Updated Derailment and Puncture Estimates

LNG Unit Trains

4/06/2020

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Overview

- Simulations of:
  - 100 LNG Tanks (DOT113s)
    - 7/16” Shell, 0.5” Head, 0.25” Inner Tank
    - Rear DP Configuration
  - Derailments are initiated at the head end of the train.

Updated Results – 40 mph

- At 40 mph, the expected number of punctures is 5 (average).
- Across the simulations conducted, the range of punctures covering 70% of the scenarios ranges from 3 punctures to 7 punctures (2-sigma).
- It is estimated that 20% of the punctures could happen on the same car.
  - In other words, if we consider the number of punctures as 5, the number of cars punctured would be 4.
- About 70% of the punctures happens in the first 8 cars
  - Therefore, there is a reasonable probability that 5 adjacent cars could experience punctures.

Updated Results – 40 mph

- At 40 mph, the expected number of derailed cars is 21 (average).
- Across the simulations conducted, the range of cars derailed covering 70% of the scenarios ranges from 16 to 25 cars (2-sigma).

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Final Updated Results (7/16”)

Speed	30 mph	40 mph	50 mph
No. of derailed cars	15	21	28
No. of Punctures	2.7	5	7.3

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Final results for 9/16th Shell at 40 mph

- Simulations of:
  - 100 LNG Tanks (Proposed Design)
    - 9/16” Shell, 5/8” Head TC 128B , 0.25” Inner Tank SS
    - Rear DP Configuration
  - Derailments are initiated at the head end of the train.
- Results for 40 mph
  - No. of Punctures: 4.2
  - No. of derailed cars: 21 (same as DOT113 7/16”tank)
- It is estimated that 20% of the punctures could happen on the same car.

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Final Updated Results (9/16”)

Speed	30 mph	40 mph	50 mph
No. of derailed cars	15	21	28
No. of Punctures	2.1	4.2	6.0

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