Universitat Politècnica de València
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Static and dynamic analysis and design of frame bridges subjected to railways load: application to single-track structures under high-speed traffic

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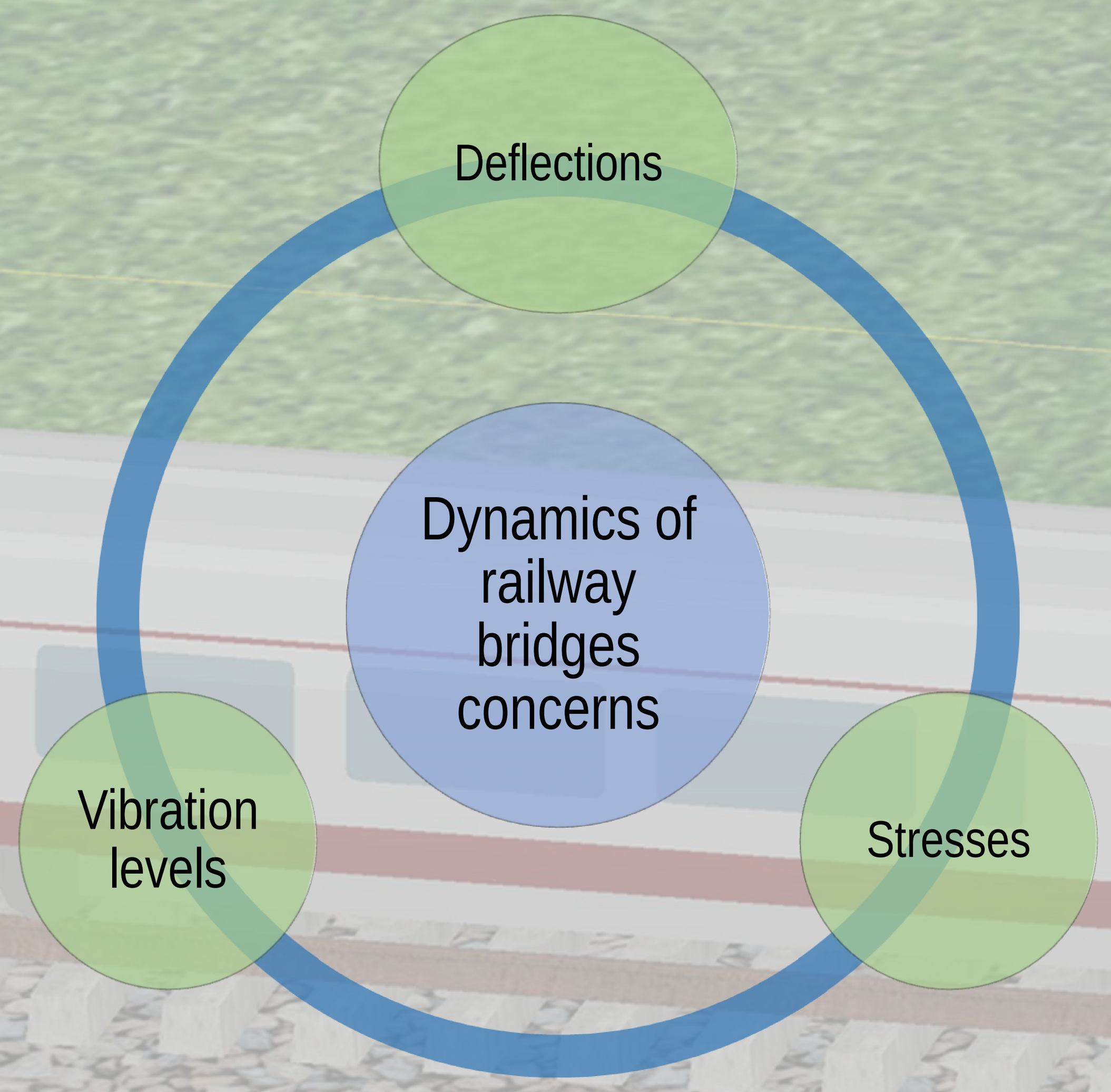
1. INTRODUCTION



Summary

The interest in dynamic behavior of railway bridges has increased in recent years, due to high-speed trains. Under high-speed dynamic loads, the bridges are subjected to large dynamic effects. The dynamic aspects have often shown to be the most important factors in structural design.

Therefore, the 3D-Finite Element Model (FEM) is necessary in order to simulate a realistic behavior of the structure. In this thesis such a model is developed for a single-track frame bridge of 7 m span. The ANSYS Finite Element software is employed in order to compute the static and dynamic effects, which are required for a subsequent assessment of the Ultimate and Serviceability Limit States according to the Eurocodes. A further analysis of the behavior of 10 m and 13 m frame bridges is accomplished in the thesis.

2. FLOW OF THE THESIS

Railway bridges subjected to high-speed traffic (traffic speeds > 200km/h)

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Finite Element Analysis (FEA)

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Selection of natural frequencies up to 30 Hz

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Dynamic analysis using HSLM-A trains

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Dynamic increment, φ'.

The most unfavorable value between load effects from high-speed rail traffic (HSLM) and normal rail traffic (LM 71) should be used

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Design values of stresses.

Vertical acceleration and vertical displacements of the deck

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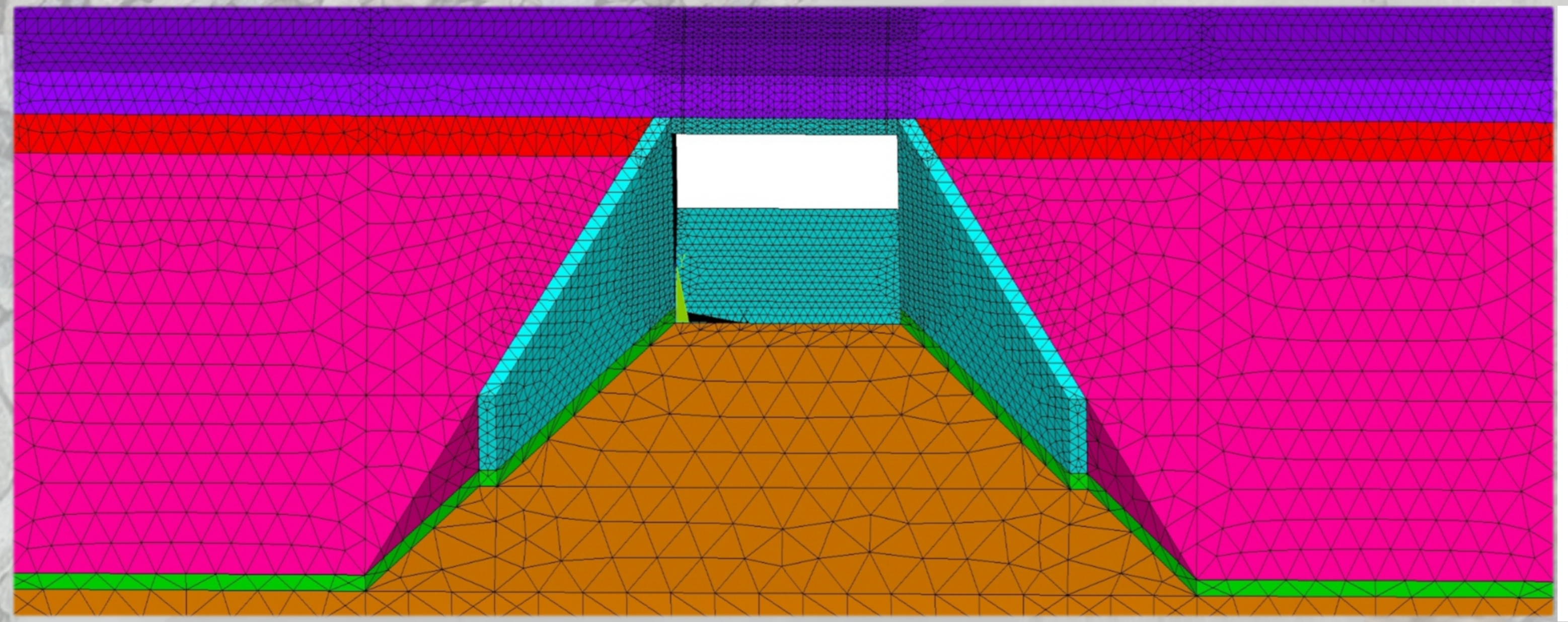
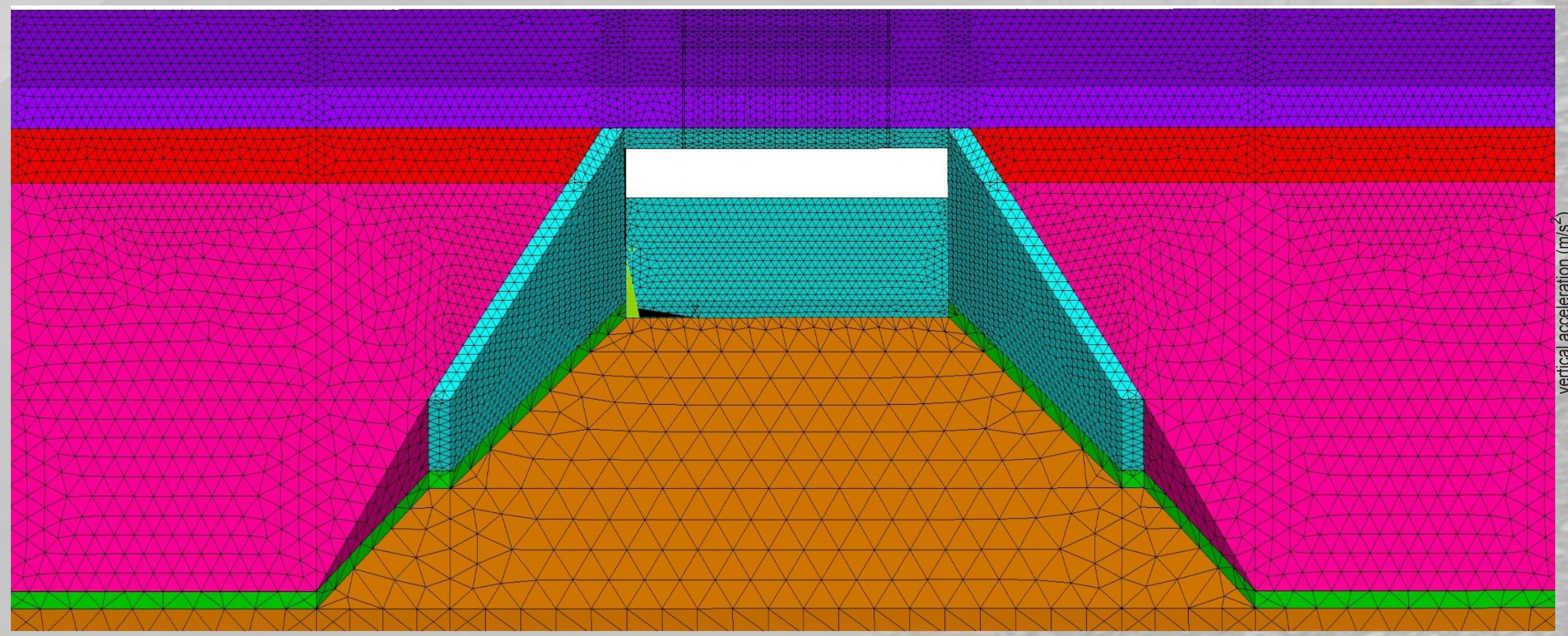
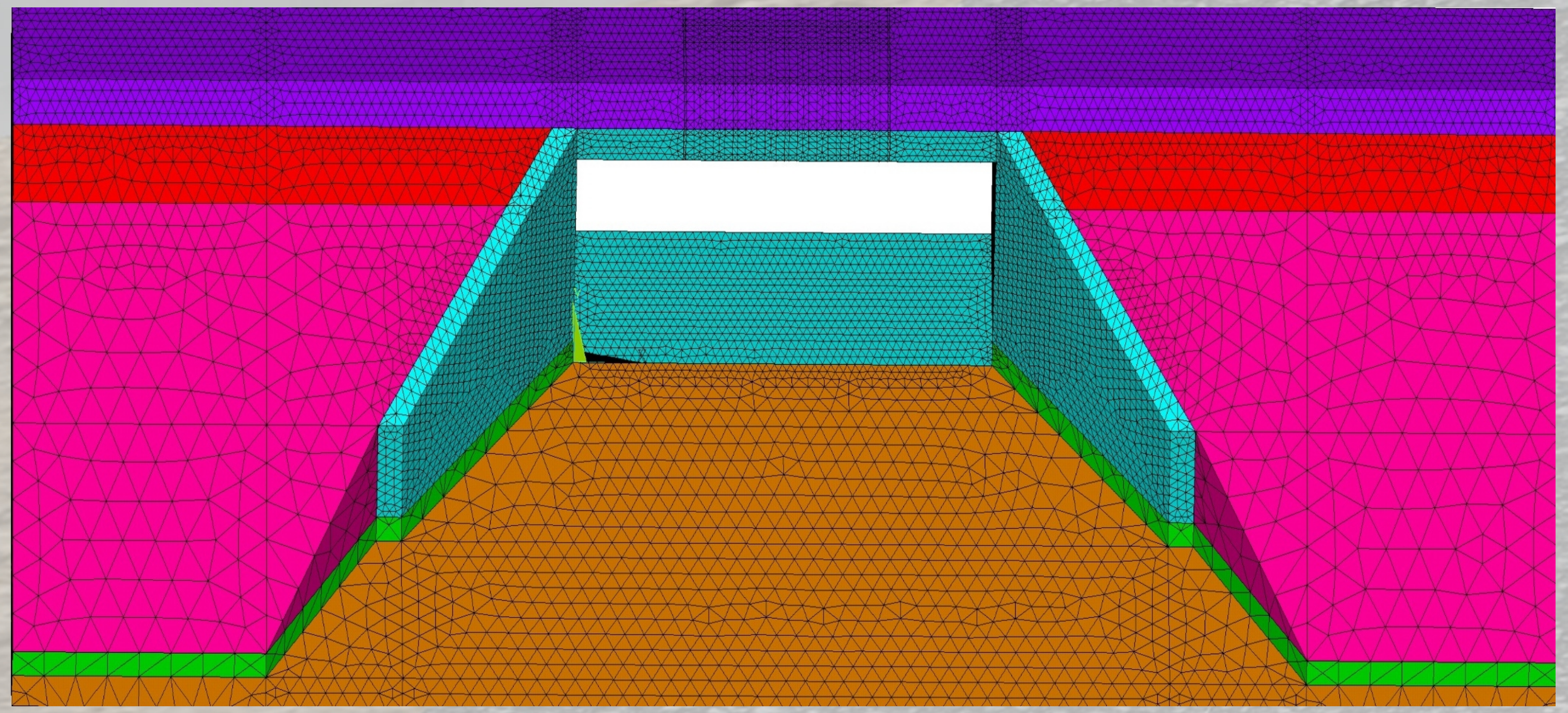
ULS and SLS verifications

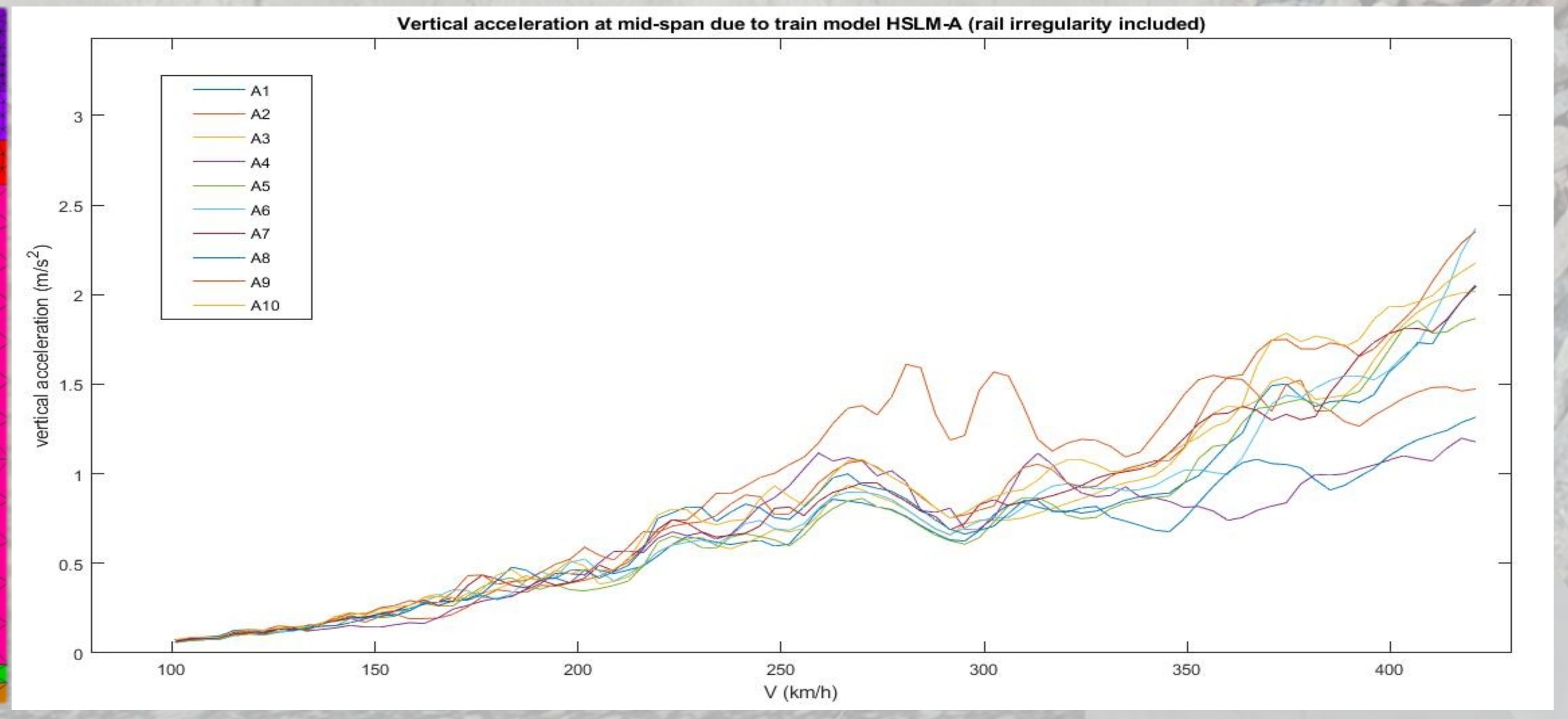
3. FINITE ELEMENT MODELS IN 3D

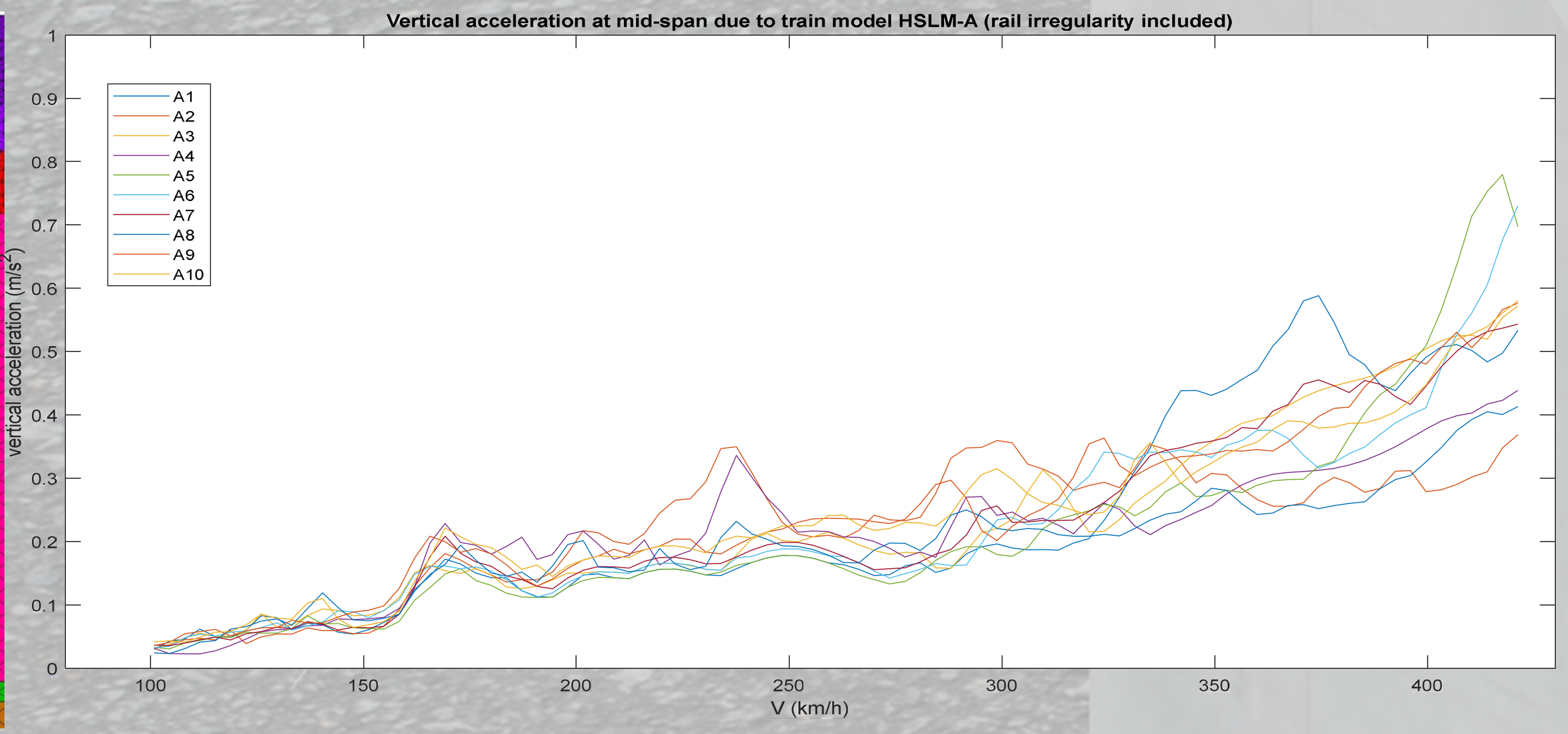


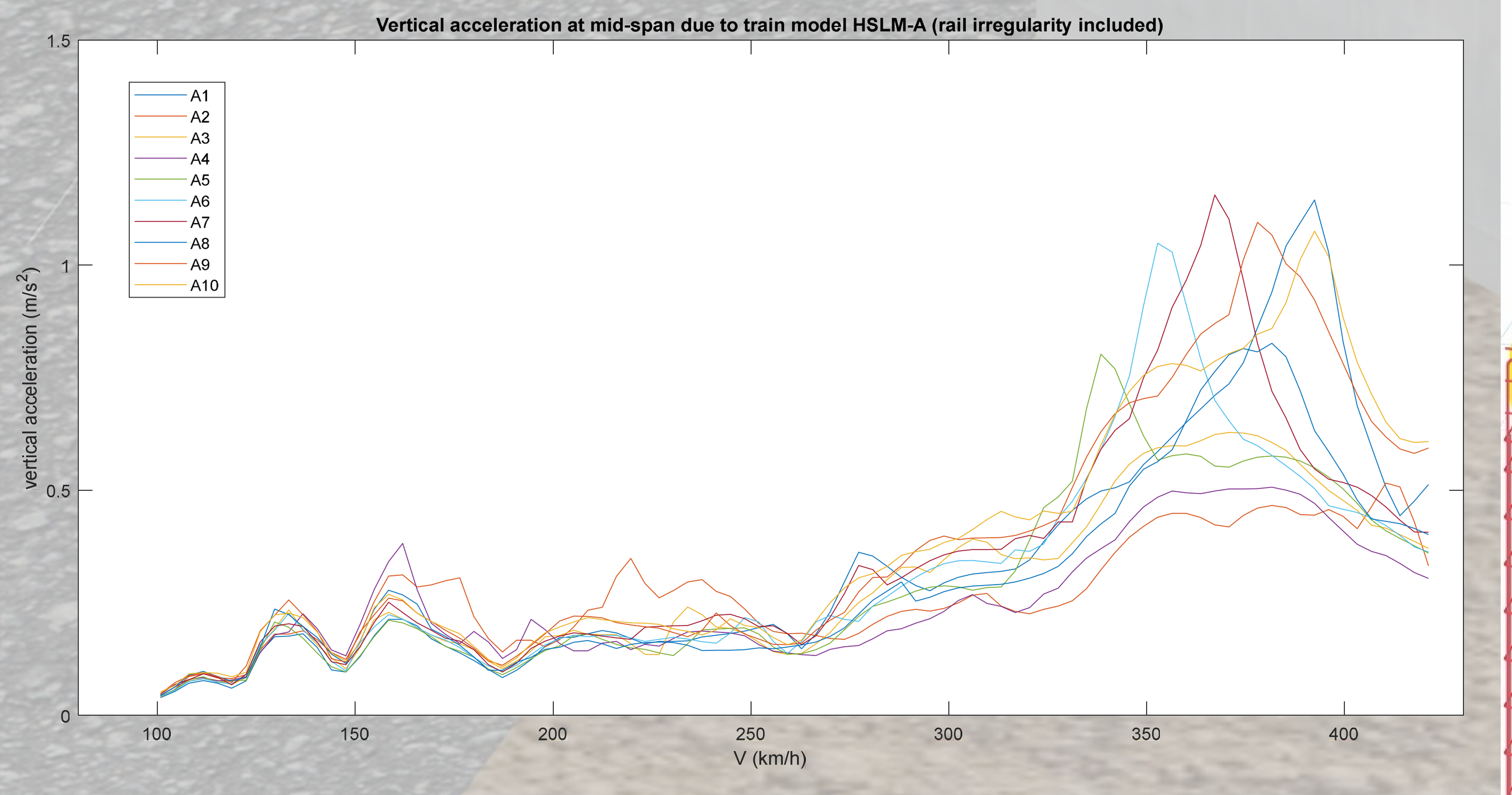




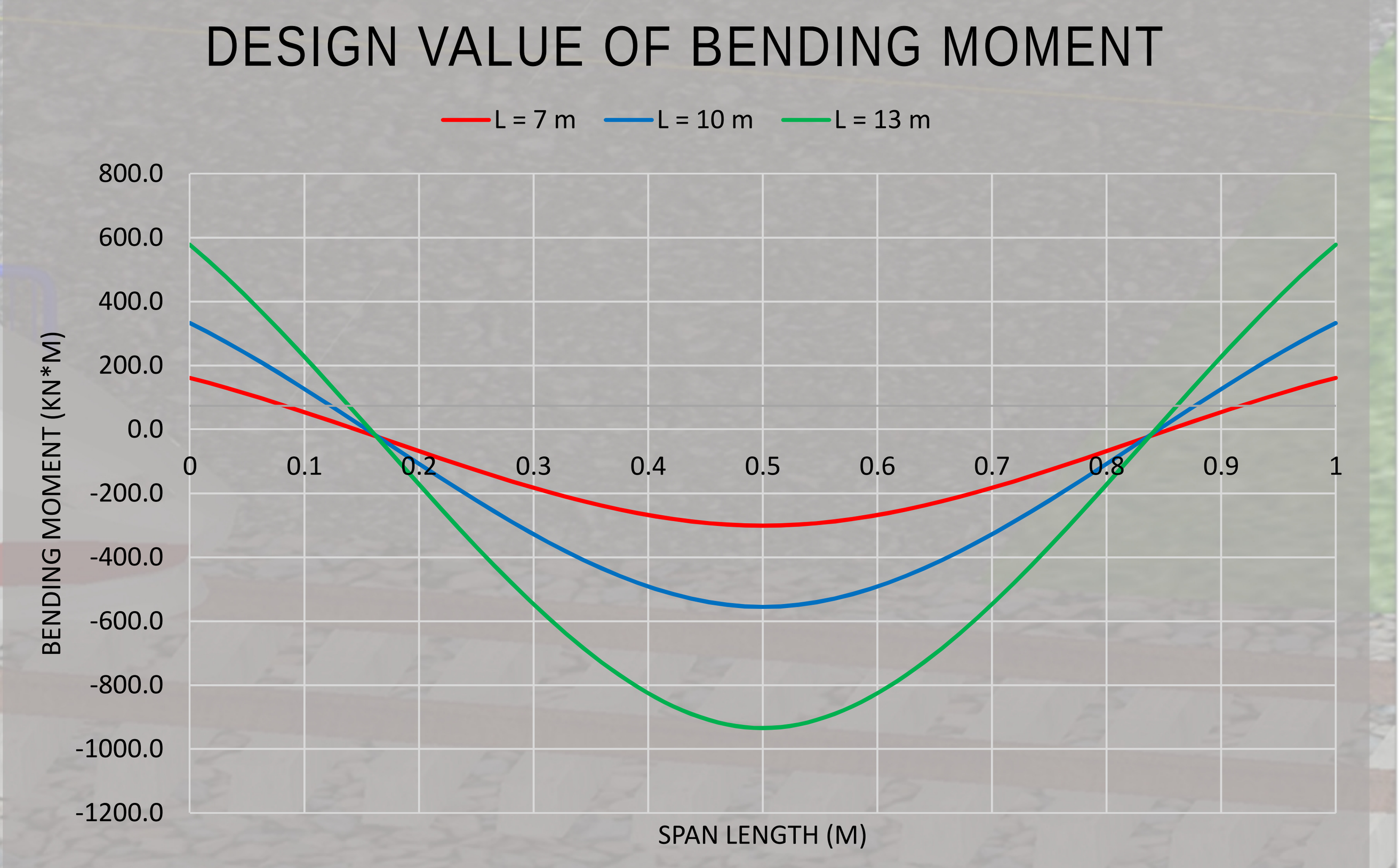
4. VERTICAL ACCELERATIONS OF THE DECK

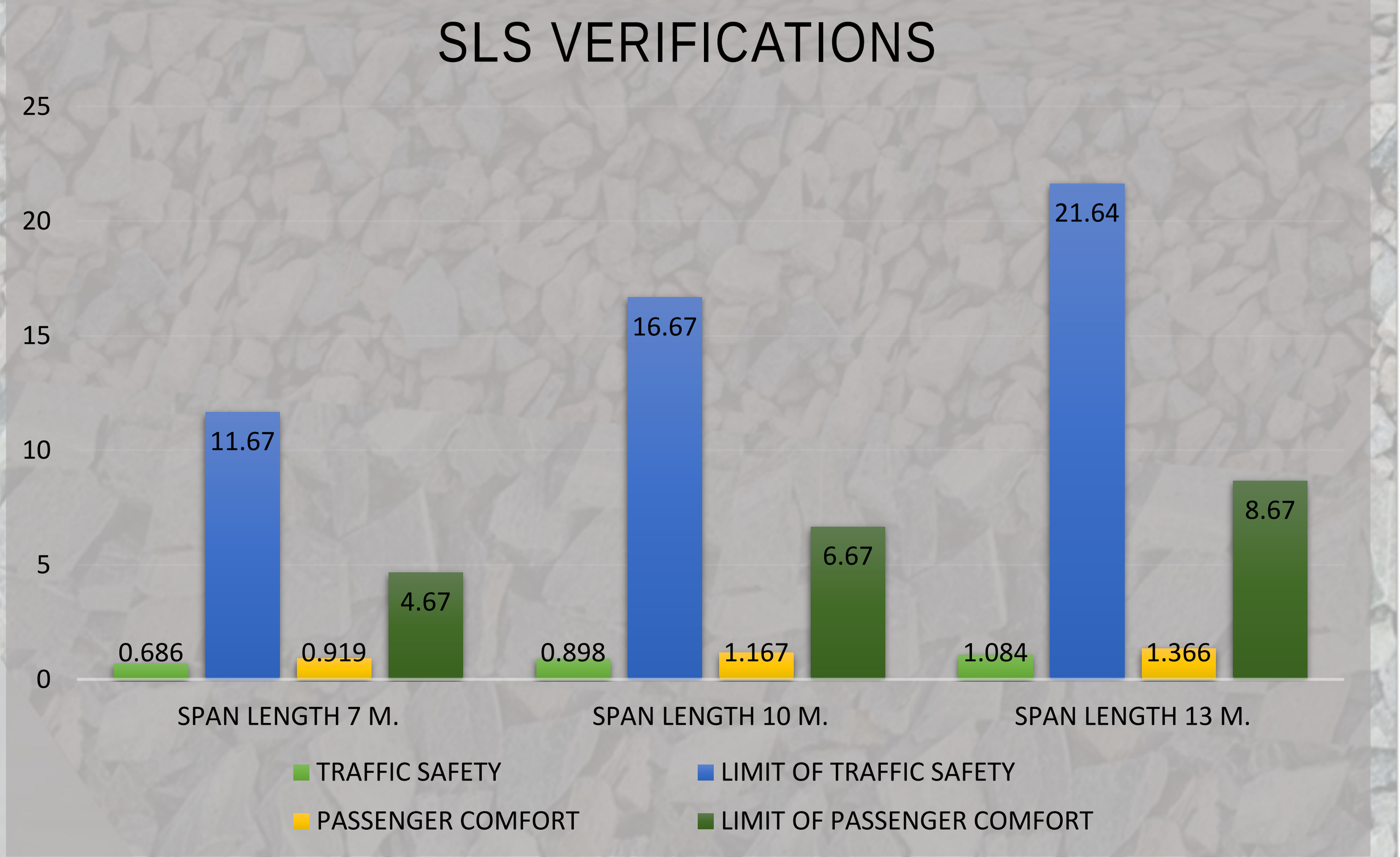






5. RESULTS DUE TO STATIC ANALYSIS





6. DECK REINFORCEMENT

Direction	Section	Reinforcement	Corresponding sectional area
Longitudinal	S1	Φ16 s=200 mm on top	1005 mm^2/m
Longitudinal	S2	Φ20 s=200 mm on bottom	1571 mm^2/m
Transversal	S3	Φ16 s=225 mm on bottom Φ12 s=225 mm on top	894 mm^2/m 503 mm^2/m
Vertical (shear reinforcement)	-	Φ12 s=300 mm 4 vertical links/meter	452 mm^2/m