

Project Database
Spanish Railways Technological Platform

Monographic

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

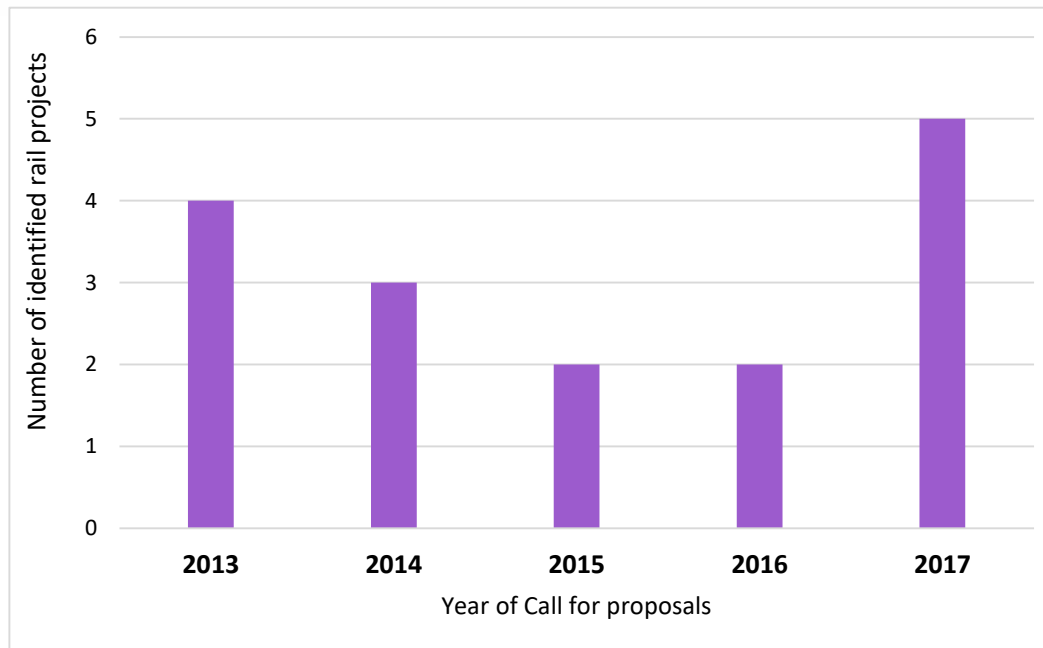
Rail Project Analysis
2013-2017 Calls

RETOS INVESTIGACIÓN: Proyectos I+D+i

- Driven by the Spanish Ministry of Science, Innovation and Universities
- Five Calls: 2013, 2014, 2015, 2016, 2017
- Analysis of awarded RAIL projects
- The information has been provided on a voluntary base by project participants, answering a call for collaboration issued to the members of the PTFE
- 16 factsheets received, corresponding to 13 projects. 6 of them are joint projects; 7 of them are individual projects
- Continuously updated document
- More info: [click here](#)

Projects analysed

16 factsheets received, corresponding to 13 projects. 6 of them are joint projects; 7 of them are individual projects. The distribution per call for proposals is the following one:



Data analysed:
16 factsheets of RAIL PROJECTS
Retos-investigación: Proyectos I+D+i 2013-2017

Beneficiaries

Beneficiary	# Projects
UNIVERSITAT POLITÈCNICA DE VALÈNCIA	4
UNIVERSIDAD DE SEVILLA	3
CENTRO DE ESTUDIOS E INVESTIGACIONES TECNICAS	2
UNIVERSIDAD DEL PAIS VASCO EUSKAL HERRIKO UNIBERTSITATEA	2
UNIVERSIDAD POLITECNICA DE MADRID	2
UNIVERSIDAD CARLOS III DE MADRID	1
UNIVERSITAT JAUME I DE CASTELLO	1
UNIVERSITAT POLITECNICA DE CATALUNYA	1

2013 CALL

Rail Project factsheets received:

- ImpAc_1
- ImpAc_2
- SAREMSIG_1
- SAREMSIG_2

ImpAc_1 - DEVELOPMENT OF NEW TECHNOLOGIES INTENDED TO REDUCE THE ACOUSTIC IMPACT OF RAILWAY TRANSPORT 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 wheel-rail noise

KEY FIGURES

Call: 2013

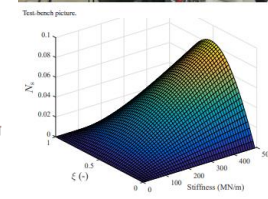
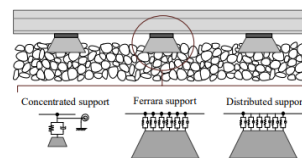
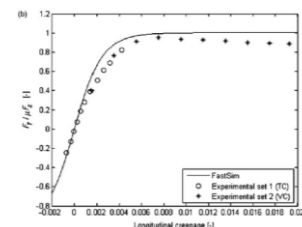
Duration: 3 years

Type: joint project

Area: Mechanical Engineering

Principal Investigator: Asier Alonso-Nere Gil-Negrete

Total budget: € 120,000



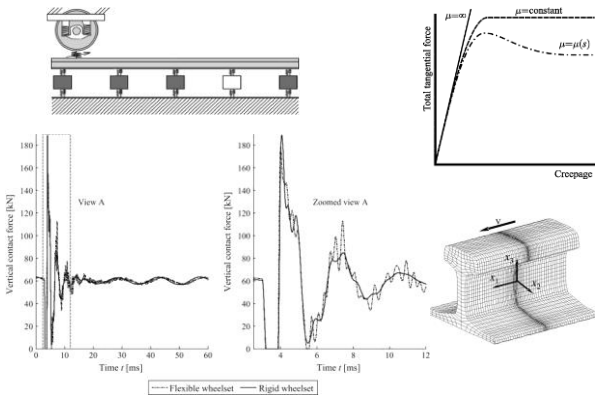
BENEFICIARY

*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 phenomena 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 <u>Call</u>: 2013 <u>Duration</u>: 4 years <u>Type</u>: Joint Project <u>Area</u>: Mechanical Engineering <u>Principal Investigator</u>: F.D. Denia Guzmán <u>Total budget</u>: € 90,000	 The figure includes a schematic of a wheelset on a track, a graph of 'Total tangential force' versus 'Creepage' showing curves for $\mu = \alpha$ and $\mu = \mu(\rho)$, and two graphs of 'Vertical contact force [N]' versus 'Time t [ms]'. The first graph is labeled 'View A' and the second is 'Zoomed view A'. A legend indicates that the dashed line represents a 'Flexible wheelset' and the solid line represents a 'Rigid wheelset'.	BENEFICIARY  CIIM CENTRO DE INVESTIGACIÓN EN INGENIERÍA MECÁNICA  UNIVERSITAT POLITÀCNICA DE VALÈNCIA
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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*

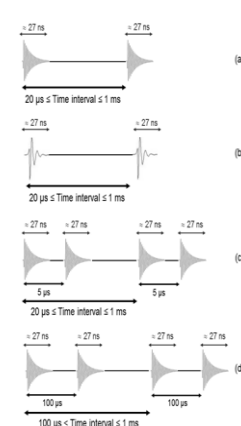
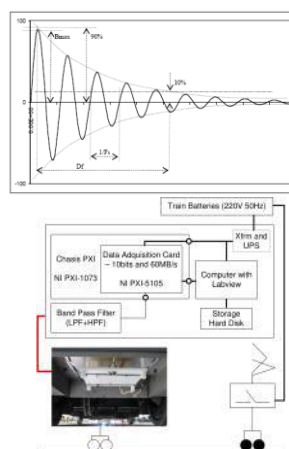
Duration: *2014-2016*

Type: *joint project*

Area: *Telecommunications*

Principal Investigator: *Iñigo Adin*

Total budget: *64,400 €*



BENEFICIARY
*Centro tecnológico
Ceit-IK4*

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

Call: TEC2013-47012-C2-1-R

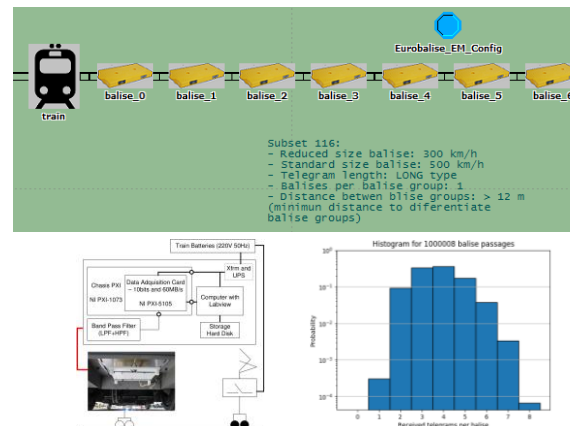
Duration: 2014 – 2016

Type: joint project

Area: Telecommunications

Lead Researcher : Marina Aguado

Total budget: 87,483 €



BENEFICIARY

*University of the
Basque Country*



Universidad
del País Vasco

Euskal Herriko
Unibertsitatea

2014 CALL

Rail Project factsheets received:

- **ESFUCON**
- **ISIBUR**
- **WARMED**

*Data analysed:
16 factsheets of RAIL PROJECTS
Retos-investigación: Proyectos I+D+i 2013-2017*

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 will be developed 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

Call: 2014

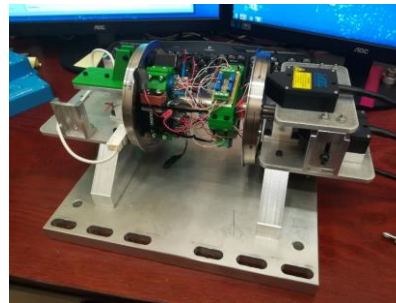
Duration: 4 years

Area: Transport

Principal Investigator: José Luis Escalona

Franco

Total budget: 112,530.00 €



CONSORTIUM

University of Seville



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 solutions, 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

Call: 2014

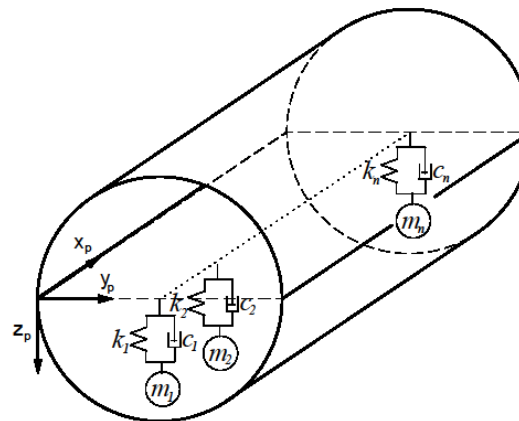
Duration: 4 years

Type: individual project

Area: Transport

Principal Investigator: Jordi Romeu

Total budget: 227 480 €



BENEFICIARY

UNIVERSITAT
 POLITÈCNICA DE
 CATALUNYA.
 DEPARTAMENTO DE
 INGENIERÍA
 MECÁNICA



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

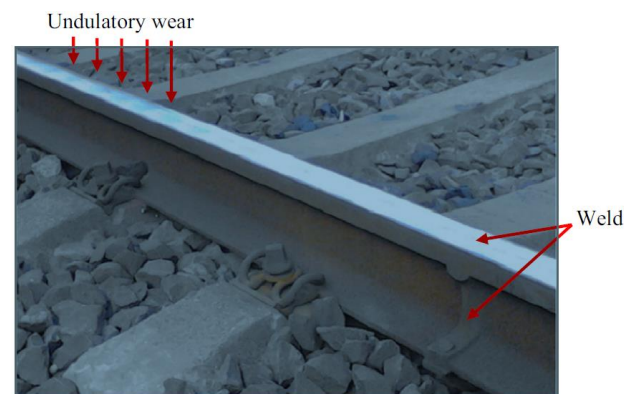
Duration: 4 years

Type: individual project

Area: Transport

Principal Investig.: Ernesto G Vadillo–Javier Santamaría

Total budget: 85.910 Eur



BENEFICIARY

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

2015 CALL

Rail Project factsheets received:

- **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

Call: 2015

Duration: 3 years

Type: individual project

Area: Civil Engineering

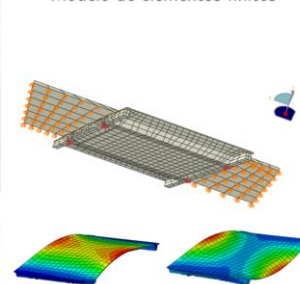
Principal Investigator: José M^a Goicolea

Total budget: 127 050 €

Análisis modal experimental



Modelo de elementos finitos



BENEFICIARY

UPM – ETSI Caminos



POLITÉCNICA



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

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

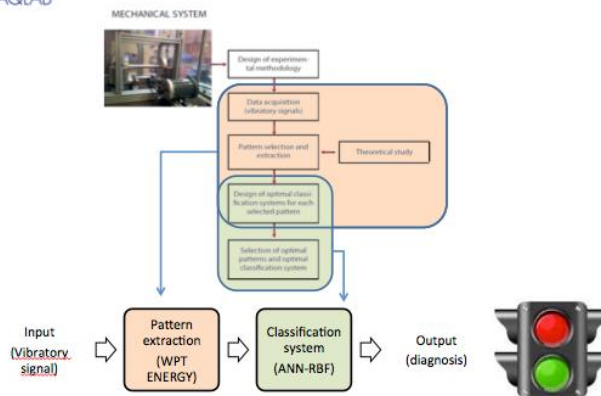
PR-2: G.N. MARICHAL (ULL)

Total budget: 136.800 €

(UC3M 96.800€ +ULL 40.000)

uc3m
MAQLAB

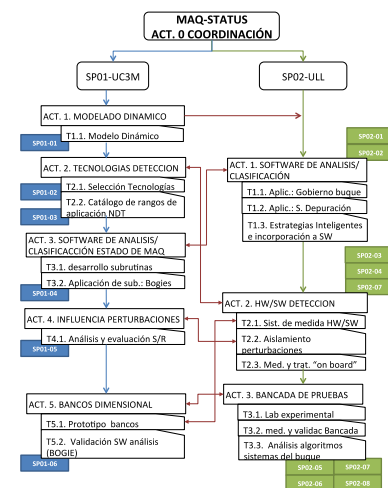
GENERAL DETECTION PROCEDURE



**Sponsor (Epo):
RENFE; SKF**

BENEFICIARY

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



2016 CALL

Rail Project factsheets received:

- SolNoisVib
- SoilBrRail

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

Call: 2016. National Programme for Research Aimed at the Challenges of Society 2013-2016

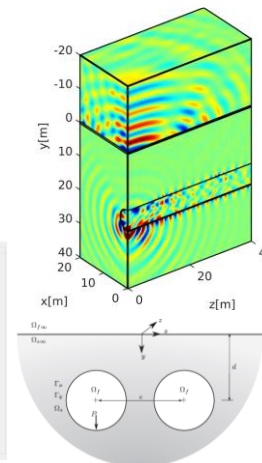
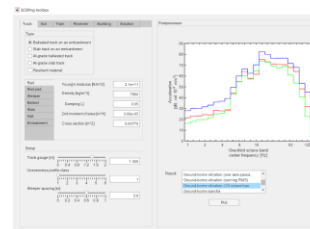
Duration: 3 years

Type: Joint Project

Area: Civil Engineer

Principal Investigator: Pedro Galvín Barrera

Total budget: 66.550 €



BENEFICIARY

Universidad de Sevilla



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.

DATA

Call: 2016. Plan Estatal 2013-2016 Retos - Proyectos

I+D+i

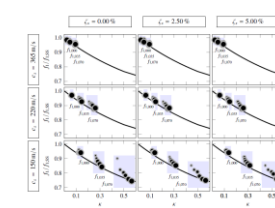
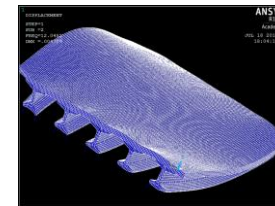
Duration: 3 años

Type: coordinated project

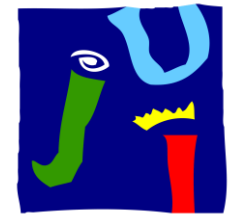
Area: Construcción

Principal Investigator: M.D. Martínez Rodrigo

Total budget: 42.350 €



BENEFICIARY



**UNIVERSITAT
JAUME • I**

2017 CALL

Rail Project factsheets received:

- **COMMET**
- **CurvImpAc**
- **IntelVía**
- **DIMALIFE**
- **OBESDINFER**

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.

KEY FIGURES

Call: 2017

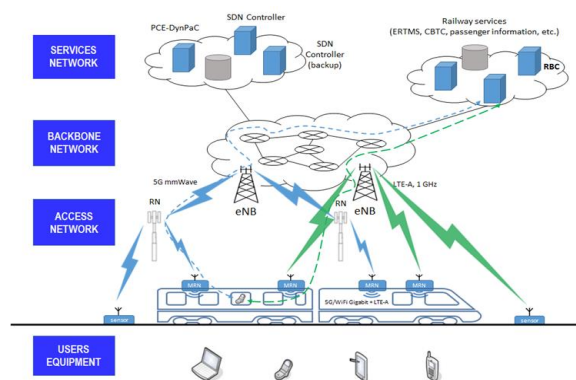
Duration: 3 years

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.



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 exist 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

Call: 2017

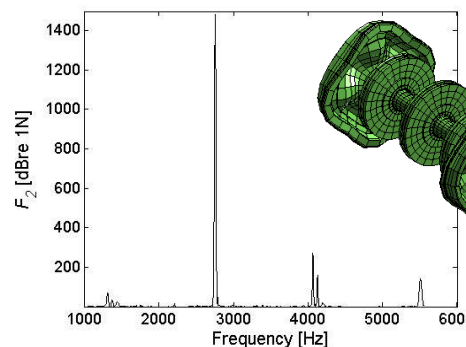
Duration: 4 years

Type: Individual Project

Area: Mechanical Engineering

Principal Investigator: F.D. Denia Guzmán

Total budget: 96,000 euros



BENEFICIARY



CIIM
CENTRO DE INVESTIGACIÓN
EN INGENIERÍA MECÁNICA



UNIVERSITAT
POLITÀCNICA
DE VALÈNCIA

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, the sustainability 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
POLITÀCNICA
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

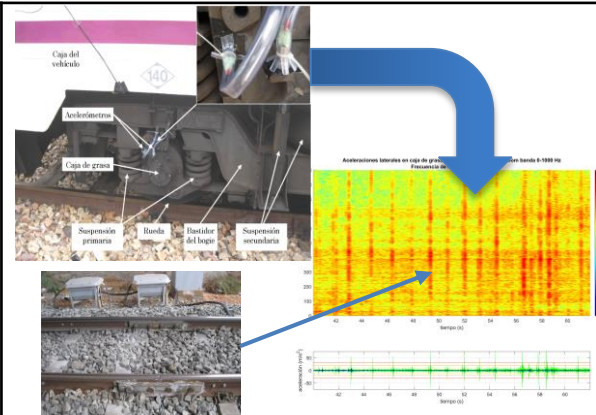
Duration: 3 years

Type: Individual Project

Area: Rail track inspection

Principal Investigator: Ricardo Insa Franco

Total budget: 114,708.00 €



BENEFICIARY

*Universitat Politècnica
de València*



**UNIVERSITAT
POLITÈCNICA
DE VALÈNCIA**

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

Call: 2017

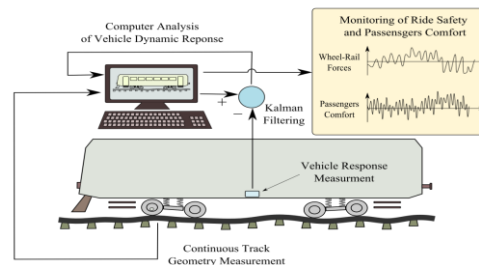
Duration: 3 years

Area: Transport

Principal Investigator: : José Luis Escalona

Franco and Rosario Chamorro Moreno

Total budget: 141.328,00 €



CONSORTIUM

University of Seville



Plataforma Tecnológica Ferroviaria Española

Spanish Railways Technological Platform

www.ptferroviaria.es

Technical Secretariat
Fundación de los Ferrocarriles Españoles

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