Maider Oregui – Motivation letter

MS Maider Oregui
Railway Engineering Group
Faculty of Civil Engineering and Geosciences
Delft University of Technology
Stevinweg 1
2628 CN Delft
The Netherlands

To: UIC Innovation Awards 2014,
Selection Committee Young Research Award,

Delft, September 1, 2014

Dear Selection Committee Young Research Award,

My name is Maider Oregui and I am writing to apply for the Young Researchers award of the UIC Innovation Awards 2014. I am in the last stage of my PhD under the supervision of Professor Rolf Dollevoet and Dr. Zili Li in Railway Engineering group at Delft University of Technology, the Netherlands. During the last five years, I have devote my investigation to railway track dynamics combining state-of-the-art numerical models and field measurements to gain a better understanding of dynamic behavior of tracks and derive information useful for the development of innovative monitoring systems.

My education and work experience has enabled me to develop skills in different research stages with a particular focus on development and application of innovative ideas. From the modeling perspective, I have developed new complex fastening models overcoming the limitations of the current models available. These new models lay the foundation for studying the deterioration of fastening systems. Regarding the more applied side of my research, I have successfully used in my research on railway different multidisciplinary concepts and methods, coming from process monitoring and road material testing. These methods can contribute to the investigation of track deterioration, and facilitate the development of monitoring system, such as Axle Box Acceleration (ABA) systems. Furthermore, within the EC FP7 PMnIDEA project, I worked on the assessment of an ABA system for bolt tightness detection which was successful.

The UIC Innovation Awards are a great motivation for me to keep working with even more enthusiasm in leading-edge railway research and new developments for the benefit of railways and the railway industry. I am very willing in the future to expand my professional network and to bring valuable research contributions to the railway industry. To obtain this prestigious recognition will definitely boost my career and will give me a platform to motivate more young researchers to select railways as a path where it is possible to devote your life with passion and professional satisfactions.

In advance, thank you very much for your time and consideration. If you have any questions regarding my application, please do not hesitate to contact me on my phone at (0031) 639491995 or my email address maideroregui@gmail.com. I am looking forward to hearing from you.

Yours sincerely,

Maider Oregui

Datum 30 August, 2014
Ons kenmerk 2014/Dollevoet/UCI
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Telefoon/fax +31 (0)15 27 82365/+31 (0)15 27 83443
E-mail R.P.B.J.Dollevoet@tudelft.nl
Onderwerp Recommendation Letter M. Oregui

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UIC Innovation Awards 2014,
Selection Committee Young Research Award,
Mr. Dennis Schut,
Mr. François Maugère,

Dear Selection Committee Young Research Award,
UIC Innovation Awards 2014.

Dear Mr. Dennis Schut,
Dear Mr. François Maugère,

We are Prof. Rolf Dollevoet and Dr. Zili Li, PhD dissertation advisors of Maider Oregui, and we are writing this letter to support Maider's nomination for UIC Innovation Awards 2014, Young Research Award. Maider is a gifted young researcher, currently in the period of concluding and publishing her best research results obtained during her PhD research period at our group.

In 2010, Maider applied for a PhD position and was accepted after a series of interviews. Although her project was founded, she applied for and was granted with a scholarship for the Basque government of Spain. This allowed the Railway group to relocate the initial founding to another PhD project so that the group could grow and cover more research topics. In almost five PhD years, her work is focused on both applied and theoretical foundations of railway engineering and health conditioning monitoring for railway infrastructure. She has investigated two main topics: investigation into the vertical track dynamics with the focus on fastening modeling, and study of fish-plated joint condition assessment, part of the EC FP7 PMnIDEA project. Both topics have been approached by combining state-of-the-art numerical models and field measurements, which demanded Maider to have a good understanding of both numerical and experimental work. The contributions of her research are not only in terms of the proposed finite-element modeling analysis which provide a theoretical framework to better understand vertical track dynamics with monoblock sleepers, but also the real-life application of her methods based on hammer test for the development of vehicle-borne monitoring systems such as Axle Box Acceleration (ABA) systems. Recently her paper:

Maider Oregui, Zili Li, and Rolf Dollevoet, "Identification of characteristic frequencies of damaged railway tracks using field hammer test measurements",

was accepted in the journal Mechanical Systems and Signal Processing, which have a 5-year impact factor 2014 of 2.903, belonging to the first quartile of the best journals in the category of Mechanical Engineering.

The overall research work of Maider combines contributions on experiment design of field measurements, analysis and characterization of the response of different classes of squats and

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TU Delft

damaged insulated joints via hammer test and ABA, as well as benchmarking and validation of the approach, which makes a complete package of very important research for the intelligent assessment of Railway Infrastructure and Railway Engineering worldwide.

In The Netherlands, squat related costs alone are more than 5000 Euro/km per year. If we include corrugation and low quality insulated joints the amount increases substantially. Considering that the railway infrastructure in the Netherlands is one of the most densely used in Europe, the reduction of cost is very relevant for the Dutch Railway Infra Structure Manager (ProRail), who are very interested in her work, because of the practical benefits they will obtain. The health condition monitoring methodology proposed by Maider is currently being extended to assess wider railway networks via the relations she established with ABA signals, and under different infrastructures such as the Dutch high speed line. In particular, the work on high speed lines is crucial for many other countries like China, where we hope our research can have a strong impact. Some results of those extensions were accepted in relevant conferences such as Railways'2014, ITSC'2014, CST'2014 and ECT'2014.

The curriculum of Maider includes 1 international journal paper, 3 international journals under peer review, and 9 conference papers. Her collaboration with other researchers has resulted in 4 joint conference publications. Additionally, she has reached out to the Edilon)(Sedra company to assess a new method of railpad testing. Other contributions from her research and thesis have been used as input in EU projects reports (detection of bolt tightness in fish-plated joints), and internal reports for Infraspeed (where she analyzed the natural frequency response of the HSL in The Netherlands). Based on her results, we have in our group started to open a number of new research lines, so to apply different and more sophisticated approaches to increase the hit rates of detection of squats, corrugation and damaged insulated joints (computational intelligence methods, pattern recognitions, etc.), and to develop new inventions for broader range of railway track condition monitoring and maintenance systems. The contribution of Maider and her papers are fundamentals for these research lines.

We really hope the nomination of Maider is well received by UIC, as we strongly believe that she is strongly committed with the foundations and innovative development of railway engineering and she will play an important role in the new generation of railway researchers that are needed in Europe and worldwide. Please do not hesitate on contacting us (R.P.B.J.Dollevoet@tudelft.nl, Z.Li@tudelft.nl) if you would need further information about Maider.

Yours sincerely,

Prof. Rolf Dollevoet
Head of the Railway Engineering Section,
Faculty of Civil Engineering and Geosciences
Delft University of Technology
Delft, The Netherlands

Dr. Zili Li
Associate Professor, Railway Engineering
Faculty of Civil Engineering and Geosciences
Delft University of Technology
Delft, The Netherlands

ProRail

Delft, September 8, 2014

MSc. Taco Sysling
Manager Civil Engineering
ProRail
Moreelsepark 3
3511 EP Utrecht
The Netherlands

To: UIC Innovation Awards 2014,
Selection Committee Young Research Award,

Dear Selection Committee Young Research Award,

On behalf of ProRail Inframanagement, I would like to recommend Maider Oregui as an excellent candidate for the Young Researcher Award of UIC Innovation Awards 2014.

ProRail is working towards a network with higher capacity and reliability. Furthermore, the maintenance measures for achieving and keeping these improvements in performance should have minimum influence on the availability of the network. To hold to our goals, we are closely working with Delft University of Technology so that we can gain a better insight into tracks dynamic behavior to understand the occurrence and development of degradation and develop condition monitoring systems which do not interfere with train operation. Maider has extensively contributed to widen and deepen our knowledge in track dynamics with her study of railpads and fastening. Moreover, the knowledge and the models developed by her are the basis for further investigation of railway problems, such as squats, poor insulated joints, corrugation and noise, which are of high interest not only for ProRail, but also for many other railways, I believe. In addition to her contribution to the understanding of track dynamics, Maider has proposed and validated a hammer test based statistical method to facilitate and speed up the implementation of the Axle Box Acceleration monitoring system in the entire ProRail network.

For all these reasons, I enthusiastically recommend Maider Oregui for the Young Researcher Award of UIC Innovation Awards 2014. I am sure this will be a high-impact opportunity for herself, her career, her visibility as a highly-qualified and successful female researcher in the railway industry. It will also serve as a good example to encourage more men and women of the young generation to work on fundamental and practical railway problems.

Yours sincerely,

Taco Sysling
Manager Civil Engineering
ProRail B.V.
E-mail: taco.sysling@prorail.nl

edilon)(sedra

edilon)(sedra bv . P.O. Box 1000 . NL-2003 RZ Haarlem

to:
Selection Committee Young Research Award
for the UIC Innovation Awards 2014

Our reference : AdM
Your reference : -
Subject : Recommendation Letter Ms M. Oregui

Haarlem, 11 September 2014

Dear honorable member of the Selection Committee,

It is with sincere interest that I read about the UIC Young Research Awards. It is of eminent importance that the international railway community is supported, challenged and nourished by initiatives like yours to improve knowledge and quality, and to secure the future of rail bound transport worldwide.

In this respect I would like to draw your attention to the important role that railway track dynamics have every day on the functioning of people: railway track dynamic relate to noise, vibrations, energy consumption, wear and tear, and thus to employment, efficiency, durability, environment and health, and all together to sustainability of our society and our world. In the very beginning of railway track dynamics lies the research subject of Ms Maider Oregui, PhD candidate at Delft University of Technology, and extremely active in the theoretical and experimental modelling and testing of rails, sleepers and the intermediate rail pad.

The company edilon)(sedra has endless interest in the behaviour of elastic, resilient elements for rail track systems, in particular rail fastening systems. The research subject of Maider Oregui has brought us together some years ago for particular, innovative testing procedures enabling to reveal unknown performance characteristics of existing products and steering parameters for new products. Her superb practical skills and theoretical, empirical knowledge gives us the deep conviction that she is a dedicated researcher with a new message to railway track engineers, designers, suppliers and contractors, responsible for construction and maintenance. In her publications as well as in her reporting, she discloses the difficult subject, draws clear conclusions and proposes accessible solutions. As a railway engineer myself working for a railway oriented company, I belief that Maider Oregui is a promising research engineer who deserves to receive gratitude for her contributions so far in railway track dynamics.

Sincerely yours,

Dr.ir. Amy de Man MSc
System Development Manager
R&D Department, edilon)(sedra bv

MAIDER OREGUI

Date and place of birth: ..... 17 October 1985, San Sebastian (Spain)
Current address: ..... Engelsestraat 115, 2627 AA Delft (The Netherlands)
Phone number: 00 31 (0) 639491995
E-mail address: ..... maideroregui@gmail.com
LinkedIn profile:..... www.linkedin.com/pub/maider-oregui/91/299/788

Experience

2010 — PhD candidate at the Road and Railway department at **Delft University of Technology**. The PhD research greatly focused on the investigation of vertical track dynamics by reproducing field hammer test measurements via numerical simulations.

2010-2012 — Worked on "Objective Assessment of Track Quality (WP3)" and "Assessment of track subcomponents (WP5)" part of **PM'n'IDEA** - Predictive Maintenance employing Non-intrusive Inspection & Data Analysis (seventh framework programme).

2008-2009 — Master's degree project at **HILTI AG** (Liechtenstein), at the Technical Centre applying finite element method (FEM) simulations to steel in concrete products, introduction into the market in 2011.

Education

2003-2009 — Mechanical Engineering at Escuela Superior de Ingenieros de la Universidad de Navarra **(TECNUN),** San Sebastian (Ranked as 4th of my year)

2007-2008 — First semester of 5th year at **KTH-Royal Institute of Technology**, Stockholm (Sweden), within the Erasmus exchange programme

2001-2003 — Scientific-Technical Secondary School degree at La Salle, San Sebastián (Spain), with Cum laude distinction

Languages

SPANISH	Native
ENGLISH	Full professional proficiency
DUTCH	Limited working proficiency. Staatsexamen Nederlands als Tweede Taal– **NT2-II** (June 2011)
BASQUE	Native, EGA title

Skills

Programs: Office, Matlab, Patran, Ansys, LS-Dyna, Latex

Grants

2010-2013 — "Programme of the Researchers Training Grant" from the Basque Government of Spain (Grant No. BFI10)

Maider Oregui – List of Publications

To: the Jury of the Young Researchers Awards
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Journal papers

M. Oregui, Z. Li, R. Dollevoet, Identification of characteristic frequencies of damaged railway tracks using field hammer test measurements, Accepted in Mechanical Systems and Signal Processing

M. Oregui, Z. Li, R. Dollevoet, Experimental investigation into the condition of insulated rail joints by impact excitation, Submitted to Experimental Mechanics

M. Oregui, Z. Li, R. Dollevoet, An investigation into the vertical dynamics of tracks with monoblock sleepers with a 3D finite element model, Submitted to Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit

M. Oregui, Z. Li, R. Dollevoet, An investigation into the modeling of the railway fastening with solid railpads, Submitted to Computers and Structures

Conference papers

M. Molodova, M. Oregui, A. Núñez, Z. Li, J. Moraal, R. Dollevoet, Axle Box Acceleration for Health Monitoring of Insulated Joints: A Case Study in The Netherlands , ITSC2014 - 17th International IEEE Conference on Intelligent Transportation Systems, 2014, (Qingdao, China)

A. Núñez, M. Oregui, M. Molodova, Z. Li, and R. Dollevoet, Expensive Optimization using Computational Intelligence Methods for Railway Track Models , CST2014 - The Twelfth International Conference on Computational Structures Technology, 2014, (Naples, Italy)

M. Oregui, Z. Li, R. Dollevoet, An investigation into the railway railpad modeling, ECT2014 - The Ninth International Conference on Engineering Computational Technology, (Naples, Italy)

M. Molodova, M. Oregui, A. Núñez, Z. Li, R. Dollevoet, Automated Monitoring System for Insulated Joints: Preliminary Results using Axle Box Acceleration Measurements, Railways2014 – The Second International Conference on Railway Technology: Research, Development and Maintenance, 2014, (Corsica, France)

M. Oregui, Z. Li, R. Dollevoet, The effect of resilient wheels on wheel/rail contact at a rail joint, ICOVP 2013 - 11th International Conference on Vibration Problems, 2013, (Lisbon, Portugal)

M. Oregui, Z. Li, R. Dollevoet, An investigation into the relation between wheel/rail contact and bolt tightness of rail joints using a dynamic finite element model , CM2012 – International Conference on contact Mechanics and Wear of Rail/Wheel Systems, 2012, (Chengdu, China)

Z. Li, M. Oregui, R. Carroll, S. Li, J. Moraal, Detection of bolt tightness of fish-plated joints by axle box acceleration, Railways2012 – The First International Conference on Railway Technology: Research, Development and Maintenance, 2012, (Las Palmas de Gran Canaria, Spain)

M. Oregui, Z. Li, R. Dollevoet, A 3D finite element railway track model for hammer test reproduction , ICEDyn2011 – International Conference on Structural Engineering Dynamics, 2011, (Tavira, Portugal)

M. Oregui, Z. Li, R. Dollevoet, Relating track parameter conditions to squats and corrugation initiation and growth, ISMA2010 – International Conference on Noise and Vibration Engineering, 2010, (Leuven, Belgium)

Workshop

Workshop on Rail Corrugation and Roughness Growth Modelling in Manchester on 14th and 15th April 2010

Collaborations with companies

Infraspeed - High speed line in the Netherlands: gain insight into the dynamics of the track by hammer test measurements

Edilon)(Sedra (on-going): assessment of a new railpad testing method to derive the dynamic behaviour of railpads

Maider Oregui – Research summary

To: the Jury of the Young Researchers Awards
UIC Innovation Awards 2014

Delft, September 1, 2014

Research summary

Extending the service life of railway tracks is a challenge for infrastructure managers as tracks have to withstand harder service conditions for longer time and at lower costs. Regarding the service conditions, the railway transport moves towards faster and heavier trains which accelerate the degradation of the tracks. To guarantee safety, high cost maintenance measures are taken, for example grinding of the rail top or rail replacement. But these measures conflict with the actual objective of reducing maintenance costs. Furthermore, the maintenance measures need to be performed in shorter time because the railway schedules are becoming more saturated to offer a more complete service to the customer. In summary, tracks are subjected to more demanding service conditions while the resources to keep the desired performance are reduced. A better understanding of the interactions and physics occurring in the complex vehicle-wheel-rail/track system helps slow-down the deterioration, and consequently, lowers the life-cycle costs.

To gain insight into the dynamics of tracks, hammer test measurements and numerical models are often combined. The measurements have two main applications (1) identify the frequency response of the track, and (2) derive unknown track parameters (i.e. stiffness and damping of railpad and ballast) which are difficult to obtain and which change under operational and environmental conditions. The success of these two applications strongly depends on the measurements performed and on the capability of the model to reproduce the measurements. Additionally, there are two main sensitive issues related to measurements, (1) there is lack of knowledge of the variability of field hammer measurements as usually only one measurement is used, and (2) the use of field hammer test measurements is mainly limited to the combination with numerical simulations. Regarding modeling, there is a gap in understanding the sleeper-fastening-rail interaction because (1) the dynamics of monoblock sleepers are not yet reproduced, although their use is already widespread and is still increasing due to their higher bearing capacity in comparison to other sleeper types and (2) the effects of simplified modeling of the fastening system are unknown. The need to have a more realistic representation of the track components and their interactions has arisen.

In my PhD project, I have addressed these issues by combining sets of field hammer test measurements, which were examined at healthy and damaged conditions, and state-of-the-art models of the sleeper-fastening-rail interaction.

From the examination of measurements, three major contributions are made. First, a method that considers the intrinsic variability of tracks was proposed to define a baseline state of tracks; this approach is commonly used in process monitoring. Second, characteristic frequencies of damaged insulated rail joints were identified after an thorough analysis of field hammer and hardness measurements at healthy and damaged insulated rail joints. Third, the FRF-based statistical method was presented to identify characteristic frequencies of damaged railway tracks. As feasibility study, the rail surface defect squats were investigated in two ballasted tracks; the results agree with those of a vehicle-borne monitoring system (i.e. Axle Box Acceleration (ABA) system). Based on the investigations performed, the structural health monitoring of railway tracks can be improved. On one hand, the application of the FRF-based statistical method to identify frequencies of isolated damaged conditions in railway tracks can significantly facilitate and speed up the development of dynamic-response-based train-borne monitoring systems such as ABA systems and strain-gauge-instrumented wheelsets, and the

adaptation to an entire network. On the other hand, the baseline state could be employed to monitor the general deterioration of railway tracks.

The numerical analysis results in four main contributions. First, insight was gained into the main characteristics that define the dynamic behavior of tracks with monoblock sleepers; new characteristics were identified and their origin found. Second, a 3D FE model was developed for tracks with monoblock sleepers to derive track parameters. The simulations followed the measurements closely; the frequency difference between the numerically calculated and measured characteristics was less than 10%, which is acceptable for engineering purposes. Third, the influence of the fastening representation in the vertical dynamic behavior of tracks was extensively investigated. The results showed the high importance of the longitudinal constraint of the rail on the vertical track dynamics. Fourth, an optimization technique was presented to derive track parameters that considers the intrinsic variability of tracks. The models presented and the insight gained can be used to study the deterioration of tracks with a solid base. In a near future, this information may be used to plan the maintenance schedule in a more cost-efficient way and with an optimum use of the resources available.

Additionally, a new method to derive the dynamic behavior of railpads is being assessed. As future work, the presented methods and models will be applied to different tracks and defects and will be used in the development of the Axle Box Acceleration monitoring system of Delft University of Technology.