IMPROVED RISK EVALUATION AND IMPLEMENTATION OF RESILIENCE CONCEPTS TO CRITICAL INFRASTRUCTURE

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Paradigm shift: from protection to resilience

- Protection has been deemed impossible for unexpected events, too costly as well as potentially leading to a false sense of security

- Resilience:
  - “The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management” - UNISDR

- Resilience is really nothing new
  - There is a strong desire to incorporate existing methods and information, without overloading operators with new analysis techniques
IMPROVER: objectives

- Understand the definition of resilience

- Understand how this can be measured

- Help operators to measure, evaluate and improve the resilience of their infrastructure **via a framework**

- With the ultimate goal of maintaining the ability of systems to continue to provide the service required
The IMPROVER Framework

- Establishing the context
  - User needs, expectations or tolerances

- CI risk assessment
  - CI risk identification
  - CI risk analysis
  - CI risk evaluation
  - CI risk treatment (reducing threat, vulnerability, impact, etc)

- CI resilience assessment
  - CI resilience analysis
  - CI resilience evaluation
  - CI resilience treatment (Improving the absorptive, adaptive and restorative capacity)

- Monitoring and review

- Communication and consultation
Establishing the context (1/2)

- Systems identification
- Determine resilience domains of the analysis
- Set system boundaries
- Outline structural components
- Set performance measures
- Criteria for risk and resilience evaluation
- Existing methods and approaches for risk and resilience assessment
Establishing the context (2/2)

- Guideline for developing these surveys for other sectors

**Establishing the context**

User needs, expectations or tolerances

- Maximum acceptable duration
  - Transportation for emergency services only
  - Alternative means
  - Reduced capacity or frequency of service
  - Local diversion
CI risk assessment

Best practices, operator risk assessments, national risk assessments, sector specific guidelines and methods

CI risk assessment

CI risk identification

CI risk analysis

CI risk evaluation
CI resilience assessment

- Other similar organisations
- The same organisation over time
- The performance with user expectations

\[ R_{T_{con}} = \int_{t_0}^{t_{0+T_{ref}}} Q \, dt \]
CI resilience treatment

- CI resilience assessment
  - CI resilience analysis
  - CI resilience evaluation

- CI resilience treatment
  (Improving the absorptive, adaptive and restorative capacity)

- Detailed statement of:
  - Technological resilience: which of the absorptive, adaptive, restorative capacities the system under study is deficient in
  - Organisational resilience: which organisational process(es) need(s) to be improved
  - Across multi-domains: which resilience indicators need to be improved
Communication and consultation

- CI communication guidelines
  - managing expectations
  - promoting engagement with the public
The IMPROVER Framework

Establishing the context

CI risk assessment
- CI risk identification
- CI risk analysis
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CI resilience assessment
- CI resilience analysis
- CI resilience evaluation
- CI resilience treatment (Improving the absorptive, adaptive and restorative capacity)

User needs, expectations or tolerances

Monitoring and review

Communication and consultation
Testing the IMPROVER framework: Pilot Implementations

- 5 living labs:
  - Municipality of Barreiro
  - French A31 highway
  - Budapest M1 Highway
  - Port of Oslo
  - The Oresund Region
Highlights and ongoing work

- To operationalise resilience, needs to be integrated into existing security activities
  - Enriches risk assessments with information about the resilience of critical infrastructure

- We propose
  - A generic framework for the integration of resilience management into risk management
  - 4 methodologies for resilience analysis

- Pilot implementation of the framework
  - Using various analysis and evaluation methodologies
  - Applied to the municipality of Barreiro and the ring road around Budapest
Thank you!

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