CrashLink

Omni-Directional Anticlimber Avoiding Derailment

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CrashLink
Omnidirectional Anticlimber

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2. Anticlimber Front Plate Designs
3. Simplified Simulations
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Introduction

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We all know about recent accidents with lateral anticlimber slip off.

Possible effects:

- near or real derailment
- loss of engagement and risk of overriding
- reduced energy absorption

In order to respect confidentiality and ongoing accident investigations it is not possible to display any details here.


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Anticlimber Front Plate Designs

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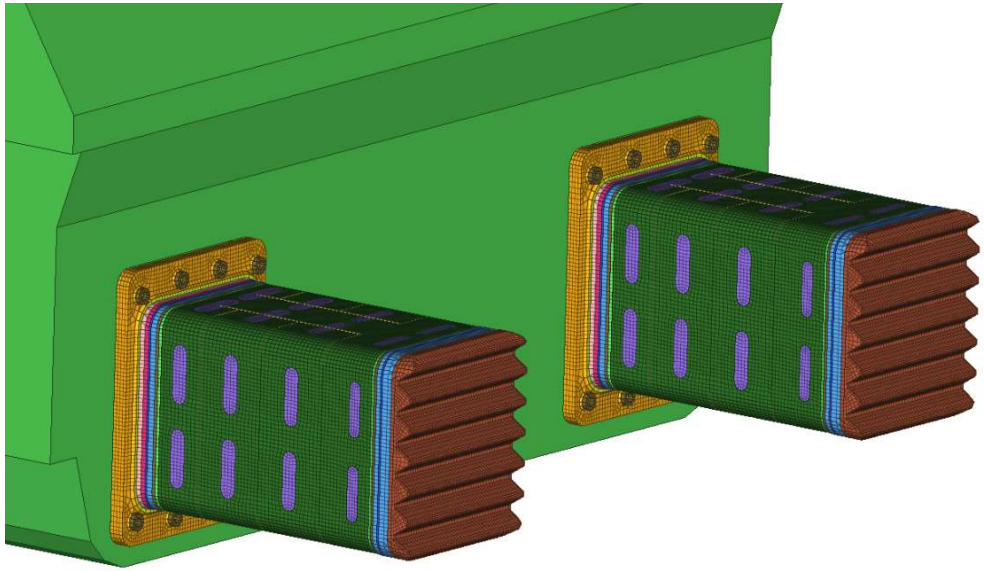
- Existing anticlimbers mostly with horizontal tooth lines only, in order to avoid vertical overriding
- Comply fully with EN15227
- Lateral offset and/or collision in curves may lead to lateral instability
- In case of lateral instability: sliding laterally and loss of contact / engagement
- Risks:
  - reduced energy absorption
  - derailment
  - overriding
- Some existing anticlimber / energy absorber designs have a higher lateral stability, some of them a lower one



➢ **No statements regarding risk potential of current anticlimber / energy absorber designs without further investigation!**

CrashLink
The Right Box for Goods Deserving Protection...

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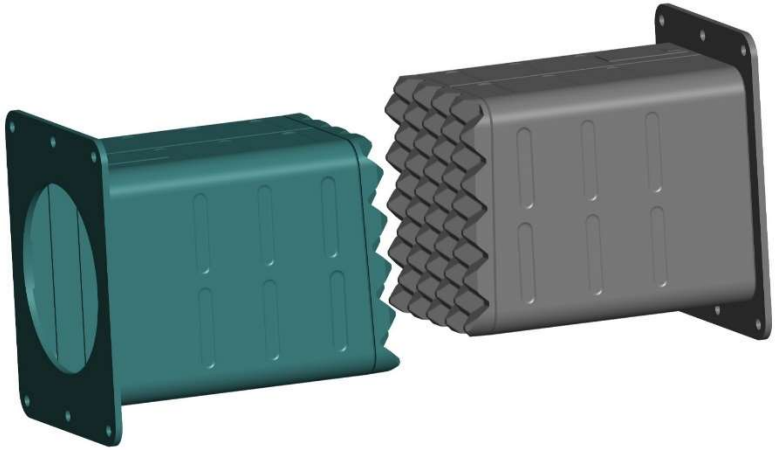

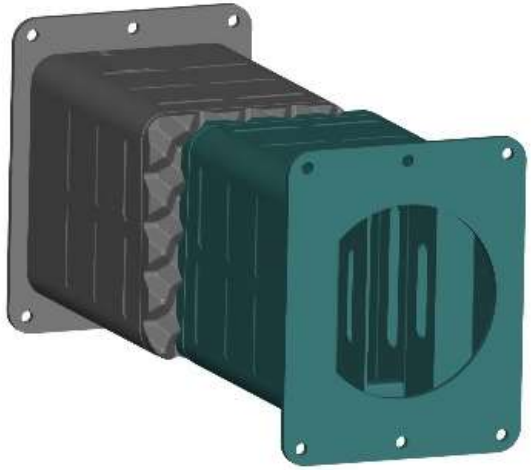

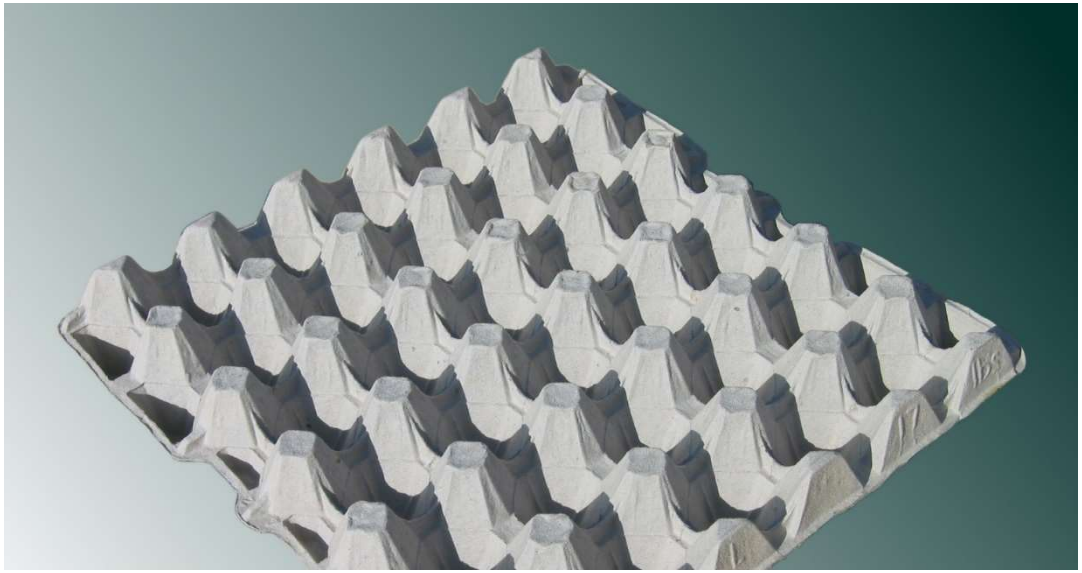

Industrial Design DM/094 456

Anticlimber Front Plate Designs

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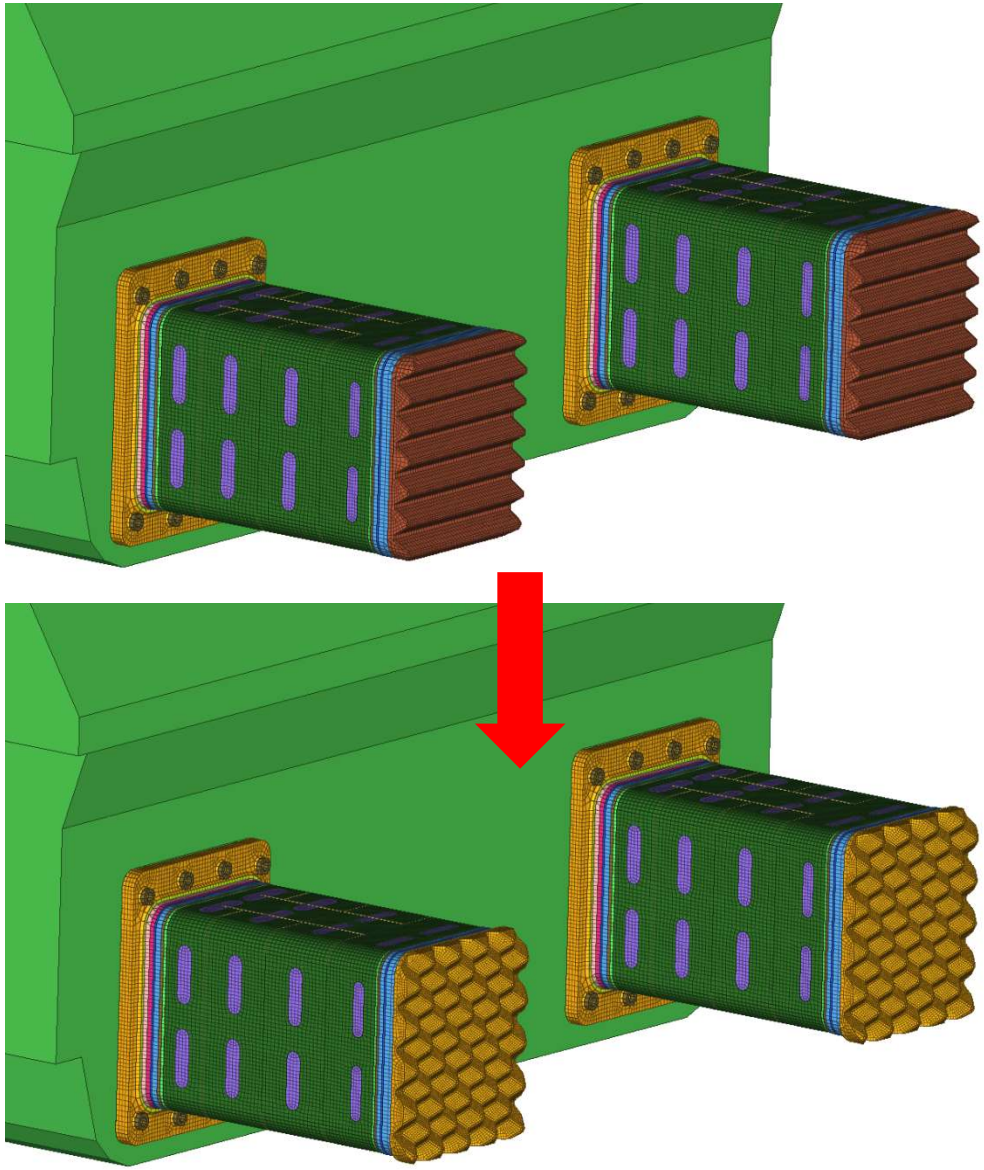
➢ **Comparison to an omnidirectional CrashLink type front plate design**



Simplified Simulations

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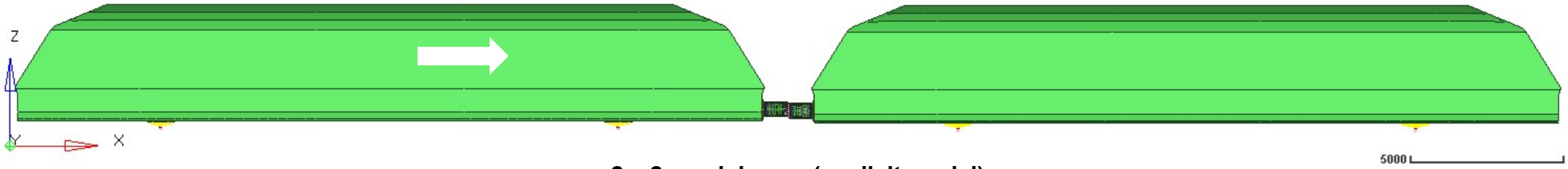
colliding vehicle
v = 30 km/h

standing vehicle



2 x 2 crash boxes (explicit model)
m = 2×160 kg

rigid carbodies
m = 52 t

Bogies with primary and secondary springs
m = 10 t

Simplified Simulations

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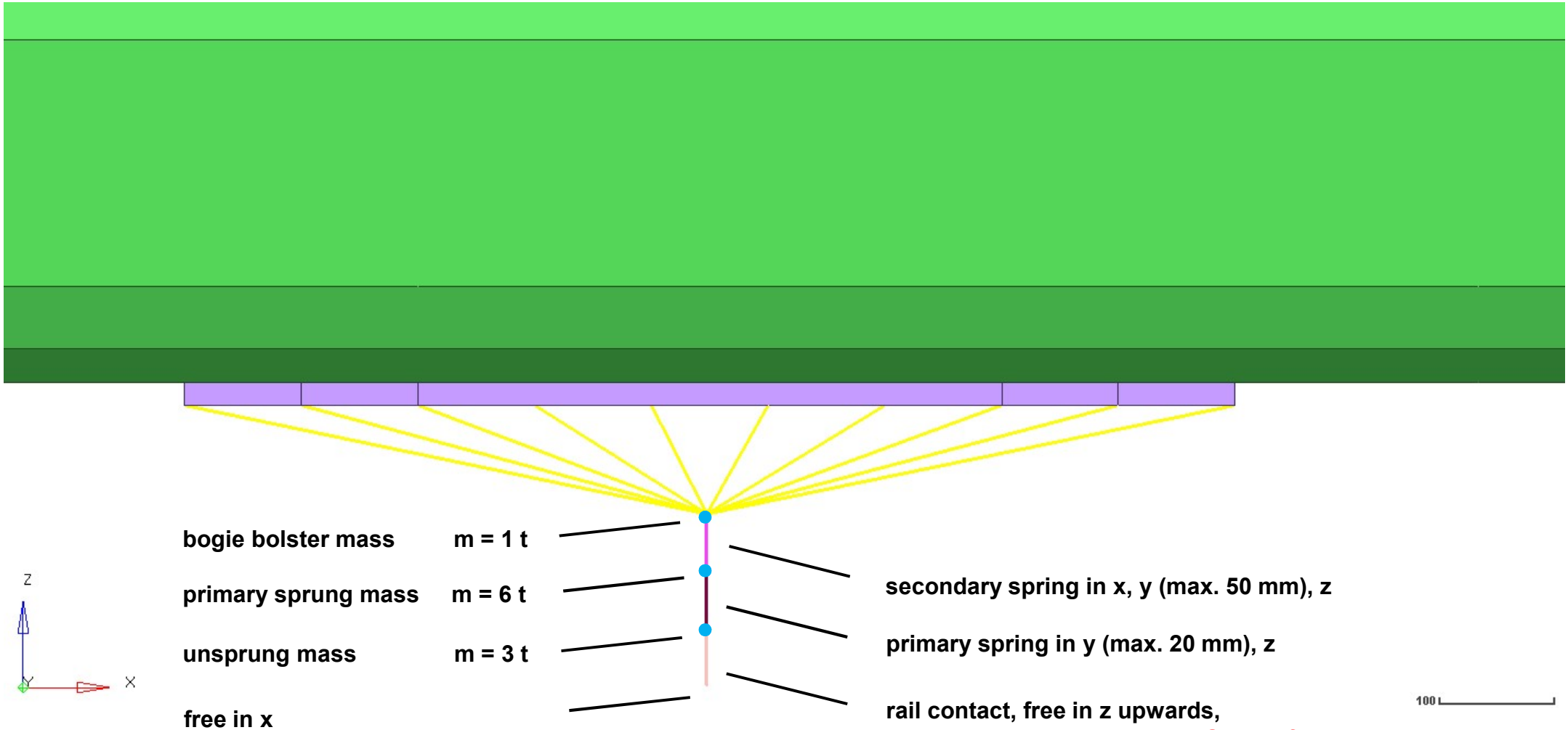
vehicle mass	73‘200 kg, including 2 bogies 10 tons each
traction pin distance	15‘000 mm
scenario 1 collision speed	30 km/h
2 crash boxes	S355J2+N, stiffeners inside, tested and certified acc. to EN15227
lateral offset	50 mm
vertical offset	0
friction coeff. anticlimbers	0.1
gear angle	0
bogie properties	simplified, see next page

Bogie Properties



bogie bolster mass m = 1 t

primary sprung mass m = 6 t

unsprung mass m = 3 t

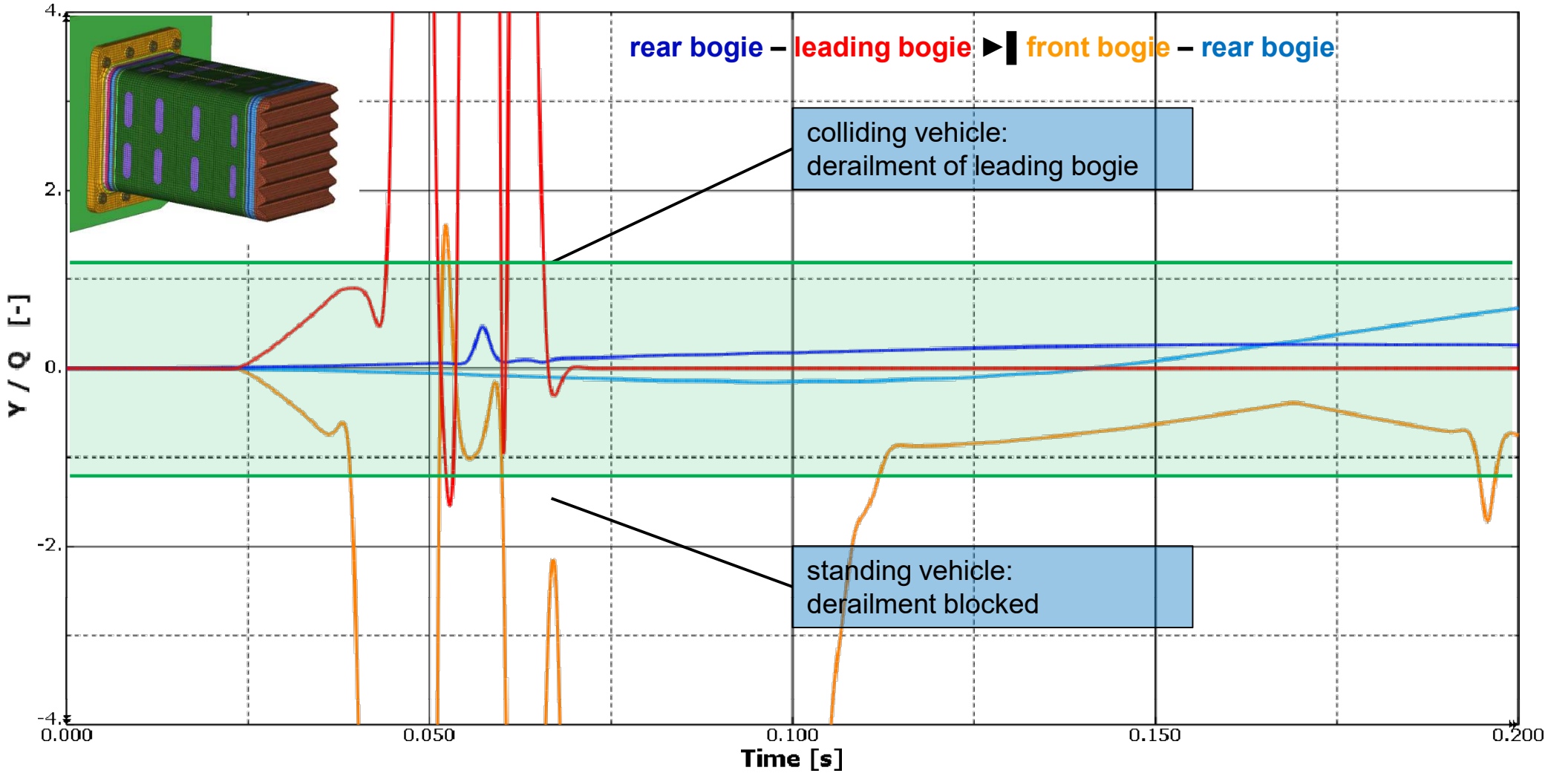
free in x

secondary spring in x, y (max. 50 mm), z

primary spring in y (max. 20 mm), z

rail contact, free in z upwards,
laterally (y) released when Y/Q > 1.2 for more than 50 ms
= derailment

Results: Conventional Anticlimber
Derailment Criterion Y/Q > 1.2



Results: CrashLink Anticlimber
Derailment Criterion Y/Q > 1.2

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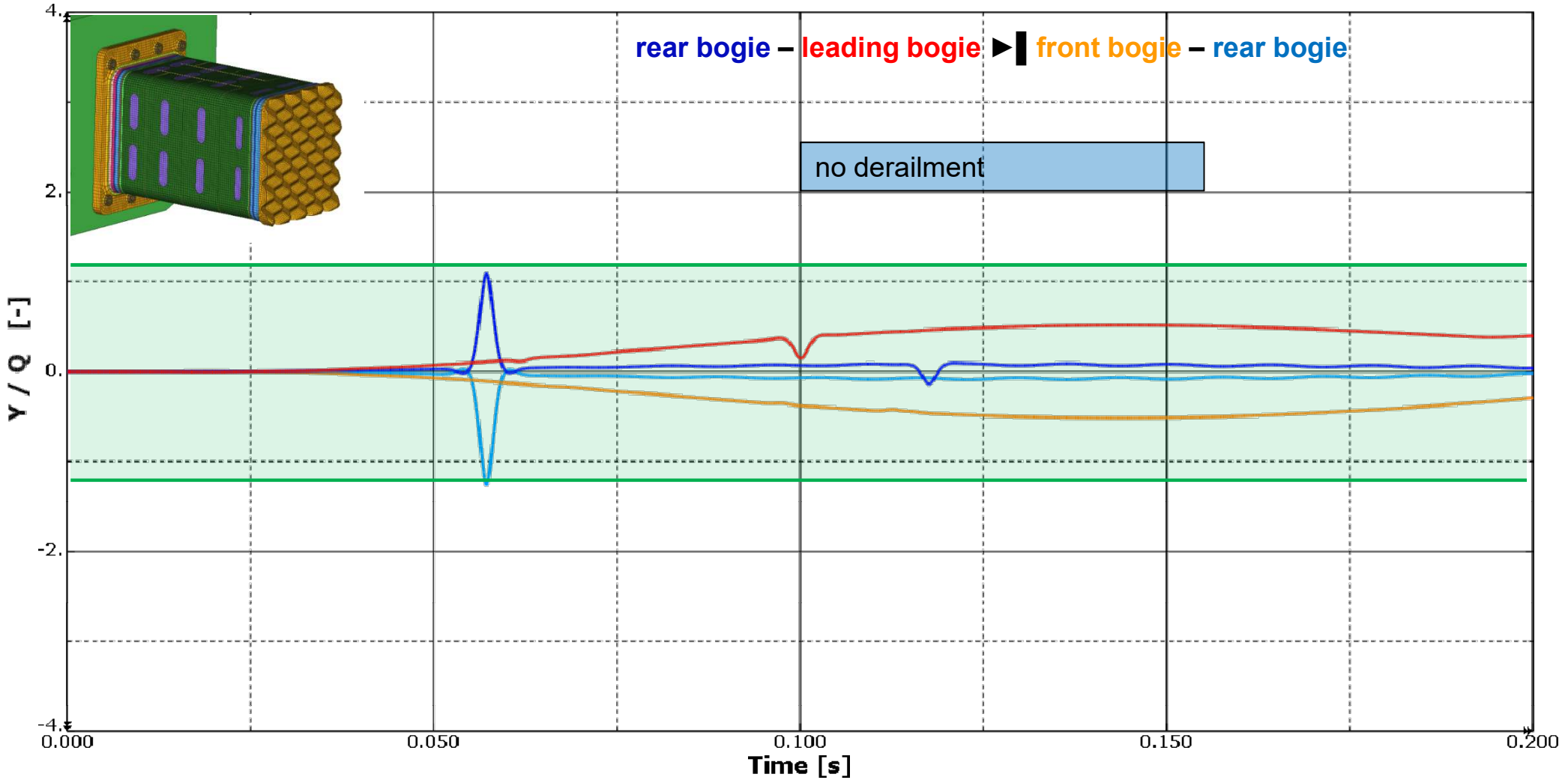

Results: Standing Vehicle Derailment Blocked

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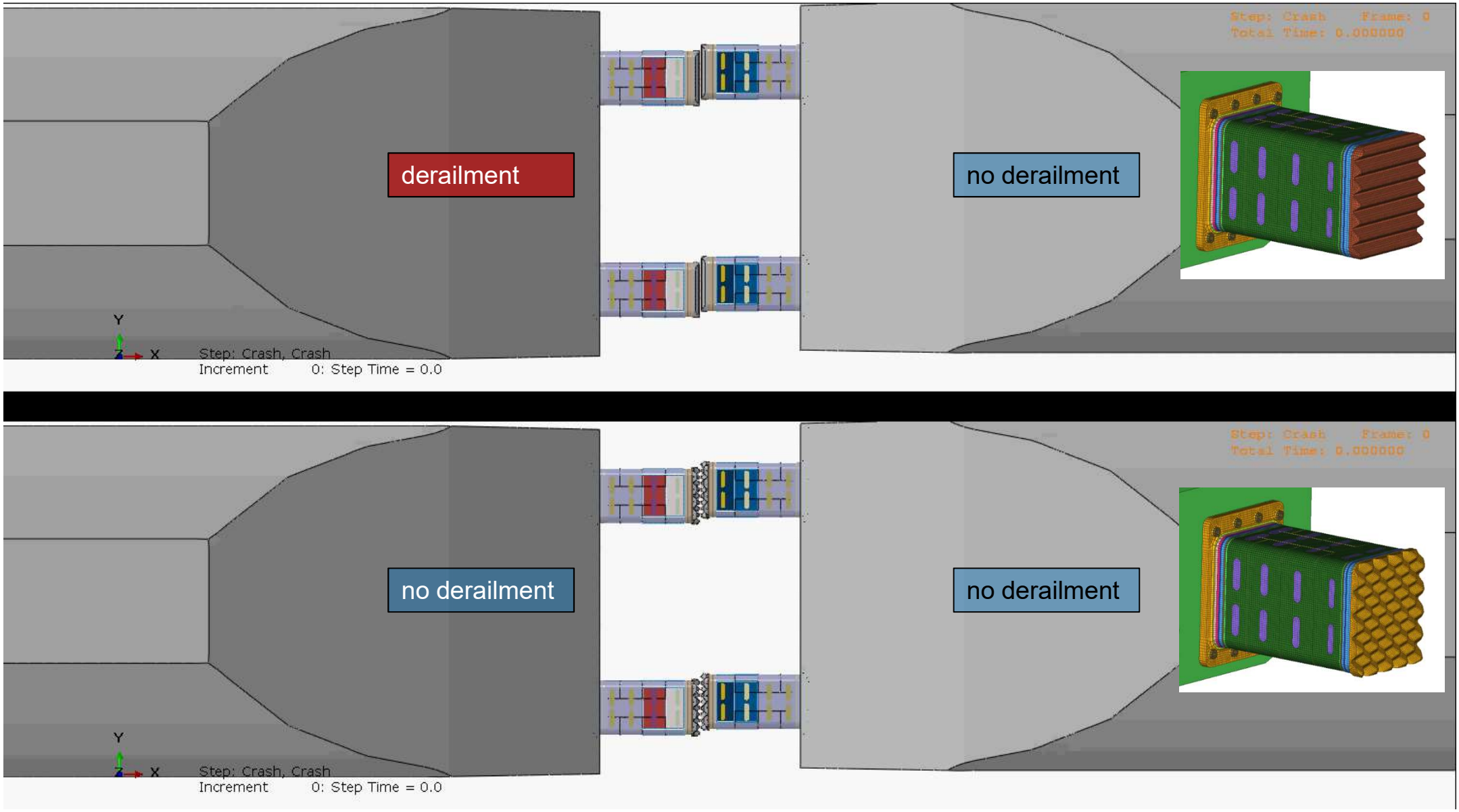

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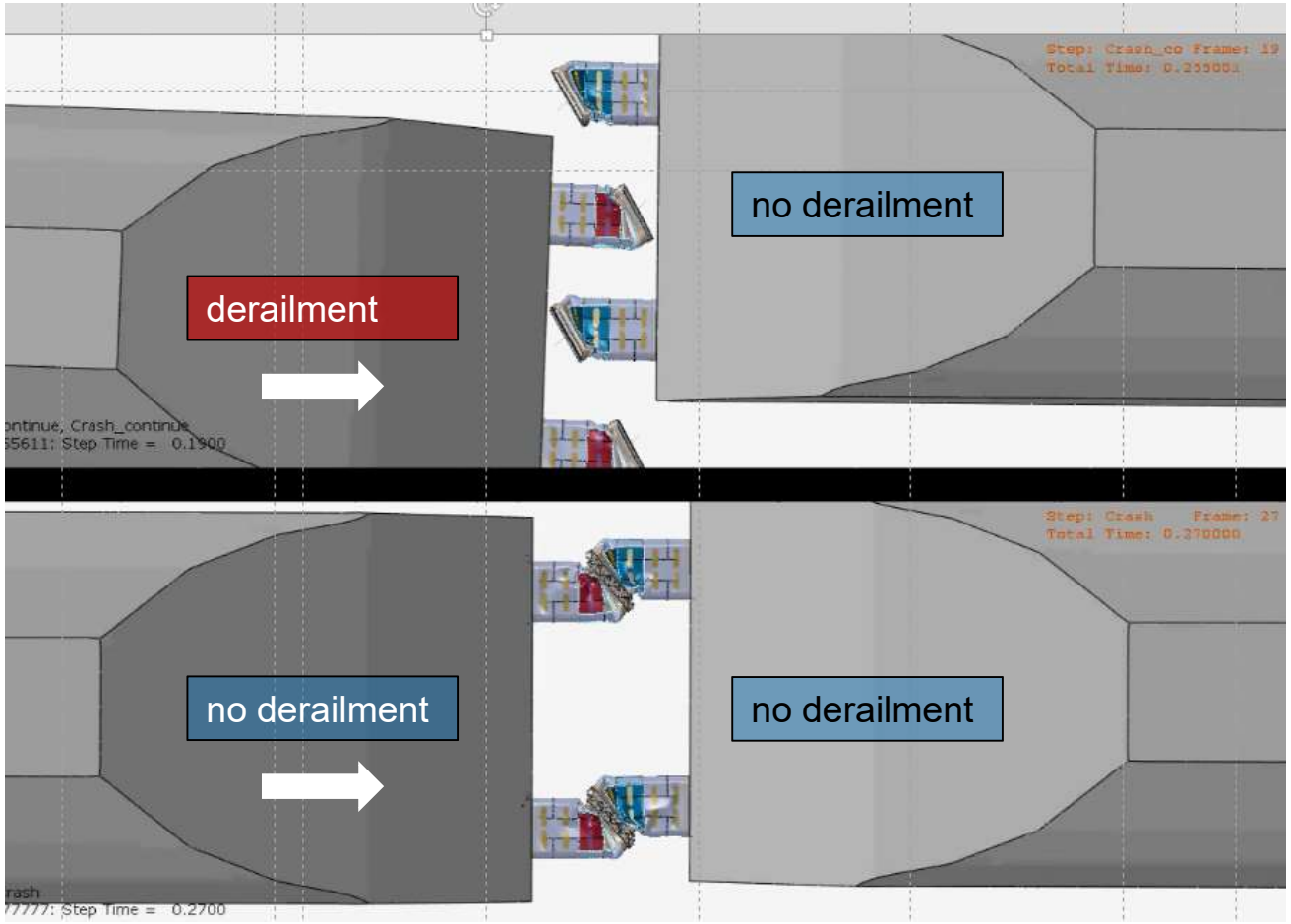
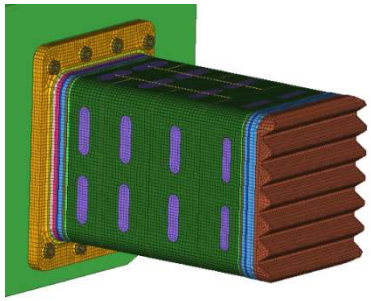
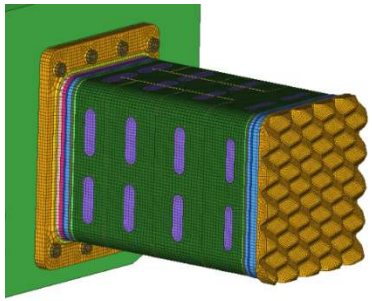


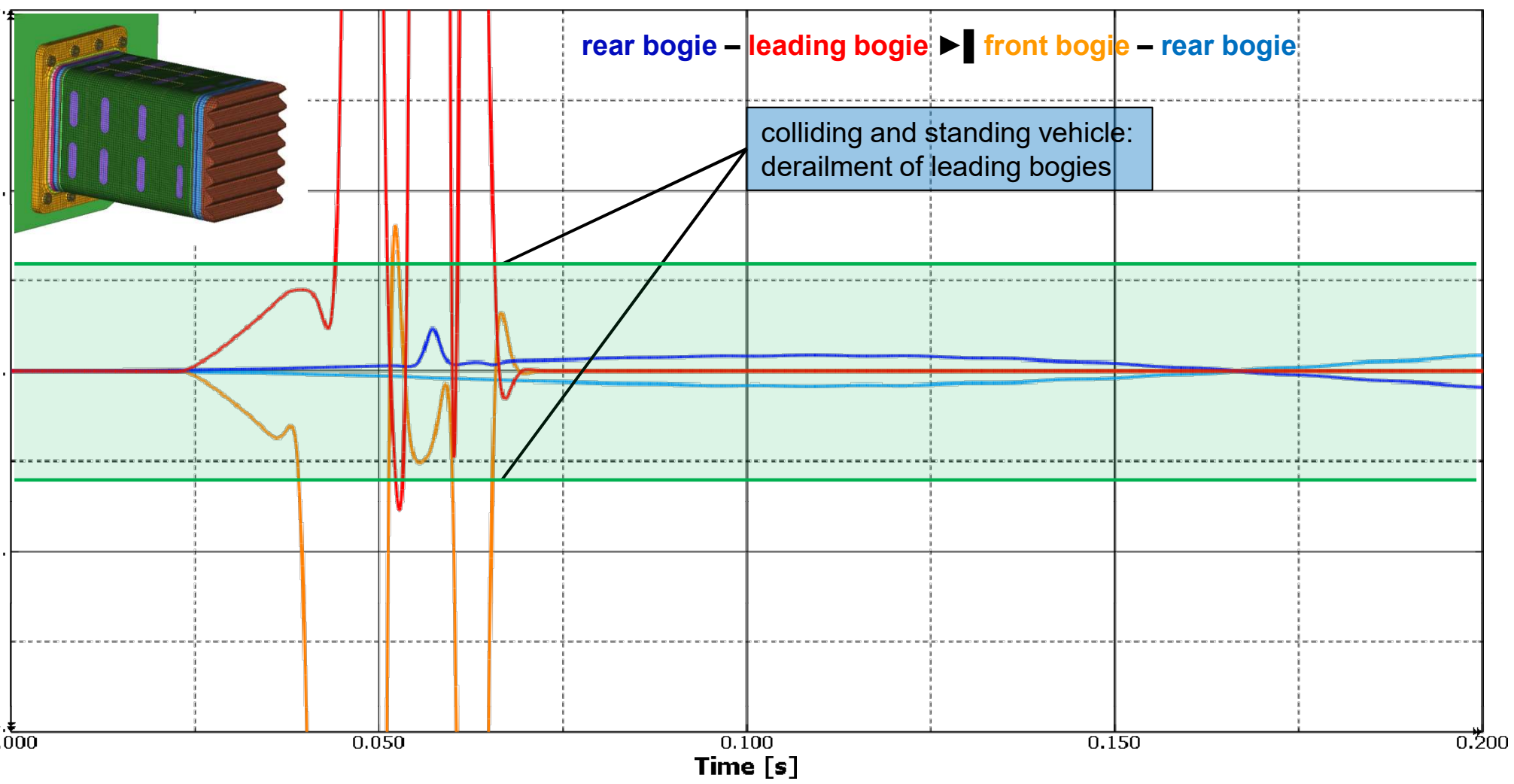




Absorbed energies:

- Conventional anticlimbers, derailment: 0.87 MJ
- CrashLink anticlimbers, no derailment: 1.08 MJ (+24%)

Results: Conventional Anticlimber
Derailment Criterion Y/Q > 1.2



Results: Both Vehicles Derailment Allowed

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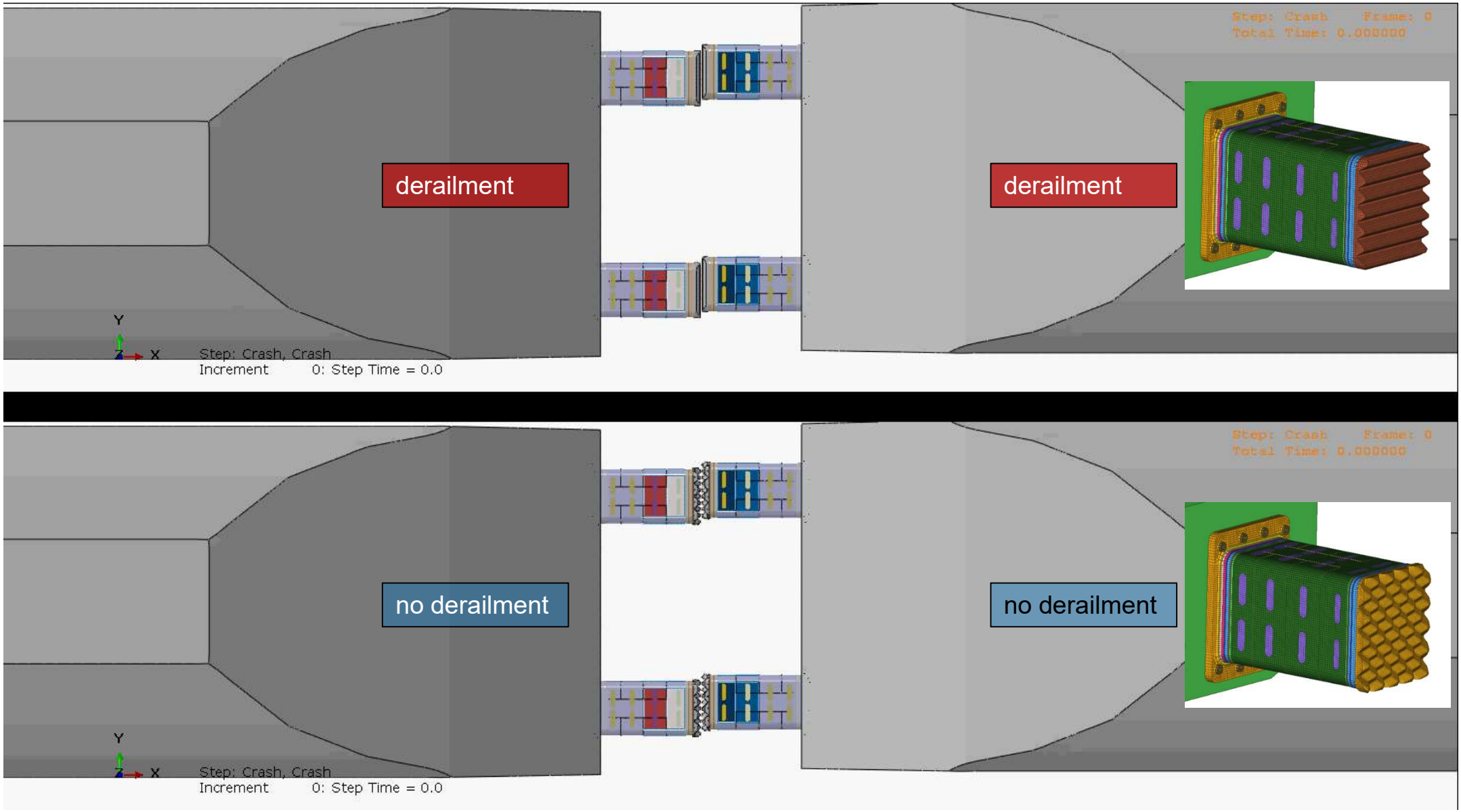

Results: Both Vehicles Derailment Allowed

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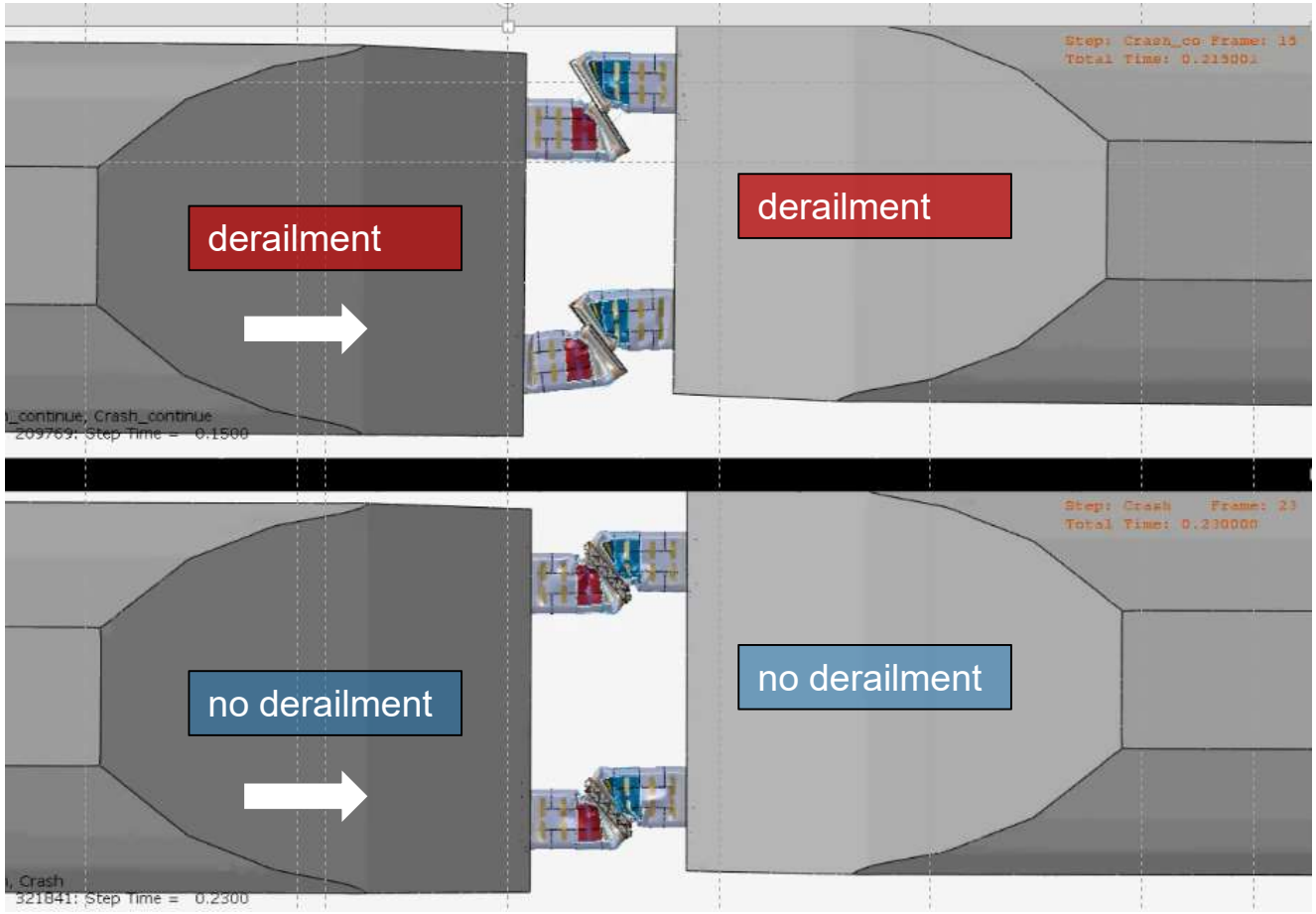

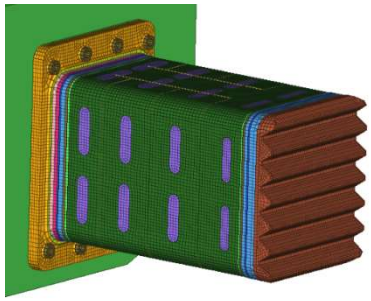

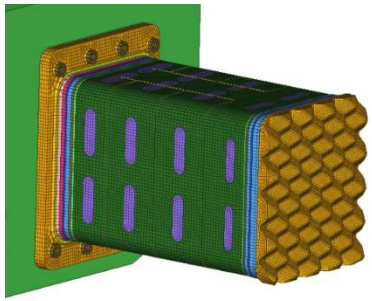

Results: Crash Box Fixation Forces Colliding Vehicle Derailment of Standing Vehicle Blocked

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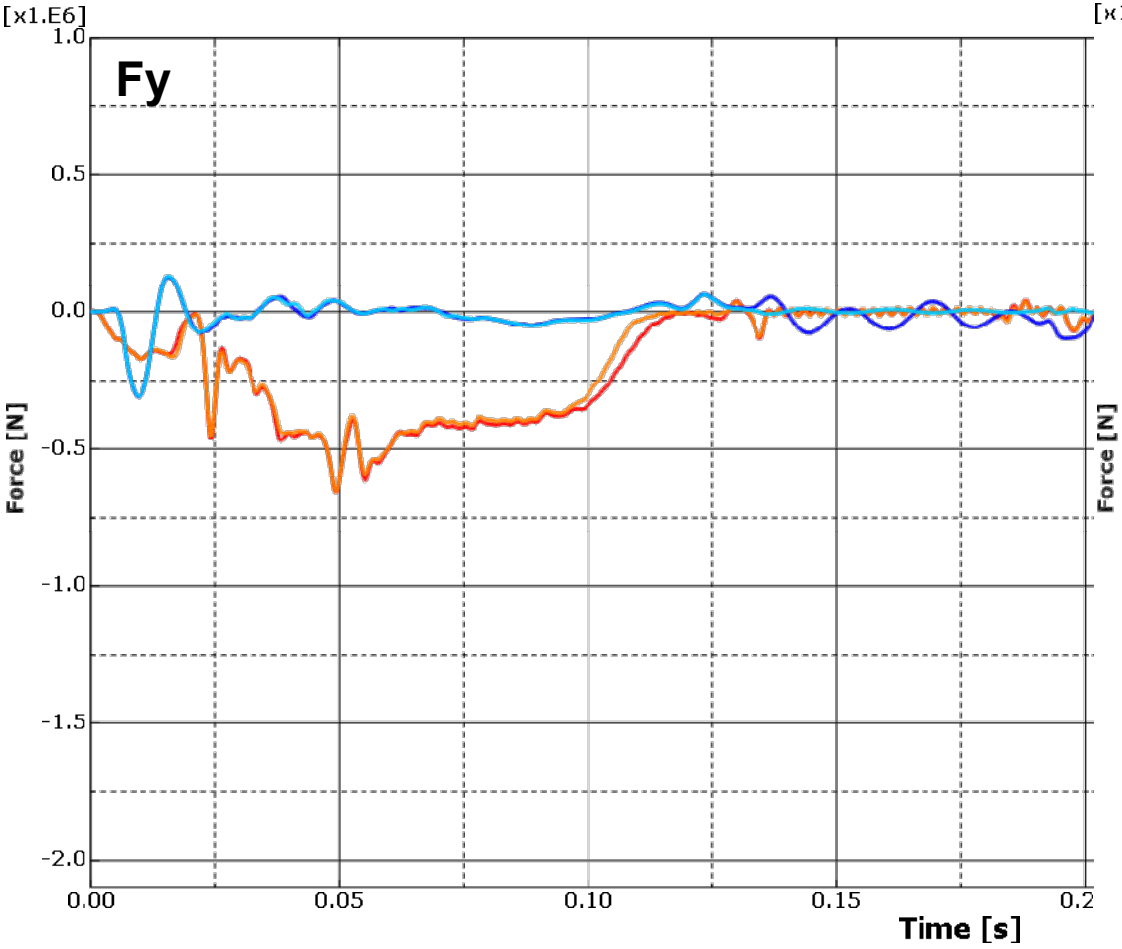
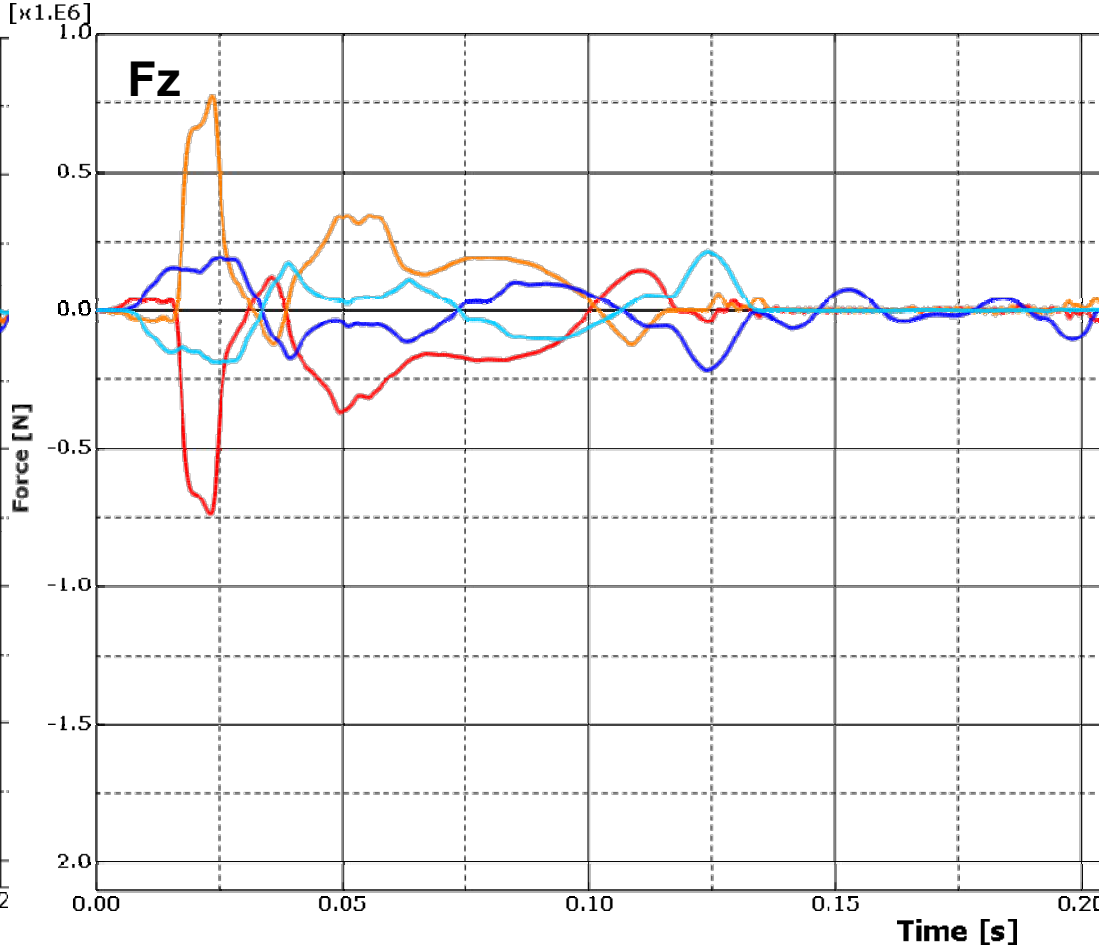
conventional anticlimber left side
conventional anticlimber right side
CrashLink left side
CrashLink right side





Conclusions

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- EN15227 requires a proof against – vertical - overriding. Therefore, usually anticlimbers with a horizontal tooth system are being installed in the front of state of the art vehicles. However, those anticlimbers do not prevent colliding vehicles from sliding laterally from each other, resulting in a reduced energy absorption capacity and/or derailment. Recent accidents showed clearly this disadvantage of current anticlimbers.
- CrashLink is a front plate shape combining vertical and lateral toothwork avoiding sliding in any direction. So the engagement of all energy absorbing devices through the entire collision process is guaranteed and derailment - particularly in low speed collisions - is avoided.
- The new CrashLink front plate design is presented as well as simulation results showing the advantages compared to existing designs.
- Depending on the lateral stiffness of energy absorbers, omnidirectional CrashLink type anticlimber front plates can avoid derailment caused by lateral offsets in head on collisions.
- Furthermore they assure full energy absorption.
- Avoiding derailments at low to medium speed in head on collisions has significant safety and operational advantages. Complicated rerailing operations are avoided.
- Energy absorbers with CrashLink type omnidirectional anticlimber front plates cause lower fixation forces than energy absorbers with conventional horizontal tooth lines only.

Proposals and Recommendations

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- It is proposed to include in the EN15227 a requirement to avoid lateral sliding of anticlimbers.
- An initial lateral offset of about 50 mm should be considered for simulations of crash scenarios 1 and 2.
- For at least operational reasons a derailment should be avoided in head on collisions according to scenarios 1 and 2 for collision speeds up to about 20 km/h.

- Existing railway vehicles with energy absorbers with conventional anticlimbers could be equipped by anticlimbers featuring omnidirectional form locking front plates, but identical energy absorbing properties.
- There would be no disadvantage.
- Those front plates will be interoperable with existing anticlimbers with horizontal tooth lines only.

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Vertical Offset 50 mm, Lateral Offset 50 mm Plus Crash Box Imperfections

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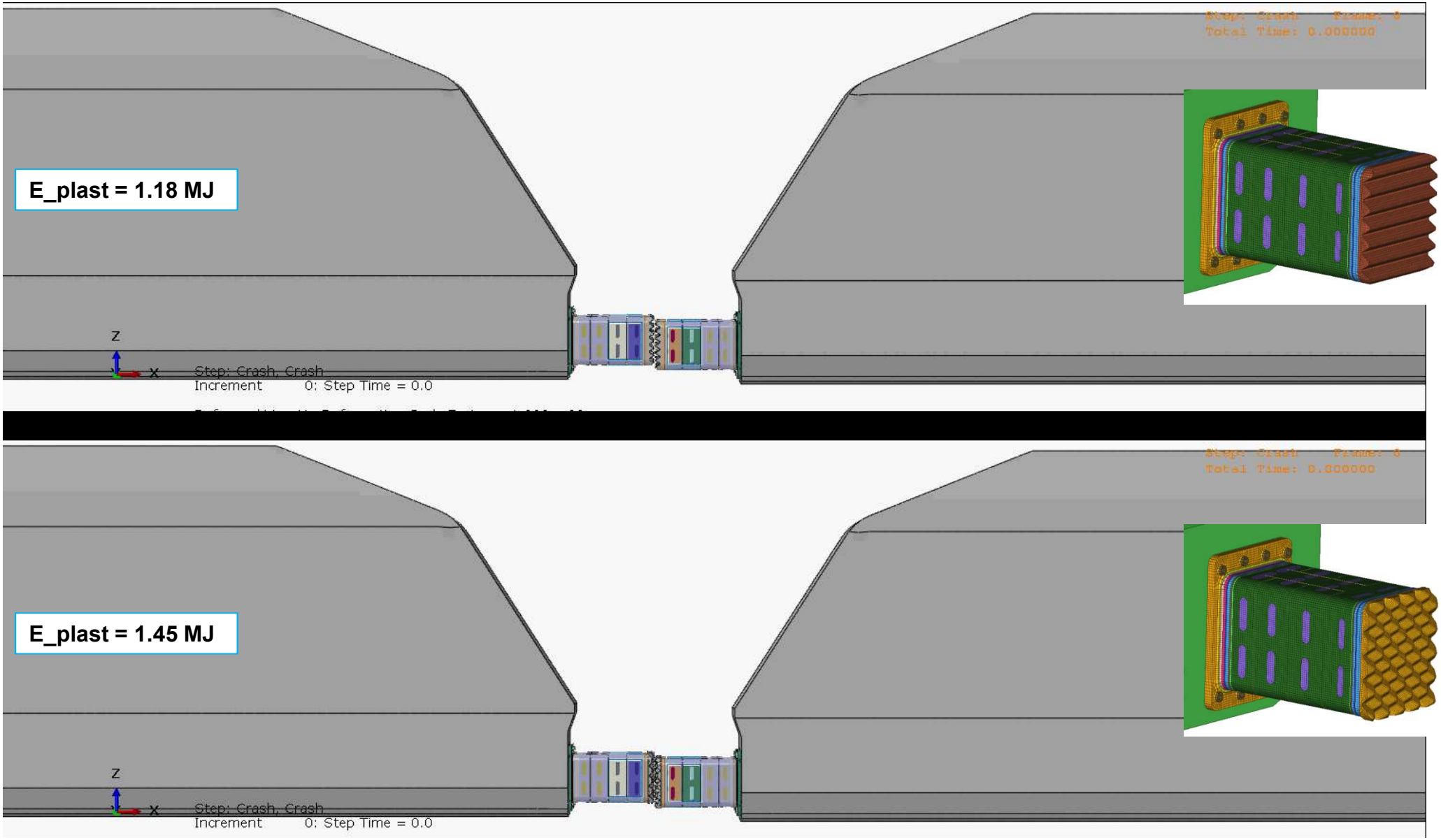

Vertical Offset 50 mm, Lateral Offset 50 mm Plus Crash Box Imperfections

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