Risk Assessment and Management for High-Speed Rail Systems

**Funding:** National (Portugal)

**Duration:** Nov 2007 - Oct 2010

**Status:** Complete with results

**Background & policy context:**

High-Speed Rail (HSR) system's construction and operation is a complicated management subject involving environmental issues, train schedules, safety, rolling stock and infrastructure reliability (transport infrastructures are critical and vulnerable). The design and safety/performance assessment of transportation facilities should include an understanding of the physical environment and also take into account various other dimensions of risk. In a global framework, technical risks as well as natural hazards risks must be considered, in both assessment and management perspectives. The project aims at incorporating environmental risks (e.g. hydrologic, geotechnical and seismic), technical risks (e.g. excessive vibrations) and robust measures into decision models for proactive risk management.

**Objectives:**

The project is organized around the following specific objectives:

- Characterizing hydrologic risk (rainfall and flood hazards) along the high-speed rail line
- Characterizing geotechnical and seismic risks and establishing mitigation strategies
- Developing, validating, and applying advanced methodologies for the analysis and assessment of the effects of mitigation measures to the risk of excessive vibrations (or deformations) in the railway track induced by the circulation of trains at high speeds
- Developing Decision Analysis Tools for HSR construction along with the associated optimization approaches for the allocation of resources
- Developing, validating, and applying advanced methodologies for the assessment of earthquake effects on the infrastructures of high-speed railway systems, and developing a methodology for the implementation of an integrated monitoring system for railway systems

**Parent Programmes:**

MIT Portugal Programme - MIT Portugal Programme

**Institute type:** Public institution

**Institute name:** Fundação para a Ciência e a Tecnologia (FCT)

**Funding type:** Public (national/regional/local)

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Key Results:

- Estimation of extreme rainfall events, e.g. in the form of intensity-duration-frequency (IDF) curves, which can be used to evaluate slope stability and flood risk and predict the frequency of unfavourable operating conditions due to intense rainfall.
  - Development of enhanced geology decision-making model to predict/avoid major accidents during tunnel construction. The model allows use of parameters observed during tunnel excavation to serve as alarms and implement mitigating measures.

- Extension of Decision Aids for Tunnelling (DAT) to any linear/networked infrastructure with specific application to the high speed rail lines in Portugal, enabling cost/time prediction under uncertainty.

- Development of optimization model using simulated annealing that allows one to optimize rail/highway alignments under a variety of technical, operational and environmental constraints.

Documents:
- ResearchPrject2008_Trans_RISK.pdf

STRIA Roadmaps: Infrastructure  
Transport mode: Rail transport  
Transport sectors: Passenger transport, Freight transport  
Transport policies: Safety/Security, Societal/Economic issues  
Geo-spatial type: Other