

# Assessment of train-induced vibration propagation through a concrete structure based on vibration measurements and ad-hoc theoretical models

Alessandro Parodi – COWI A/S







#### Contents:

- 1. Background
- 2. The case study
- 3. Measurement campaigns and outcome
- 4. Measurements correction
- 5. Examples from the case study
- 6. Conclusions and further development







#### Background: estimate of train-induced vibrations in buildings



3 24/10/2022



#### The case study

- > Train maintenance base with buildings above
- Complex structure

4

- > Different track types
- > Non-standard layouts (e.g., track above basement)
- > Need for vibration mitigations





Applicable measurement basis

+ A

Analytical corrections





#### Measurement campaigns

- > Criteria for choosing the measuring locations
  - > Train type
  - > Track and structure layout
  - > Geology
  - Operation (i.e., train speed)







- Selected locations
  - Ballasted track
  - Slab track on basement
  - Maintenance track on columns
  - > Different locations in building structure











#### Outcome of the measurements



### Correction of measurements

1. Source selection

2.

8





#### Examples – Case-study scenarios





9 24/10/2022





#### Conclusions and further development

> Methodology for vibration assessment based on:

Vibration measurements (source) Theoretical models (insertion loss) Empirical models (speed correction) Semi-empirical models (ground propagation)

- > Application to a case study with diverse layouts
- > Lessons learned:
  - Gather exhaustive knowledge of the measuring location (e.g., presence of mitigations, subgrade conditions, structural layout etc.)
  - Choose strategically the measuring points, while being aware of the corrections required
  - > Ensure redundancy of measurement data
- > Further development:
  - Assessment of the vibration propagation through structural elements
  - Measurement-based study of ballast insertion loss (e.g., impact of thickness, coupling loss)
  - Study of the impact of the track's age and conditions





#### 10 24/10/2022





## Thank you!

