6th International Scientific Conference
organized by Railway Research Institute
and Faculty of Transport of Warsaw University
of Technology

ADVANCED RAIL TECHNOLOGIES

Book of abstracts

Warsaw, 2017
The conference is held under the patronage of:

MINISTER OF INFRASTRUCTURE AND CONSTRUCTION
JM RECTOR OF WARSAW UNIVERSITY OF TECHNOLOGY
PRESIDENT OF OFFICE OF RAIL TRANSPORT
PRESIDENT OF POLISH STATE RAILWAYS JSC
POLISH ACADEMY OF SCIENCES COMMITTEE OF TRANSPORT
SPONSORS OF THE CONFERENCE

- MABO
- CONTROL PROCESS
- ZAKŁADY AUTOMATYKI KOMBUD SA
- Alma
- HUTREM SERWIS
Scientific Committee

Chairman
Andrzej Żurkowski (Railway Research Institute)

Honorary Chairman
Henryk Baluch (Railway Research Institute)

Marek Bartosik (Lodz University of Technology)
Mirosław Chaberek (University of Gdańsk)
Witold Choromanski (Warsaw University of Technology)
Andrzej Chudziński (Warsaw University of Technology)
Paloma Cucula (Instituto de Investigacion Tecnologica) Spain
Iuriu Domin (Volodymyr Dahl East Ukrainian National University) Ukraine
Antonio Fernandez (Instituto de Investigacion Tecnologica) Spain
Maria Franekova (University of Žilina) Slovakia
Gebhard Hafer (bbw Hochschule Berlin) Germany
Bogusław Kazarz (Silesian University of Technology)
Zbigniew Łukasik (University of Technology and Humanities in Radom)
Andrzej Massel (Railway Research Institute)
Jury Merkisz (Poznan University of Technology)
Jerzy Mikulski (Polish Association of Transport Telematics)
Vitalij Nichoga (Lviv Polytechnic National University) Ukraine
Marek Pawlik (Railway Research Institute)
Iwan Prudys (Lviv Polytechnic National University) Ukraine
Dariusz Pyza (Warsaw University of Technology)
Jolanta Radziszewska-Woźnińska (Railway Research Institute)
Karol Rastocny (University of Žilina) Slovakia
Efrim N. Rozenberg (Research&Design Institute for Information Technology, Signalling and Telecommunications on Railway Transport)
Mirosław Siergiejczyk (Warsaw University of Technology, Railway Research Institute)
Juraj Špalek (University of Žilina) Slovakia
Wiesław Starowicz (Cracow University of Technology)
Witold Zawiejski (The Rail Vehicles Institute “TABOR”)
Anna Stelmach (Warsaw University of Technology)
Victor Stepow (JSC VNIIZhT) Russia
Viktor Sychenko (Dneprprivtovsk National University of Railway Transport)
Adam Szałata (Cracow University of Technology)
Adam Szeląg (Warsaw University of Technology)
Franciszek Tomaszewski (Poznan University of Technology)
Wojciech Wawrzyński (Warsaw University of Technology)
Sławomir Wiak (Lodz University of Technology)
Andrzej Wojciechowski (Polish Scientific Society for Recycling)
Władimir Zajcew (NDKI) Ukraine
Krzysztof Zboiński (Warsaw University of Technology)

Organizing Committee

Chairman
Mirosław Siergiejczyk (Warsaw University of Technology)

Vice-Chairman
Eliza Wawrzyn (Railway Research Institute)

Conference Secretary
Renata Barcikowska (Railway Research Institute)

Dorota Adamska (Railway Research Institute)
Jolanta Cybulinska-Drachal (Railway Research Institute)
Dorota Galkowska (Railway Research Institute)
Izabella Grzegorzka (Railway Research Institute)
Agnieszka Jagodzinska-Kurta (Railway Research Institute)
Agnieszka Marchela (Railway Research Institute)
Małgorzata Ortel (Railway Research Institute)
Andrzej Szmigiel (Warsaw University of Technology)
MODELLING OF SPECIAL TRAIN DYNAMIC FOR CONSTRUCTION SIMULATOR TO TRAIN DRIVERS TRAINING WITH USING VBS3

Robert Konowrocki\textsuperscript{1,2}, Adam Dąbrowski\textsuperscript{2}, Roman Wantoch-Rekowski\textsuperscript{3}, Przemysław Brona\textsuperscript{2}
\textsuperscript{1}Institute of Fundamental Technological Research, Polish Academy of Sciences, \textsuperscript{2}Railway Institute
\textsuperscript{3}Military University of Technology, Faculty of Cybernetics
e-mail: rkonow@ippt.pan.pl, adabrowski@ikolej.pl, roman.rekowski@wat.edu.pl, pbrona@ikolej.pl

Keywords: railway vehicle simulator, railway vehicle dynamics, virtual environment VBS3

Introduction
Due to the fact that training simulators of railway vehicles must fulfill unique requirements resulting from the specific properties of the simulated vehicles \cite{1}, in this article on determining the main criteria for modeling the dynamics of such systems was presented. A methodology used in the study on the selection of parameters of the modeled vehicle and its driveline \cite{2,3} based on experimental studies was described. Adaptation of parameters obtained from the experimentally test into the dynamics model of vehicle was presented. Currently used solutions in simulators as well as issues related to animation and presentation of the image was provided. The requirements for the operation of the rail vehicle simulator, as well the design requirements for visualization of the image were defined and discussed \cite{4}.

Considered problem
The heavy-duty, 4-axle motor tower cars are specific railway vehicles structures that are designed to pull, push wagons and repair traction. Depending on their purpose, they are equipped with various types of power units and equipment on their decks. Maximum speed achieved by these vehicles do not exceed 90 km/h, but in spite of this the operators of such vehicles a lot of experience and skills are required. The high inertia of such vehicles is one of the features that make driving them can be complicated and requires proper prediction of more situations. In this paper problems related to the construction of a general numerical model constituting the main element describing the movement dynamics of special rail vehicles and their drivetrain \cite{2} was discussed. This model to build simulators for the training of operators using such vehicles was used. Such a simulator must take into account not only the aforementioned conditions but a number of different requirements, which primarily concern the functioning of the vehicle and its ability to reflect real operating conditions, track geometry and weather conditions \cite{1}. In the article, the results of experimental tests done on real vehicles to describe unique them parameters and working conditions were presented.

Considered railway vehicle
MTW 100 - a network emergency train manufactured by the Austrian company Plasser & Theurer, designed for repair and maintenance of the traction network was considered. Structure of the vehicle was presented in fig 1.

Fig. 1. Considered real railway vehicle
VBS3 comes equipped with several built-in applications that support development training capabilities. These include the following: mission editors, which allow users to add, modify or delete objects before and during training, and an after-action review module, which allows administrators and users to conduct post-training analysis with the ability to fast-forward or rewind to events; a full development suite, allowing users to create buildings and railway line, edit terrains and convert 3D models to the VBS3 simulation environment; a massive content library, including more than 9,000 entities; an HLA/DIS gateway that connects VBS with other simulations or interconnects many VBS servers together. The Virtual Battlespace 3 (VBS3) is a flexible simulation training solution for multiplayer scenario training, mission rehearsal and more. The Virtual Battlespace (VBS3) to visualize the motion of the rail traffic was used (fig. 2).

Summary
The use of numerical technologies to study the processes accompanying the operation of specialized rail vehicles used on railway infrastructure in Poland was presented. The used of numerical technologies to study the phenomena accompanying the dynamics longitudinal ride of specialized rail vehicles used on railway infrastructure in Poland was occurs. The experimental methodology used to obtain the unique parameters of the vehicles considered was also discussed. The results of these studies to validate the resulting numerical models describing the dynamics of vehicles during operation were used. The obtained results of the theoretical convergence with the experiment results indicated.

The Virtual Battlespace (VBS3) to visualize the motion of the rail traffic was used.

Reference