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Simulation of Road safety H2 Railing with different Spacing between Pillars

The purpose of this paper is to verify through finite element analysis, behaviour of road impact railing. The vehicle used is a hard type, in our case a bus. By definition, the railing is a wall or a railing of little height witch serves to delimit the edge of a road, a bridge, aimed at stopping vehicles and restoration mainly on carriageway, pedestrians and conveyance of other road users.

Keywords: *safety, railing, protection, steel, deformation*

1. Introduction

In order to improve road safety, the design of a road requires certain sectors and in certain places to install devices that prevent vehicles and pedestrians to enter the danger areas [7]. Protective guardrails have varying levels of performance and aim to stop vehicles, restoring them on the carriageway, to reduce the damage and possible disasters and ensure the management of pedestrians and other road users [1]. Protective guardrails are designed optical guidance [3].

In the context in which our country is trying to develop a new road infrastructure based on a network of highways that connect us with other European countries, but to ensure a more rapid movement across regions, with elements that will be fitted these roads are not an issue [2], [4].

These elements constitute the safety concern of this paper, and many scientists and research institutes through their performance determined that reducing the number of road accidents, damages, and most importantly, the saving of human life.

2. The description of the simulation.

According to SR EN 1317-2, in Chapter 3.2 table 2 - levels of protection, we find that the high protection level H2, seeking acceptance is TB 51 and TB 11 [8].

We refer in this paper to test for TB 51, using as a test vehicle, with the characteristics specified in the same standard from part one [9].

The purpose of this is to verify simulations, finite element analysis, behavior of the parapet level road restraint H2, according to EN 1317-2, using a spacing between pylons (2, 5 m) different from that tested (1,5 m). He used finite element code LS-DYNA, developed by Livermore Software Technology Corporation [10].

For the calibration of the FEM model, we use the experimental results of a AISICO test, with spacing of railing support pillars 1,5 m. Interesting to follow developments in it useful width (W) and the conclusion of the simulation, because this simulation allows the determination of the useful widths without performing a physical crash test. Classification of the levels of the working widths (W) is found in EN 1317-2 [8].

3. Description of finite element models for vehicles used in simulations.

TB51 vehicle consists of:

Table 1.

Nr. NODE	80485
Nr. ELEMENTS	75549
Nr. MATERIALS	8
Nr. PARTS (components)	8

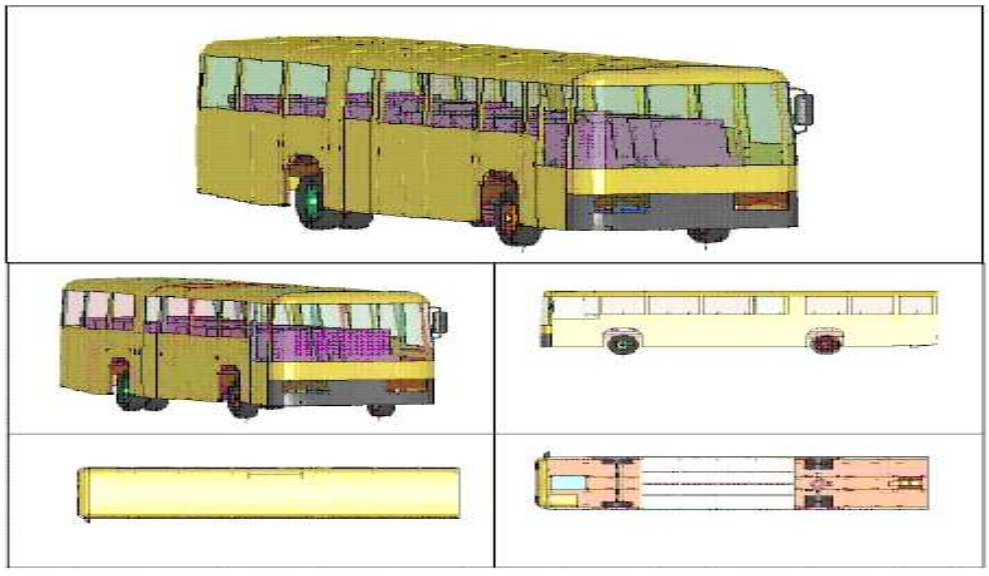

Figure 1. Vehicle TB51

4. FEM model of safety railing H2.

Table 2.

Nr. NODE	80485
Nr. ELEMENTS	75549
Nr. MATERIALS	8
Nr. PARTS (components)	8

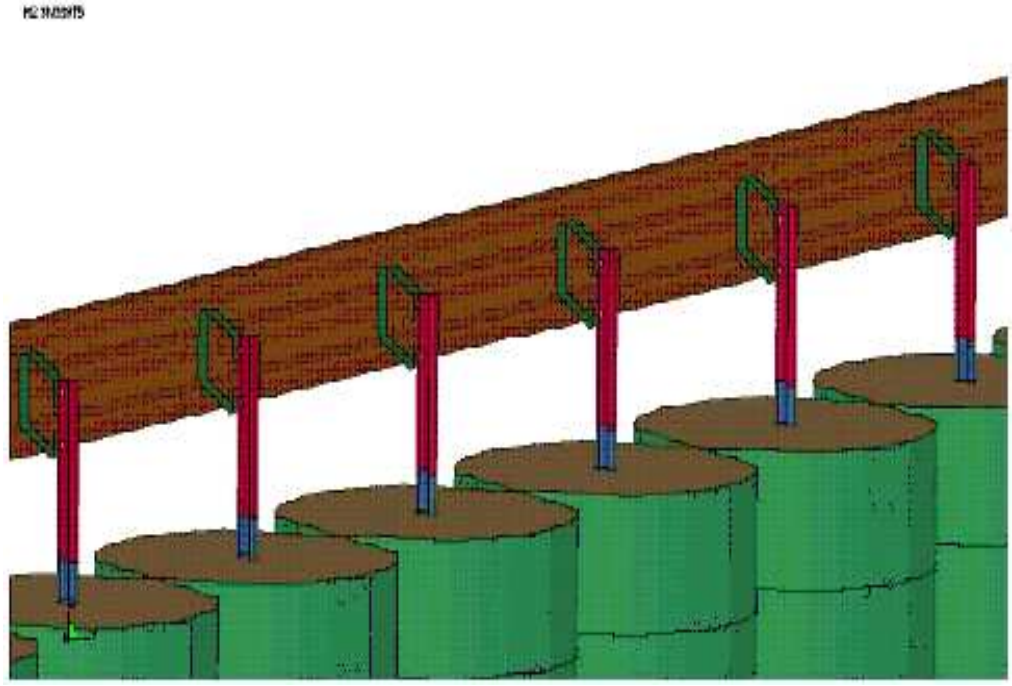

Figure 2. FEM model H2 guardrail

5. FEM model calibration of railing H2.

We achieved a simulation to verify the consistency of the FEM of railing. Below is the results of calibration, compared with experimental data. The comparison between experimental [5], [6] and simulated results is found in table 3.

The simulated results are very close to experimental ones. FEM model of the parapet is calibrated.

Table 3.

	Simulation	Experimental data from the AISICO[5]
Vehicle	TB51	TB51
The length of railing [m]	48	76
Mass of the vehicle [kg]	12720	12722
Impact velocity [km/h]	70,4	70,4
The angle of impact [°]	20	20
Maximum dynamic deflection [m]	1,24	1,2
Useful width [m]	1,33	1,3
Contact length [m]	16,5	17,1

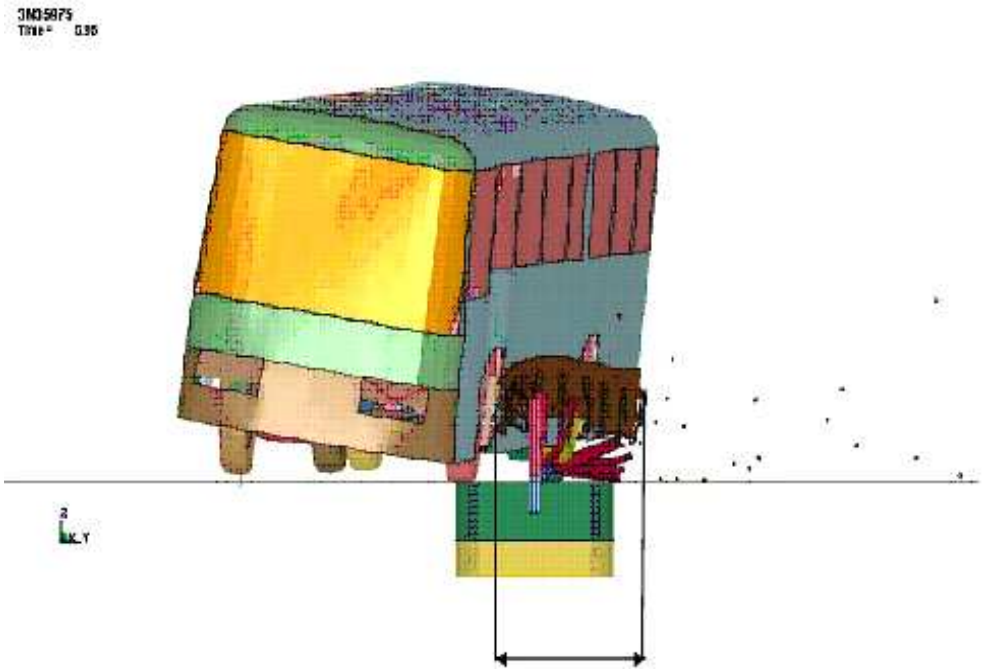

Figure 3. The width of the H2 railing (1.5 m spacing between pillars)

6. Simulation of collisions with H2 railing with spacing between pylons 2,25m.

We achieved a simulation for checking behaviour of H2 road guardrail spacing between pylons 2.25 m. The mechanical results calculated spacing between pylons of 2.25 m, can be found in table 4.

Table 4.

Spacing between pylons 2.25 m.	Simulation
Vehicle	TB51
The length of railing [m]	48,0
Mass of the vehicle [kg]	12720
Impact velocity [km/h]	70,4
The angle of impact [°]	20
Maximum dynamic deflection [m]	1,5
Useful width [m]	1,6
Contact length [m]	15

7. Conclusion.

The railing road H2 (spacing between pylons of 1.5 m) has been tested pursuant to EN1317-2. The width of the resulting output was 1.3 m (W4).

Mechanical calculations, after proper calibration, indicates that the same barrier with a spacing between the pillars of 2.25 m leads to a useful width (W) of 1.6 m (W5 according to the standard).

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