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An Asset Management perspective for Railways Infrastructures resilience on the cases of Extreme Weather Events

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«The species which survive aren't the strongest species, nor the more intelligent, but the ones which adapt themselves to the evolutions»

Charles Darwin (1809-1882)

Disaster definition

- A natural disaster is a serious disruption to a community or region caused by the impact of a naturally occurring rapid onset event that threatens or causes death, injury or damage to property or the environment and which requires significant and coordinated community response.
- Such serious disruption can be caused by any one, or a combination, of the following natural hazards: bushfire; earthquake; flood; storm; cyclone; storm surge; landslide; tsunami; meteorite strike; or tornado.

Such natural hazards are difficult to foresee and effectively guard against other than through disaster risk assessment and disaster mitigation.

Resilience

Resilience is “action taken to reduce or eliminate long-term risk to people and property from hazards and their effects”.

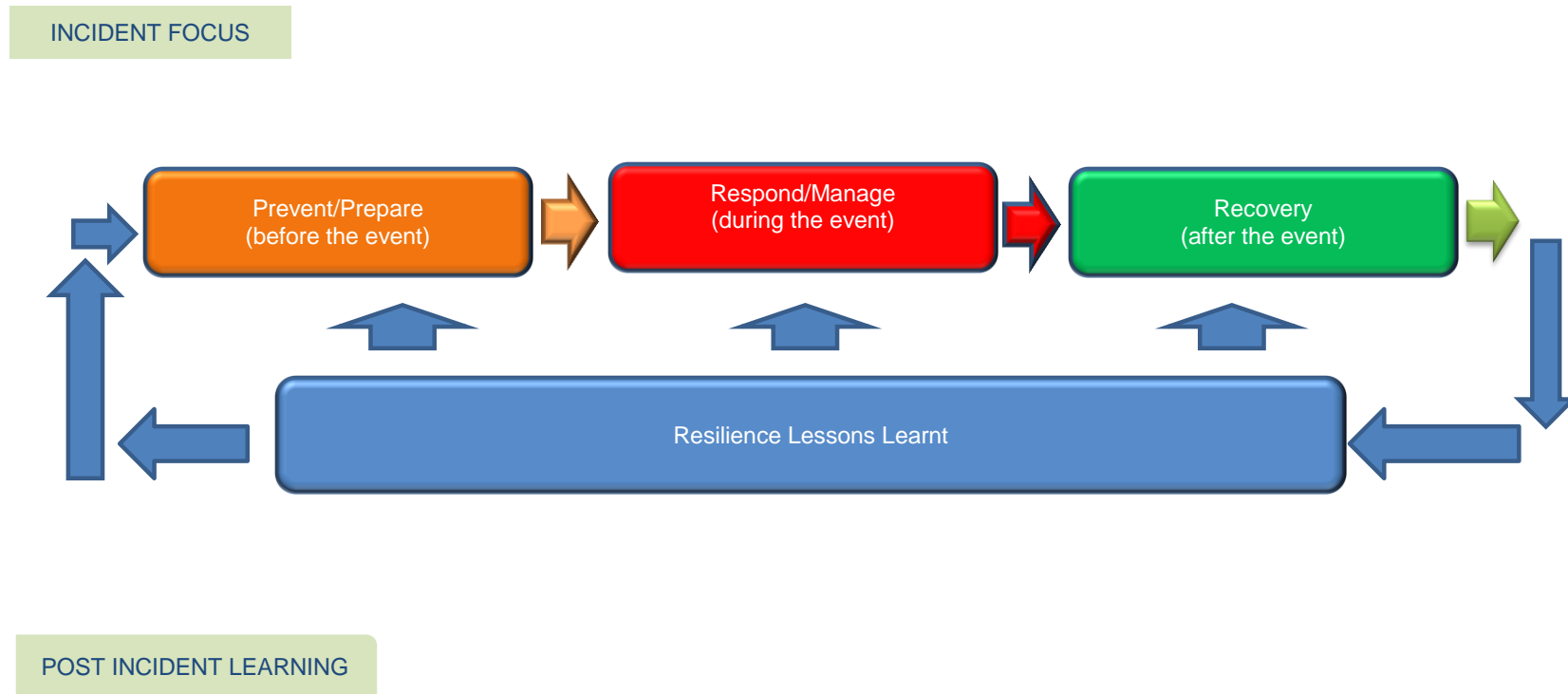
In the context of critical infrastructure, resilience refers to:

- *coordinated planning across sectors and networks*
- *responsive, flexible and timely recovery measures, and*
- *the development of an organisational culture that has the ability to*

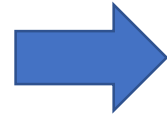
provide a minimum level of service during interruptions, emergencies and disasters, and return to full operations quickly.

In this way, building capacity in organisations to be *agile, adaptive and to improve by learning from experience.*

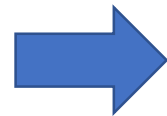
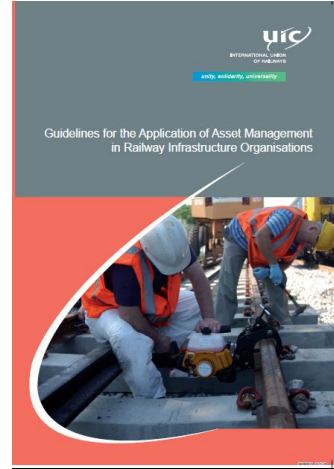
Resilience in Sequence



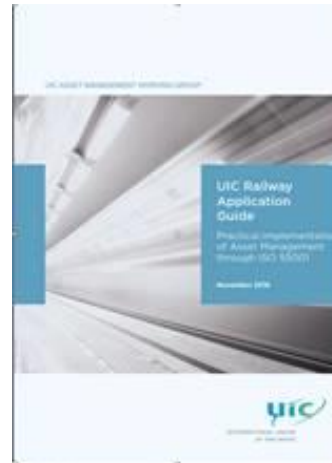
Development of AM Guidelines



2010



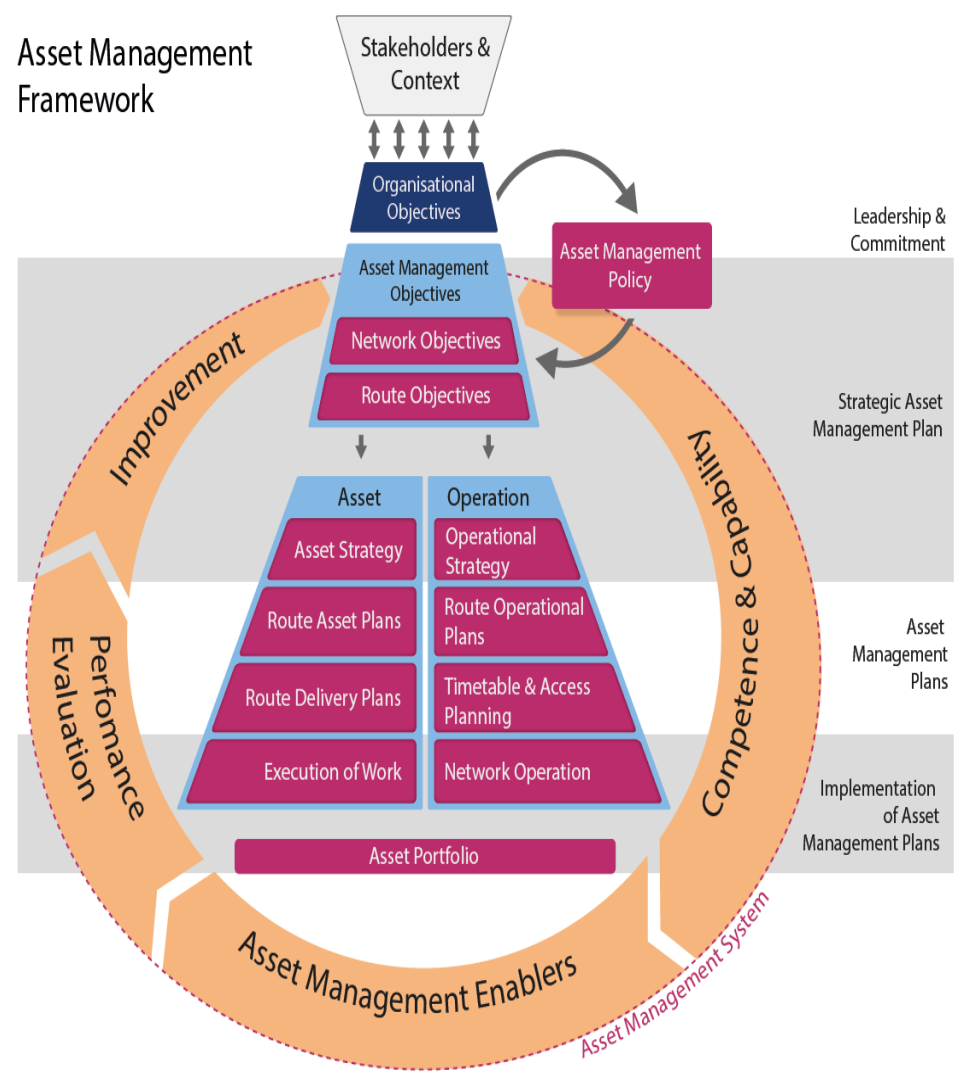
2017



- General requirements in PAS 55 and ISO 55001 can be applied within a railway context
- Implementation guidelines need to be sector specific
- Target audience for the guidelines
 - Individual railways
 - Benchmarking Groups
 - Research programmes

UIC Asset Management Framework

- Describes the strategic, planning and delivery processes
- Railway specific, covers assets and operations
- Plan, Do, Check, Act cycle
- Identifies key enablers
- Supports continual improvement



Life cycle activities to improve the resilience of rail assets

	PREVENTION AND PREPARATION (before the event)	RESPOND/MANAGE (during the event)	RECOVERY (after the event)
Asset Creation/Acquisition			
Asset Operation			
Asset maintenance and improvements			
Asset Disposal			

	PREVENTION AND PREPARATION (before the event)	RESPOND/MANAG (during the event)	RECOVERY (after the event)
Asset creation/ acquisition	<p>Integrated Land and Transport Planning</p> <p>Corridor selection considerations</p> <p>Opportunities to share alignment and formation with other mode to improve risk mitigation and reduce land and construction costs (rail)</p> <p>Integrated design approach : consider other assets that can reduce the impact</p> <p>Risk based design</p> <p>Resilient Design – safe to fail</p> <p>Asset Redundancy</p> <ul style="list-style-type: none"> - back ups <p>Smart technologies</p> <ul style="list-style-type: none"> - Fire proof railcars - Smart-truck - Real time flood monitoring 	<p>NA</p>	<p>Design review to identify if current approach supports resilience</p>

	PREVENTION AND PREPARATION (before the event)	RESPOND/MANAGE (during the event)	RECOVERY (after the event)
Asset operation	<p>Asset Plans linked to resilience Level of Service</p> <p>Resilience KPIs: e.g. Rail Closure due to flooding</p> <p>Critical infrastructure, e.g. strategic links, critical assets, the most vulnerable in the category</p> <p>Cross assets/agencies/sectors dependability</p> <p>Identify alternative Routes Alternative Modes</p> <p>Risk assessment and mitigation scenarios</p> <p>Agency's emergency plans</p> <p>State and Interagency emergency Agreements and Protocols</p>	<p>Road /rail track closures (partial or total)</p> <p>Signs/signals/alerts on the ground to prevent access</p> <p>Ongoing monitoring of weather conditions</p> <p>Communication protocols (internally and externally) One source of messages</p> <p>Emergency Alert Community Warning' (Emergency Alert) system</p> <p>Provide alternative routes/detouring</p> <p>Alternative modes</p>	<p>Asset Recovery Plans – priorities</p> <p>Reconstruction at and improved resilient standard</p> <p>Coordination of utility services recovery</p> <p>Relocation of utility services (e.g. power and telecomm) under ground)</p>

	PREVENTION AND PREPARATION (before the event)	RESPOND/MANAGE (during the event)	RECOVERY (after the event)
Asset operation	<p>Real time information (weather bulletins and forecasts (e.g . Firewatch Aurora; Monitoring water level - sensors, video camera data)</p> <p>Bush fire and cyclone ranking and alert protocols</p> <p>Funding Recovery Arrangements</p> <p>Contracts in place for post-disaster management (for annually recurring events)</p> <p>Resources (Identify and ensure access plant, materials, specialised workers)</p> <p>Insurance</p>	<p>Emergency Teams</p> <p>Lead Agency</p> <p>Coordinated activities (internally and with the external agencies)</p>	<p>Traffic management and ongoing information to the community</p> <p>Partial and total opening for traffic operations</p> <p>Funding access protocols</p> <p>Insurance access protocols</p> <p>Lessons Learnt (the approach next time)</p>

	PREVENTION AND PREPARATION (before the event)	RESPOND/MANAGE (during the event)	RECOVERY (after the event)
Asset Maintenance	<p>Maintenance Strategy linked to resilience Maintenance Level of Service</p> <p>Asset Condition : % of the network in Good, Medium or Poor ; critical assets identified</p> <p>Additional attention to critical and most vulnerable assets and critical deficiencies</p> <p>Routine Maintenance Program e.g. Drainage inspections and management Vegetation clearance/control e.g. around timber bridges, Severe pavement failure</p> <p>Asset Preservation Program</p> <p>Prescribed burning (fuel hazard reduction)</p>	Activities as required	<p>Focus on maintenance activities to restore the service</p> <p>Debris clearing</p> <p>Inspections to assess the damage</p> <p>Lessons learnt – may need to review the Maintenance Strategy, inspection and programs</p>
Asset Disposal/ Decommissioning	Does the disposal of the asset create any risk in regard to the impact of disasters ?		

Conclusions

- Transport Infrastructure is critical infrastructure
- The risks to critical infrastructure from natural hazards are increasing globally
- Asset managers and custodians of the public infrastructure assets have a responsibility to reduce the impact of natural disasters on the asset and hence on the community and restore services as soon as possible
- A **Resilience** based approach containing: prevention and preparation, response and recovery measures and lessons learnt activities is considered to be the ultimate objective in the context of hazard mitigation.

Conclusions

- The goal is not only to survive or recover, but to adapt and transform over time as to better respond to a changing environment.
- Asset Managers need to ensure resilience activities are embedded in the organisation's asset management processes and systems.
- Resilience needs to be considered from the planning and design stage of an asset through operation, maintenance, improvements and disposal.
- Organisational resilience facilitates a resilient infrastructure

***The battle of resilience by Asset
Management is won in the design phase***

Thank you

UIC ASSET MANAGEMENT WORKING GROUP

**UIC Railway
Application
Guide**

Practical implementation
of Asset Management
through ISO 55001

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