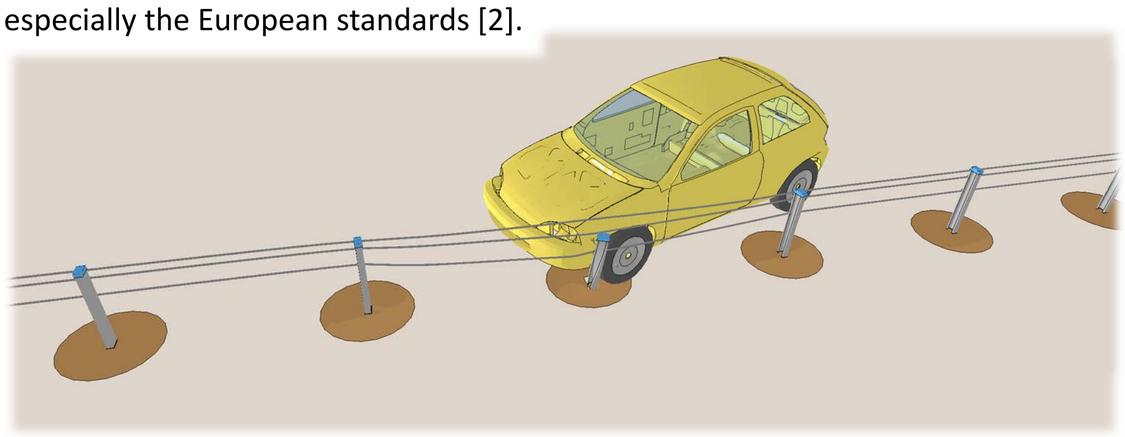
NUMERICAL STUDIES ON THE INFLUENCE OF SELECTED CONSTRUCTION FEATURES AND ROAD CONDITIONS ON THE PERFORMANCE OF ROAD CABLE BARRIERS

Dawid Bruski, Gdańsk University of Technology, **dawid.bruski@pg.edu.pl**
Wojciech Witkowski, Gdańsk University of Technology, wojciech.witkowski@pg.edu.pl

INTRODUCTION

Safety barriers are one of the safety devices used to increase safety on the roads. Current standards EN 1317 [1] concerning crash tests established the requirements that barriers must fulfil to be used on roads. A really useful tool that can be used as a supplement to the real full scale crash tests are numerical simulations. Currently, the importance of simulations in the test process of barrier systems increases. Part 5 of the standards [1] enables, under some conditions, certification of the modified barrier systems based on numerical calculations. Additionally in recent time many works about virtual crash tests appeared, especially the European standards [2].

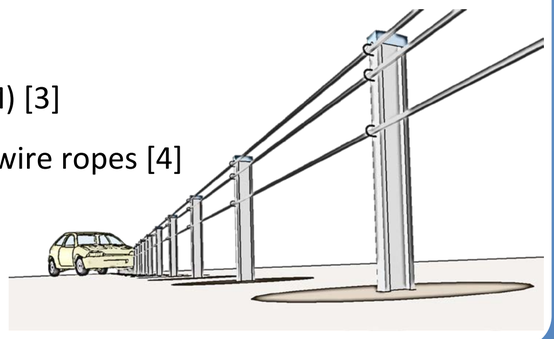


OBJECTIVES

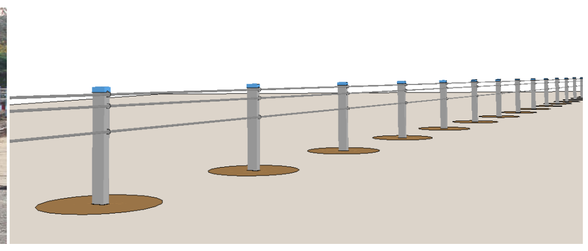
This study is concerned with the analysis of the influence of selected construction features and road conditions on the performance of cable barrier system.

METHOD

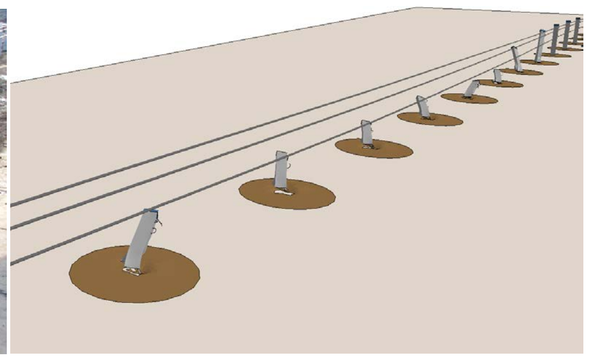
- **LS-DYNA** explicit finite element code (CDM) [3]
- Advanced **material models**, especially for wire ropes [4]
- Advanced **contact** realizations
- Comparison to **full-scale crash test** results

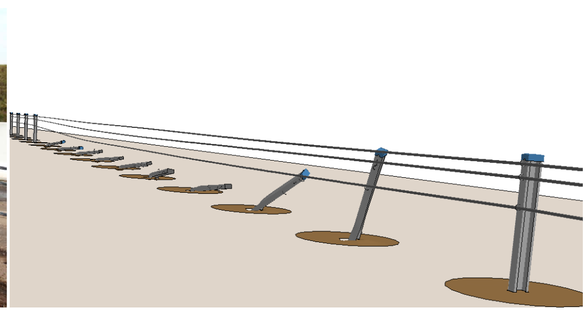


- Recreate geometry and build a **FEM model**

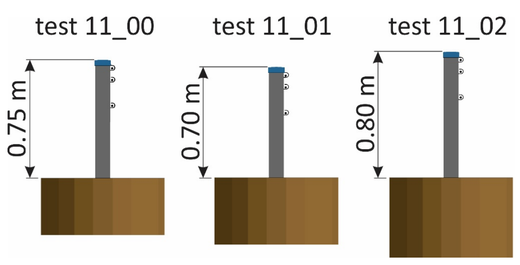


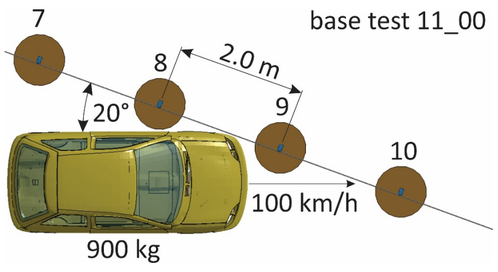
- **Validation** according to PD CEN/TR 16303 standards [2]





- Further **parametric analysis**
  - change construction features (barier's height, tensile force in cable)
  - change vehicle motion's parameters (impact angle and velocity)



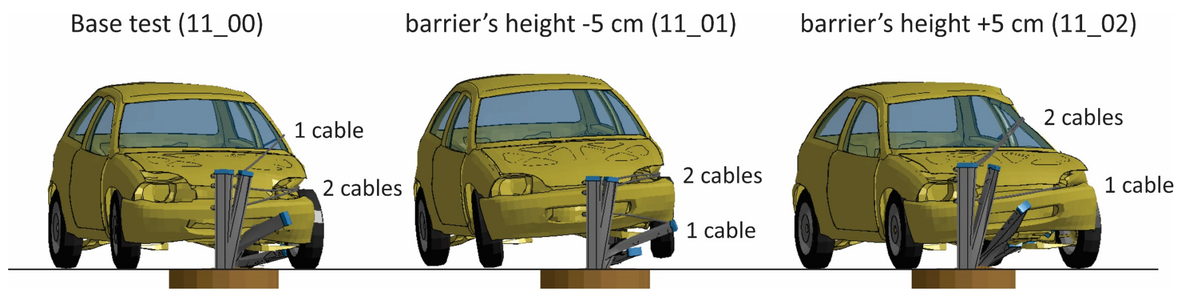


RESULTS

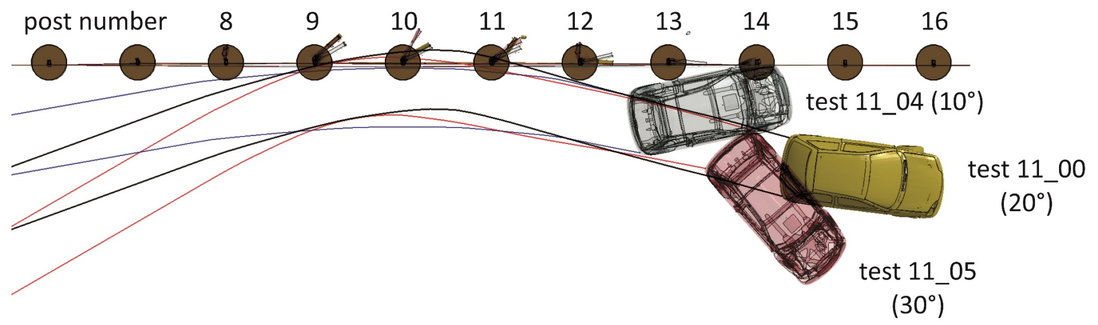
To determine the influence of selected construction features of the barrier and vehicle motion's parameters on barrier's performance, eight numerical simulations were performed. The results from all numerical simulations carried out are presented in table below.

Test	Descriptions	ASI, -	THIV, km/h	W_N, m	Contact length, m
11_00	base test TB11	0,68	26,9	0,87	8,0
11_01	height decreased by **-5 cm**	0,75	28,5	0,79	7,5
11_02	height increased by **+5 cm**	0,75	29,2	1,11	9,0
11_03	**50%** of initial force	0,66	26,6	0,89	9,0
11_04	impact angle **10°**	0,53	20,8	0,60	14,5
11_05	impact angle **30°**	1,06	35,3	1,22	7,5
11_06	impact speed **50 km/h**	0,49	21,7	0,68	3,5
11_07	impact speed **140 km/h**	1,04	30,8	1,33	13,0

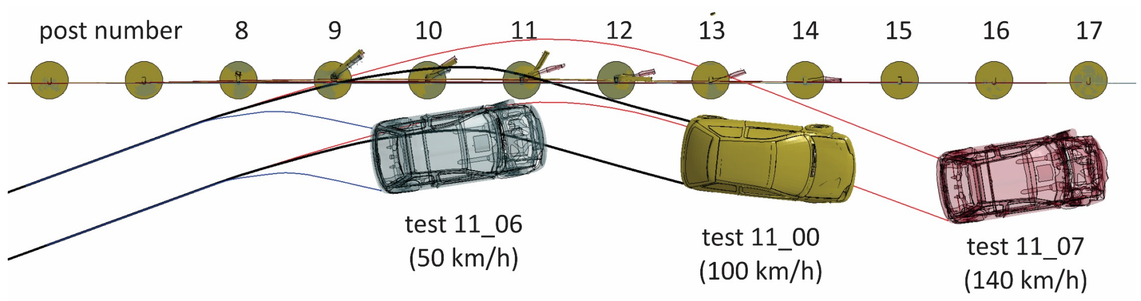
Influence of barrier's height



Influence of vehicle impact angle



Influence of vehicle impact velocity



CONCLUSION

- Influence of the vehicle impact angle and velocity on the barrier's performance was presented.
- Effect of the barrier's height and cable's tension on the system's behaviour was shown.
- Usefulness of numerical simulations to study the properties of safety barriers.

ACKNOWLEDGEMENTS

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2. PD CEN/TR 16303: 2012. *Road Restraint Systems* – part 1-4 (2012)
3. Hallquist J. O., *LS-DYNA Theory Manual* (2006)
4. Reid J., Lechtenberg K, Stolle C., *Development of Advanced Finite Element Material Models for Cable Barrier Wire Rope* (2010)

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