



SIRMA

STRENGTHENING INFRASTRUCTURE RISK
MANAGEMENT IN THE ATLANTIC AREA

NEW FRAMEWORK FOR INFRASTRUCTURE RISK MANAGEMENT AFFECTED BY EXTREME NATURAL EVENTS

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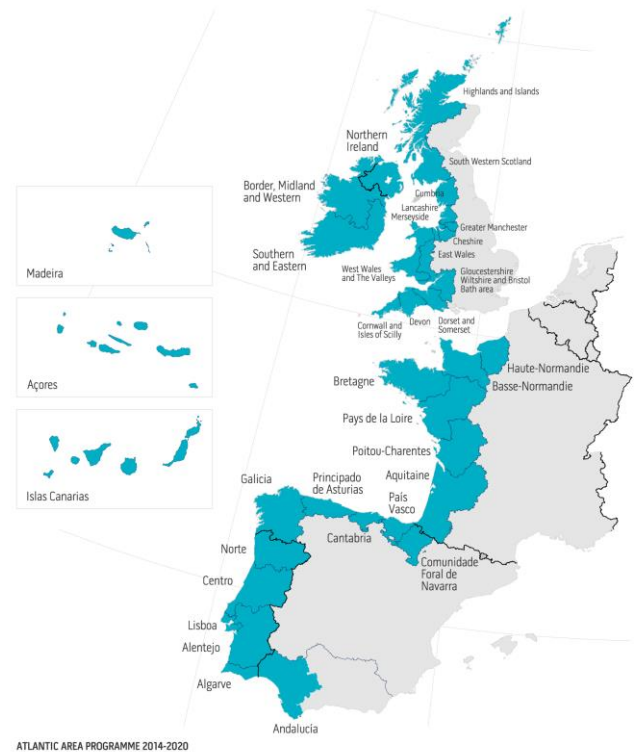
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SUMMARY

- Most of the transportation of people and goods in the Atlantic Area is made through rail and road. The performance of this infrastructure is directly affected by extreme natural events and by the strong corrosion processes that result from proximity to the Atlantic Ocean.
- **SIRMA (Strengthening Infrastructure Risk Management in the Atlantic Area)** project aims to develop a robust framework for the management and mitigation of extreme natural events, by implementing immediate, medium and long-term measures, thus increasing the resilience of transportation infrastructure.
- With this framework it is expected to reduce the consequences of extreme natural hazards, such as flood and fire, for people and on the local and national economy.
- It is also expected that this framework can be generalized and implemented in other countries (not only in the Atlantic Area).



CONSORTIUM

Entity	Position	Country	Region
Universidade do Minho	Lead partner	Portugal	Norte
University College Dublin	Partner	Ireland	Southern and Eastern
Universidade de Vigo	Partner	Spain	Galicia
Université de Nantes	Partner	France	Pays-de-la-Loire
University of Surrey	Partner	UK	South East England
AZVI, SA	Partner	Spain	Andalucia (Huelva, Cádiz and Sevilla)
Iarnród Éireann (Irish Rails)	Partner	Ireland	Southern and Eastern
Infraestruturas de Portugal, SA	Partner	Portugal	Lisboa
The University of Birmingham	Partner	UK	Northern Ireland
Queen's University Belfast	Associated partner	UK	West Midlands



Universidade do Minho



UNIVERSIDADE DE VIGO



UNIVERSITÉ DE NANTES



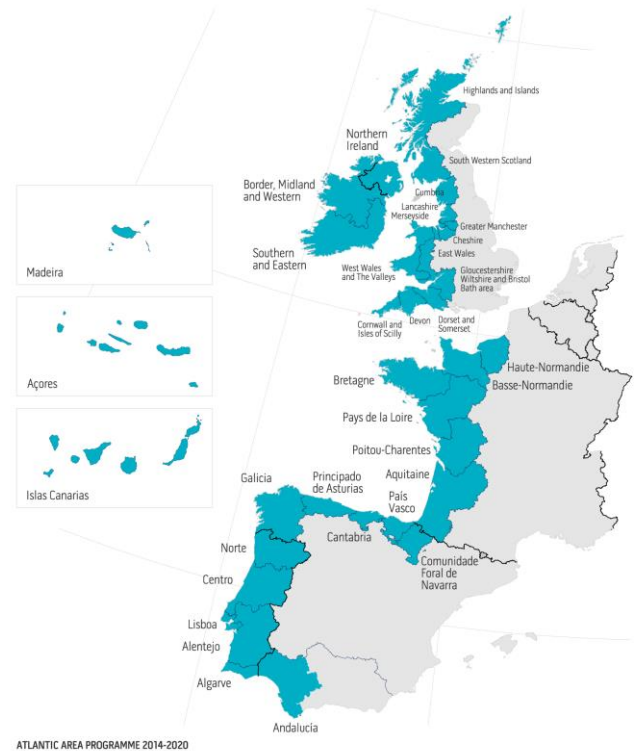
UNIVERSITY OF SURREY



QUEEN'S UNIVERSITY BELFAST

OBJECTIVES

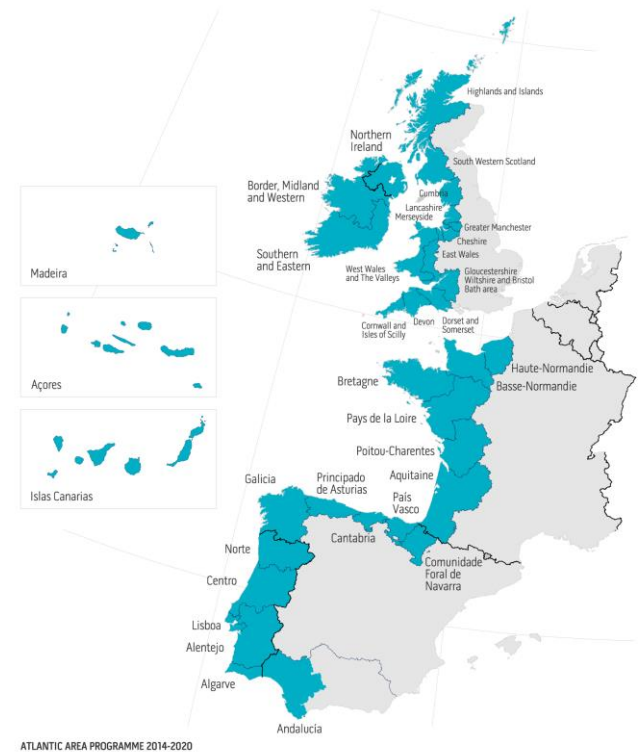
- Development of a systematic methodology for risk-based prevention and management (procedures for inspection, diagnosis and assessment);
- Implement a decision making algorithm for a better risk management;
- Create a hierarchical database (inventory data, performance predictive models, condition state indicators and decision-making tools), where information can be exchanged between entities and across regions/countries;
- Development of a real-time process for monitoring the condition state of transportation infrastructure;
- Enhance interoperability of information systems in the Atlantic Area, by taking account of data normalization and specificity of each country.



METHODOLOGY

To achieve the project aim and objectives, it was proposed the distribution into different work packages:

- Climate change & natural hazards in Atlantic Area;
- Instrumenting transportation infrastructure for extreme natural hazards;
- Risk & resilience-based decision-making procedure for transportation infrastructure;
- Test bed.





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CLIMATE CHANGE & NATURAL HAZARDS IN ATLANTIC AREA

CLIMATE CHANGE

PARTNERS:

- Université de Nantes (Lead)
- University of Surrey



ACTIONS:

- Database for structural lifetime assessment under climate change scenarios
- Stochastic model for extreme events
- Methodology for assessment of infrastructure vulnerability and failure consequences

CLIMATE CHANGE

DELIVERABLES:

- Database containing climate change indicators under different scenarios for each selected location.
- Predictive models for non interceptable events necessary to evaluate the vulnerability/consequences of infrastructures subjected to such events.
- Framework to assess the vulnerability and failure consequences on transportation infrastructure depending on the infrastructure location and climate change scenarios (required to WP6).

RESULTS:

- A freely available database of climate change indicators that could be used in the future by anyone for estimating vulnerability of transportation infrastructure at different Atlantic regions.
- Increased capacity to predict extreme events through the developed algorithm, based on a given infrastructure asset location and climate change scenarios.



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INSTRUMENTING TRANSPORTATION INFRASTRUCTURES FOR EXTREME NATURAL HAZARDS

INSTRUMENTING

PARTNERS:

- University College Dublin (Lead)
- Universidade de Vigo



ACTIONS:

- Instrumentation Design and Calibration
- Development of Algorithms
- Development of Experimental Evidence Base

INSTRUMENTING

DELIVERABLES:

- Repository of Instrumentation Design for a Range of Deployment Scenarios, including the development of two reports: a numerical & experimental repository, and a guideline.
- Demonstrative benchmark, including a numerical repository on developed algorithms, software tools for bespoke SHM and feature of interest extraction, a report of algorithm performance, and implementation guidelines.

RESULTS:

- Customizable climate-aware instrumentation capable of quantifying information level & accuracy for decision-making frameworks.
- Guideline to allow infrastructure owners to deploy commercial monitoring with benchmarked performance.
- Novel software suite in portable and scalable climate-aware infrastructure monitoring for Atlantic Area hazard types.



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RISK & RESILIENCE-BASED DECISION-MAKING PROCEDURE

DECISION MAKING

PARTNERS:

- Universidade do Minho (Lead)
- AZVI, S.A.
- The University of Birmingham



Universidade do Minho



UNIVERSITY OF
BIRMINGHAM

ACTIONS:

- Risk-based model for transportation infrastructure
- Risk mitigation measures on transportation infrastructures
- Resilience-based decision-making

DECISION MAKING

DELIVERABLES:

- Risk-based predictive model (algorithm) for transportation infrastructures (includes climate change effects on the impact and return period of extreme events).
- Relational database with a list of risk mitigation measures for transportation infrastructures, their effects and costs.
- Framework (user-friendly software) for multi-criteria decision-making, i.e., by maximizing resilience and minimizing the risk mitigation measures costs.

RESULTS:

- Forecasting of transportation infrastructure performance to multiple hazards in Atlantic Area, comprising the likelihood of such extreme events and their impact in the infrastructures.
- Database with the most relevant risk mitigation measures, including their description, when should be used, with what time frequency, effects and costs (direct and indirect).



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TEST BED



TEST BED

PARTNERS:

- Iarnród Éireann (Lead)
- Infraestruturas de Portugal, SA



ACTIONS:

- Integration of existing data into the risk-based model and decision-making framework
- Integration of innovative indicators, obtained from the sensing system
- Application and validation of the SIRMA system with the test beds

TEST BED

DELIVERABLES:

- A risk-based model and decision-making system integrating a set of historical and existing data from the road and railway infrastructure networks (test beds in Portugal and Ireland).
- The models developed in WP6 will be validated, also integrating innovative indicators obtained from the sensor system developed at WP5

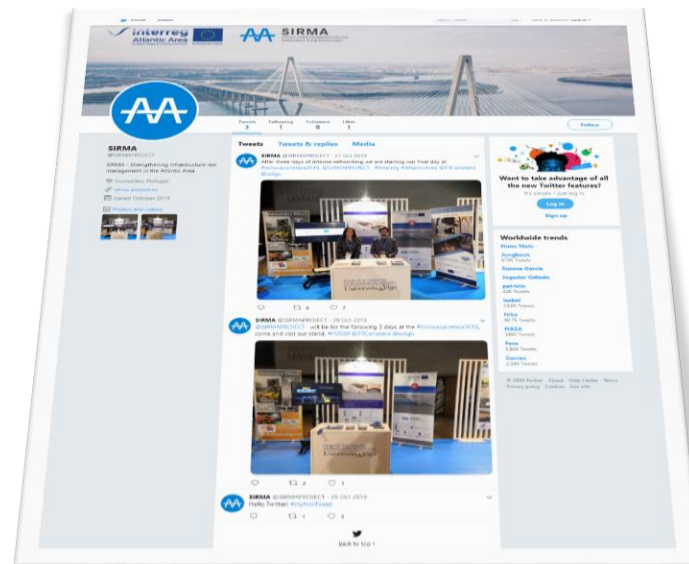
RESULTS:

- Improvement of risk based model and decision-making system.
- Integration of a set of historical and existing data from the road / railway infrastructure networks (test beds in Portugal and Ireland) will allow the validation of developed tool

SOCIAL NETWORKS



SIRMA-PROJECT.EU



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THANK YOU FOR YOUR ATTENTION

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