Your test & Evaluation Department
Anywhere, Anytime

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HOTTINGER BRÜEL & KJÆR

Railway acoustics: applications, measurements and evaluation

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Agenda

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CETEST: your test and evaluation department

- Jesús Otero Yugat
  - Ph.D. in Mechanical Engineering, Fluids and Aeronautics
  - Head of Acoustics, Noise and Vibration

- CETEST: Anywhere, anytime
  - Fully accredited test laboratory: ISO 17025, ISO 9001, ISO 14001, EN 9100 and EN 9712
  - Five continent presence
  - More than 40 years in the rail sector

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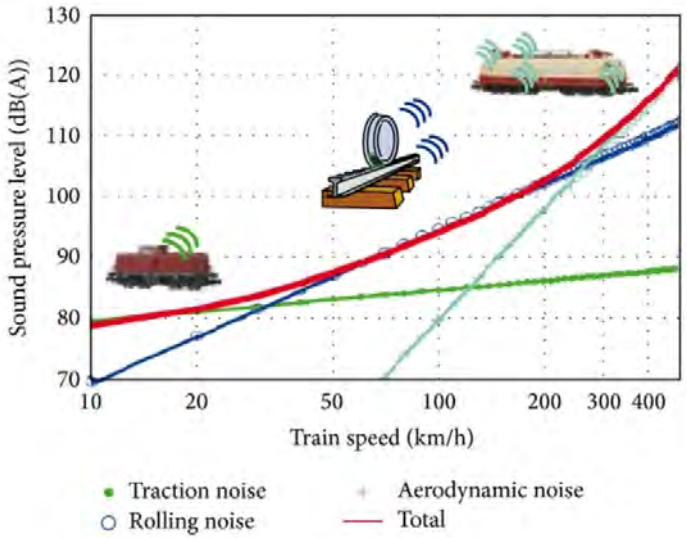
Introduction

- Environmental noise has become an increasingly important issue
- Railway noise is often identified as a source of dissatisfaction by residents and passengers
- International standards defines methodologies for acoustic evaluation
- Mandatory acoustic requirements have been defined by the European Union Agency of Railways, international standards and customer requirements
- High quality of measurements with less uncertainties are needed



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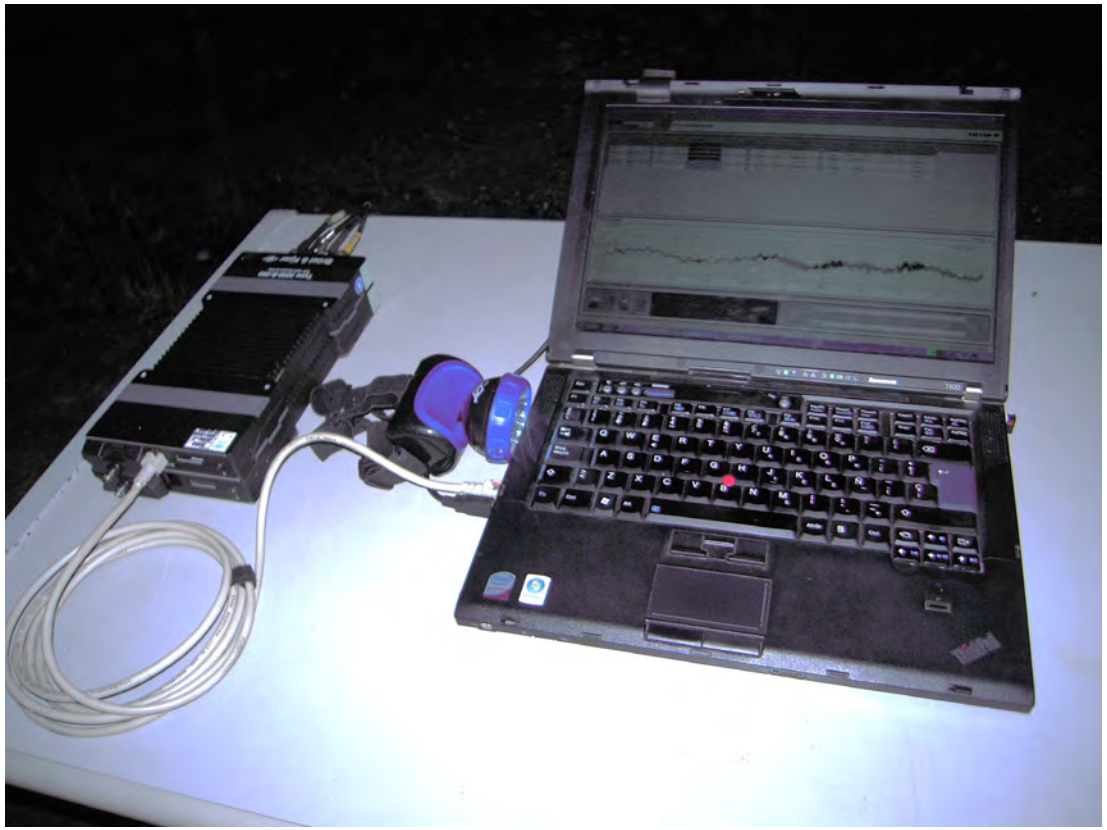
Tests: scope and validation of a railway vehicle

- Validation in terms of interior and exterior acoustic behaviour
- Evaluation of different situations
- Class 1 instrumentation according to IEC 61672-1:2013
- Quick and easy installation
- Fast processing and accurate results



Interior noise: test procedure

- All type of vehicles:
  - Tramways or light rail vehicles
  - Electrical Multiple Units (EMU)
  - Diesel Multiple Units (DMU)
  - High-speed trains.
- Measurements according to standards ISO 3381:2005, DIN 5566-1 and EN 15892:2011
  - Measurements on stationary vehicles
  - Tests on vehicles with constant speed
  - Measurements on accelerating trains from standstill
  - Tests on decelerating vehicles
- Warning horn tests according to standard EN 15892:2011 and TSI 1304/2014.

Exterior noise: test procedure

- Measurements according to standard ISO 3095:2013, VDV 154:2011 and TSI 1304/2014
  - Exterior noise in stationary
  - Exterior noise at constant speed
  - Exterior noise in acceleration from standstill
  - Exterior noise during braking
- Measurements according to standard EN 15153-2:2020 and TSI 1302/2014
  - Warning horn tests
- Exterior noise emitted by railway components (that is, power inverters) according to standard ISO 3744:2010
- Equipment and sensors operating in heavy weather conditions

Interior and exterior noise: test setup

- Omnidirectional microphones
- LAN-XI multi-channel input modules
- Sound level meter
- Sound calibrator
- PULSE Time Data Recorder, LabShop and Reflex

Don’t forget the dongle!

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Speech intelligibility

- Characterization of the PA system
  - Evaluation of the broadcast system
  - Quality of conversation between adjacent passengers
  - Evaluation of the STIPA by means of TSI 1300/2014 and IEC 60268-16:2011
- Test setup
  - Echo speech sound source
  - Omnidirectional microphones
  - LAN-XI modules and sound calibrator
  - PULSE Time Data Recorder and DIRAC

Acoustic characterization

- Sound power evaluation
  - Characterization of railway components (that is, gearboxes or traction equipment)
  - Sound intensity level measurements using a sound intensity probe
  - Test procedure according to standards ISO 9614-1 and ISO 9614-2
- Reverberation time according to ISO 3382-2:2008
- Acoustic insulation
  - Sound intensity level measurements using a sound intensity probe
  - Calculations based on standard ISO 717-1:2013

Summary and conclusions

Challenges

Evaluation of acoustic behaviour in railway vehicles and components.

Verification of criteria defined on international standards and customer requirements.

Solutions

Quick and easy installation.

Fast calculations and processing.

Reliability in heavy weather conditions.

Final comments

Several years of successful testing all over the world.

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Thank You

Questions?

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Do you have a question for the Presenter? Visit the Guest Speakers Virtual booth within the next hour for an interactive Q&A session.