INFRARISK

HOW RESILIENT IS EUROPEAN CRITICAL INFRASTRUCTURE TO THE EFFECTS OF NATURAL HAZARDS...?

INFRARISK or NOVEL INDICATORS FOR IDENTIFYING CRITICAL INFRASTRUCTURE AT RISK FROM NATURAL HAZARDS is a 3 year EU 7th Framework Funded Research Project aimed at developing reliable STRESS TESTS to establish the resilience of Critical European Infrastructures to rare low frequency extreme natural hazard events and to aid decision making in the long term regarding robust infrastructure development and protection of existing infrastructure. INFRARISK will enable infrastructure managers to minimise the impact of extreme events by providing them with the tools to develop robust mitigation and response strategies. The project consists of eleven partners from seven different countries including universities, research institutions, SME's and Large Enterprise.

WHY?

- Europe is the 3rd most effected region in the world based on average 10 year disaster costs of €10 Billion
- Increase in natural hazards expected over next 50 years
- Increased land occupation
- Eastwards expansion of the EU
- Human activity in hazard zones
- Climate change
- Ageing infrastructure
- Increase in Traffic Volume
- Interdependent Networks
- Lack of resources

HOW?

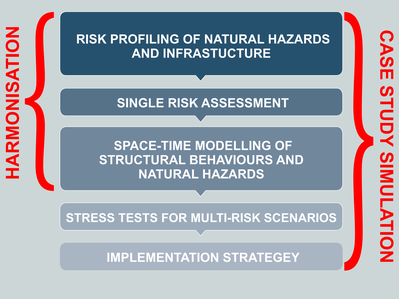
By developing novel indicators for identifying critical INFRAstructure at RISK from natural hazards INFRARISK will:

- Develop reliable STRESS TESTS to establish the resilience of Critical European Infrastructures to rare low frequency extreme natural hazard events
- Aid decision making in the long term regarding robust infrastructure development and protection of existing infrastructure

EXPECTED IMPACTS

- Improved & more reliable stress tests of Critical Infrastructure
- Support for decision making & Prioritisation in the field of mitigation options and support to preparedness
- Pan European and Optimised risk assessment process
- Optimised operational risk assessment for maintenance and management
- Resilience to climate risks
- Decoupling of economic growth & energy use

METHODOLOGY



Risk Profiling of Natural Hazards and Infrastructures

Develop a Database of Critical Infrastructure in Europe, identifying the risks posed by natural hazard events and develop methods to estimate the effects of climate change on the occurrence of natural hazards.

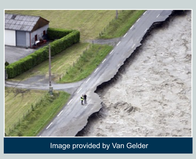


Image provided by Van Gelder


Image provided by Tucker


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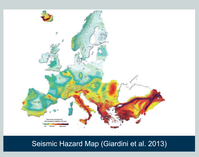
Image courtesy of Erdik (1999)

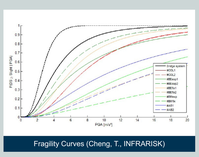
Single Risk Assessment

Single event risk analysis methodologies for seismic, flood and landslide hazards to evaluate the probability of occurrence of actions on infrastructural elements/networks and resulting physical consequences to the elements/networks.


Landslide Hazard Map (Panagos et al. 2012)

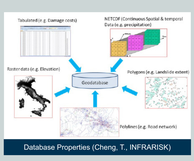

Seismic Hazard Map (Giardini et al. 2013)


Flood Hazard Map (Alfieri et al. 2013)

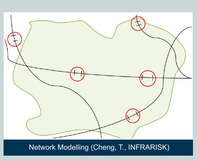

Fragility Curves (Cheng, T., INFRARISK)

Space-Time Modelling of Structural Behaviours and Natural Hazards

Develop space-time models to analyse the impact of natural hazards on structural behaviours of critical infrastructures that may be location (space) or/time dependent.



Database Properties (Cheng, T., INFRARISK)

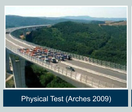

Network Modelling (Cheng, T., INFRARISK)

Harmonisation

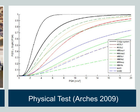
Develop an overarching process by which infrastructure managers can identify the risk related to critical infrastructure. THe overarching methodology or HARMONISED risk process will be used to evaluate the risks associated with multiple infrastructure networks for various hazards with spatial and temporal correlation. It will capture and incorporate, into a GIS platform, outputs from the extensive profiling of natural hazards and infrastructure, the analysis of single event risk for multiple hazards and the space time variability of a Critical Infrastructure network.

Stress Test for Multi-Risk Scenarios

The purpose of the stress test is to be able to quantify the probability of failure more accurately i.e. to reduce uncertainty. A Stress test framework will be developed for the evaluation of the consequences that would be incurred if the critical scenarios identified in previous work streams realised.

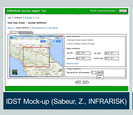

Physical Test (Arches 2009)


Actual Observations (Image provided by Gavin, K).


Physical Test (Arches 2009)

Implementation Strategy

Specify, design and develop a strategic INFRARISK Decision Support Tool (IDST) to ensure that the INFRARISK stress tests and the harmonized risks management methods are practically integrated and used under specific process workflows and modules. In other words it will provide computational support to the risk assessment process.


IDST Mock-up (Sabeur, Z., INFRARISK)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Case Study Simulation

Test the applicability and validate the effectiveness of the tools and methodologies developed in INFRARISK through the simulation of complex case studies consisting of Road & Rail Infrastructure of the TEN-T Transport network and elements thereof.


TEN-T Road Network (EC '13)


Rio Torto Viaduct (Di Sarno et al. 2011)


TEN-T Road Network (EC '13)


Rječina Bridge (Lažeta et al. 2008)

FOR FURTHER INFORMATION

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- Alfieri, L., Salamon, P., Bianchi, A., Neal, J., Bates, P. and Feyen, L. (2013). Advances in pan-European flood hazard mapping. Hydrol. Process., doi: 10.1002/hyp.9947
- Casas, Joan R. , Piotr Olaszek, Aljoša Najna, Aleh Nyskarš, Igor Lavrič, Recommendations on the use of soft, diagnostic and proof load testing, Report ARCHES Assessment and Rehabilitation of Central European Highway Structures, August 2009
- Di Sarno, L., Giannini, R., Pantoacci, F., and Taucer, F. (2011). Seismic analysis and retrofitting of an existing R.C. highway bridge part I: Assessment of the "as-built" configuration', ANIDIS 2011, Bari, Italy.
- Erdik, M., Report on 1999 Kocaeli and Duzce (Turkey) Earthquakes', Bogazici University - Department of Earthquake Engineering
- European Commission, (2001). The Network Corridors, Trans European Transport Network
- Giardini, D., Woessner, J., Danciu, L., Crowley, H., Cotton, F., Grünthal, G., Pinho R., Valensise G. and the SHARE consortium, (2013), SHARE European Seismic Hazard Map for Peak Ground Acceleration, 10% Exceedance Probabilities in 50 years, doi: 10.2777/03345, ISBN-13, 978-92-79-25145-1
- Lažeta, T. et al. (2008). Projekt ţeleznička pruge Botovo – Zagreb – Rijeka. In: Sabor hrvatskih graditelja
- Panagos, P., Van Liedekerke, M., Jones, A. and Montanarella, L., (2012). European Soil Data Centre: Response to European policy support and public data requirements, Land Use Policy, 29, 329-338.

INFRARISK Consortium

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