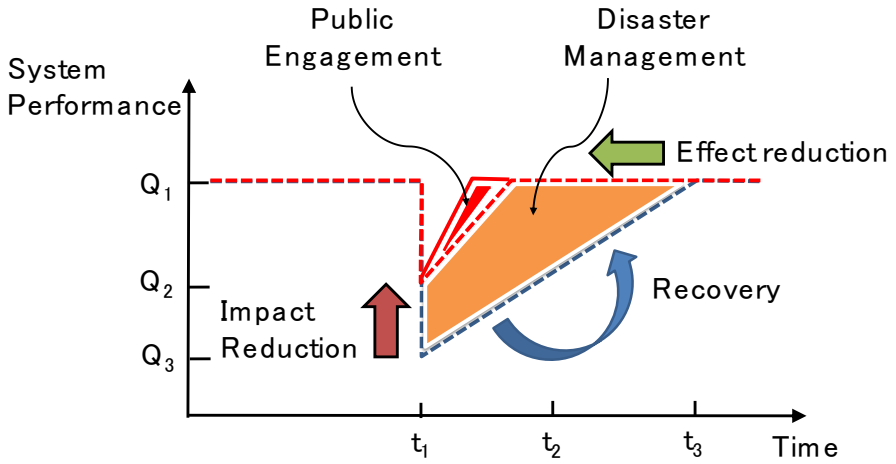
Information management in road organisations has considered:

- Communication structures
- Gathering information (Social network, ITV, etc.)
- Sharing information (mass media, web media, social network)
- Roads Users Information and Technical Information

Part 1: Disaster management with the public

Disaster management with the public has considered:

- How emergency response systems behave in a timeline
- Collecting practical examples of communication problems, how data is collected and shared, use of social networking and data technology management
- Recommendations for managing road information during disasters



Disaster management system performance curve

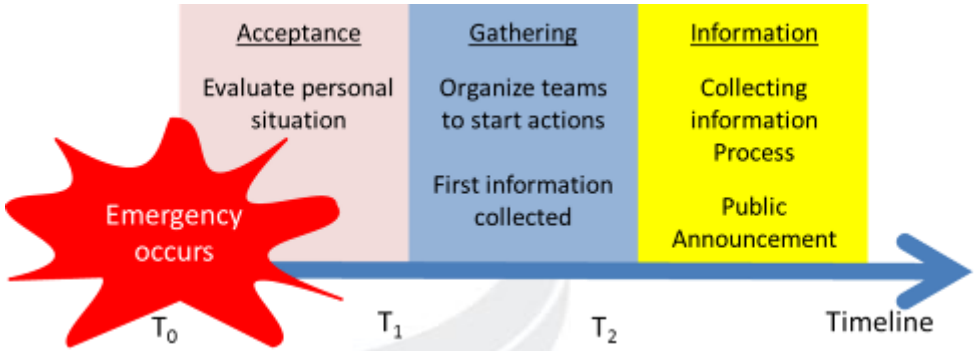
- Public engagement plays a small but important part during the disaster timeline
- Effective public engagement reduces the impact and effect on system performance

International disaster management survey

Disaster timeline used to document information management survey data

- 19 responses from 11 countries
- Data on communication structure, communication planning, actions before public announcements, emergency information for public announcements, standardized forms (SitReps)
- Data on collection and use of public and technical information

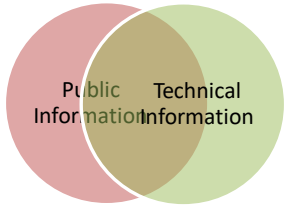
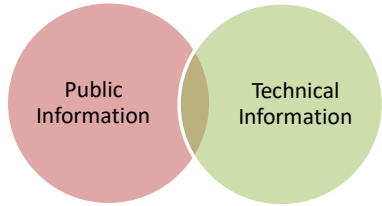
Australia
Austria
Chile
Czech Republic
Denmark
Dominican Republic
Hungary
Japan
Mexico
USA
UK

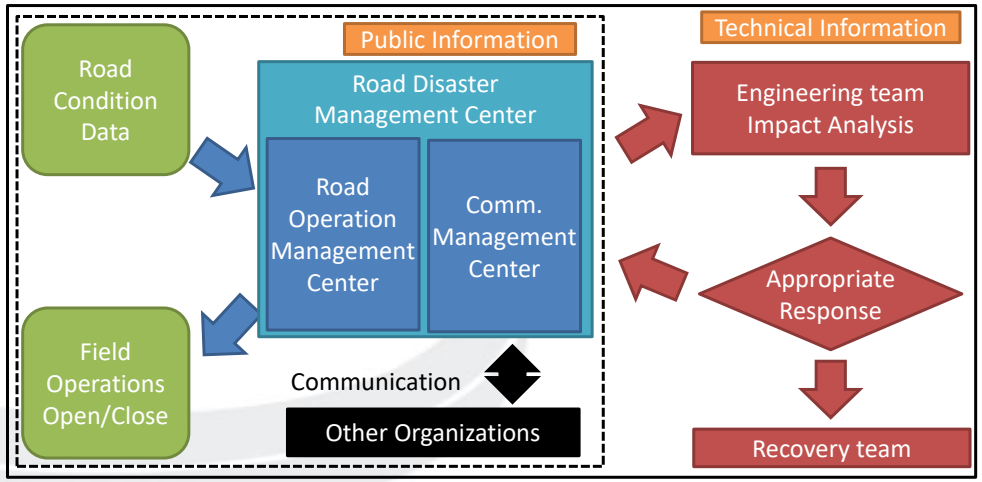


International survey findings

Survey findings:

- Processing & dissemination of public information and technical information varies
- Emergency management centres typically act as disaster information hubs
- Technical information is typically processed by engineering teams
- Public and technical information is not always coordinated by a single management centre.
- Independent use of public and technical information can cause subsequent issues.

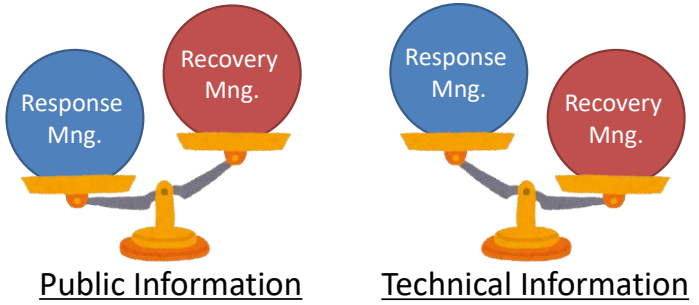
 Public information office serves as the liaison between technical and public information	 Public information and technical information disseminate separately considering their functions.
4/12 countries	8/12 countries

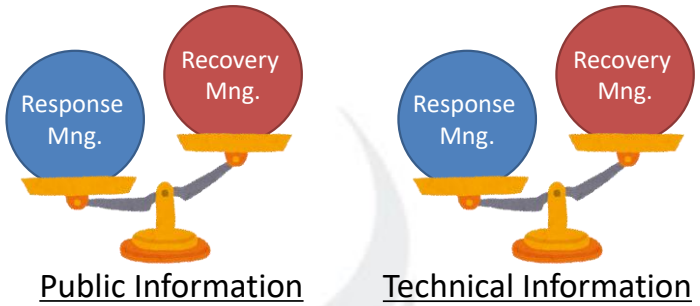


International survey findings

Survey findings continued…

- Public information is very important to response management. Technical information is very important in recovery management
- Treating public & technical information separately is effective for single mode disasters but not multiple (simultaneous or consecutive) mode disasters such as earthquakes and tsunamis, land slides and debris dams, and also heavy rain and floods.



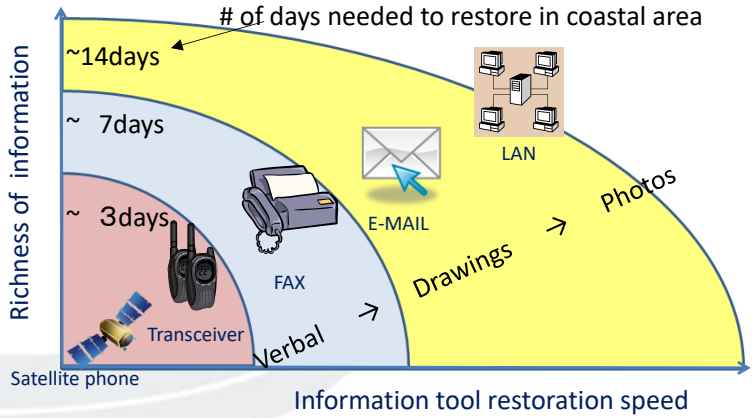


International survey findings

Disaster communication tools

- Countries use a range of communication tools depending on the nature of disasters and impact on normal communications
- Loss of communication lines should be considered in building disaster resilience
- Countries should prepare for disasters in poor communication environments

Communication condition	AUT	AUS	CHL	UK	US	JPN
Full condition	Internet					
Restricted condition	Telephone, FAX					
No communication available	Courier, Transceiver, Satellite phone					

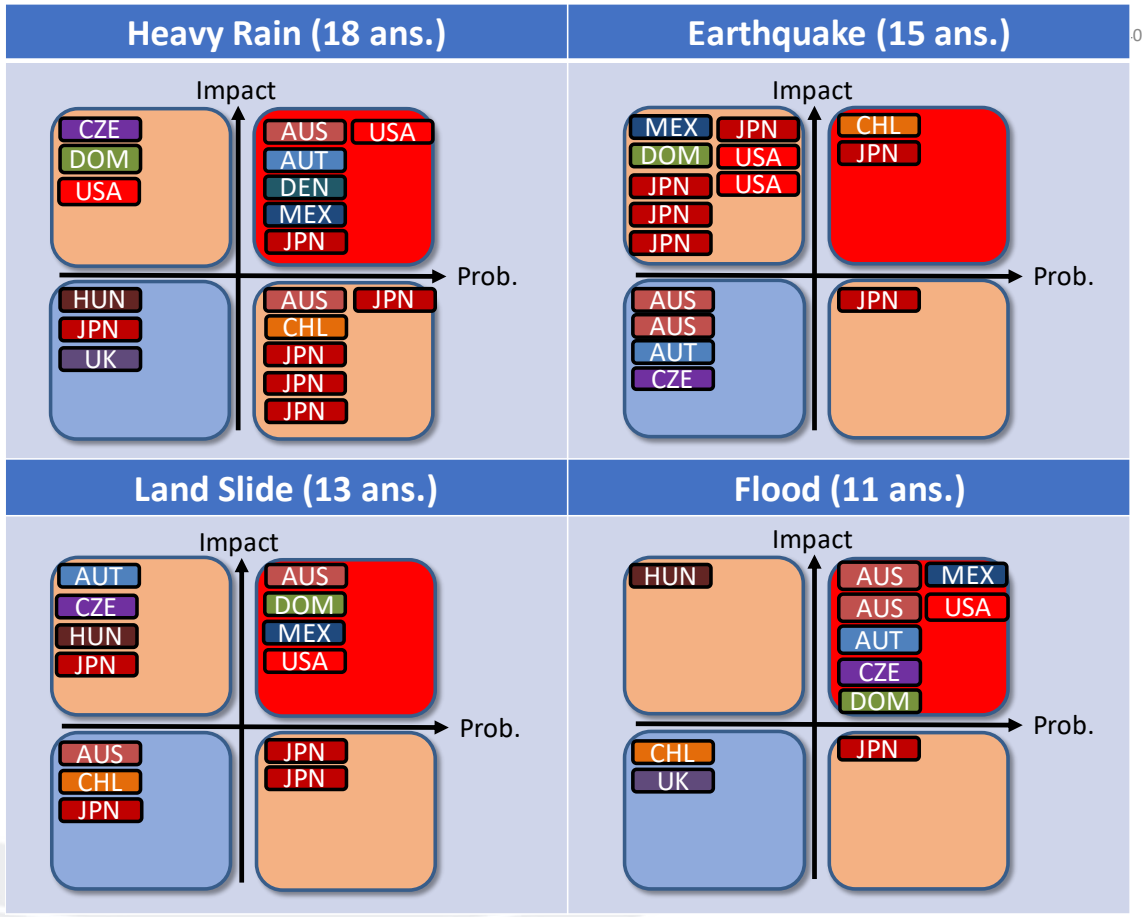


Communication recovery from 2011 East Japan earthquake and tsunami.

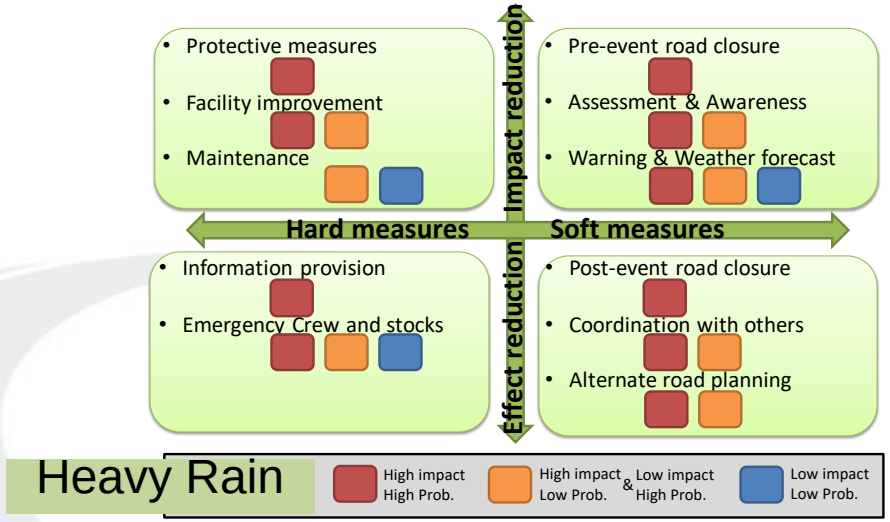
International survey findings

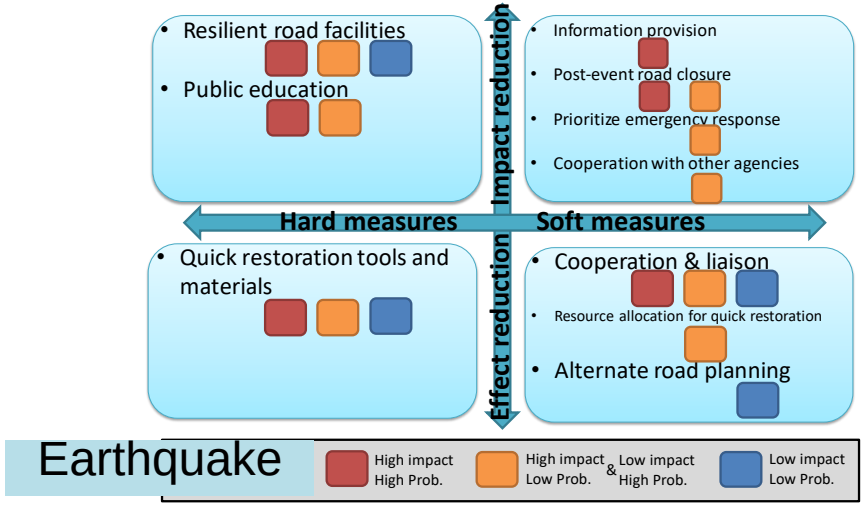
Key disaster types

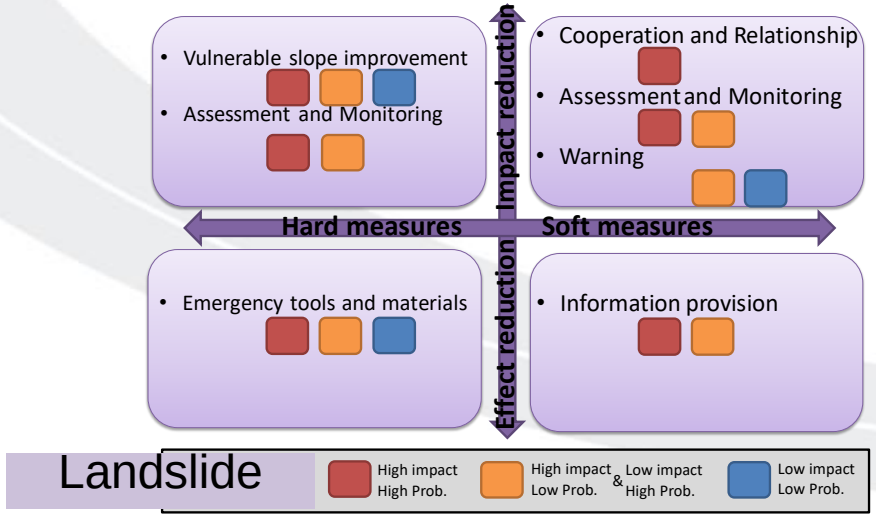
- Disasters grouped into four categories: Heavy rain; Earthquakes; Landslides; Flooding
- Survey responses collected data on:
  - 1) Facing disasters
  - 2) Disaster management policies
  - 3) Disaster management methodologies and practices

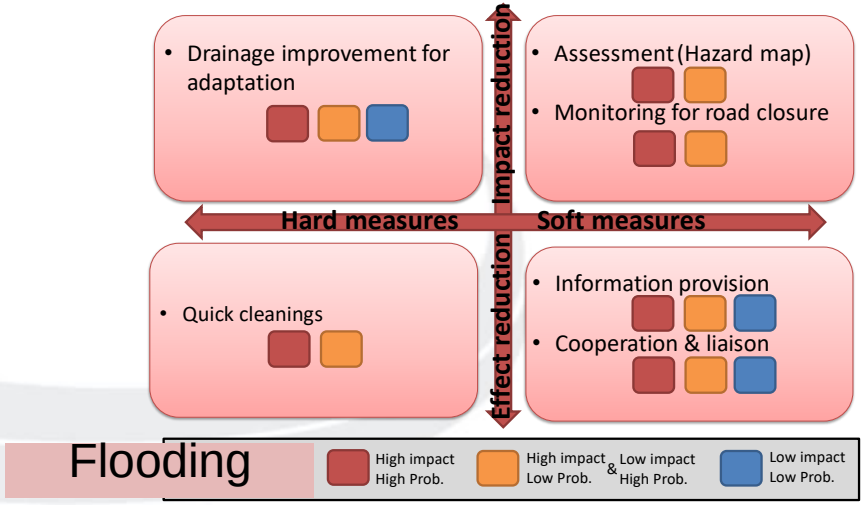


International survey – countermeasures to reduce disaster impacts









Case Studies

- Chile (2010 earthquake and tsunami)
- Dominican Republic (Emergency Operations Centre)
- Japan (2016 snowfall response and GIS based management)
- Australia (State Department Coordination Centre planning and 2017 cyclone Debbie)
- USA (2017 California wildfires)
- UK (Forth Road Bridge closure and Community Resilience)

Case study: Chile 2010 Earthquake & tsunami

Event facts

- Earthquake magnitude 8.8 followed by tsunami
- 525 dead, 2 million homeless, 370 thousand damaged homes

Road authority learning

- Information flows from the emergency not to it
- Communication hierarchy and responsibility is first priority
- Consider all types of communication gathering
- Clearly establish the procedures and obligations of each officer
- Adopt formal language to avoid misunderstandings or lack of communication.

Case study: Chile 2010 Earthquake & tsunami

Road authority learning continued

- Establish protocols on the veracity, extent and content of the information
- Information is key for decision-making. Correct and pertinent information improves the effectiveness of decisions
- Higher hierarchical levels tend to request information to make a decision that must be made on site and not at headquarters.

Case Study: Dominican Republic COE

CENTRO DE OPERACIONES DE EMERGENCIAS

Event facts

- Last 34 years has seen 16 tropical cyclones (5 hurricanes and 11 tropical storms)
- Estimated economic losses from last 6 severe events approximately US $ 2,340 million
- Emergency Operations Centre established in 2001

COE Contingency planning

- Established information flows ‘one version of truth’ to reduce event impacts and facilitate real time responses
- Information used to coordinate all response organisations and update politicians to guarantee efficient and timely operation
- Coordination has enhanced management tools to improve response and rehabilitation.
- Key has been maintaining information flow with all organisations

Case study: Japan 2016 Snowfall response

Event facts

- Heavy snowfall in Niigata prefecture caused 38 hours of road closures, 74 stranded vehicles and 50 hours of travel disruption
- Major impact on economic activities and daily living
- Information Communication Headquarters (ICH) convened for disasters including snowfall

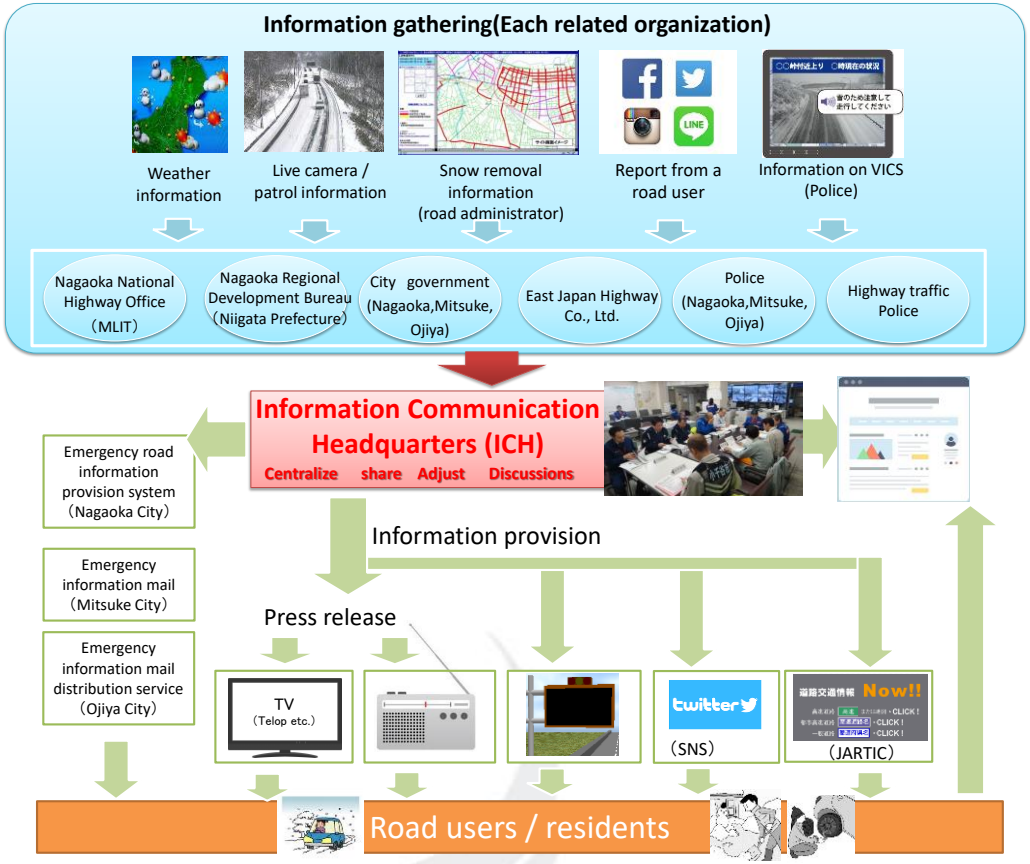
Road authority learning

- Common information issued:
  - Easy to understand
  - Useful for all transport modes
  - Real time
  - Visual images add confidence
- ICH has strengthened information sharing, planning, monitoring of snow clearance, provided information to road users.

Case study: Japan 2016 Snowfall response

Road authority learning continued

- Central information collection provided ‘one unified version’
- Multiple information outlets used to reach all users eg FM (Emergency Interrupt Broadcasting), Area email, webpages, SNS, Cable television
- Snowfall information shared with transport modes including: road conditions, snow clearance, accident information, etc.



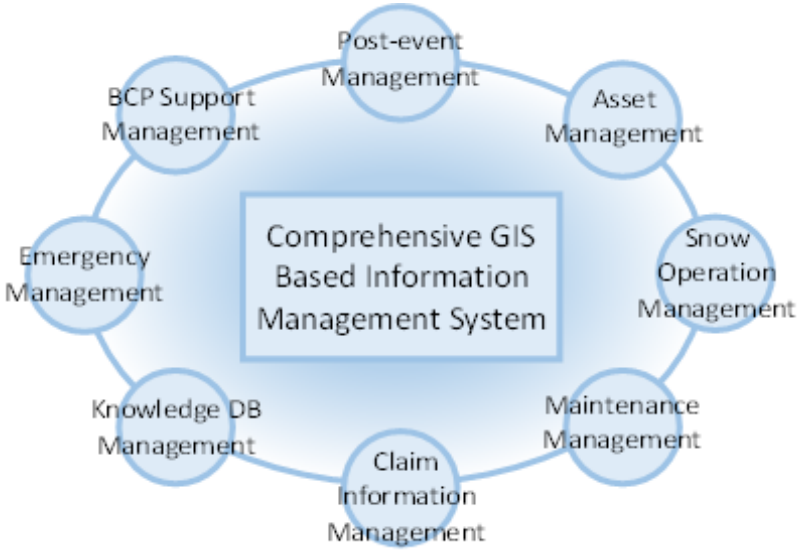
Case study: Japan
GIS based management

Event facts

- Background from 1997 Kobe earthquake and collapse of bridges, falling bridges
- Unpredicted damage to telecommunication systems
- Hanshin expressway (major expressway network) developed and implemented GIS based disaster information management system in 2012

Road authority learning

- Comprehensive disaster information management system required to manage disaster information and support routine road maintenance



Case study: Japan
GIS based management

Road authority learning continued

- Goal was comprehensive GIS data base

Earthquake damage

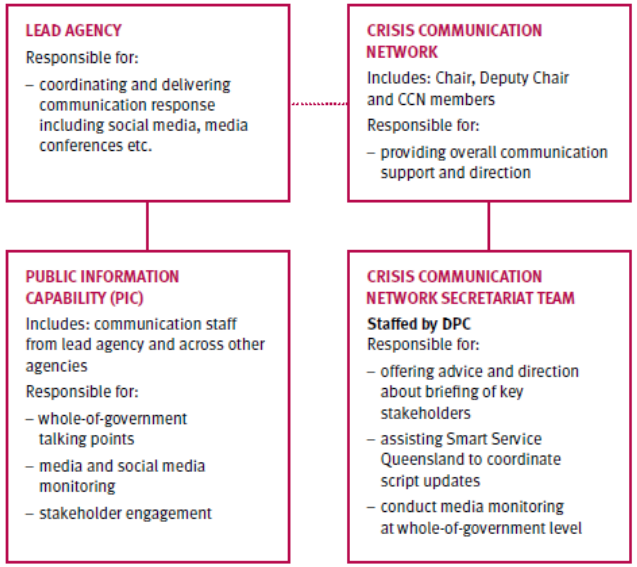
Tsunami inundation

- Collection and sharing of basic disaster information eg customer's injuries, the status of remaining vehicles, the damage situation of roads, the situation of employees' participation, etc.
- Database monitors disaster event data, ensures efficient investigation, inspection, emergency restoration activities at the time of disaster, and also supports daily road maintenance management work

Case study: Australia
SDCC disaster planning

Event planning

- Queensland State Disaster Management Plan (QSDMP) and Crisis Communication Plan
- State Department Coordination Centre (SDCC)



Road authority learning

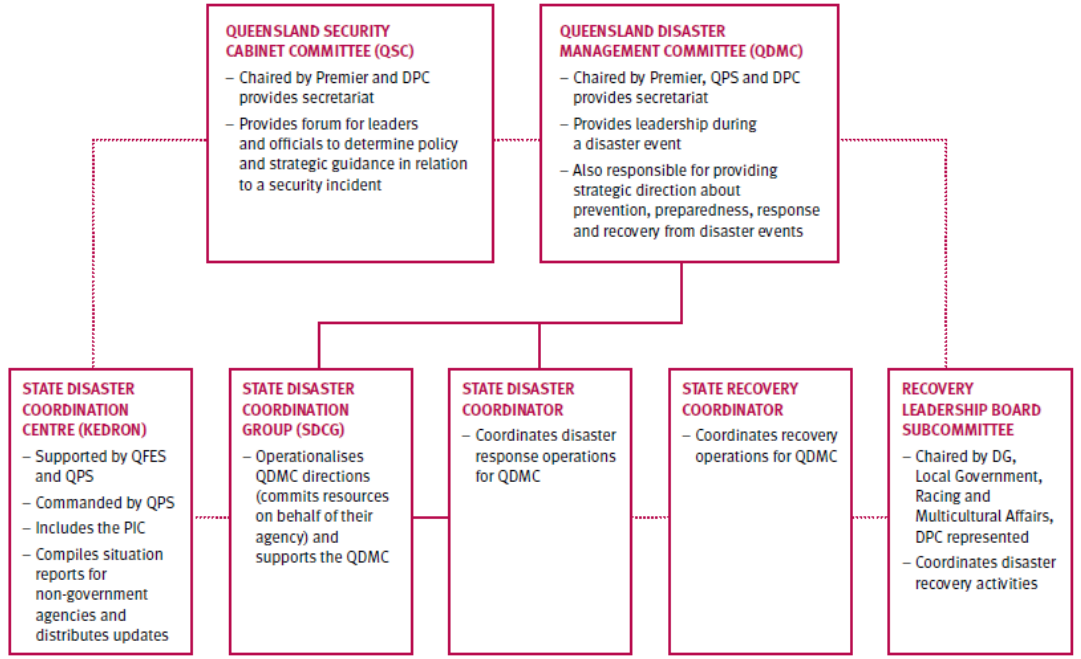
- Communication with stakeholders needs clarity of roles and responsibilities of the lead and supporting agencies
- Need to ensure coordinated, consistent communication
- Need to protect and manage Government's reputation
- Use key principles for coordinating public information: *empathy, consistency, integrity, collaboration and effectiveness*.

Case study: Australia
SDCC disaster planning

Road authority learning continued

- SDCC needs to consolidate and coordinate multiple agency information:
  - Disaster warnings
  - Emergency alerts and dealing with disasters
  - Media updates (live and sign language interpretation from a media room)

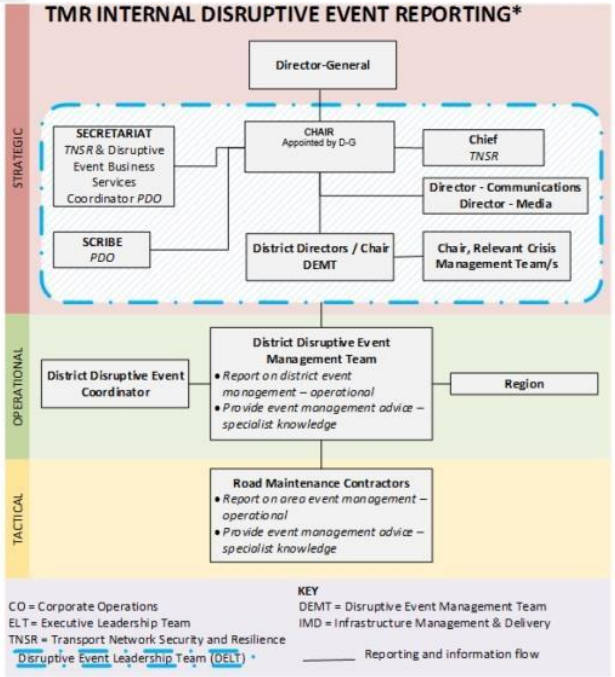
- Information outlets: TMR website, social media (FTIL), Call Centre, QLDTraffic app, Notices to Mariners, TransLink website, MyTranslink app (push notifications)



Case study: Australia
Cyclone Debbie 2017

Event facts

- Severe Tropical Cyclone (STC) with major flooding in C and SE Queensland and NE New South Wales



Road authority learning

- Response considered a success, all levels of government worked together.
- Communication learning – (1) cross-district coordination to staff and stakeholders is key, (2) loss of power or mobile network capacity issues required VHF radio, (3) industry communication helped to save harvests from floods
- Community social media using QLDTraffic successful

Case study: Australia Cyclone Debbie 2017

Road authority learning continued

- Preparation phase - districts built situational awareness using flood sensors, CCTV, disruptive event monitoring and tools to map high risk roads and bridges

- Response phase – (1) road clearance and land slip repairs to allow emergency vehicles access to assess local community impact, (2) Recording Asset Damage and Restoration (RADAR) app collected GPS data to prove eligibility of disaster recovery works for national funding, (3) road closure protocols with real time travel information (4) Flood Recovery Road Access Group (FRRAG) provided permitting and network access to freight and heavy vehicles.

Case study: USA 2017 Wildfires Social networking (SNS)

Event facts

- 2017 Californian wildfires
- 9,000+ fires, >$18b costs, 40+ fatalities
- Caltrans Public Affairs HQ and 12 district Public Information Officers (PIOs) provided 24/7 information to the public through Facebook, Twitter, YouTube and the Department's website

Caltrans Responds to State's Largest Ever Wildfire - Caltrans News Flash #179

CaltransVideo
6 days ago • 1,802 views
The Mendocino Complex is now the single largest wildfire in California's history. In this Caltrans News Flash, Public Information ...
NEW CC

Road authority learning

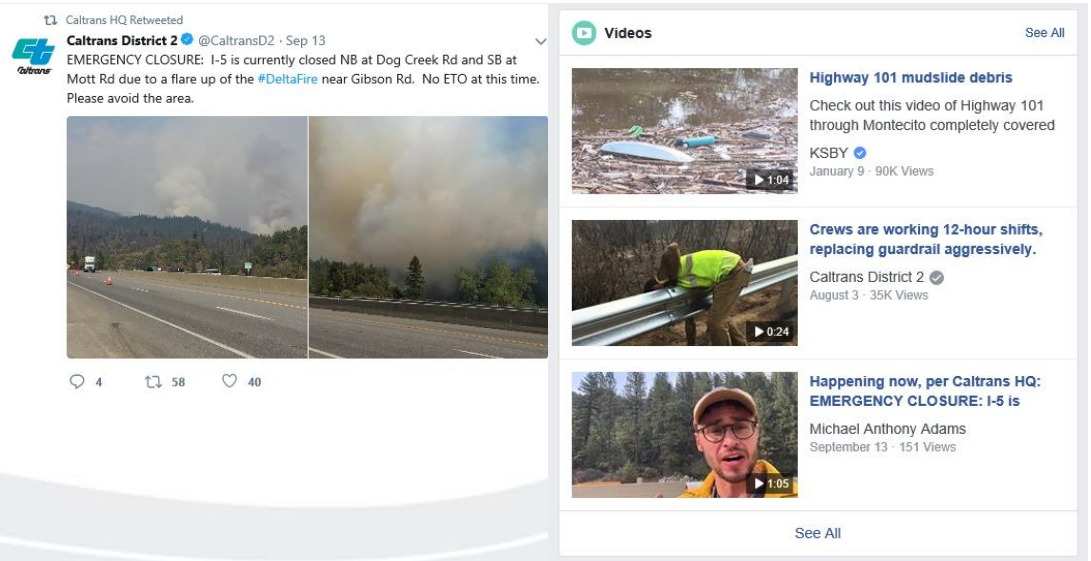
- Caltrans used the speed, frequency and simplicity of SNS communications as a key tool to inform the public during wildfires
- Because of current smart phone technology and distribution, well worded posts with graphics provided greater clarity and accurate information to effected populations and first responders alike.

Case study: USA 2017 Wildfires Social Networking (SNS)

Road authority learning continued

- Future developments include more safety messaging across several platforms, better use of SNS analytics to track audience preferences, better implementation approaches based on performance metrics, and enhanced use of mobile technologies.

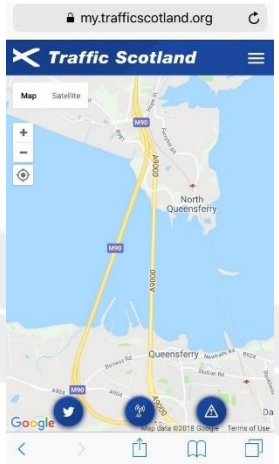
- For example increasing the SNS footprint includes Google Analytics to monitor information dissemination and frequency of use. Tracking of post viewings allows adjustments to the needs of the consumer.



Case study: UK
Forth Road Bridge Closure

Event facts

- Forth Road Bridge provides a strategic east coast Scotland link with a 22 mile detour if closed
- Structural failure led to bridge closure from 3rd December 2015 to 20th February 2016 (partially reopened 23rd December)



Road authority learning

- Repair and Resource Plan was developed in 48 hours (including staff rotas)
- Major Event cell created to develop Traffic Diversion Plan and Communications Strategy
- All actions planned and recorded for future scrutiny auditing and to capture lessons learned

Case study: UK
Forth Road Bridge Closure

Road authority learning continued

- ‘Feeding the media machine’ was vital to inform all stakeholders during mitigation development and bridge repairs all the way to reopening

- Social media played a key role during the 3-month closure: 13.5million tweets (33% increase), 4.5million Facebook impressions (64% increase) and 1.1million visits to forthroadbridge.org (178% increase)
- Building and maintaining experienced multi-skilled resilience team (with frequent training and resilience built-in)

Case study: UK (Northern Ireland) Community resilience

Event facts

- Significant rainfall and flooding in 2012
- ‘Flood warning and informing Strategy’ developed by NI Government
- Uses existing weather and river level information to warn and support communities at known flood risk areas to improve flooding preparedness
- Multi-agency Regional Community Resilience Group (RCRG) formed in 2013

Road authority learning

- Aim is to help local communities prepare and respond to weather related emergencies affecting property, roads and local communities
- Communities manage their own local plans and materials to respond quickly and relieve pressure on finite resources of emergency services

Regional Community Resilience Group

Case study: UK (Northern Ireland) Community resilience

Road authority learning continued

- Development of communities' appetite to 'self-help' has been key. Includes flood protection to houses, municipal buildings and some road protection.

- Communication is key - understanding the limitations of weather warnings and joint responsibilities to deliver local response is vital
- Newsletters reinforce messages

Early conclusions

Perception of risk and influence on disaster management

- Risk-awareness is a key influence on the ability of a country to prepare for managing disasters
- Similar types of disaster management technologies are used by all surveyed countries for some counter measures
- Developing countries can use shared learning to mitigate impacts including disaster information planning and disaster management responses

Early conclusions

Disaster management with the public

- Road organisations need to not only develop a mitigation strategy, but use their risk-awareness to develop an adaptation strategy
- Organisations are increasingly using SNS and ‘self-help’ within local communities to provide more effective disaster information and improve local resilience
- Effective disaster management engagement with the public is a key potential strategy for mitigating the effects of disaster events.

Thank you

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