ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE

OPPONENT'S REVIEW
DIPLOMA THESIS

I. IDENTIFICATION DATA

Thesis title:	**The impact of the ballast and track interaction on the dynamic behaviour of a short span steel bridge**
Author's name:	**Melaku Seyoum Lemma**
Thesis type:	Diploma thesis
Faculty:	Faculty of civil engineering
Department:	K134
Opponent:	Ing. Vojtěch Stančík
Opponent's workplace:	FSv ČVUT Praha/ VPÚ DECO Praha

II. EVALUATION OF PARTICULAR CRITERIA

Assignment — **challenging**

Successful achievement of the specified goals is quite challenging task because of the needed high complexity of the numerical models for the track/bridge interaction analysis.

Assignment fulfillment — **fulfilled**

All the assigned goals were fulfilled.

Scientific approach — **excellent**

Chosen methodology is suitable given the scientific character of the thesis.

Level of expertise — **B - very good**

Student has proven excellent knowledge of experimental and numerical methods for analyzing bridge structures. Opponent would however appreciate more thorough study of the scientific literature and more detailed description of numerical models and obtained results.

Form and language level, intelligibility — **A - excellent**

Thesis is very good written and easy to understand.

References, citation correctness — **B - very good**

References are in accordance with valid citation standards. There are however repeatedly missing references in figures.

Other comments

III. OVERALL RATING, QUESTIONS, CLASSIFICATION

Generally the presented thesis is on very good level. Its extent and quality meets the requiremets for Diploma thesis and the performed numerical analysis even exceeds them. Opponent appreciates the complex numerical models, which were developed in Abaqus and CSI Bridge. There have been however found some minor issues regarding the description of numerical analysis and its results.

Questions and comments:

1) Introduction and state of the art review.

- p.6. Review lacks thorough description of the fastening systems and tension clamps types, which belong amongst the crucial components affecting the longitudinal and vertical bridge/track interaction.

- p.9. and 10. State of the art with the extent of 1,5 pages is quite shallow. Student mainly focuses on describing the possibility of coupling interface modelling. However it is also an important question how to set the coupling input parameters describing the vertical and horizontal interaction since these parameters values are quite uncertain. There is large number of scientific literature dealing with this problem.
- Missing references in figures: Fig. 1 (p.3.), Fig.5 and Fig.6 (p.6), Fig.7 (p.7),Fig.9 (p.13) , Fig.12,13,14,15 (p.17),

2) Experiment

- p.40. Was the evaluation of experimental data including the fast fourier transformation carried out by the student? It is not clear from the text since there is reference [13] cited at the end of the paragraph.

3) Numerical analysis

- p.50. How were determined the material properties of the ballasted bed?
- p.51. Was the mass of the cantilever beams, railings and box girder stiffeners incorporated in the model? If not, how could its neglecting affect the results?
- p.53. How was modelled the vertical stiffness of the pad and the tension clamp?
- p.54 and 55. How was modelled the longitudinal interaction function between the rail and the bridge? Text mentions only general recommendations taken from the standards which refer to one meter of the railway track (2 rails with fastenings, sleepers and ballasted bed related to 1 meter of track length). Therefore longitudinal resistance should be recalculated for each node of the fastening system differently for each numerical model. Also different longitudinal resistance functions for track on the bridge and track behind abutment should be taken into account.
- On p.69 Author defines 5 load cases aiming on numerical verification of the static deflections and accelerations, but the results and subsequent comparison weren't in the thesis presented.
- What was the influence of track/bridge interaction on static deflections? How good was the accordance of the numerical static deflections with the experimental ones?
- By comparing values of vertical accelerations in Fig.82 (p.74) and values in table 6. (p.33) it looks like numerical results of the forced vibration analysis weren't in very good accordance with the experimental results (ca 1,5 ms^{-2} vs measured ca 0,8 ms^{-2}). What could cause this discrepancy?

I rate the submitted Diploma thesis with the grade **B – very good.**

Date: 30.1.2017 Podpis: