Project Database
Spanish Railways Technological Platform

Monographic

RETOS INVESTIGACIÓN: Proyectos I+D+i
Spanish National R&D and Innovation Programme

**Rail Project Analysis
2013-2019 Calls**

January 2021 edition

GOBIERNO
DE ESPAÑA

MINISTERIO
DE CIENCIA
E INNOVACIÓN

AGENCIA
ESTATAL DE
INVESTIGACIÓN

Secretaría Técnica:
Technical Secretariat:

FUNDACIÓN DE LOS
FERROCARRILES
ESPAÑOLES

RETOS INVESTIGACIÓN Programme: Proyectos I+D+i

- Driven by the Spanish Ministry of Science and Innovation

- Seven competitive calls: 2013, 2014, 2015, 2016, 2017, 2018, 2019

- Analysis of awarded **RAIL** projects, according to the information available at the website of the Ministry and the information provided by the participating entities

- A total of 34 rail-related projects have been identified, from which 25 factsheets have been collected, provided by the participating entities

- Continously updated document

Identified projects

The following graphic shows the distribution of the 34 rail-related projects identified according to the year of the call in which they were selected for financing.

Number of rail-related projects identified per call for proposals
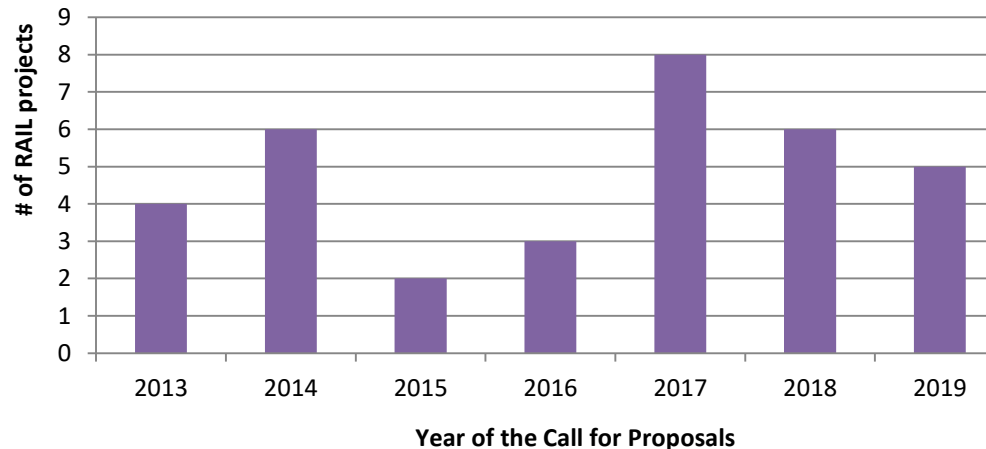
Beneficiaries

The 34 rail-related projects identified correspond to a total of 16 beneficiaries. These are the four entities with the highest number of awarded projects:

Beneficiary	# Projects
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	6
UNIVERSIDAD DE SEVILLA	4
UNIVERSIDAD DEL PAIS VASCO EUSKAL HERRIKO UNIBERTSITATEA	4
UNIVERSIDAD DE CASTILLA-LA MANCHA	3

Other entities participated in the following number of projects:

- 2 awarded projects: Centro de Estudios e Investigaciones Técnicas; Univ. de Granada; Univ. de la Iglesia de Deusto; Univ. Politécnica de Madrid; Univ. Jaume I de Castello; Univ. Politécnica de Catalunya

- 1 awarded project: Univ. Carlos III de Madrid; Univ. De Valencia; UNED; Univ. Pública de Navarra; Univ. Rovira i Virgili.

Retos-investigación: Proyectos I+D+i

2019 CALL

5 rail-related projects identified

- **CONFRIC**

- **INTERAC**

- **INTELIGENCIA ARTIFICIAL***

- **PATRIMONIO**

- **SATURN**

* Factsheet not available

CONFRIC. Wheel/Rail Contact Modelling for Real Friction Conditions

DESCRIPTION

The project pursues the development of new and more precise models that include the friction phenomenon and that, therefore, can be used to obtain wheel-rail contact results as accurate as possible to those being produced in real railway traffic conditions. The project includes theoretical aspects as well experimental work in real tracks.

RESULTS

The new models are aimed at obtaining more precise results on the wheels and rails wear, the analysis of vehicle stability, lateral forces on rails, risk of derailment, squeal noise, rail corrugation, vehicle curve negotiation, modeling of the conformal contact between rail flank and transition to the flange of the wheel tread, traction and braking limits, adhesion problems, etc.

KEY FIGURES

Call:	*2019*
Duration:	*4 years (2020-2023)*
Type:	*Individual*
Area:	*Mechanical Engineering*
Principal Investigator:	*Ernesto G Vadillo*
	Javier Santamaría
Total budget:	*106.480 Eur*

BENEFICIARY

University of The Basque Country (UPV/EHU) Bilbao School of Engineering

eman ta zabal zazu

UPV EHU

Retos-investigación: Proyectos I+D+i

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Plataforma Tecnológica Ferroviaria Española

UNIVERSIDAD DE SEVILLA

UJI UNIVERSITAT JAUME I

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

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Secretaría Técnica:
Technical Secretariat:

INTERAC. Rail-soil-structure interaction and damping effects in railway bridges. Experimental analysis of existing structures and development of advanced numerical models

DESCRIPTION

In this project, the coupling effect exerted by the ballast track in railway bridges and the relevance of its consideration in numerical models will be analyzed. Likewise, the usual methods of experimental identification of structural damping in both free and forced vibration will be critically evaluated. Finally, soil structure interaction effects in short railway bridges will be evaluated, trying to detect different interaction phenomena that give rise to a reduction in the structural response. The theoretical results achieved will be contrasted with experimental data from test campaigns planned and executed by the researchers.

RESULTS

Development of advanced models to simulate rail traffic on isostatic structures considering the coupling effect exerted by the track components. Development of new methods for the identification of damping so that it is representative of the behavior of the bridge under conventional and High-Speed vehicles. Development of advanced soil-structure interaction model.
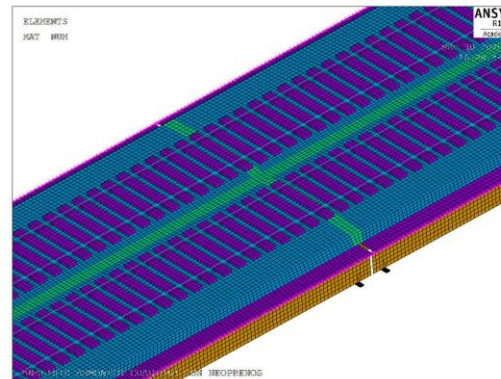
KEY FIGURES		BENEFICIARY
Call: 2019		UJI UNIVERSITAT JAUME I
Duration: 3 years		
Type: joint		
Area: Civil Engineering and Architecture		
Principal Investigator: M.D. Martínez-Rodrigo		
Total budget: 102 850 €		

Analysis and definition of strategies for the characterization, restoration and enhancement of the heritage of public works. An approach from the territorial scale.

DESCRIPTION

The identification and conservation of the heritage of public works still needs the definition of conceptual and strategic keys that allow us to have a critical discourse capable of repositioning and giving content to a heritage whose specificity has generally been dissolved in the heritage of architecture, the industrial archaeology or cultural landscapes. In addition, and regardless of the consideration of other variables, the project is proposed in response to the idea that any strategy aimed at characterizing, recovering or enhancing the heritage of public works must pay special attention to three decisive problems: the problems derived from the scale of approximation to the heritage of public works (compared to the usual orientation that has circumscribed the protection and conservation of the heritage of civil engineering that focuses on bridges, dams, lighthouses or railway stations, the project will focus on the analysis of public works on a territorial scale - road and railway infrastructures, canals, etc.), the problems derived from their functional rigidity (and it is that, with few exceptions, public works of historical interest keep in use and, consequently, deeply transformed) and the excessive weight given to the value of the age of these assets.

RESULTS

The aim of the project is to define and propose strategies that, considering the peculiarities of the Civil Engineering heritage, allow its correct (1) characterization, (2) recovery and (3) enhancement. According to Challenge 6, the research aims to unify "application criteria, methodology and action protocols in heritage conservation", define "techniques for its restoration" and establish "work methodologies aimed at formulating strategies for its future conservation", focusing on a poorly maintained and especially vulnerable heritage. It also has an explicit social vocation as it aspires to spread the value of an emerging but little-known heritage and to contribute to the development of depressed territories affected by depopulation.
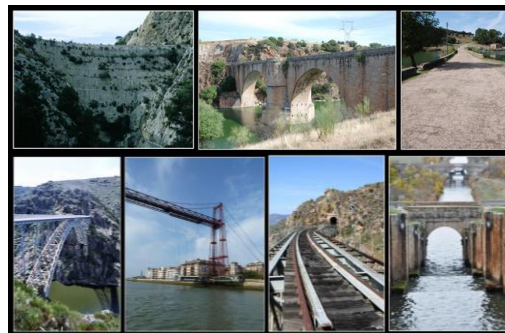
KEY FIGURES

Call: *2019*

Duration: 3 years

Type: *individual (Young researchers).*

Area: istory/Archaeology

Principal Investigator: Rita Ruiz

Total budget: 44.770 euros

BENEFICIARY

School of Civil Engineering.
University of Castilla-La Mancha

UCLM — UNIVERSIDAD DE CASTILLA-LA MANCHA — Escuela de Ingenieros de Caminos Canales y Puertos de Ciudad Real

SATURN. Prediction and experimental measurement of noise and vibration in railway systems for improving European traffic based on continuous innovation with technological stakeholders

DESCRIPTION: The general objective of the proposed project is the experimental analysis of noise and vibration due to train passage to improve the prediction capabilities of numerical models, and the development of new tools for the design and construction stages of new railway lines.

RESULTS: Noise measurement in railways from construction and maintenance activities. Vibration and radiated noise from train passage: numerical modelling and experimental validation. Models cloud computing virtualization. Experimental characterization of bridge vibrations in railway lines. Development and tuning of energy harvesters for optimum performance.

KEY FIGURES		BENEFICIARY
Call: *2019. National Programme for Research Aimed at the Challenges of Society 2017-2020*		*Universidad de Sevilla*
Duration: 3 years		
Type: *Joint*		
Area: Civil Engineer		
Principal Investigator: Pedro Galvín / Antonio Romero		
Total budget: 114.950 €		
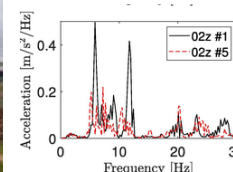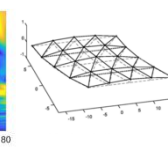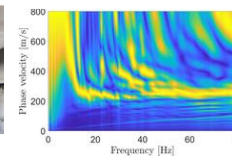
2019 Call:
Projects without factsheet available

Project Title	Beneficiary	Centre
ADVANCED ARTIFICIAL INTELLIGENCE TECHNIQUES APPLIED TO NEW DATA SOURCES AND TO THE USE OF MOBILITY EMERGING MODES FOR A MORE SUSTAINABLE TRANSPORTATION	UNIVERSIDAD DE LA IGLESIA DE DEUSTO	FACULTAD DE INGENIERIA

2018 CALL

6 rail-related projects identified

- **ECO-Smart Pads**

- **IoTrain (3 subprojects)**

- **PUENTES***

- **VIBWAY**

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"ECO-Smart Pads" Smart and Sustainable Resilient Pads for the Railway of the Future

DESCRIPTION. The main objective of the project focuses on developing sustainable resilient elements manufactured from waste polymers, including next generation sensors at a competitive prize to be added into the pads for continuous track monitoring.

RESULTS. This solution aims to provide eco-friendly and smart resilient-elements that can be used to efficiently graduate the track stiffness and reduce problems associated with degradation and poor behavior, whilst economically monitoring the performance of the infrastructure under current and future traffic conditions. This aims for efficient and predictive maintenance planning.
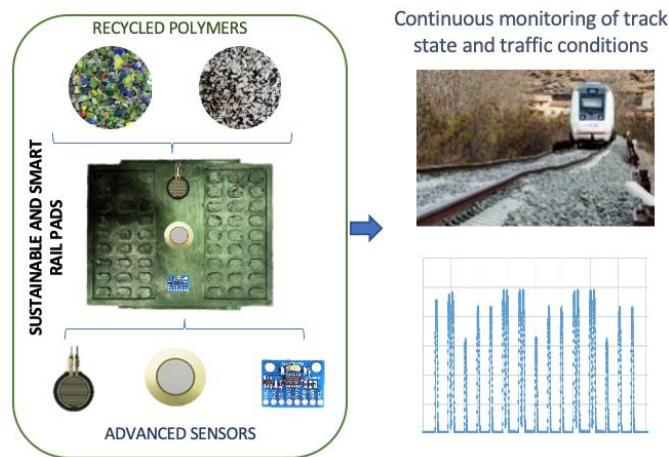
KEY FIGURES

Call: *2018*

Duration: *3 years*

Type: *Individual*

Area: *Civil Engineering*

Principal Investigator: *Miguel del Sol Sánchez*

Total budget: *152,581.00€*

RECYCLED POLYMERS

SUSTAINABLE AND SMART RAIL PADS

ADVANCED SENSORS

Continuous monitoring of track state and traffic conditions

BENEFICIARY

Laboratory of Construction Engineering at the University of Granada

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UNIVERSITAS GRANATENSIS · PLUS ULTRA · 1531

Retos-investigación: Proyectos I+D+i

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IoTrain, Implementation of Interactive, Connected and Secure Contextual Environments for Passenger Rail Transport supported by the Internet of Things and Soft Computing techniques

DESCRIPTION: The project addresses the implementation of contextual-interactive environments for passenger transport in the railway field. To do this, the analysis of heterogeneous wireless communications is combined with space-time data mining and lightweight cryptography mechanisms to provide security and privacy. It counts with 3 sub-projects:

- **Communications-UPNA**: IMPLEMENTATION OF INTERACTIVE, CONNECTED AND SAFE CONTEXTUAL ENVIRONMENTS FOR RAILWAY PASSENGER TRANSPORTAT SUPPORTED BY IOT AND SOFT COMPUTING TECHNIQUES
- **Spacio-temporal mining-U. Deusto**: OPTIMIZATION OF PASSENGER TRACKING DATA EXPLOITATION IN RAILWAY ENVIRONMENTS THROUGH SOFT COMPUTING TECHNIQUES.
- **Seguridad/privacidad-U. Rovira i Virg**ili: SECURITY FOR THE INTERNET OF THINGS IN CONTEXTUAL ENVIRONMENTS AND PROTECTION OF USERS PRIVACY IN RAILWAY ENVIRONMENTSDE SUS USUARIOS EN ENTORNOS FERROVIARIOS

RESULTS: The current development of the project counts with more than 10 JCR indexed publications, 1 patent granted, various contributions at congresses and progress being made in the preparation of several doctoral theses in this field. Performed developments:

- Development of CRFID passive sensor networks for deployment in transport environments
- Deployment and integration of sensor networks - vehicles as mobile and ubiquitous sensors
- Design of data mining methods based on Soft Computing for predicting behaviour and detecting incidents

KEY FIGURES

<u>Call</u>: *Proyectos de I+D Retos Investigación (RTI2018-095499-B-C31, C32, C33)*
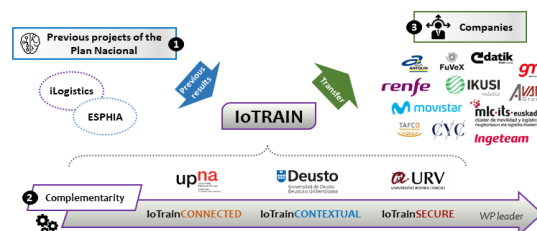
<u>Duration</u>: 3 years

<u>Type</u>: *joint*

<u>Area</u>: Commuication Technologies

<u>Principal Investigator</u>: Francisco Falcone (UPNA); Asier Perallos / Unai Hernández (Deusto)

<u>Total budget</u>: 189.607€ (for the 3 subprojects)

BENEFICIARY

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LEAM UPC

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN

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FUNDACIÓN DE LOS FERROCARRILES ESPAÑOLES

VIBWAY. Rapid computational model for calculating railway-induced vibrations and radiated noise

DESCRIPTION

In this project, a numerical model for the prediction of the railway-induced ground-borne noise and vibration in nearby buildings to be implemented in the framework of a web-based computational tool that is been developed. The proposed method is computationally efficient and, at the same time, accurate in most of the real scenarios encountered when dealing with railway-induced ground-borne noise and vibration predictions. easy to be implemented particularly compatible with long sections of track. The computational tool includes the option of evaluating the effectiveness of the different isolation countermeasures in the mitigation of the railway-induced vibrations, as under-ballast or under-slab mats, rail pads or vibration mitigation screens.

RESULTS

The most important result of the project will be a computational tool with web-based interface that determines the level of vibration and re-radiated noise inside regular buildings located in the surroundings of a railway line, taking into account for the calculation the characteristics of the rolling stock, the track, the tunnel, the soil and the building. A beta version of the tool is expected for the end of 2021.
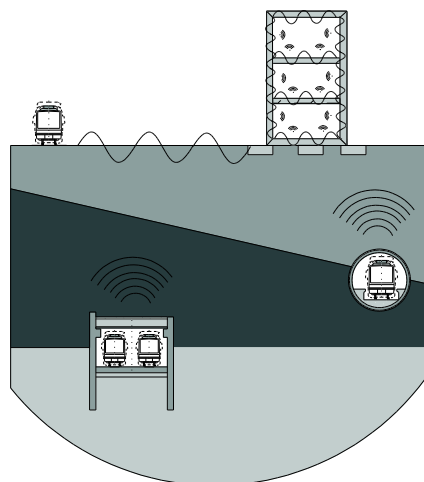
KEY FIGURES

Call: *2018*

Duration: 3 years

Type: *Individual*

Area: Industrial production, civil engineering, engineering for society.

Principal Investigator: : Jordi Romeu // Robert Arcos

Total budget: 100.430,00 €

BENEFICIARY

Acoustical and Mechanical Engineering Laboratory Universitat Politècnica de Catalunya

LEAM UPC

2018 Call:
Projects without factsheet available

Project Title	Beneficiary	Centre
INTEGRATED NON-LINEAR SIMULATION OF RAILWAY BRIDGES STRUCTURAL BEHAVIOR FACING DYNAMIC ACTIONS AND HIGHER TRAFFIC REQUIREMENTS	UNIVERSITAT POLITÈCNICA DE VALÈNCIA	ESCUELA TECNICA SUPERIOR DE ING. CAMINOS, CANALES Y PUERTOS

2017 CALL

8 rail-related projects identified:

- **AMORTIGUADORES***
- **COMMET (2 Sub-projects)**
- **CurvImpAc**
- **IntelVía**

- **DIMALIFE**
- **OBESDINFER**
- **VirtualCat**

* Factsheet not available

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FUNDACIÓN FERROCARRILES ESPAÑOLES

COMMET. Communications with MIMO LTE-A/mmW Transceivers for Advanced Services un High Mobility Transport

DESCRIPTION: The goal of the present project is to address an deal with one of the main limitations of the current broadband connectivity in high mobility proposed by 5G, which in fact is not tailored to transport scenarios with high density of vehicles and high speed. To deal with these topics, a novel integral architecture to manage the connectivity in mobile 5G scenarios is proposed. This architecture is based on a mobile network solution that uses novel Moving Relay Nodes, consisting of transceivers that work simultaneously in the LTE and millimeter bands and with a management of the radio resources through Virtualized and Software Defined Radio Access networks. The proposal also includes the integration and management of communications associated with services related to operations and safety in transport, mainly in the railway environment.

RESULTS. a) Design and development of dedicated Relays Nodes with LTE / millimetric frequency conversion as part of the integral network architecture. **b)** Study of the feasibility of using MU_MIMO techniques in the signals transmitted between the base stations and the Moving Relays Nodes (MRNs) and between these and the user terminals. **c)** Simulation and modeling of the propagation channel in the millimeter wave frequencies in railway and metropolitan environments, **d)** Service security and monitoring systems play a key role in rail transport environments. New techniques based on passive MIMO radars will be addressed which will allow the establishment of "perimeter" security mechanisms using LTE opportunity signals, and **e)** Proposal of a comprehensive architecture for the management of the radio access network (Radio Resource Management) and of the Evolved Packet Core, through Virtualized and Software Defined Access Networks.

Retos-investigación: Proyectos I+D+i
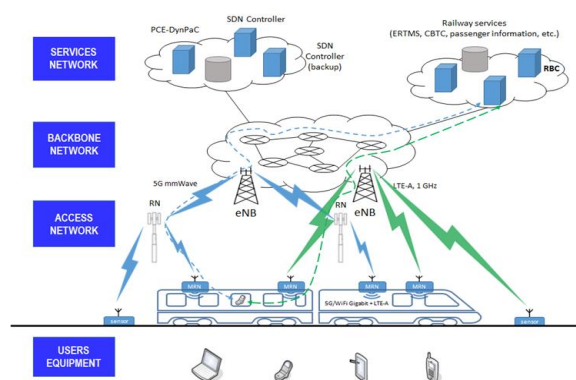
KEY FIGURES

Call: *2017*

Duration: 3 years

Type: *Joint Project*

Area: Smart, sustainable and integrated transport.

Principal Investigator: JOSÉ-IGNACIO ALONSO MONTES.

Total budget: 348,480 €.

BENEFICIARY

"INFORMATION PROCESSING AND TELECOMMUNICATIONS CENTER". *UNIVERSIDAD POLITÉCNICA DE MADRID*.

iptc
Information Processing and Telecommunications Center

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Secretaría Técnica:
Technical Secretariat:

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MINISTERIO DE CIENCIA E INNOVACIÓN

FUNDACIÓN de los FERROCARRILES ESPAÑOLES

CurvImpAc - Development of a comprehensive vehicle/track interaction model in curves to reduce the acoustic impact of rail transport

DESCRIPTION The main objective of this project is to address in a comprehensive way the problems associated with the negative impact of railways concerning acoustic pollution and vibrations. Such an impact is especially significant in curves, where phenomena such as squeal and rail corrugation take place, which arise as a consequence of the dynamic interaction between the vehicle and the track. Often, both are closely related to each other and there are some features of curve squeal that may indicate a link with the development of corrugation. Thus, these problems must be investigated by simultaneously assuming the most realistic hypotheses available to study these complex phenomena.

RESULTS In this project, it is proposed: (1) the development of a broadband dynamic model of vehicle/track interaction in curves, including the detailed profile of the track and the wheel, and a non-linear unsteady rolling contact model; (2) the proposal of convincing mechanisms for squeal and corrugation growth in curves; (3) the development and evaluation of actions aimed at mitigating the problems of squeal and rail corrugation in curves, acting on the wheel design and friction properties.

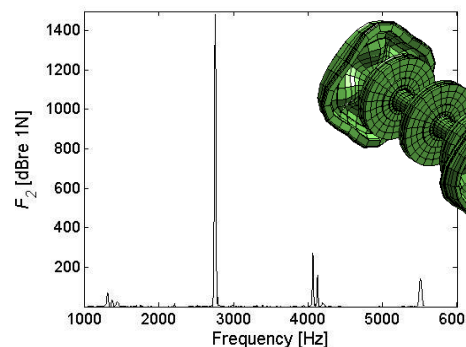| KEY FIGURES		BENEFICIARY
Call: 2017		
Duration: 4 years		CIIM CENTRO DE INVESTIGACIÓN EN INGENIERÍA MECÁNICA
Type: Individual Project		
Area: Mechanical Engineering		UNIVERSITAT POLITÈCNICA DE VALÈNCIA
Principal Investigator: F.D. Denia Guzmán		
Total budget: 96,000 euros		

DIMALIFE. Reliability-based robust optimum design and maintenance of high social and environmental efficiency of bridges and highway infrastructures under restrictive budgets

DESCRIPTION

The main objective of the DIMALIFE project is to develop a methodology that allows taking into account the variability of analytical methods in the decision-making processes during the whole life cycle of bridges and highways infrastructures, including the procurement of projects, new infrastructures as well as current ones, considering social and environmental needs.

RESULTS

After a sensibility analysis of different budgetary policies, the results of this project aim to determine what typologies, specific actions of maintenance and demolition and re-use alternatives are suitable for minimizing environmental and social impacts taking into account the variability. In this respect, an important aspect is to determine which criteria and indicators are key to include, in an effective manner, sustainability issues in the procurement procedures of new projects and maintenance of highways.

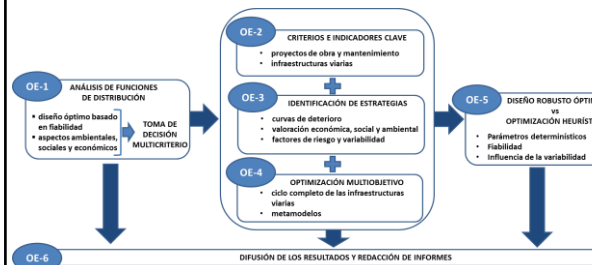## KEY FIGURES

Call: *2017*

Duration: 3 years

Type: *Individual Project*

Area: Construction Engineering

Principal Investigator: Víctor Yepes & Eugenio Pellicer

Total budget: 41,170,00 €

BENEFICIARY

Universitat Politècnica de València
ICITECH

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

IntelVía - SmartTrack. Smart track dynamic surveying approaches based on digital image processing

DESCRIPTION

The present project proposes the development of a dynamic surveying and data analysis approach which is able of detecting the position, nature and degradation of different track defects along the layout. For this, accelerations, both vertical and lateral, are recorded on board the trains. This process is aimed to happen in a fully automated way. For this purpose, digital signal processing tools, such as the spectrograms, are used. Such tools decompose the signal and allow its analysis in the time and frequency domain simultaneously. In such representation, track defects show specific patterns, thus allowing for their identification and classification. These patterns may be automatically recognised by means of digital image processing techniques. For this pattern recognition, a training-testing process with the recorded data are carried out.

RESULTS

As a result, the output data of the proposed approach may serve as the input data for today-in-use track deterioration models and track maintenance management tools. In the same way, since a first diagnostic is given on the track conditions, duration of visual inspection and later maintenance tasks may be dramatically reduced, thus lowering the respective costs.

KEY FIGURES

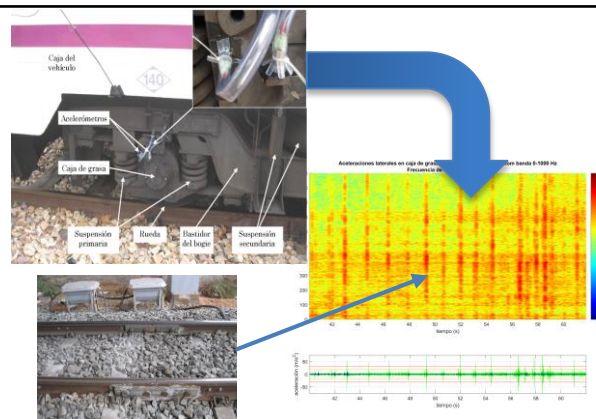Call: *Programa RETOS – Proyectos I+D+i 2017*

Duration: *3 years*

Type: *Individual Project*

Area: *Rail track inspection*

Principal Investigator: Ricardo Insa Franco

Total budget: 114,708.00 €

BENEFICIARY

Universitat Politècnica de València

Retos-investigación: Proyectos I+D+i

OBESDINFER. Development of observers on embedded systems for the estimation of the dynamic response of railway vehicles

DESCRIPTION

This project continues the development of a mechatronic system for the online dynamic response of in-service railway vehicles. This system aims to improve the ride safety and comfort, as well as the preventive maintenance of vehicle and track.

RESULTS

Development of an on-board smart system that combines sensor networks, computer simulation and signal processing that provides as outputs track geometry irregularities, wheel-rail contact forces and passenger's comfort indexes.

KEY FIGURES		CONSORTIUM
		University of Seville

KEY FIGURES

Call: 2017

Duration: 3 years

Area: Transport

Principal Investigator: : José Luis Escalona Franco and Rosario Chamorro Moreno

Total budget: 141.328,00 €

CONSORTIUM

University of Seville

PTFE — Plataforma Tecnológica Ferroviaria Española
I2MB — INSTITUTO DE INGENIERÍA MECÁNICA Y BIOMECÁNICA
ai2 — INSTITUTO DE AUTOMÁTICA E INFORMÁTICA INDUSTRIAL
GOBIERNO DE ESPAÑA — MINISTERIO DE CIENCIA E INNOVACIÓN
AGENCIA ESTATAL DE INVESTIGACIÓN
FUNDACIÓN FERROCARRILES ESPAÑOLES
Secretaría Técnica: Technical Secretariat:
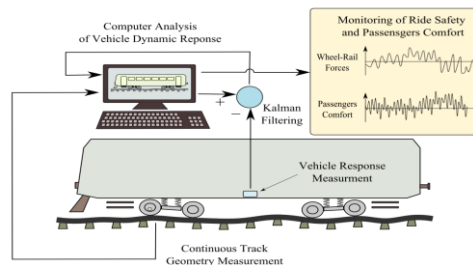
VirtualCat. Development of a HIL test system for pantographs with virtual catenaries

DESCRIPTION

Given the high costs related to the homologation processes of rolling stock, this project proposes the design and assembly of a Hardware-In-the-Loop (HIL) test bench to simulate the dynamic interaction between pantograph and catenary. The latter is replaced by a virtual finite element model, which is solved in real time, and a linear actuator that reproduces the position of the contact point on the pantograph. For this, it is necessary to have catenary models that are as realistic as possible and whose dynamic resolution has a very low computational cost. The aim of this methodology is to contribute to the reduction of pantograph homologation costs by conducting laboratory tests.

RESULTS

The following results have been achieved in this project: (i) Algorithm for solving the dynamics of catenaries in real time using a modal approach and an offline / online strategy. (ii) Modeling and optimization of sectioning in high speed rail catenaries. (iii) Preparation of catenary analytical models for application in HIL tests. (Iv) Design, construction and development of a test bench HIL pantograph and the associated control system. With these results obtained, it has been possible to carry out HIL tests of pantographs with virtual catenaries obtaining a very high precision in the results.

| KEY FIGURES		BENEFICIARY
Call: 2017		I2MB — INSTITUTO DE INGENIERÍA MECÁNICA Y BIOMECÁNICA
Duration: 3 years	REAL TIME simulation	ai2 — INSTITUTO DE AUTOMÁTICA E INFORMÁTICA INDUSTRIAL
Type: Individual	Control action	UNIVERSITAT POLITÈCNICA DE VALÈNCIA
Area: Mechanical Engineering	Measurements	
Principal Investigators: Manuel Tur Valiente and Antonio Correcher Salvador		
Total budget: 76835 €		
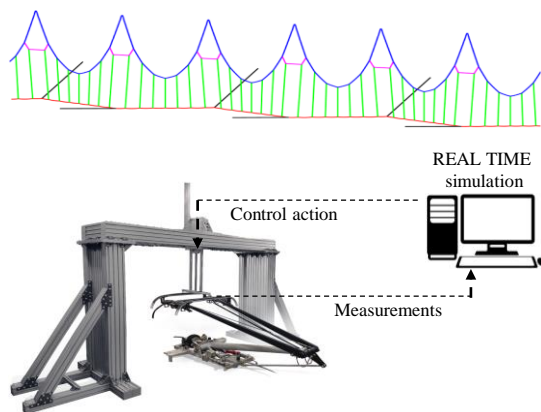
2017 Call:
Projects without factsheet available

Project Title	Beneficiary	Centre
MAGNETOREOLOGICAL SHOCK ABSORBERS, DYNAMIC ABSORS AND VISCOELASTIC PANELS FOR IMPROVING THE COMFORT OF RAILWAY VEHICLES WITH LIGHTENED STRUCTURES AND VARIABLE LOAD	UNIVERSIDAD DE CASTILLA-LA MANCHA	INSTITUTO DE INVESTIGACIONES ENERGÉTICAS Y APLICACIONES INDUSTRIALES

2016 CALL

3 rail-related projects identified :

- **BIG DATA***

- **SoilBrRail**

- **SolNoisVib**

SoilBrRail: Numerical analysis and experimental validation of soil structure interaction effects on the dynamic response of railway bridges

DESCRIPTION: In this research project the effect of soil structure interaction on the dynamic response of railway bridges is analysed using different modelling alternatives such as boundary element – finite element analyses in the time domain. Numerical conclusions are compared to experimental measurements performed on real structures both under ambient vibration and forced vibration, including resonant situations.

RESULTS: Fundamental tendencies on the structural properties and dynamic response with the evolution of the soil properties have been derived for an ensemble of representative bridges, assuming simplified substructure geometries. Experimental campaigns have been performed in order to characterize the soil, identify the bridge dynamic properties and its response under railway traffic both under resonant and not resonant conditions.

Retos-investigación: Proyectos I+D+i

DATA

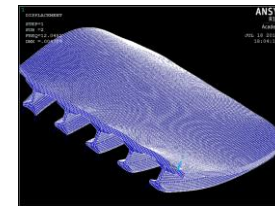Call: *2016. Plan Estatal 2013-2016 Retos - Proyectos I+D+i*

Duration: 3 años
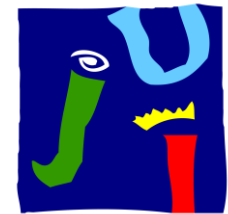
Type: *coordinated project*

Area: Construcción

Principal Investigator: M.D. Martínez Rodrigo

Total budget: 42.350 €

BENEFICIARY

UNIVERSITAT JAUME·I

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FUNDACIÓN FERROCARRILES ESPAÑOLES
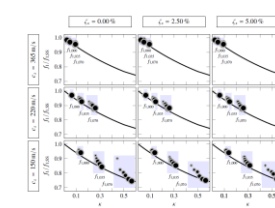
SolNoisVib. Quantification and solutions development for the railway induced noise and vibration problem

DESCRIPTION: This project deals with the development of a methodology for the prediction of railway induced noise and vibration levels. As a result, a series of recommendations and apps for railway lines are being developed both for surface and underground railway traffic.

RESULTS: Development of a numerical model for the simulation of railway induced noise and vibration propagation phenomenon. Analysis of soil structure interaction effects on the vibrational response of railway bridges. Development of a simplified and fast solution for the assessment of vibration levels in constructions built in the vicinity of railway lines <http://personal.us.es/pedrogalvin/scoping.en.html>. Experimental validation of the numerical results obtained in the different project phases.

KEY FIGURES

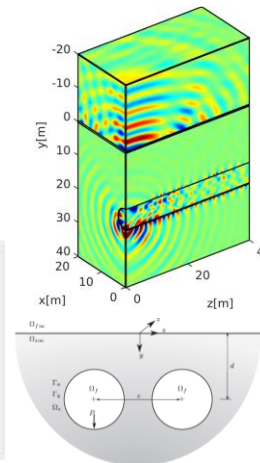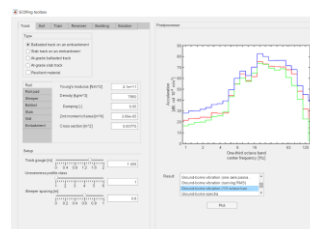<u>Call</u>: *2016. National Programme for Research Aimed at the Challenges of Society 2013-2016*

<u>Duration</u>: 3 years

<u>Type</u>: *Joint Project*

<u>Area</u>: Civil Engineer

<u>Principal Investigator</u>: Pedro Galvín Barrera

<u>Total budget</u>: 66.550 €

BENEFICIARY

Universidad de Sevilla

UNIVERSIDAD DE SEVILLA

2016 Call:
Projects without factsheet available

Project Title	Beneficiary	Centre
FROM BIG DATATEMPORAL SERIES PROCESSING TOWARDS INTELLIGENT MAINTENANCE OF RAILWAYS	UNIVERSIDAD DE GRANADA	E.T.S. DE INGENIERIAS INFORMATICA Y DE TELECOMUNICACION

2015 CALL

2 rail-related projects identified:

- **EDINPF**
- **MAQ-STATUS**

EDINPF. Dynamic assessment of railway bridges; Safety and interoperability of existing, upgraded and new structures.

DESCRIPTION

The main goal of the proposed project is the evaluation and improvement of the dynamic performance of new and/or existing railway bridges, for high speed lines or upgrading of conventional lines with fast passenger traffic. This objective will be achieved through the development of new computational models and improvement of existing models, adjusted and updated through experimental measurements, and their application to the Spanish railway network.

RESULTS

Two experimental tests have been carried out in railway bridges from the Spanish railway network in order to evaluate their dynamic behaviour by measuring their modal properties (Eigen frequencies, modal shapes and damping). From these experimental results, some Finite Element models have been calibrated so as to study the dynamic performance of those bridges when real European trains and trains from European codes pass along them. Moreover, some new features have been added to existing 2D analytic models (software *Caldintav*) and the procedure to go from 3D models to 2D models have been studied.

KEY FIGURES		BENEFICIARY
Call: *2015*	Análisis modal experimental — Modelo de elementos finitos	*UPM – ETSI Caminos*
Duration: 3 years		UNIVERSIDAD POLITÉCNICA DE MADRID
Type: individual project		POLITÉCNICA
Area: Civil Engineering		
Principal Investigator: José Mª Goicolea		
Total budget: 127 050 €		
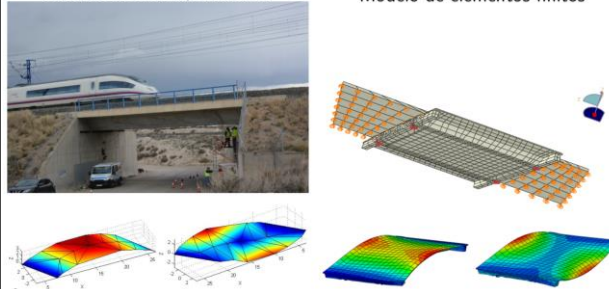
MAQ-STATUS: DPI2015-69325-C2-1-R-MINECO-FEDER-UE

DESCRIPTION

INTEGRATED MONITORING SYSTEM OF CRITICAL MECHANICAL SETS FOR RAIL TRANSPORT MAINTENANCE IMPROVEMENT

KEY FIGURES		BENEFICIARY

KEY FIGURES

Call: RETOS 2015 (2016-2018)

Duration: 3 YEARS

Type: JOINT PROJECT

Area: MECHANICAL ENGINEERING

Principal Investigator:

PROF. J.C. GARCIA-PRADA

MAQLAB-UC3M
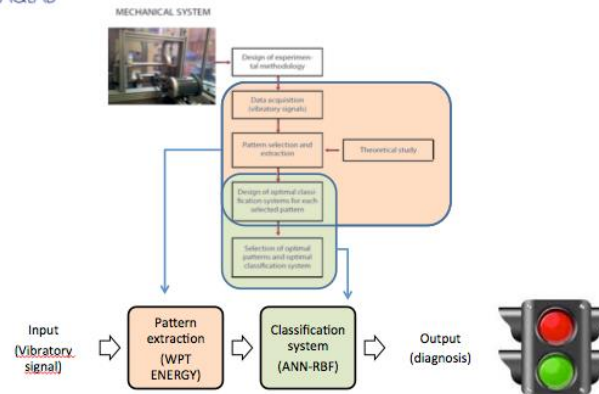
PR-1: JC GARCIA-PRADA / C. CASTEJON

PR-2: G.N. MARICHAL (ULL)

Total budget: 136.800 €

(UC3M 96.800€ +ULL 40.000)

uc3m MAQLAB

GENERAL DETECTION PROCEDURE

Sponsor (Epo):
RENFE; SKF

BENEFICIARY

uc3m | Universidad **Carlos III** de Madrid
Grupo de Investigación: MAQLAB

Retos-investigación: Proyectos I+D+i
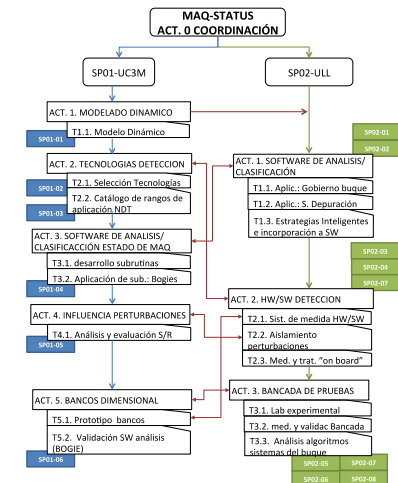
2014 CALL

6 rail-related projects identified :

- **CONFORT***

- **ESFUCON**

- **ISIBUR**

- **MERCANCÍAS***

- **REGUTRAIN**

- **WARMED**

* Factsheet not available

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ESFUCON. *Estimation of wheel/rail contact forces in vehicles instrumented with inertial and optic sensors using advances computational models*

DESCRIPTION

This project develops a railway vehicle dynamic model specially adapted for the estimation of wheel/rail contact forces, using multibody system dynamics.

RESULTS

Development of an on-board smart system that combines inertial and optical sensors with a previously calibrated dynamometric wheel for the estimation of wheel-rail contact forces.
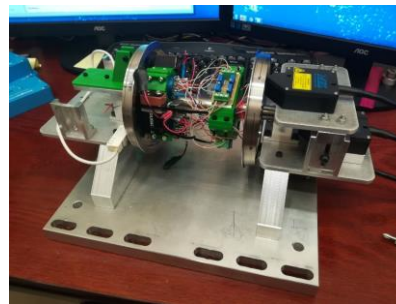
KEY FIGURES		CONSORTIUM
Call: 2014		*University of Seville*
Duration: 4 years		
Area: Transport		
Principal Investigator: José Luis Escalona Franco		
Total budget: 112,530.00 €		

ISIBUR. Innovative solutions for the railway induced-vibration isolation of buildings

DESCRIPTION: Development of theoretical models of antivibration solutions based on dynamic vibration absorbers, anti-vibration screens and redesign of segments, and their experimental validation at scale.

RESULTS: It is expected to have an analytical, numerical or hybrid theoretical model of each of the proposed anti-vibration solution, which allows calculating the efficiency of each of them based on their integration in a broader model that includes the railway infrastructure, type of circulation, land and buildings receivers.
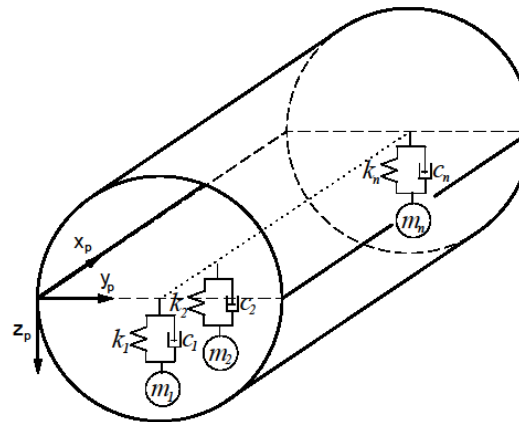
KEY FIGURES		BENEFICIARY
Call: *2014* Duration: 4 years Type: individual project Area: Transport Principal Investigator: Jordi Romeu Total budget: 227 480 €		*UNIVERSITAT POLITÈCNICA DE CATALUNYA. DEPARTAMENTO DE INGENIERÍA MECÁNICA* UPC

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FUNDACIÓN DE LOS FERROCARRILES ESPAÑOLES

REGUTRAIN: DESIGN OF AN EFFECTIVE REGULATION FOR THE OPENING OF THE SPANISH PASSENGER RAILWAY TRANSPORT TO COMPETITION

DESCRIPTION: The general objective of the research Project is to deepen the knowledge of the regulatory techniches in order to design instruments that allow an intelligent regulation of passenger rail services in Spain.

RESULTS: REGUTRAIN has made it possible to develop knowledge about the regulation of the railway sector with a view to its liberalization on December 14, 2020. On the one hand, the existing liberalizing experiences in Europe have been identified and studied: Italy, Czech Republic, Austria and Sweden. Economic circumstances and results have been analyzed from the perspective of the liberalization user. Likewise, the conflicts that have arisen between the new operators and the incumbent operators have been analyzed, especially in the field of competition law. On the other hand, the knowledge of the legal framework of the European Union for the liberalization of the railway sector has been deepened.

KEY FIGURES		BENEFICIARY
Call: *2014*		
Duration: *4 years*		UNED
Type: *individual*		
Area: *Law*		
Principal Investigator: *Juan José Montero Pascual*		
Total budget: *36,905€*		

WARMED. Wheel and Rail Modelling for Enhanced Durability. Development of models to reduce the wear of wheels and rail tracks

DESCRIPTION

The project addresses wheel and rail wear problems, including wheel profile wear as well as corrugation or rail undulatory wear, paying special attention to the conformal contact areas between wheel and rail in curved track. The study is aimed at obtaining possible solutions for the reduction of these types of wear.

RESULTS: The following JCR Q1 papers have been published so far:

N. Correa, E.G.Vadillo, J. Santamaria, J. Gómez, "On the study of train-track dynamic interactions caused by rail welds on discrete supported rails", WEAR, Vol.: 314, 291-298, 2014.

N. Correa, E.G.Vadillo, J. Santamaria, J. Herreros, "A versatile method in the space domain to study short-wave rail undulatory wear caused by rail surface defects", WEAR, Vol.: 352, 196-208, 2016.

J.Blanco-Lorenzo, J. Santamaria, E.G.Vadillo, N. Correa, "On the influence of conformity on wheel-rail rolling contact mechanics", Tribology International, Vol 103, 647-667, 2016

J.Blanco Lorenzo, J. Santamaria, E. G. Vadillo, N. Correa, "A contact mechanics study of 3D frictional conformal contact", Tribology International, Vol 119, 143–156, 2018

N.Correa, E.G.Vadillo, J.Santamaria, J.Blanco Lorenzo, "On the non-proportionality between wheel/rail contact forces and speed during wheelset passage over specific welds", Journal of Sound and Vibration, Vol 413, 79-100, 2018

KEY FIGURES

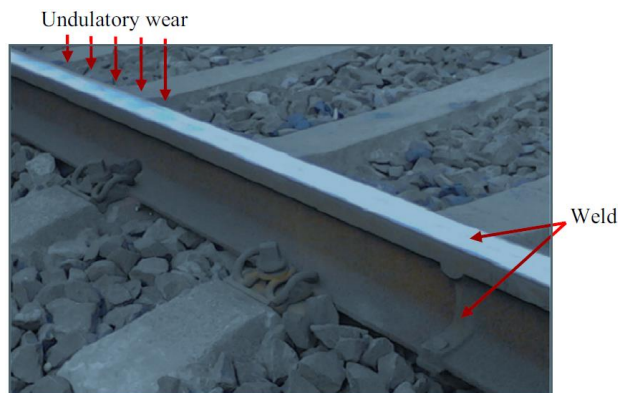Call: 2014   *Retos-investigación: Proyectos I+D+i*

Duration: 4 years

Type: individual project

Area: Transport

Principal Investig.: Ernesto G Vadillo–Javier Santamaría

Total budget: 85.910 Eur

Undulatory wear

Weld

BENEFICIARY

*University of The Basque Country (UPV/EHU)
Bilbao School of Eng.
Dep of Mech Eng.*

eman ta zabal zazu

2014 Call:
Projects without factsheet available

Project Title	Beneficiary	Centre
IMPROVING HIGH SPEED RAIL TRANSPORT COMFORT THROUGH ADAPTIVE PNEUMATIC SUSPENSIONS AND MAGNETOREOLOGICAL SHOCK ABSORBERS	UNIVERSIDAD DE CASTILLA-LA MANCHA	INSTITUTO DE INVESTIGACIONES ENERGÉTICAS Y APLICACIONES INDUSTRIALES
THE CHALLENGE OF THE TRANSFER OF GOODS TO THE RAILWAY IN A CONTEXT OF INTERMODALITY: MODELING THE MODAL CHOICE BY INCORPORATING ENVIRONMENTAL EXTERNALITIES	UNIVERSIDAD DE VALENCIA	INSTITUTO DE ECONOMIA INTERNACIONAL

2013 CALL

4 rail-related projects identified :

- – **ImpAc_1**

- – **ImpAc_2**

- – **SAREMSIG_1**

- – **SAREMSIG_2**

ImpAc_1 - DEVELOPMENT OF NEW TECHNOLOGIES INTENDED TO REDUCE THE ACOUSTIC IMPACT OF RAILWAY TRANSPORTATION IN URBAN ENVIRONMENTS

DESCRIPTION The main objective of this project is to study thoroughly three problems which are the main cause of acoustic impact of rail transport in urban environments: corrugation, squeal noise in small radius curves and the passage of vehicles over railway turnouts

RESULTS

- Track model - distributed model of support to substitute the common models based on concentrated connections
- Vehicle-track interaction model.- development of a vehicle-track interaction model for mid and high frequency problems. Application to weel-rail noise

KEY FIGURES

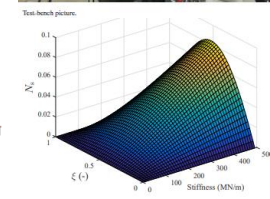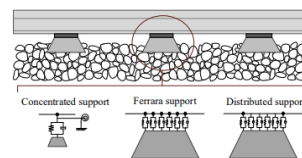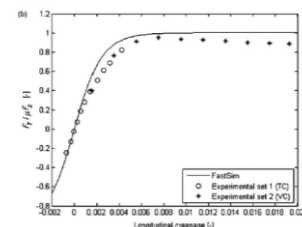<u>Call</u>: *2013*

<u>Duration</u>: *3 years*

<u>Type</u>: *joint project*

<u>Area</u>: *Mechanical Engineering*

<u>Principal Investigator</u>: *Asier Alonso-Nere Gil-Negrete*

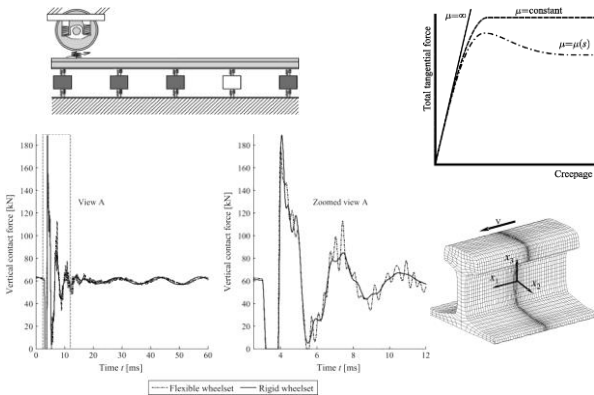<u>Total budget</u>: *€ 120,000*

BENEFICIARY

Ceit-IK4 Technology Center

ImpAc_2 - Development of new technologies aimed at reducing the acoustic impact of rail transport in urban environments

DESCRIPTION This project addresses the vibro-acoustic impact of rail in urban environments. It focuses on the vibroacoustic emission originated by the vehicle-track dynamic interaction, as it is the most important in the running conditions that occur in these environments. Vibratory phenomenon are studied in which the dynamics of the track and the vehicle are coupled. In particular, the broad-spectrum rolling noise and the response to discrete defects (impacts produced in detours, crossings, joints and wheel-flats), as well as the squeal that is generated in curves.

RESULTS Through modeling and experimentation, some contributions have been made that are summarized below: improvement of the interaction models through advanced formulations of the wheelset that consider the flexibility and the inertial effects due to rotation; development of advanced wheel-rail contact models tuned to experimentation; simulation of squeal in curves; and improvement of corrugation models, sound radiation and track dynamics. The latter allow to reduce the associated computational cost and are able to increase the validity until covering the audible frequencies.

KEY FIGURES		BENEFICIARY
Call: 2013		CIIM — CENTRO DE INVESTIGACIÓN EN INGENIERÍA MECÁNICA
Duration: 4 years		
Type: Joint Project		
Area: Mechanical Engineering		UNIVERSITAT POLITÈCNICA DE VALÈNCIA
Principal Investigator: F.D. Denia Guzmán		
Total budget: € 90,000		

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IK4 Research Alliance

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FUNDACIÓN FERROCARRILES ESPAÑOLES

SAREMSIG_1. For a Dependable Railway Operation: Evaluation of the Effect of the Electromagnetic Interferences in Railway Signalling Systems

DESCRIPTION

The impact of electromagnetic disturbances in the railway signalling systems is investigated. This Project requires a holistic approach and a solid experience on various fields, such as railway environment, signalling systems, telecommunications and Electromagnetic Compatibility (EMC). The main goal of this Project is to establish the relation ship between the threats caused by electromagnetic interferences and the quality of service (QoS) and/or other KPIs relevant for Railway Control and Signalling Systems (RCSS).

RESULTS

The electromagnetic interferences that are present in the environment of the signalling systems of the European standard ERTMS have been characterized and modelled. To do so, real signals obtained from field data have been processed in both time and frequency domains. Then these models have been converted into QoS-related parameters, assessing the influence of the physical noises with the operation. With these data, the lower layers of the communications and signalling technologies have been characterized. Finally, new testing procedures have been proposed (in the lab/model) in order to guarantee the safety of the railway signalling systems.

KEY FIGURES

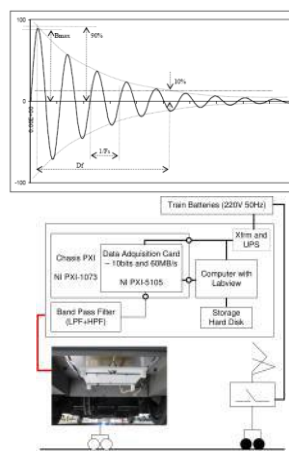Call: *TEC2013-47012-C2-1-R*

Duration: *2014-2016*

Type: *joint project*

Area: *Telecommunications*

Principal Investigator: *Iñigo Adin*

Total budget: *64,400 €*

Retos-investigación: Proyectos I+D+i

BENEFICIARY

Centro tecnológico Ceit-IK4

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FUNDACIÓN FERROCARRILES ESPAÑOLES

SAREMSIG_2. For a Reliable Railway Operation: Evaluation of the effect of Electromagnetic Interferences in Railway Signaling Systems

DESCRIPTION

This research project studies the impact of electromagnetic disturbances on railway signaling systems. It identifies the potential risks in the common operation of equipment. This project has demanded a multidisciplinary approach and a high experience in topics such as the railway environment, signaling systems, telecommunications and electromagnetic compatibility. The main objective of this project is to establish the link between the threats caused by electromagnetic interference and the quality of service (QoS) or key performance indicators (KPI) of a Railway Control and Signaling System (RCSS).

RESULTS

Model and characterization of the impact of electromagnetic interferences on quality of service (QoS) parameters of railway signaling systems. Testing procedures have been defined for safety requirements of railway signaling systems. The lower layers of railway communication technology such as GSM-R have been characterized. The behavior of other RCSS component modules, such as the balise, have also been modeled.

KEY FIGURES		BENEFICIARY

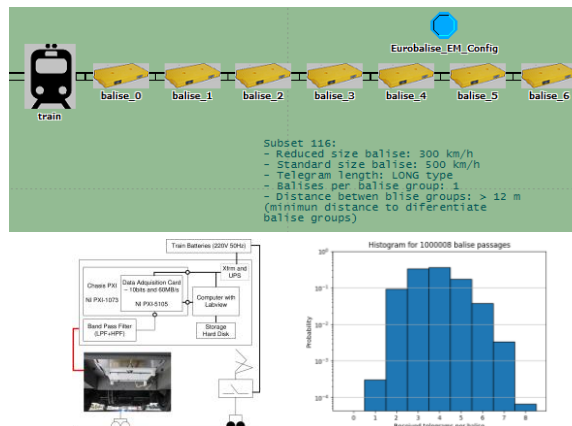**KEY FIGURES**

Call: TEC2013-47012-C2-1-R

Duration: 2014 – 2016

Type: joint project

Area: Telecommunications

Lead Researcher : Marina Aguado

Total budget: 87,483 €

BENEFICIARY

University of the Basque Country

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Universidad del País Vasco
Euskal Herriko Unibertsitatea

Retos-investigación: Proyectos I+D+i

Spanish Railways Technological Platform

Technical Secretariat

Spanish Railways Foundation

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