RESILIENCE OF ROAD INFRASTRUCTURE
PANOPTIS project

Silvia Ientile[1], Franziska Schmidt[1], André Orcesi[1], Boumediene Nedjar[1], Lucas Adelaide[1], Christophe Chevalier[2]

[1] MAST-EMGCU, [2] GERS-SRO

Financial support has been provided by the Innovation and Networks Executive Agency (INEA) under the powers delegated by the European Commission through the Horizon 2020 program "PANOPTIS-development of a decision support system for increasing the resilience of transportation infrastructure based on combined use of terrestrial and airborne sensors and advanced modelling tools", Grant Agreement number 769129. www.panoptis.eu

Project Partners include:

Introduction

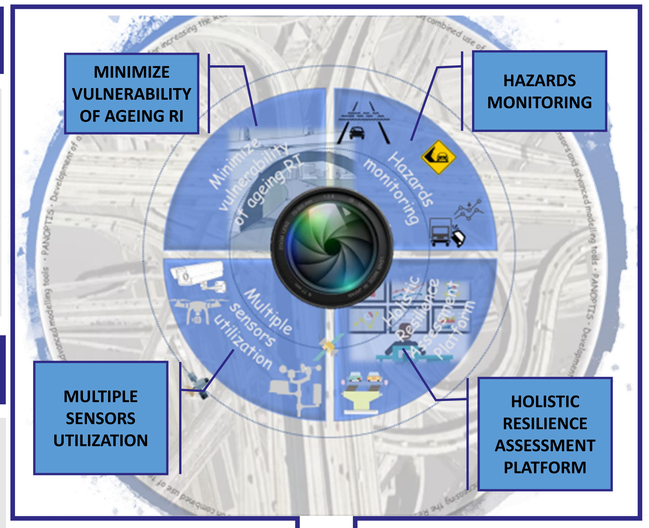
PANOPTIS project aims to improve the resilience of the road infrastructures (RI), to provide the operators with an integrated tool addressing multi-hazard risk understanding, smart prevention and preparedness, and faster, adapted and efficient response, combining down-scale climate change scenarios with structural and geotechnical simulation tools, and with actual data from sensors (terrestrial and airborne).

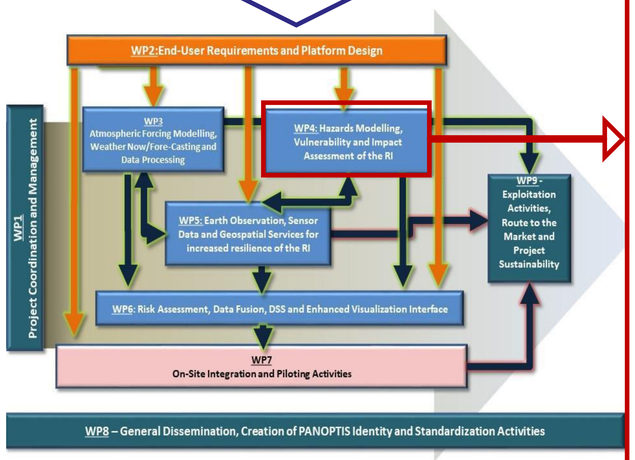
The project

- Multidisciplinary team of 14 partners, coordinated by AIRBUS DS SAS
- EU's Horizon 2020 framework, launched in May 2018 for a 42 months duration
- PANOPTIS integrated platform HRAP implemented for:
  - 77.5 km-long section of A2 Spanish Highway managed by ACCIONA
  - 66.2 km-long section of A2 Greek Motorway managed by EGNATIA ODOS

PANOPTIS Technologies

- Climate, Atmospheric Forcing and MultiHazard Modelling
- Networked micro-climate and smart tags
- Fore-Now/Casting Weather Predictions methods and tools
- Geotechnical and Structural Simulation Tool (SGSA)
- Multi-Hazard Vulnerability Modules and Assessment Toolkit for RI (Geo)Structures
- Quick Assessment Damage Maps
- Improved multi-temporal, multi-sensor observations with robust spectral analysis, computer vision and Machine Learning damage diagnostic for diverse RI





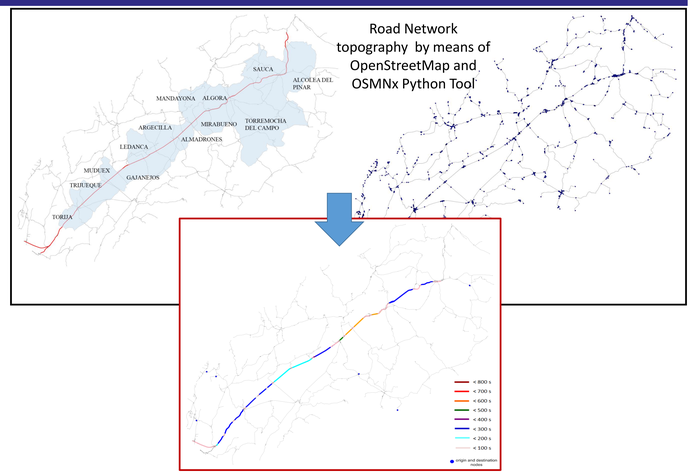
UGE/IFSTTAR is leader of WP4 - Multi-Hazards Modelling, Vulnerability and Impact Assessment of the RI:

NATURAL AND MAN-MADE HAZARD	RI ELEMENTS	VULNERABILITY ASSESSMENT	INPUT DATA MONITORED	COMPONENT INTEGRATED IN HRAP
Snow, ice	Pavement	Traffic management: speed, intervehicular distance	Measured friction	EARLY WARNING SYSTEM THROUGH MONITORING SENSORS
			Predictions	
		Optimization of deicing salt plan	Temperature	
	RC bridges	Chloride progression	Water levels	
			Sensors for corrosion	
Weather Actions	Lightweight steel structures	Fatigue assessment	Remaining Lifetime	
		Corrosion	Effects on strength and fatigue	
Earthquake	RC bridges	Structural Vulnerability	Accelerations	BRIDGE-SPECIFIC FRAGILITY CURVES CONSEQUENCE FUNCTIONS
	Slopes	Structural Vulnerability	Displacements	
Earthquake & Landslide (rainfall)	RC bridges founded on vulnerable slopes	Structural Vulnerability	Accelerations of bridge structure	
			Displacements of slope	

Complex network analysis

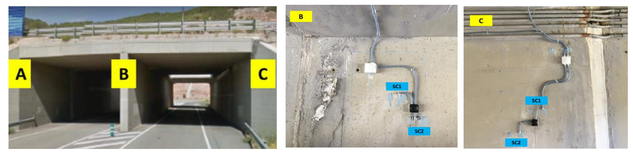
The application of the graph theory to RI network allows to carry out complex network analysis to assess the performance of the RI-network and road vulnerability, strictly related to the resilience concept for the protection against the risks and natural hazard they are exposed to.

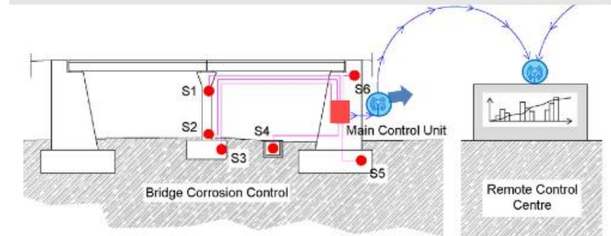
- Network functionality in terms of average increase of travel times.
- Loss of functionality as resilience indicator evaluated through shortest paths weighted by travel time

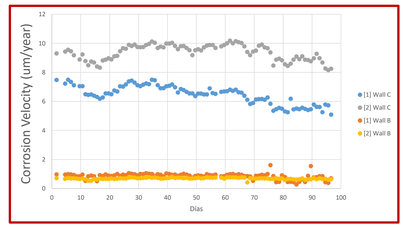


Monitoring of corrosion in RC bridges

Early Warning System through in-situ measurements by a remote-real-time-automated corrosion surveillance installed by Universitat Politecnica de Valencia for monitoring corrosion velocity in steel rebars of RC bridges structures.







Corrosion rate (um/year)	Corrosion Level
<1.16	negligible
1.6 to 5.8	low
5.8 to 11.6	moderate
>11.6	high

Thresholds according to Standard UNE 112072