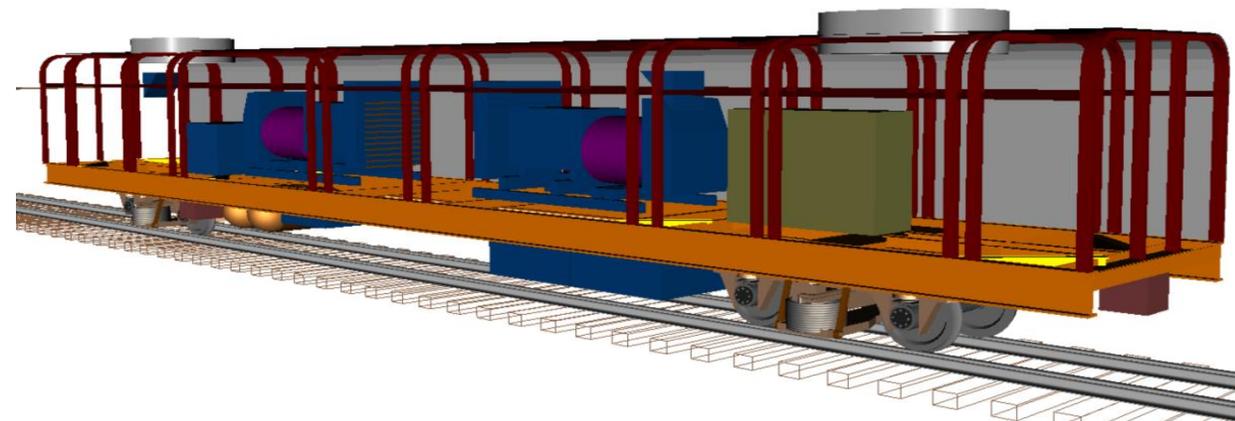


Thailand Customized Power Car



Center of Excellence for Road and Railway
Innovation (NU-RRI)
Faculty of Engineering, Naresuan University

About US

Establish Since 2013 Under University Regulation Aims to Enhance NU to be a “World Class” University.



OUR ALLIANCE



State Railway of Thailand

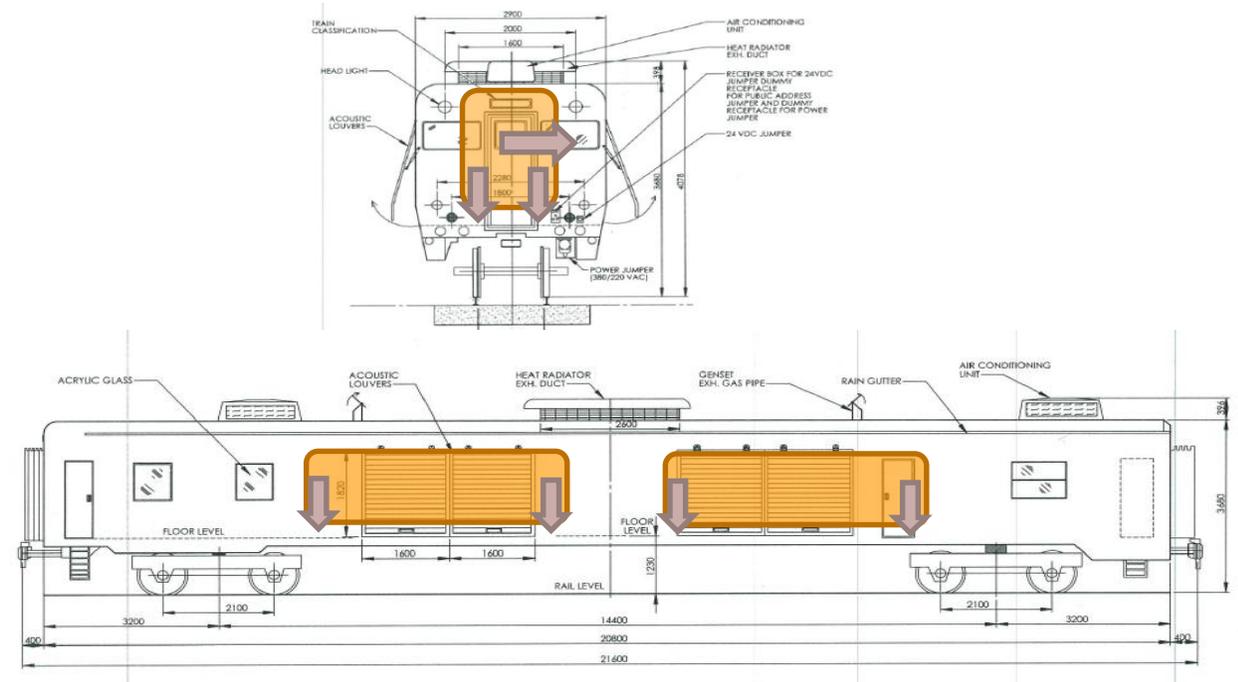
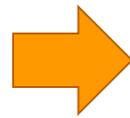


Connect to a Better Future

Power Car



Challenges



Original Train

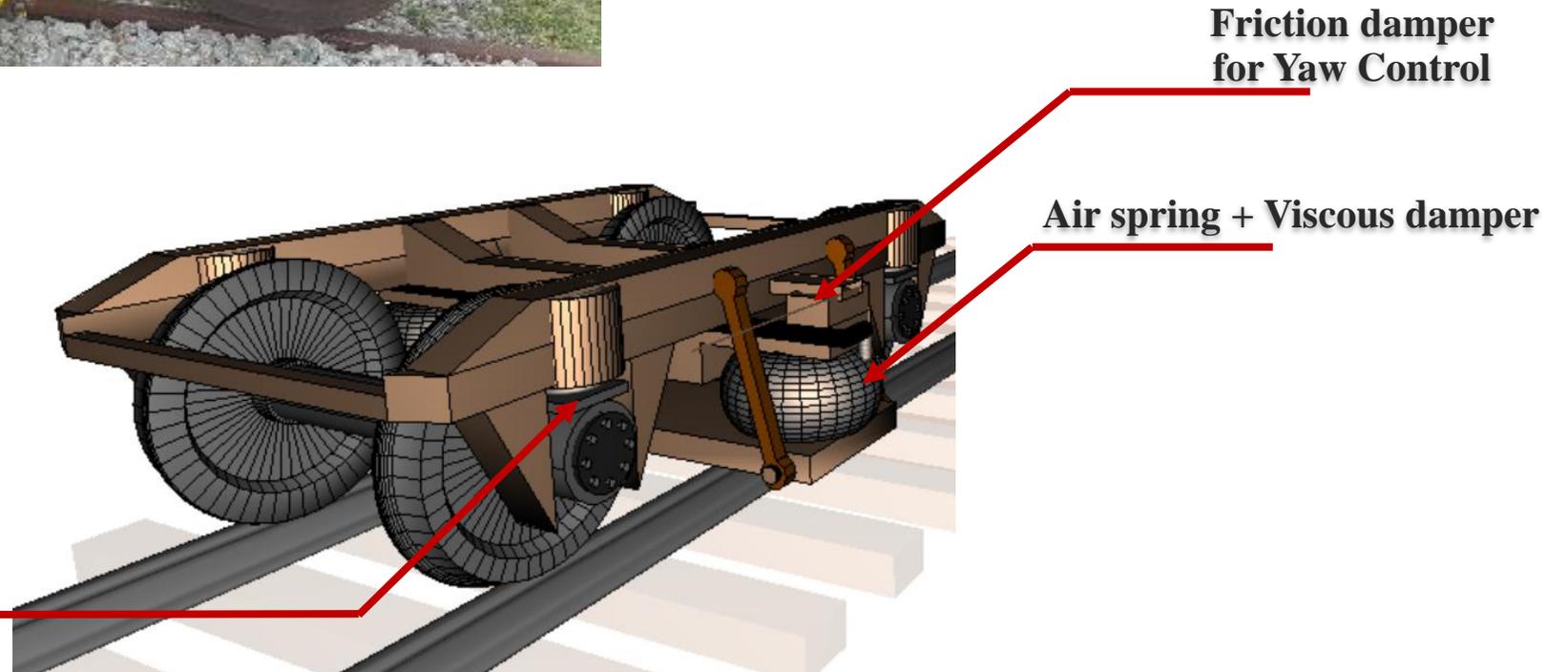


Constraint: Old bogie



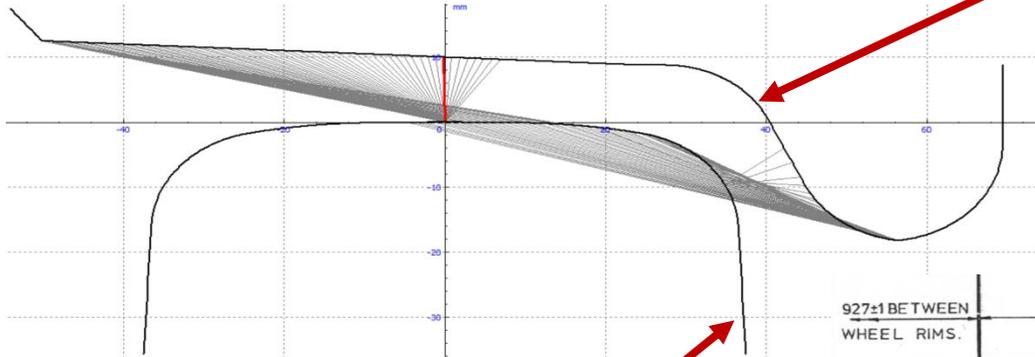
- **No information of suspension characteristics**
- **Limited axle load capacity**
- **Remaining fatigue life?**

Bogie mass 4 tons

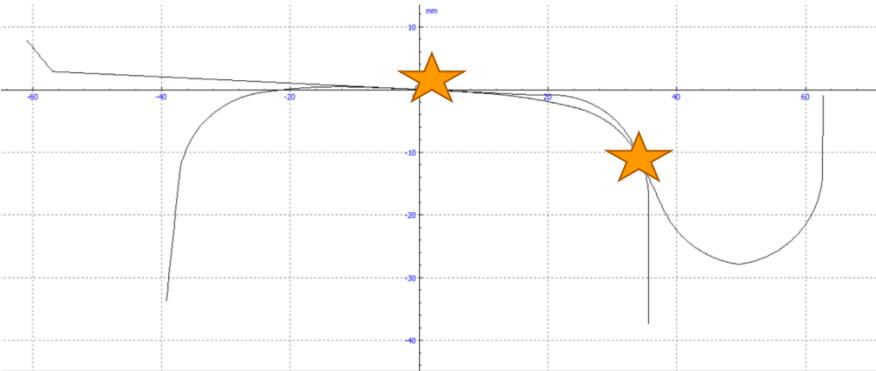
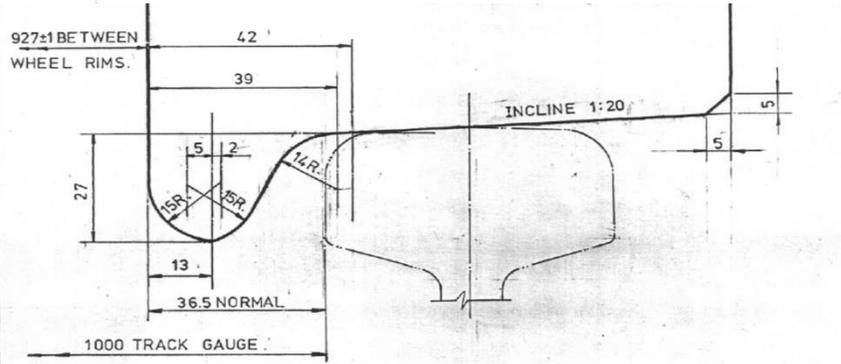


Constraint: Inconsistent Wheel-Rail Profile

Vidura Wheel Profile

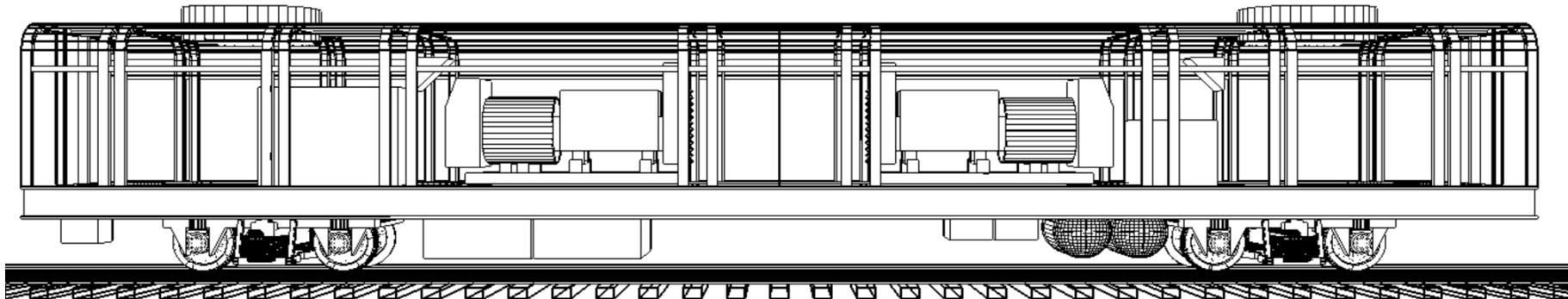
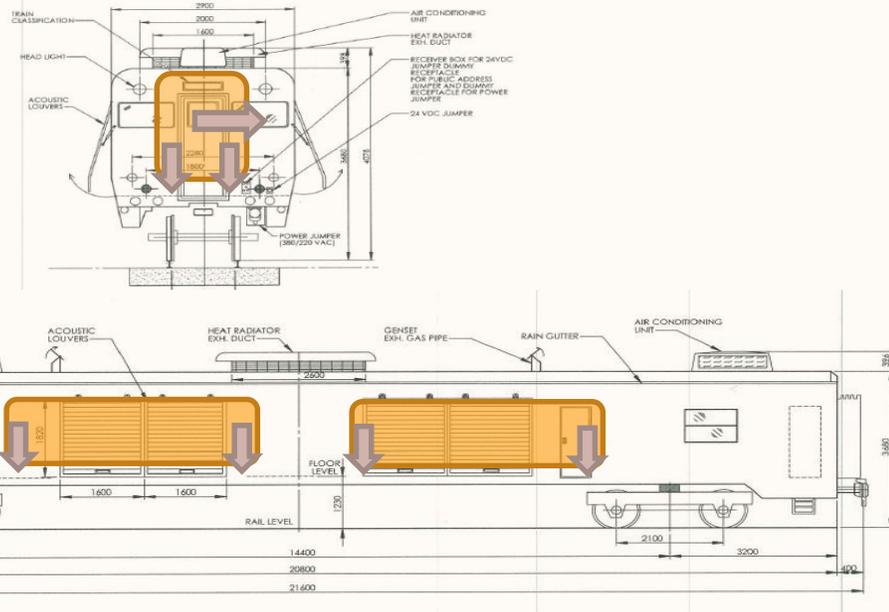


BS100A Rail



Two points contact

Overall Plan

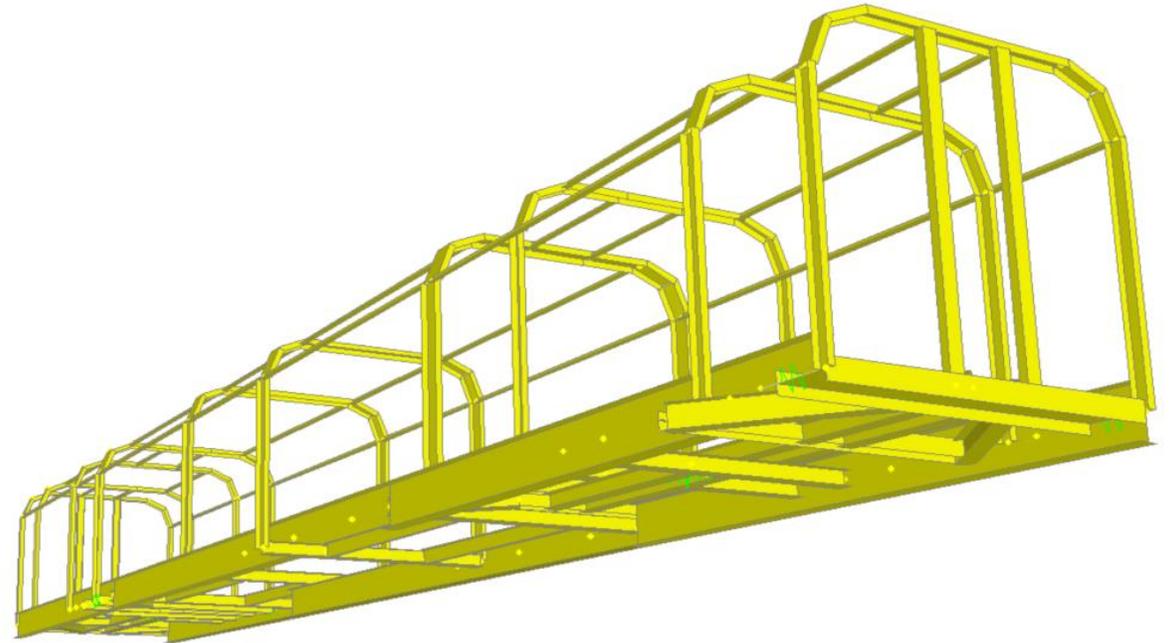


Why we do it



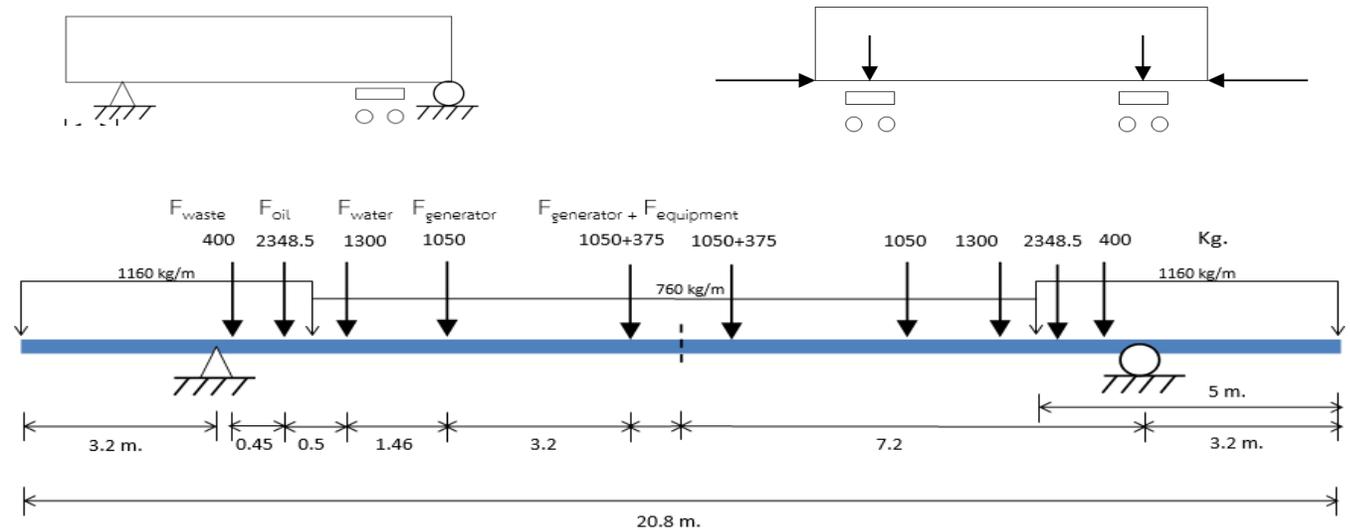
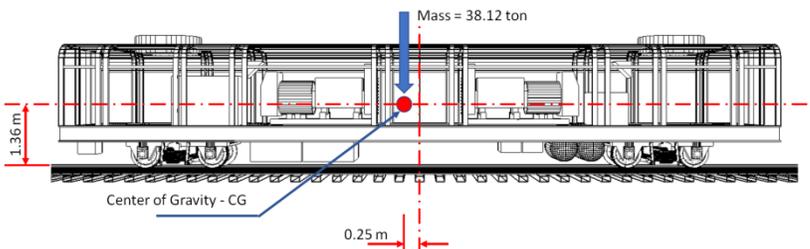
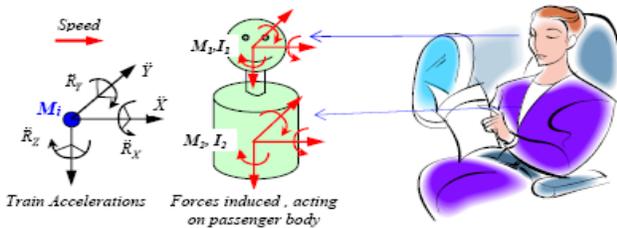
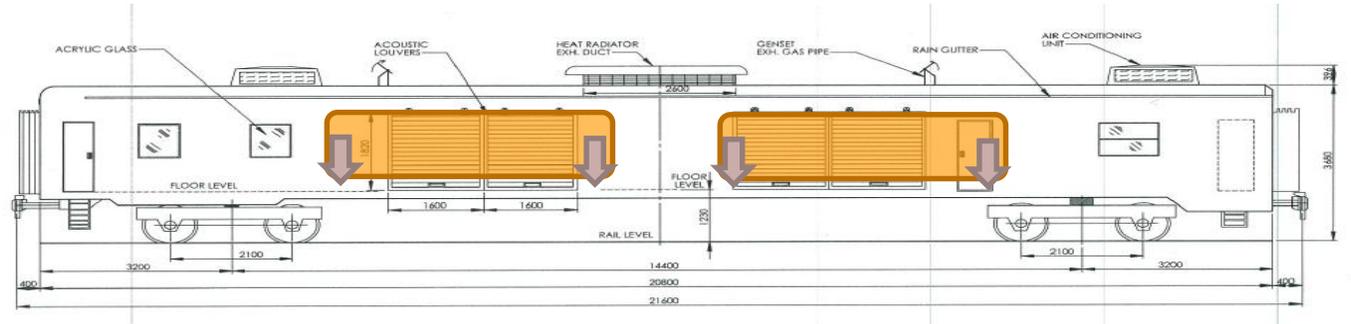
- **First Step for Self Reliance**
- **Only 8 cars with customisation, nobody gonna make it for us**
- **The import one cost more than 2m USD**

Design of Car Body



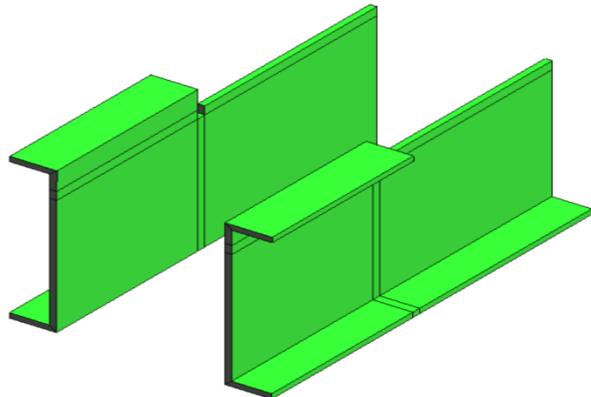
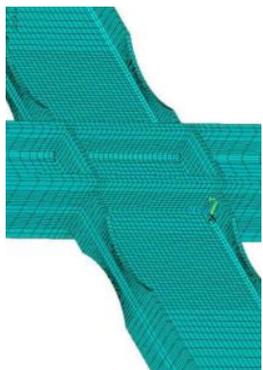
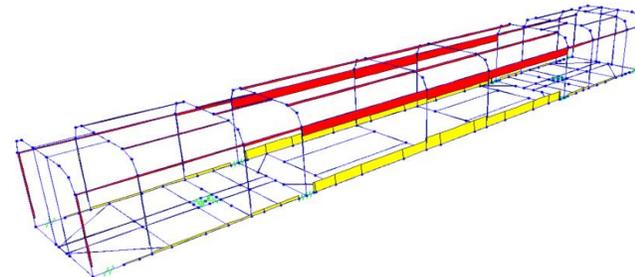
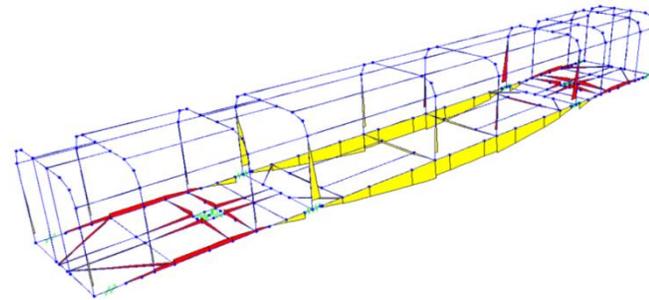
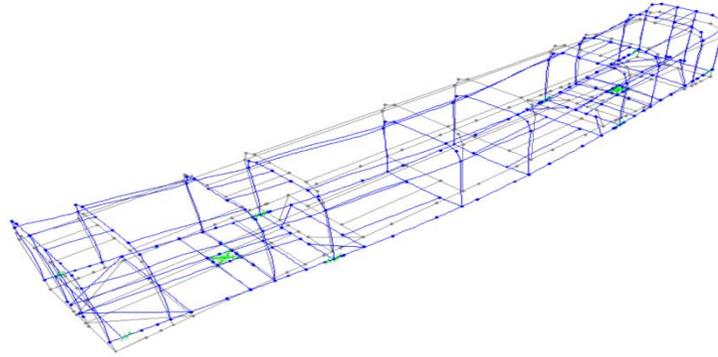
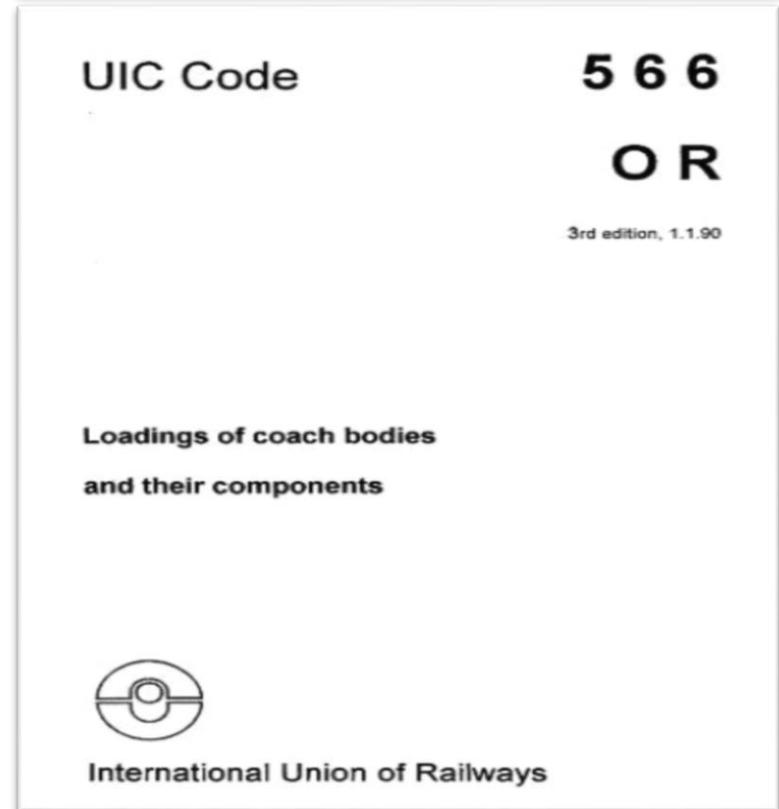
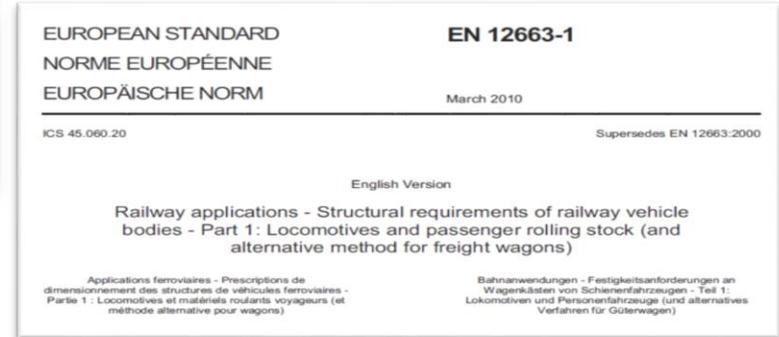
Design consideration of Car body

- Load capacity
- Strength
- Stiffness (bending, torsional, etc.)
- Dynamic response
- Center of Gravity
- Crash worthiness
- Member joint/connection
- Fatigue life
- Door, window & other opening
- Ride comfort
- Construction method
- Maintenance method



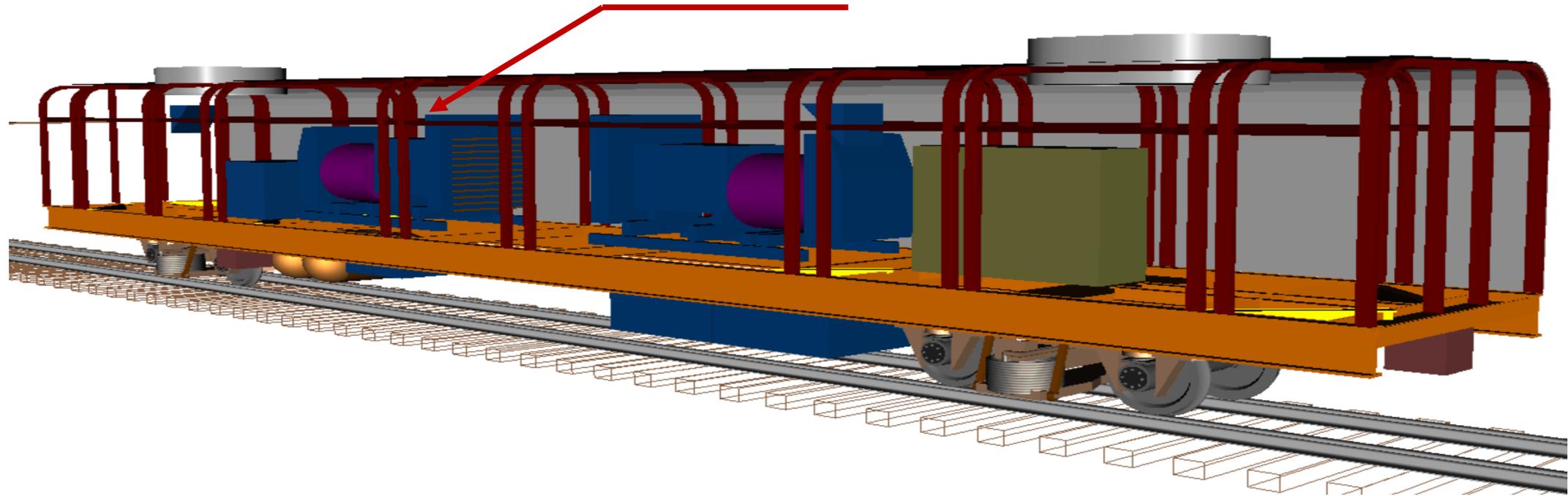
Design standard & Structural Design

- SRT Manual & Guideline
- EN 12663 – European Norm
- UIC 566 – International Union of Railways



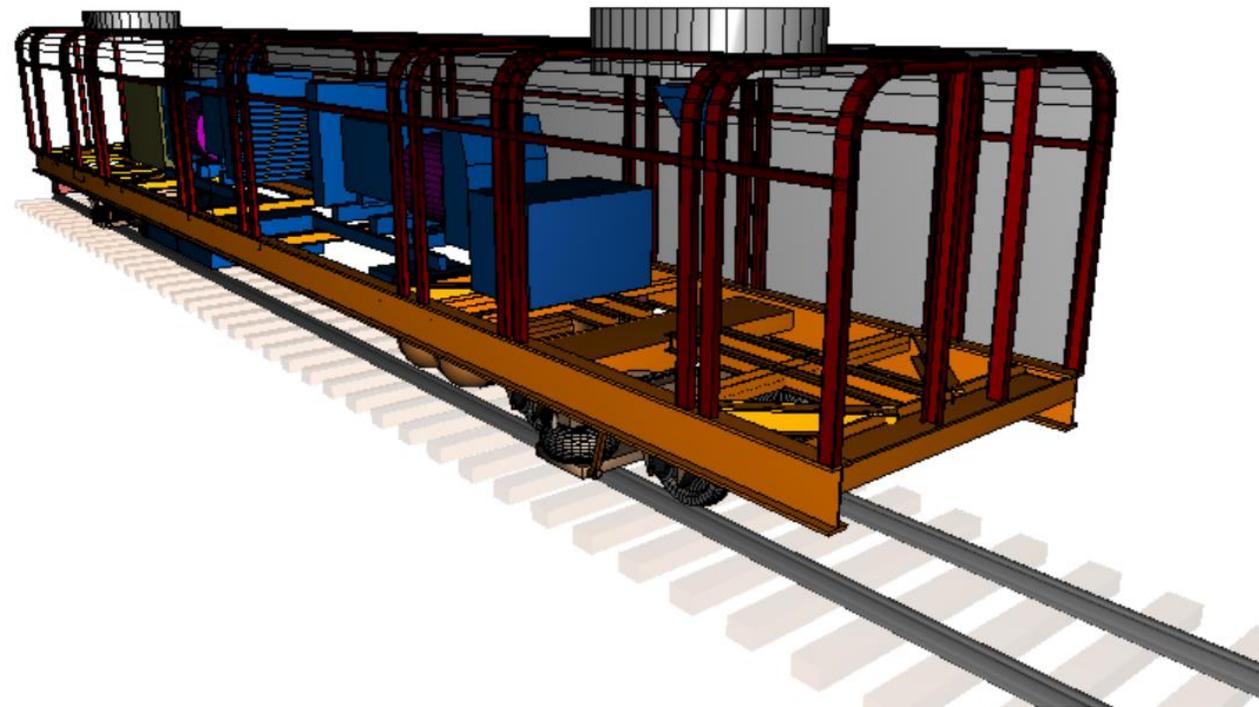
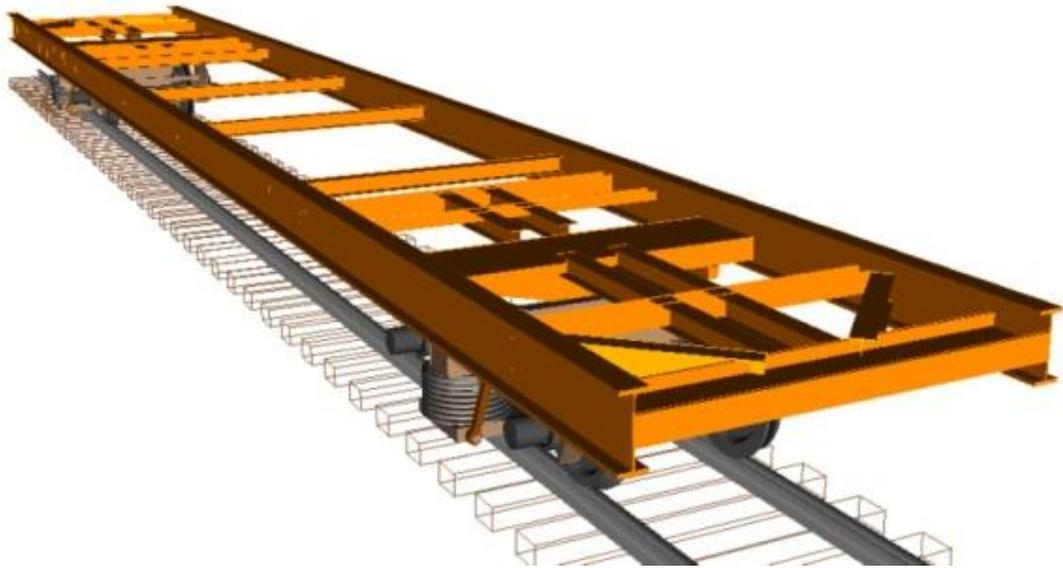
Final Train Layout

3.5 tons electric generator

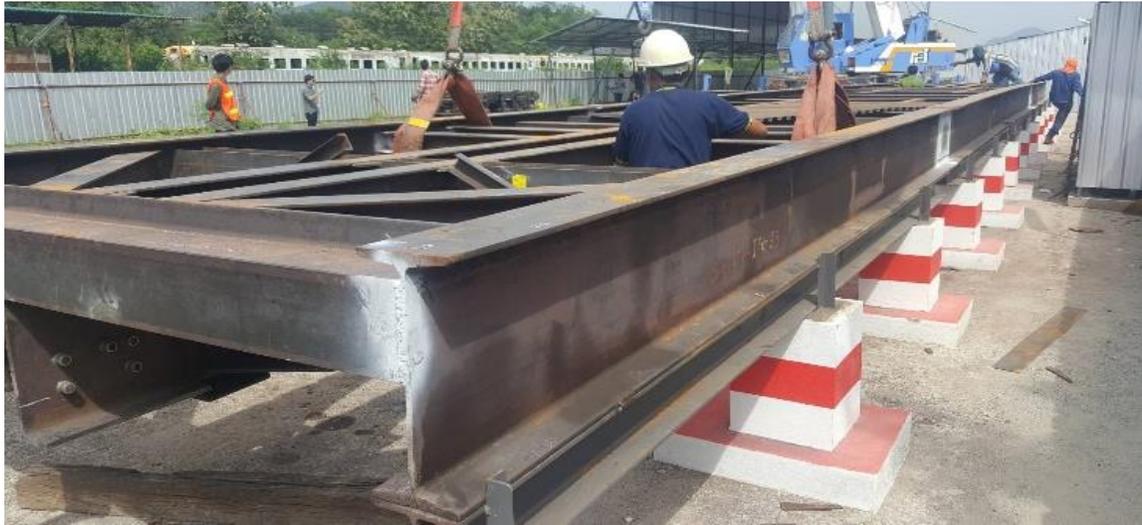


Total train mass 38 ton

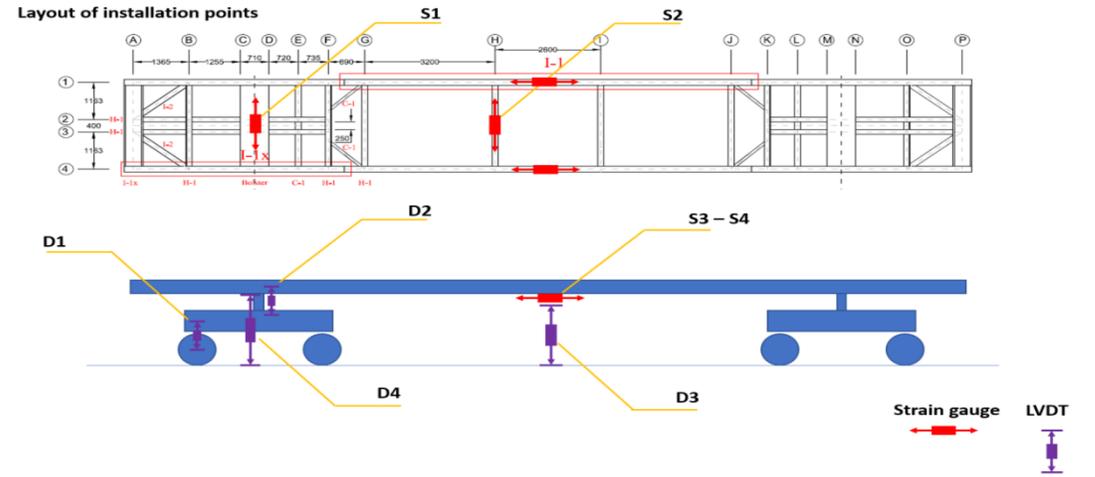
Construction



Construction



Inspection and Testing

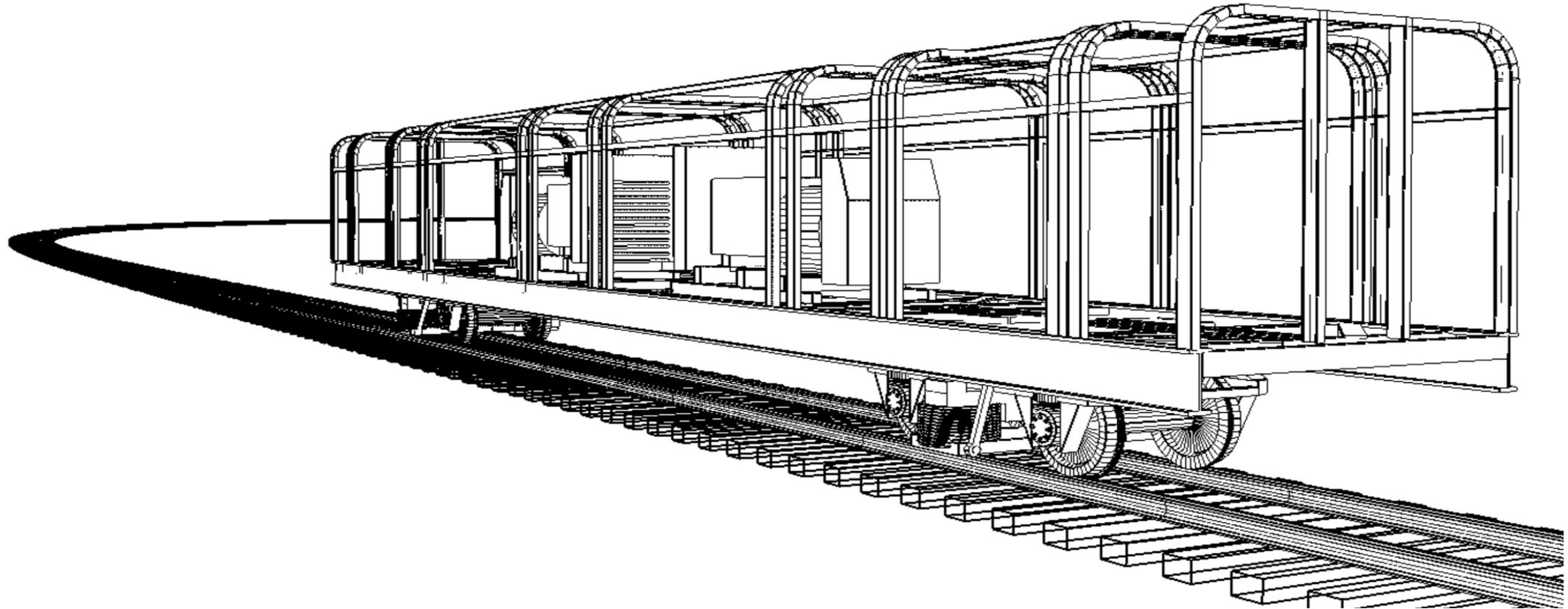


Final Product





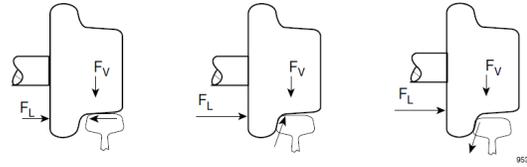
Dynamic Simulation



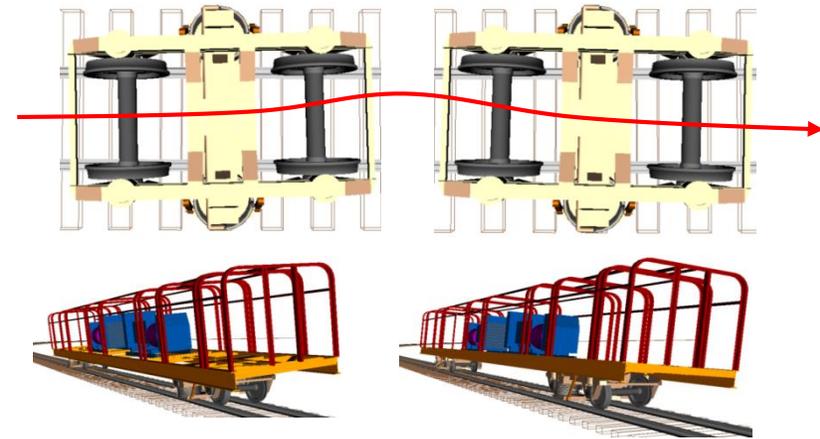
Purpose of Dynamic verification



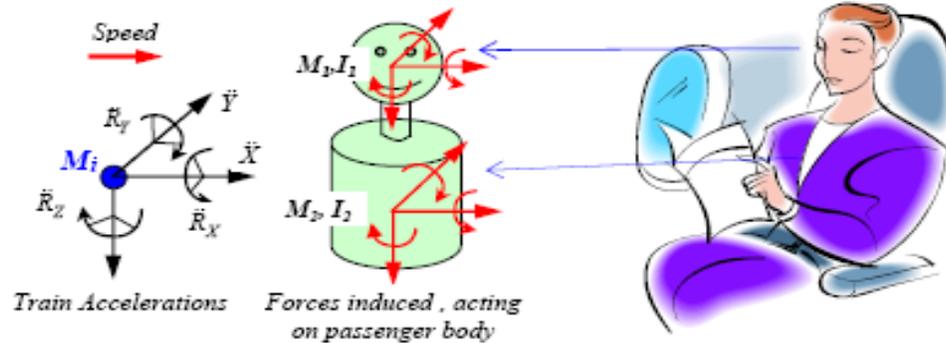
Running Safety



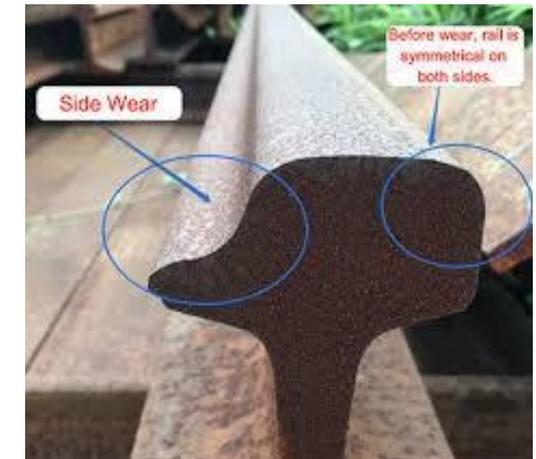
Running Stability



Ride Comfort

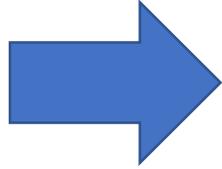


Wear & Fatigue

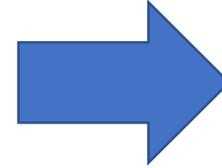
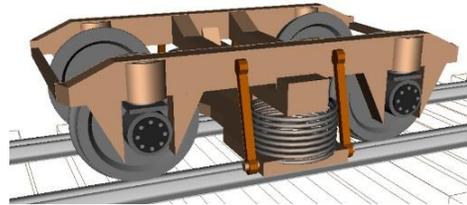


Test Program

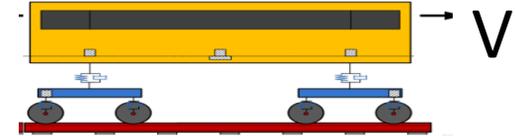
Track Layout



Suspension Variation



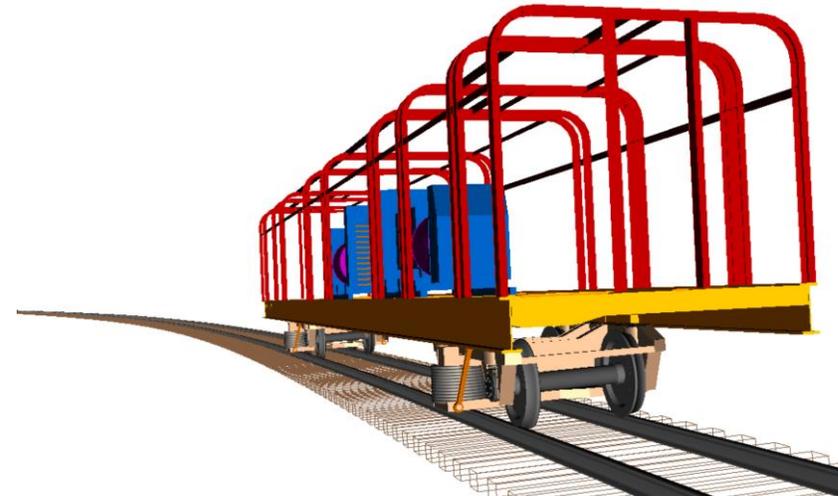
Speed Variation



Tangent Track



Curved Track



Suspension properties

UM Experiment option is Very Useful !



Air spring stiffness ← Calculate from
Car-body bouncing frequency
0.5, 1.0, 1.5, 2.0 Hz

Damping ratio of 2nd suspension
1.0, 1.5

Dynamic Analysis using Universal Mechanism

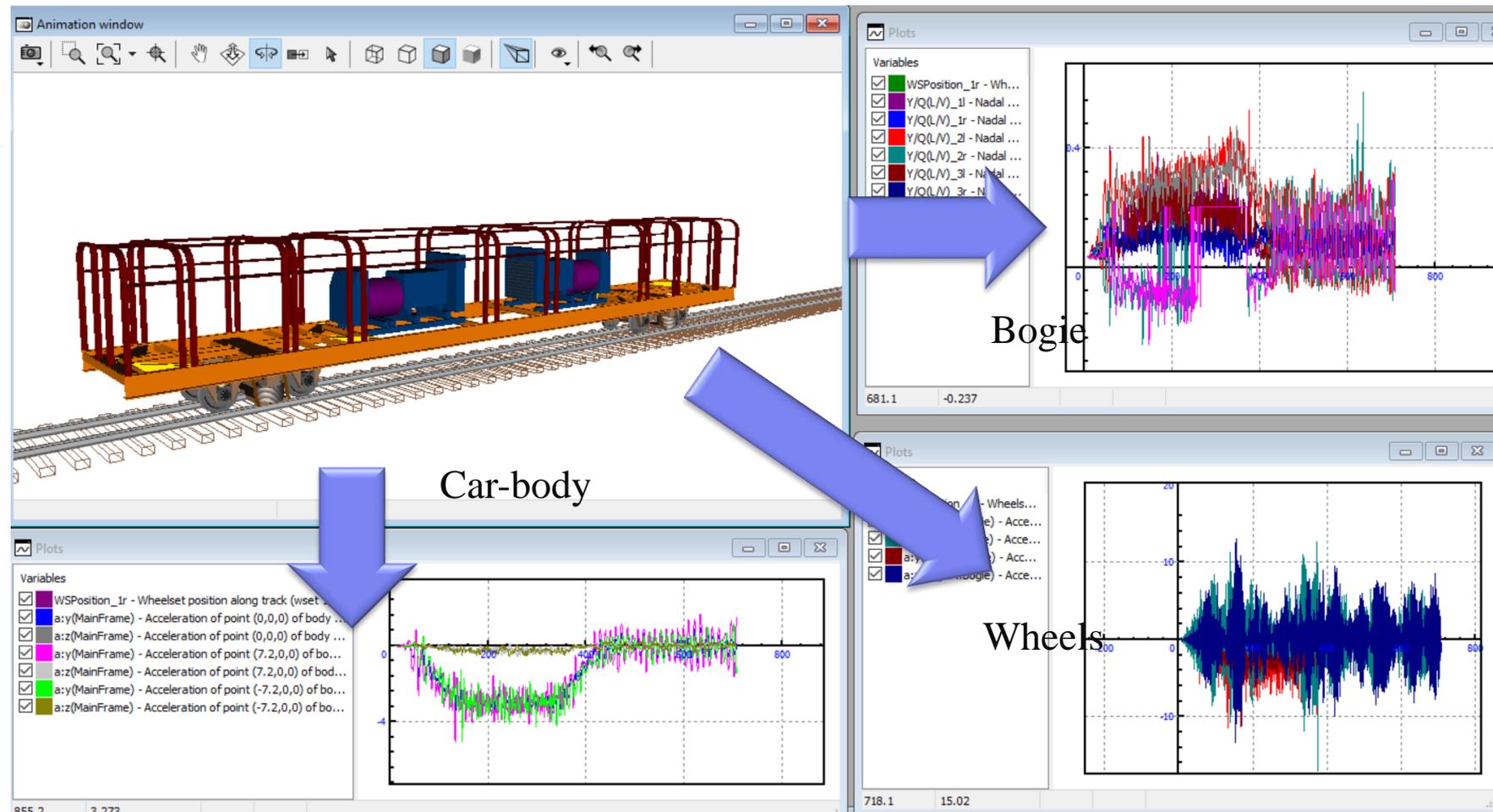


- SRT Manual & Guideline
- EN 14363 – European Norm
- UIC 518 – International Union of Railways

BRITISH STANDARD

BS EN
14363:2005

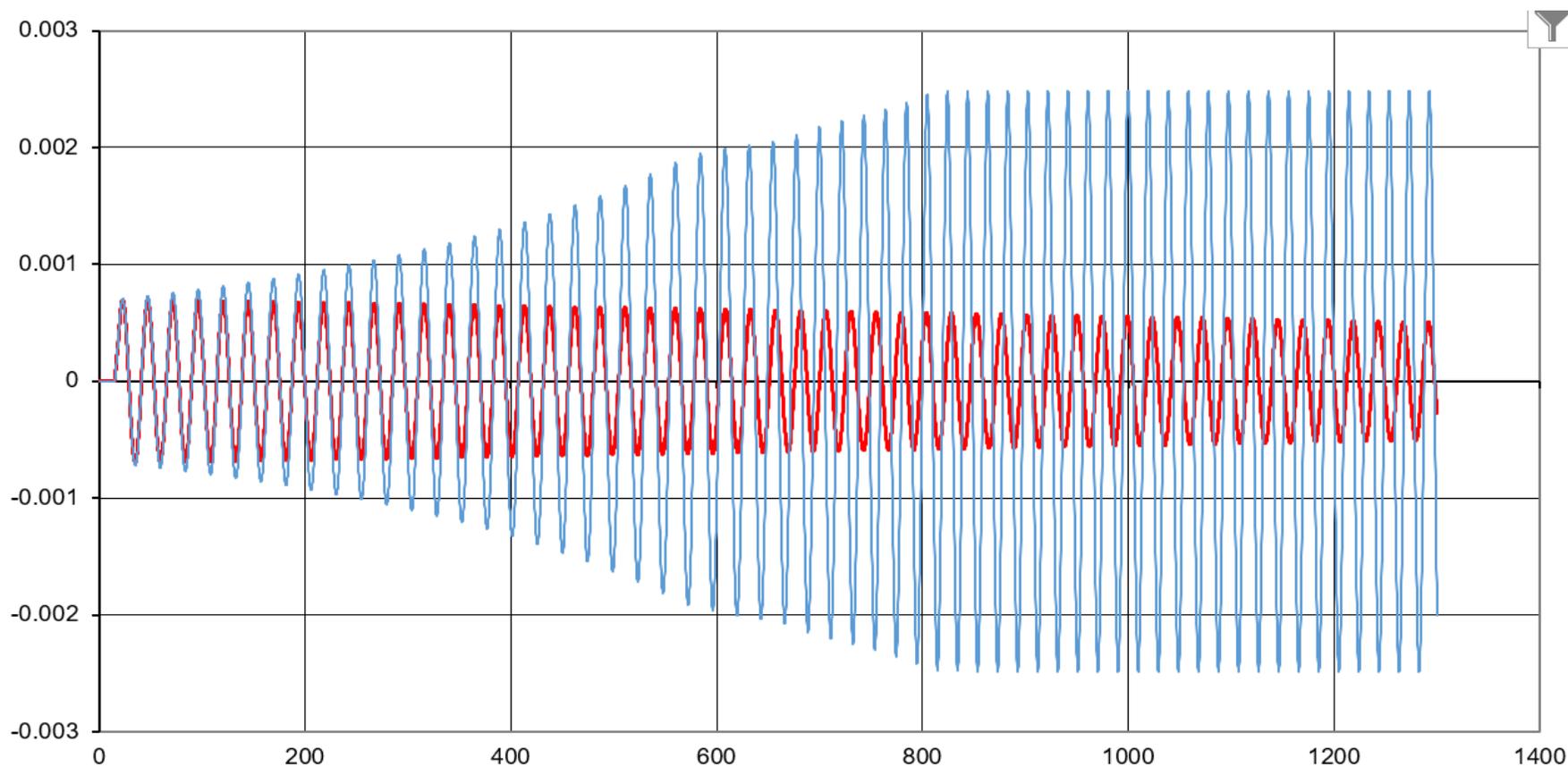
Railway applications —
Testing for the
acceptance of running
characteristics of
railway vehicles —
Testing of running
behaviour and
stationary tests



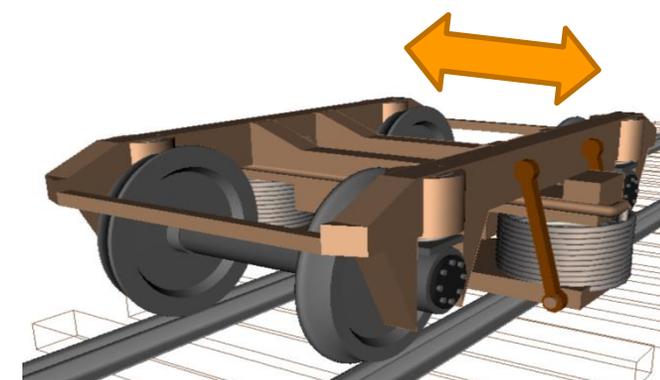
Running Stability



Critical at approx. 100 km/h



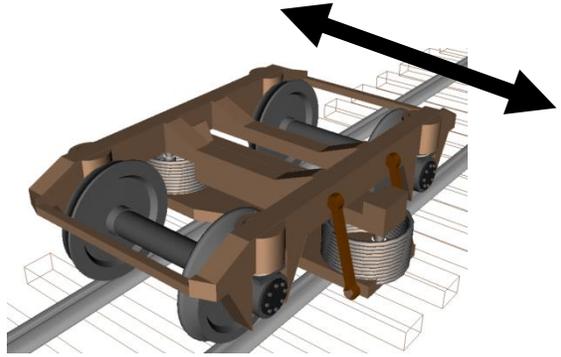
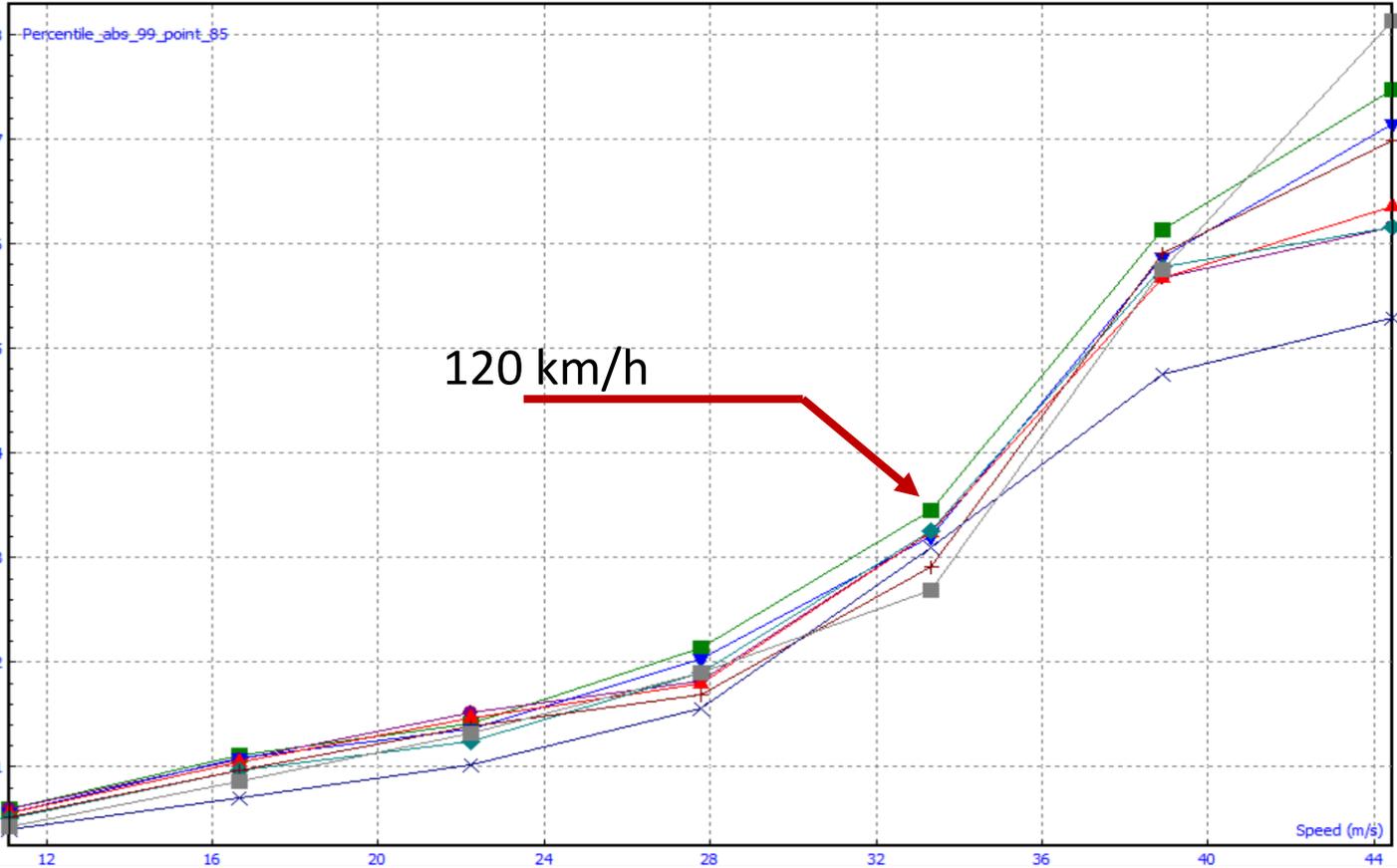
Tangent track



Safety Evaluation (UIC-518)

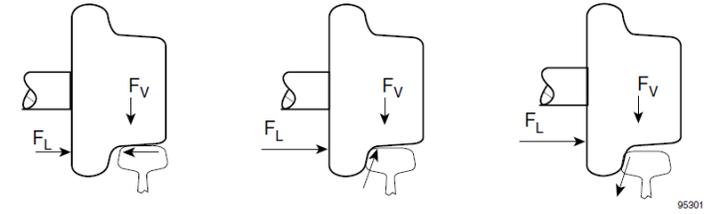
max = 8.2

UIC-518 Limit = 11.2

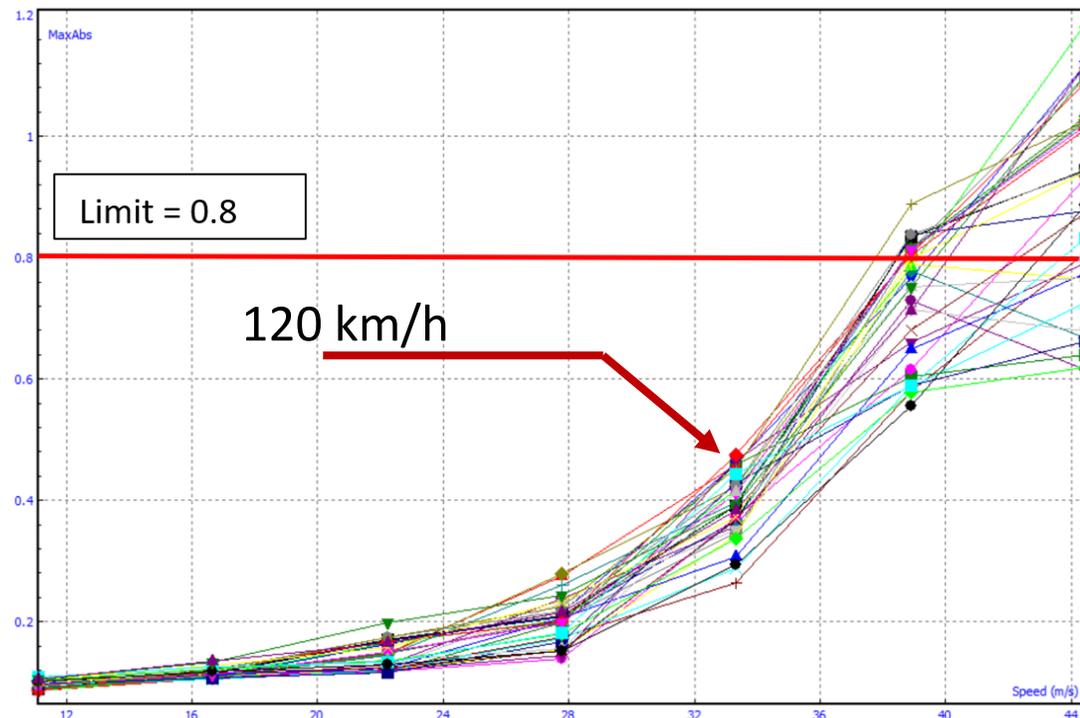


Speed m/s

Derailment ratio of all wheelset (L/V)

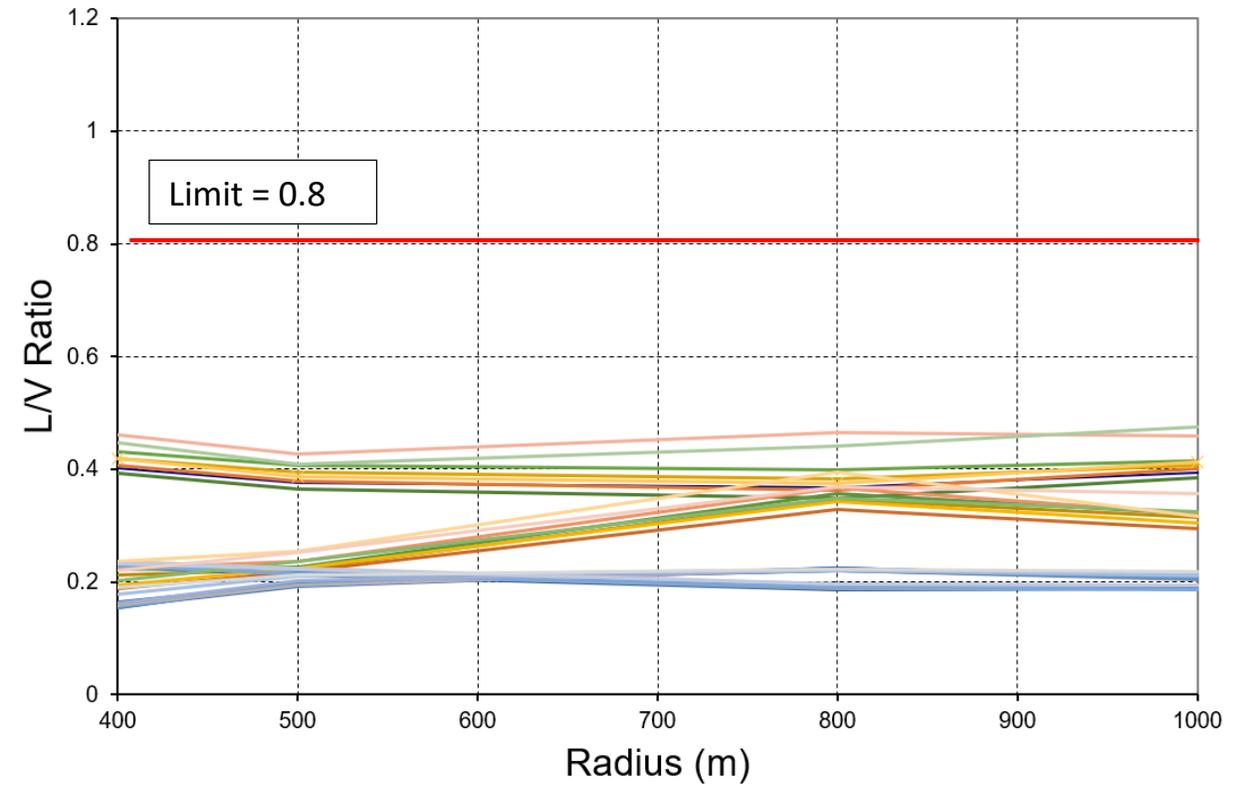


Tangent



Speed m/s

Curve



Small to large curve

Animation

The screenshot displays a simulation software interface with the following components:

- Top Bar:** Includes a menu bar (File, Analysis, Scanning, Tools, Windows, Help) and a toolbar with icons for simulation control and data analysis.
- Control Panel:** A floating window with buttons for "Pause", "00:00:00", "Select Area", "Audio", and "Record Pointer".
- Animation window:** Shows a 3D model of a train on tracks, with a dashed line indicating its path.
- Plots (Top Right):** A graph showing variables over time. The y-axis ranges from -4 to 4, and the x-axis ranges from 0 to 800. The variables listed are WSPositi..., a_u:y(Bogi..., and a_u:y(Bogi....
- Plots (Bottom Left):** A graph showing variables over time. The y-axis ranges from 0 to 1, and the x-axis ranges from 0 to 800. The variables listed are WSPositi... and a_u:y(Mai....
- Plots (Bottom Right):** A graph showing variables over time. The y-axis ranges from 0 to 1, and the x-axis ranges from 0 to 400. The variables listed include WSPositi..., Y/Q(L/M)_, and Y/Q(L/M)_. A "Process parameters" dialog box is open over this plot, showing simulation settings.

Parameter	Value
Simulation time (s)	3.42
Duration time (s)	5.485
Step duration (s)	0.00095029
Step size (s)	0.001

On-Track Test



Preliminary On-Track Test by SRT



การรถไฟแห่งประเทศไทย

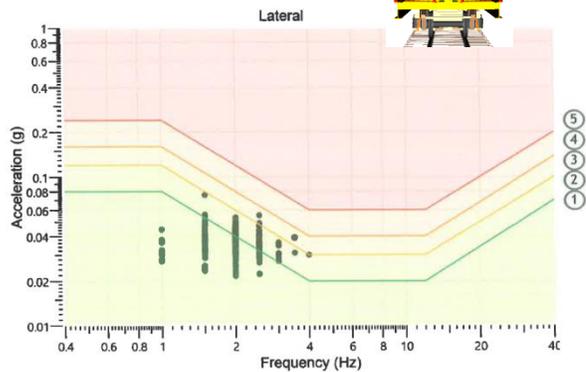


Chiangmai

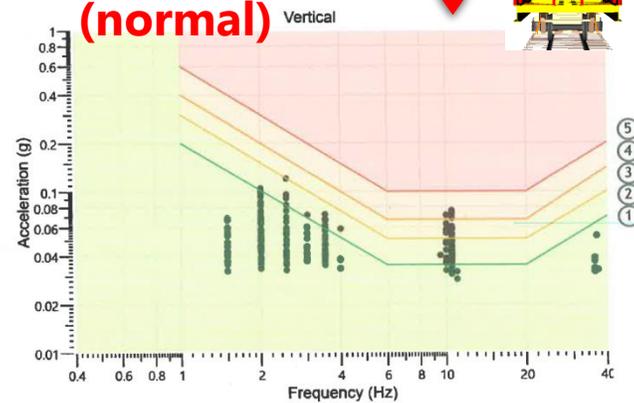
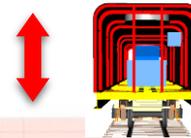


Bangkok

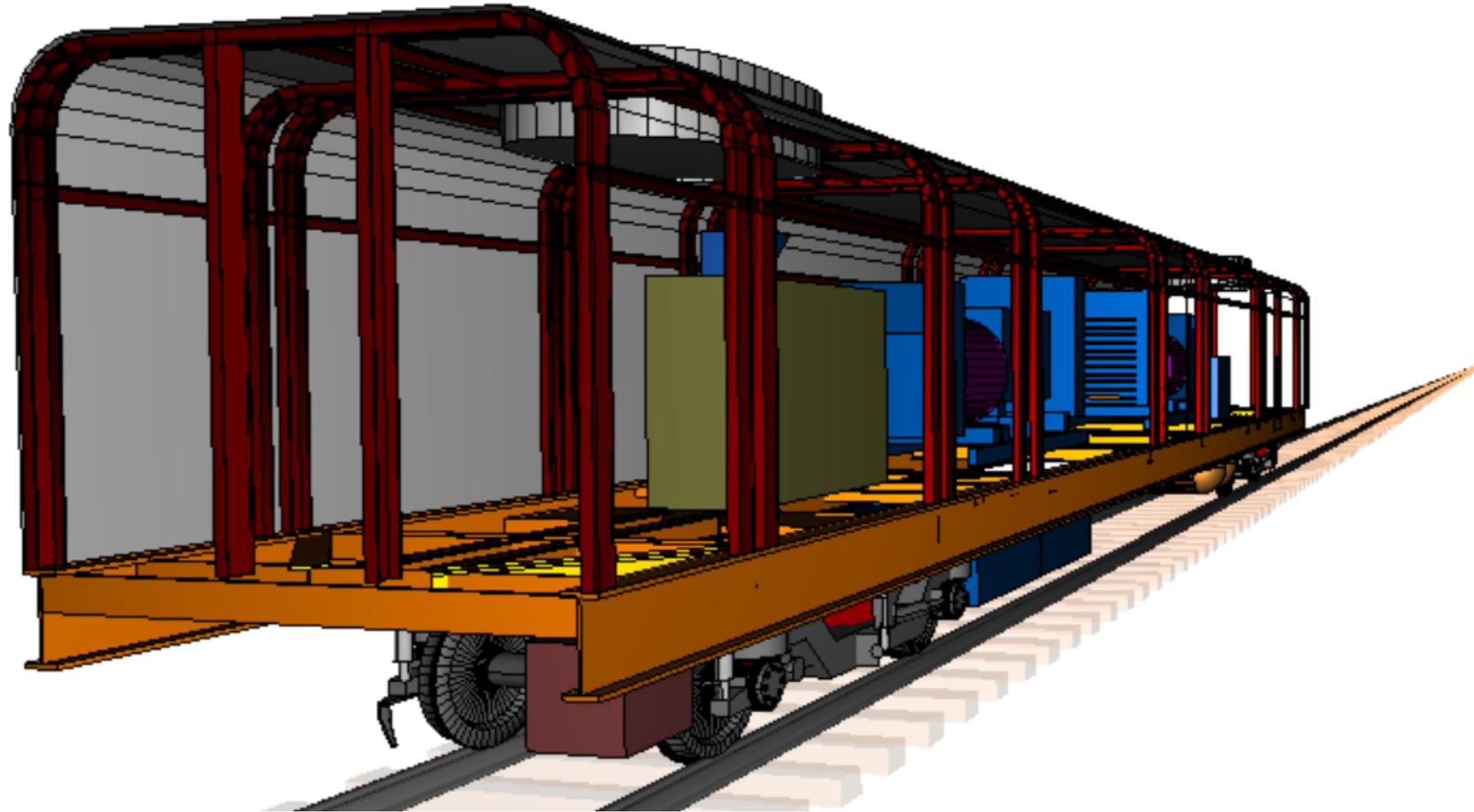
80 km/h (good)



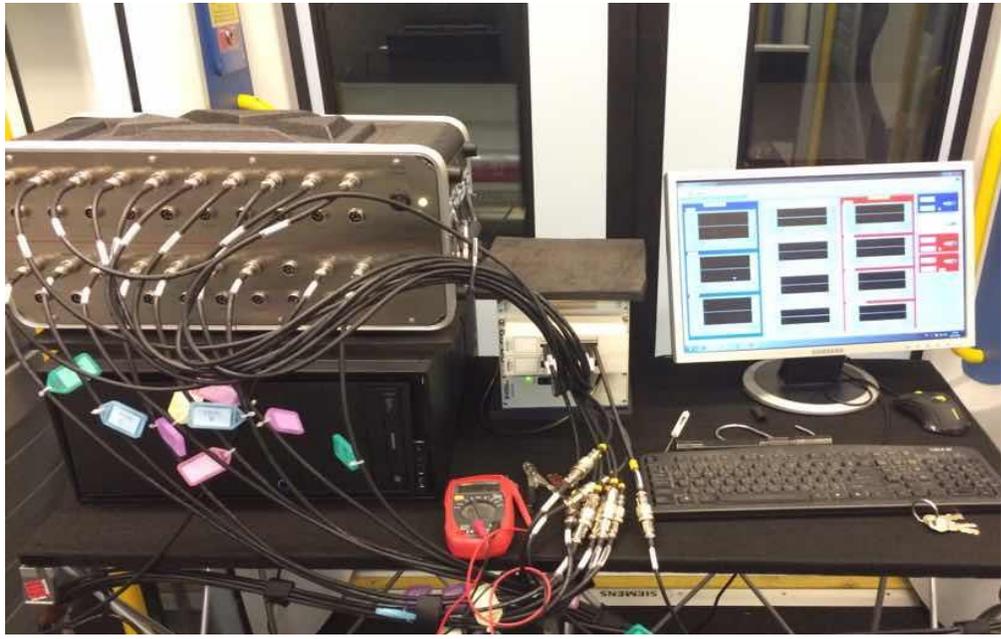
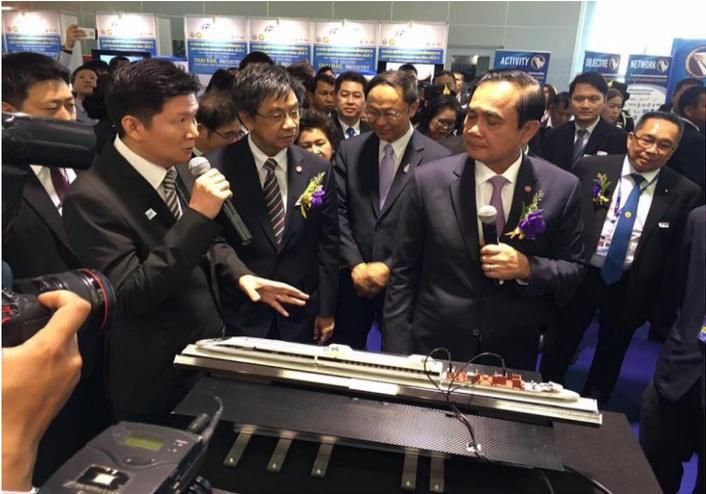
80 km/h (normal)



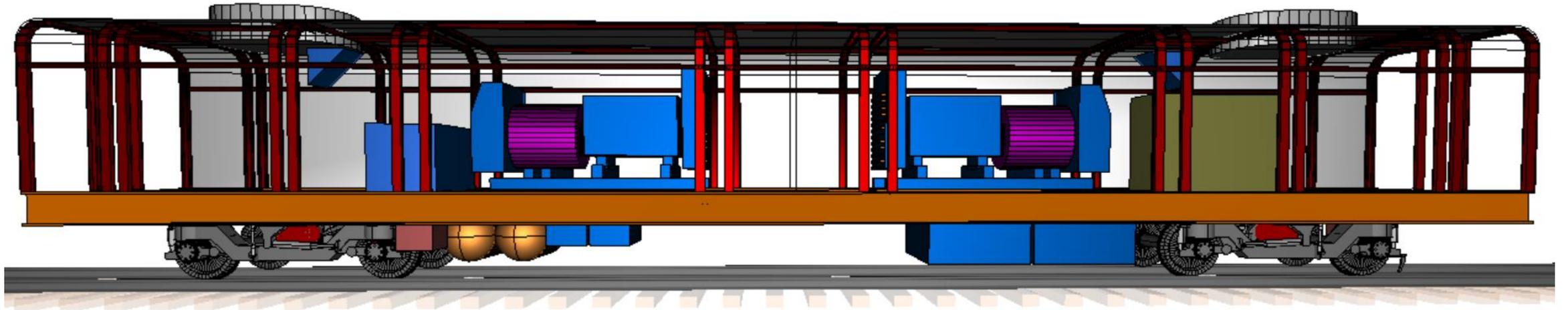
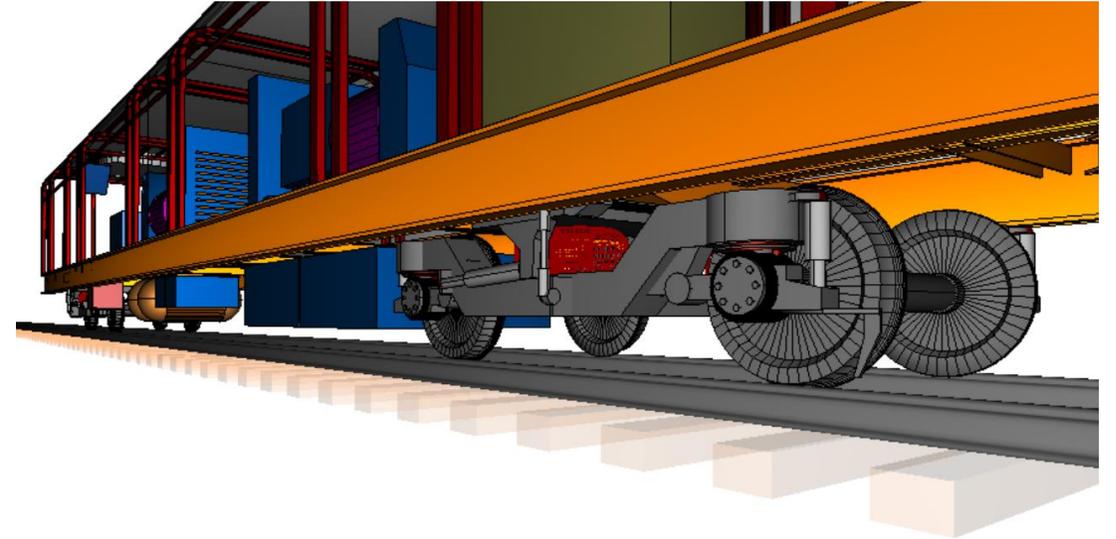
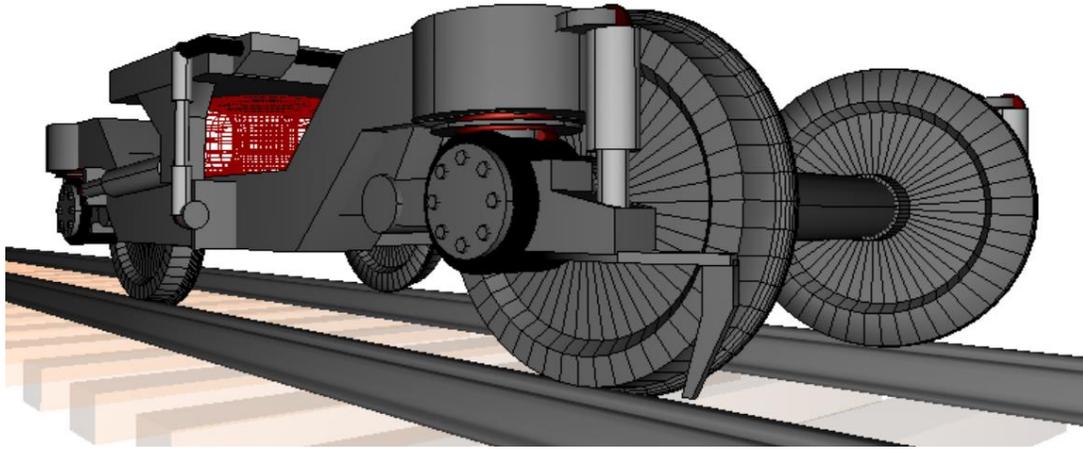
Further Work



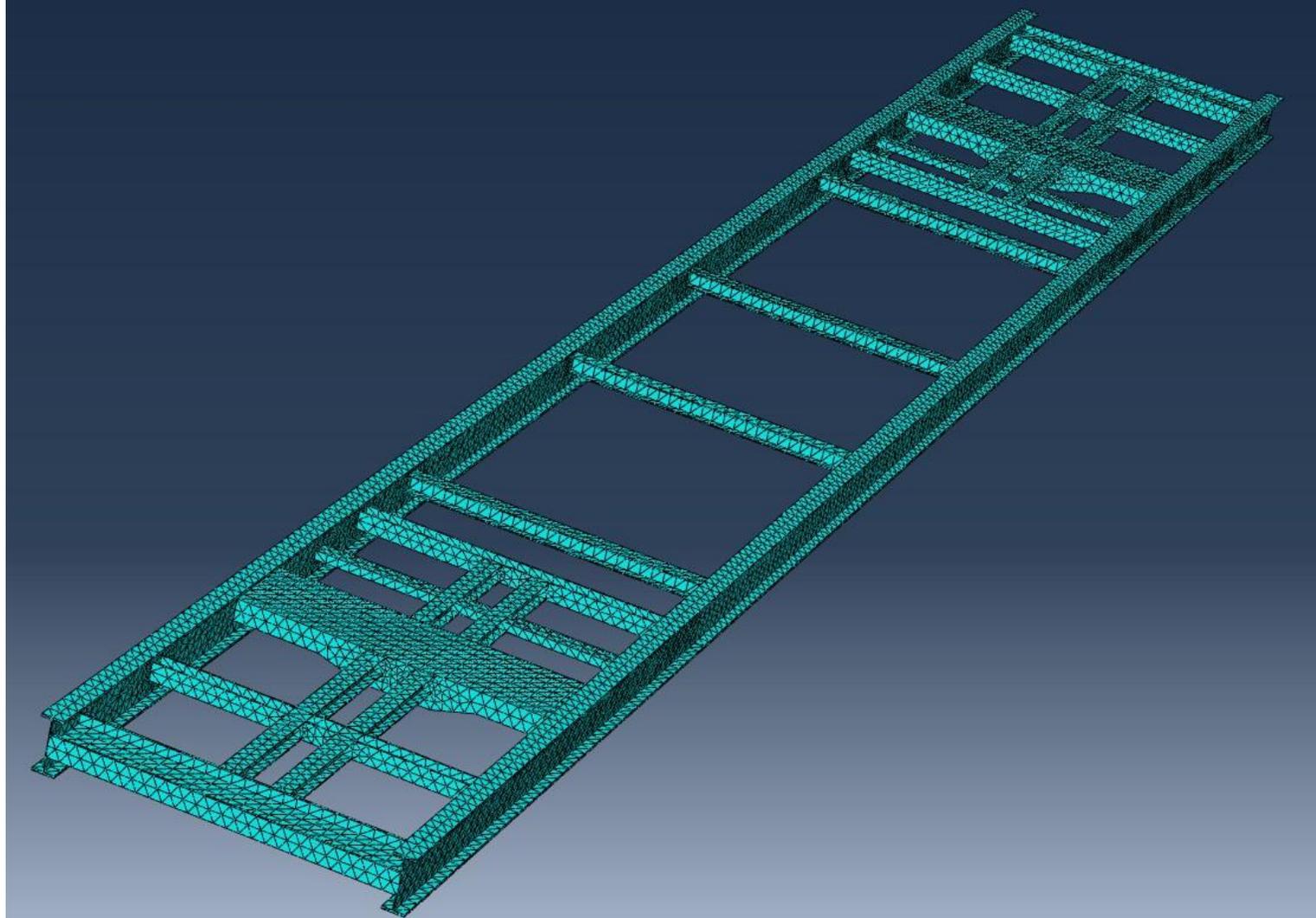
Running Test in Accordance with UIC-518



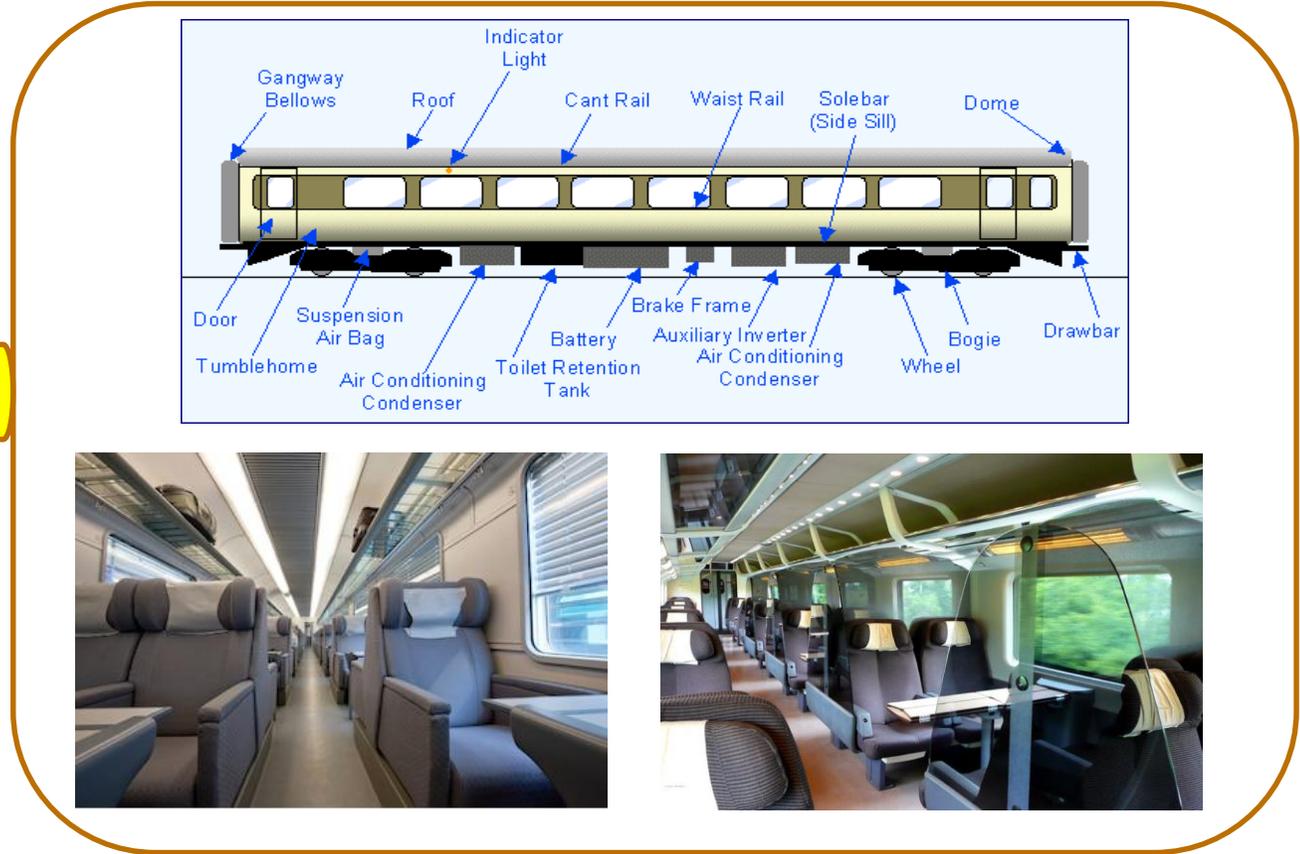
New Suspension



MBS vs Flexible Body Analysis



Development of Thailand Train-Set: Power Car and 1st Class Passenger Coach Customization

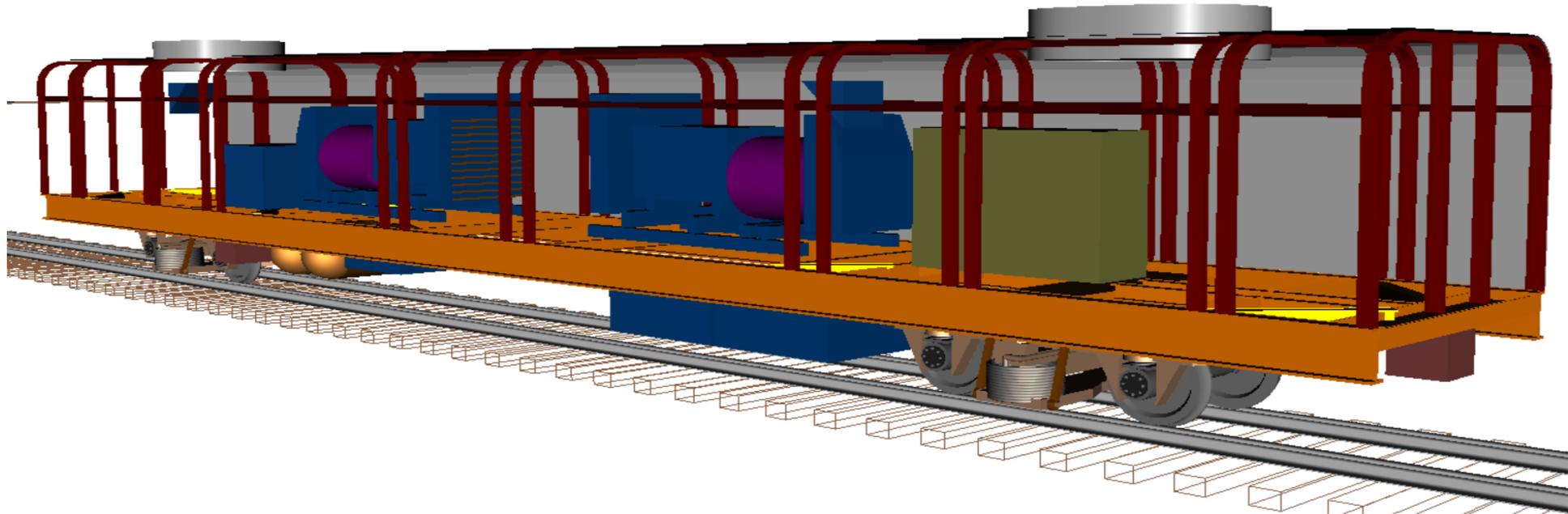




การรถไฟแห่งประเทศไทย



THANK YOU

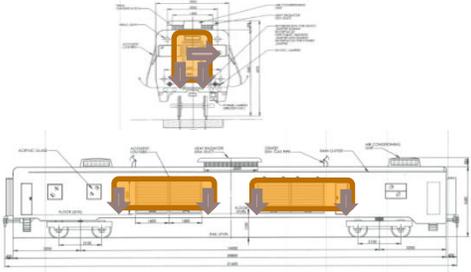


Overall Work Procedure

Design & Construction of Customized Train: Pre-Construction Process

Planning

- List all requirement
- Standard to be used



UIC Code

566

OR

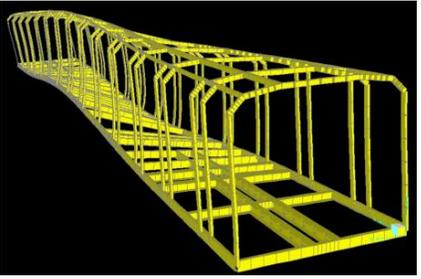
3rd edition, 1.1.90

Loadings of coach bodies and their components

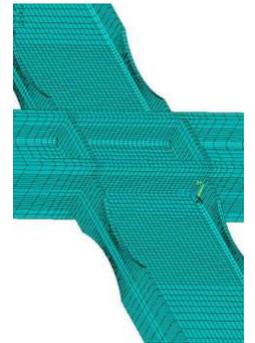
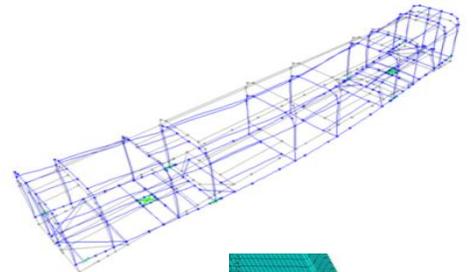
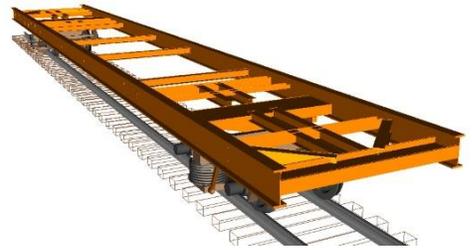
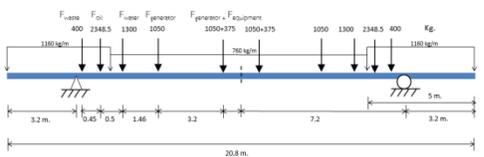


International Union of Railways

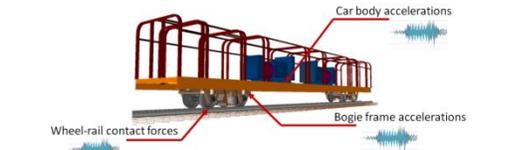
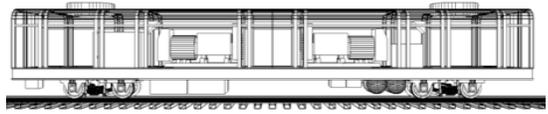
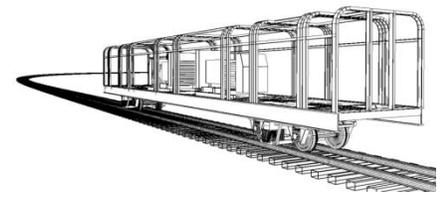
Inspection & Evaluation of Based Train



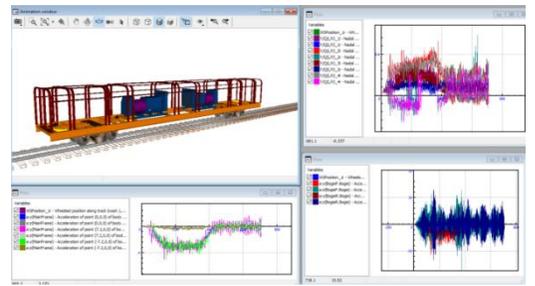
Car body Analysis & Design



Dynamic Analysis & Safety Evaluation



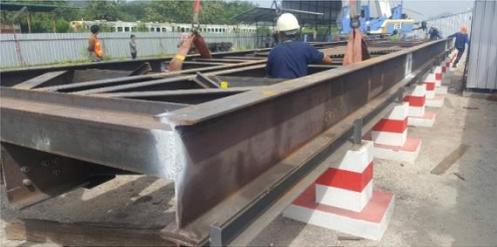
<p>Maximum Value L/V ratio</p>	<p>Ride Comfort Sperling ride index</p>	<p>Running Safety & Running Behavior UIC-518</p>
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Design & Construction of Customized Train: Construction & Testing Process

Construction

- Alignment
- Member and joint quality



Static Test

- Structural performance



On-track test

- Running safety & comfort
- Running stability

