

Appendix E – Preliminary Railcar-to-Cradle Attachment Interface Gap Analysis

Introduction

As discussed in Report Section 3.3.4, the question of how the mechanical connection to the railcar would affect the dynamic modeling and performance required by AAR S-2043 was evaluated. In the evaluation, TTCI performed a study as documented in this appendix. From this enclosed study, it can be concluded that the potential gaps created by the mechanical attachment and their positioning (see Appendix B) will not have any effect on the performance of the railcar.

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Gap Analysis of Preliminary ATLAS Cask Car Simulations

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The logo for TTCI (Transportation Technology and Consulting, Inc.) features the letters 'TTCI' in a stylized, bold, sans-serif font. The letters are dark blue with a white outline. A thick, grey, curved swoosh underline starts under the 'T' and extends to the right, passing under the 'I'.

TTCI Background

- ◆ In 2016 TTCI performed simulations of the 12-axle railcar loaded with the TN-68.
- ◆ Simulations were done before it was found that the attachment components would have to be modified to accommodate the additional casks.
- ◆ The simulations were done with the original 12-axle car design before modifications were made to reduce the deck height.





Regimes Simulated with the TN-68

- ◆ 4-2-01 Truck Twist
- ◆ 4-2-02 Car Body Twist
- ◆ 4-2-03 Static Curve Stability
- ◆ 4-2-04 Curve Negotiation
- ◆ 4-3-09-6 Twist and Roll
- ◆ 4-3-09-6 Twist and Roll 38ft
- ◆ 4-3-09-7 Pitch and Bounce
- ◆ 4-3-09-7 Pitch and Bounce 38ft
- ◆ 4-3-09-8 Yaw and Sway
- ◆ 4-3-09-8 Yaw and Sway 38ft
- ◆ 4-3-09-9 Dynamic Curve
- ◆ 4-3-09-9 Dynamic Curve 38ft
- ◆ 4-3-10-1 Single Bump
- ◆ 4-3-10-2 Curving single bump
- ◆ 4-3-11-3 Hunting
- ◆ 4-3-11-4 Constant Curving
- ◆ 4-3-11-5 Curve-Worn-Lube
- ◆ 4-3-11-6 Spiral Negotiation
- ◆ 4-3-11-7 Turnouts
- ◆ 4-3-12 Ride Quality
- ◆ 4-3-13 Buff and Draft Curving





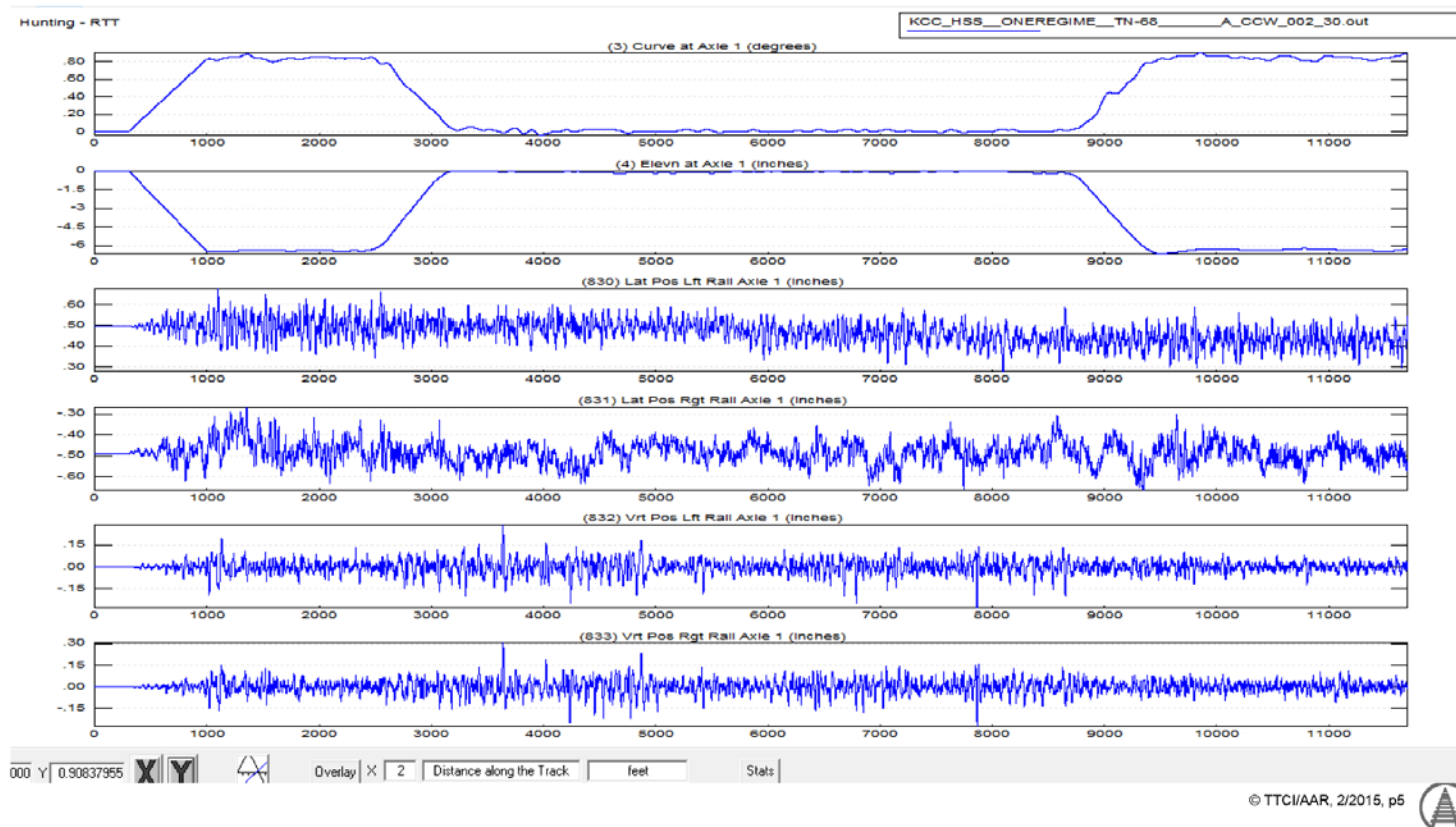
Results – Maximum Lateral Displacement

Regime	Maximum (inches)
4-3-09-6 Twist and Roll	0.04
4-3-09-6 Twist and Roll 38ft	0.04
4-3-09-7 Pitch and Bounce	0.05
4-3-09-7 Pitch and Bounce 38ft	0.04
4-3-09-8 Yaw and Sway	0.05
4-3-09-8 Yaw and Sway 38ft	0.04
4-3-09-9 Dynamic Curve	0.05
4-3-09-9 Dynamic Curve 38ft	0.05
4-3-10-1 Single Bump	0.00
4-3-10-2 Curving single bump	0.01
4-3-11-3 Hunting	0.37
4-3-11-4 Constant Curving	0.05
4-3-11-5 Curve-Worn-Lube	0.06
4-3-11-7 Turnouts	0.01
4-3-12 Ride Quality	0.12



TTCI Track Geometry of the Hunting Regime

◆ Low curvature but large superelevation



TTCI Lateral Displacement in the Hunting Regime

◆ Lowest speed run had the highest displacement

