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BEFORE THE
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION

DOCKET NO. PHMSA—2012—0082 (HM-251): HAZARDOUS MATERIALS: ENHANCED TANK CAR STANDARDS AND OPERATIONAL CONTROLS FOR HIGH-HAZARD FLAMMABLE TRAINS

COMMENTS OF THE ASSOCIATION OF AMERICAN RAILROADS

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BEFORE THE
PIPELINE AND HAZARDOUS MATERIALS
SAFETY ADMINISTRATION

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COMMENTS OF THE ASSOCIATION OF AMERICAN RAILROADS

The Association of American Railroads (AAR),[1] on behalf of itself and its member railroads, submits the following comments in response to the notice of proposed rulemaking (NPRM) on requirements for the transportation of flammable liquids by rail.[2] AAR's member railroads account for most of the rail transportation of flammable liquids and have a substantial interest in the proposed tank car standards and operating requirements.

I. Introduction

AAR has been eagerly awaiting the notice of proposed rulemaking on tank car standards. In 2011, AAR petitioned PHMSA to adopt new tank car standards for packing group I and II materials, including flammable liquids. In comments responding to the 2013 ANPRM, AAR endorsed new tank car standards for all class 3 flammable liquids, including those classified as packing group III. AAR strongly supports new tank car standards for all class 3 flammable liquids.

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[1] AAR is a trade association whose membership includes freight railroads that operate 83 percent of the line-haul mileage, employ 95 percent of the workers, and account for 97 percent of the freight revenues of all railroads in the United States; and passenger railroads that operate intercity passenger trains and provide commuter rail service.

[2] *See* 79 Fed. Reg. 45,016 (August 1, 2014). AAR is filing separate comments on the issue of providing crude oil routing information to State Emergency Response Commissions.

However, PHMSA has proposed additional requirements that, if adopted, would have a devastating impact on the railroads' ability to provide their customers with efficient rail transportation. In particular, the proposals for significantly more stringent speed limits than in place today and electronically-controlled pneumatic (ECP) brakes could dramatically affect the fluidity of the railroad network and impose tremendous costs without providing offsetting safety benefits.

AAR and its member railroads have a record of putting safety first and taking action to enhance the safe transportation of hazardous materials, including flammable liquids. It is in that spirit that AAR files these comments on the NPRM. AAR has long been an advocate of improved tank car designs. But putting in place more stringent speed restrictions and requiring ECP brakes is not in the public interest. The result would be reduced network fluidity and traffic moving off rail lines onto less safe modes of transportation.

The railroads have taken significant steps to enhance the safety of hazardous materials transportation. The railroads' approach to hazardous materials transportation safety has three prongs. One is to enhance operating and infrastructure maintenance practices to reduce the probability of an accident occurring. The second is to strengthen the ability of tank cars to withstand an accident without a breach. The third is to enhance the ability of railroads and public officials to respond to a release of a hazardous material.

The railroads have instituted a number of measures to reduce the probability of an accident occurring. In August 2013, AAR expanded the application of its recommended operating and maintenance practices for hazardous materials, embodied in Circular OT-55, to any train with 20 or more loaded cars containing hazardous materials, including flammable liquids. These voluntary measures include a maximum speed of 50 mph, passing restrictions, the placement of defective bearing detectors along the right-of-way, and enhanced track inspections.[3]

Furthermore, as set forth in a February 20, 2014, letter sent by Secretary Foxx to AAR, the Class I railroads committed to Secretary Foxx that they would institute special requirements for Key Crude Oil Trains (trains with at least 20

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[3] AAR, Circular OT-55-N, "Recommended Railroad Operating Practices For Transportation of Hazardous Materials," www.regulations.gov, Document No. PHMSA-2012-0082-0009 (Aug. 15, 2013).

carloads of crude oil).[4] Specifically, the railroads committed to conducting route analyses for Key Crude Oil Trains in order to select the routes posing the least overall safety and security risk; limit Key Crude Oil Train speeds in High Threat Urban Areas (HTUAs) to 40 mph if the train has a legacy DOT-111 car with crude oil; use distributed power or 2-way end-of-train devices; perform additional track inspections; install wayside detectors every 40 miles, unless track configurations or safety considerations dictate otherwise; inventory emergency response resources; and spend $5 million in 2014 on training emergency responders, including the development of a crude oil emergency response training program at AAR's Transportation Technology Center, Inc., (TTCI) and funding for emergency responders to attend the program, as well as a module for field training. The railroads have honored their commitment to Secretary Foxx.

With respect to tank cars standards, in 2011 AAR adopted its own, more stringent interchange standards for tank cars used to transport crude oil and ethanol, embodied in AAR Circular CPC-1232, effective for cars ordered after October 1, 2011.[5] That same year, AAR petitioned PHMSA to upgrade the tank car specification for packing group I and II materials.[6] In comments submitted on the 2013 ANPRM, AAR again sought more stringent tank car standards for packing group I and II materials and flammable liquids.[7]

The third prong of the railroads' initiatives, emergency response, is addressed by the Advance Notice of Proposed Rulemaking also issued by PHMSA on August 1. In addition to the emergency response measures addressed in Secretary Foxx's February 20 letter, the railroads continue to train approximately 20,000 emergency responders annually. Furthermore, in October AAR will be unveiling a new system enabling emergency responders to obtain information on the hazardous materials in a train through an app. AAR more fully discusses emergency response issues in its comments responding to the ANPRM.

The railroads' safety record demonstrates that these and other measures have borne fruit. The context for this rulemaking proceeding is a railroad industry that is continuously improving its overall safety record and its hazardous materials transportation record in particular. According to Federal Railroad Administration (FRA) statistics, the rate of train accidents per million train miles has dropped 42 percent since 2000, from 4.13 to 2.41. In the same time period, railroad employee

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[4] *See* http://www.dot.gov/briefing-room/letter-association-american-railroads.

[5] www.regulations.gov, Document No. PHMSA-2012-0082-0020.

[6] P-1577, www.regulations.gov, Document No. PHMSA-2012-0082-0005.

[7] www.regulations.gov, Document No. PHMSA-2012-0082-0090 (Nov. 14, 2013).

casualty rates have shown a similar decline, dropping from 3.44 casualties per 100 full time employees annually to 1.84.[8] Since 2000, the rate of train accidents with a release for every thousand carloads of hazardous materials transported has declined 62 percent, from 0.020 to 0.008. Looking at the record from another perspective, 99.997 percent of hazardous materials cars are transported to destination without a release.[9]

The NPRM proposes major new requirements in four areas: (1) speed restrictions; braking systems; routing analyses; and tank car specifications. AAR summarizes the major sections of its comments on each of these areas below.

Section II (*operating restrictions*) describes the severe operational concerns should PHMSA decide to impose speed restrictions beyond the HTUAs. Expanded speed restrictions would degrade the fluidity of the rail network. Network fluidity is important not only because it improves the quality of service to customers and lowers costs; it is also important because it enhances the overall safety of the transportation network and reduces the environmental impact of transportation. Ill-advised action by PHMSA to lower the speed limit would inevitably have a ripple effect on other traffic (that PHSMA admittedly ignores). The result would be the diversion of traffic off the rail network and onto less safe and less environmentally friendly modes of transportation.

Section III (*ECP brakes*) describes the substantial flaws in the justification for mandating the use of ECP brakes for the transportation of flammable liquids. The technology is not widely used in the industry. The Federal Railroad Administration (FRA) already undertook a rulemaking proceeding on ECP brakes just six years ago in which it concluded that it could not justify mandating ECP brakes. In this section, AAR respectfully urges PHMSA to show the same wisdom that FRA showed in 2008.

Section IV (*routing analysis*) of these comments addresses PHMSA's proposal to require routing analyses and require railroads to adjust their routes accordingly. As is the case with speed restrictions, adjusting the routing for too

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[8] http://safetydata.fra.dot.gov/officeofsafety/publicsite/summary.aspx (September 2014 data).

[9] AAR Analysis of FRA Train Accident Database as of September 2014. Carloads from ICC/STB Waybill Sample, 1995-2012. For the year 2013, carloads from the BOE Annual Report. Association of American Railroads, Bureau of Explosives, "Annual Report of Hazardous Materials Transported by Rail: 2013," p. 13, Ex. 9 (Report BOE 13-1, July 2014).

many trains when there is no significant safety advantage would also impair network fluidity. In this section, AAR urges PHMSA to limit the adverse impact on network fluidity by restricting the scope of the trains subject to the routing provisions.

Section V (*tank car design*) of AAR's comments addresses AAR's perspective on improvements to the current tank car standards. AAR supports strengthening the standards governing the transportation of flammable liquids. AAR also emphasizes that the new tank car standards should apply to all tank cars transporting flammable liquids, not just those in so-called HHFT trains.

Section VI addresses some miscellaneous concerns, including the pejorative and misleading label chosen by PHMSA to describe trains carrying flammable liquids.

II. Speed Restrictions Could Substantially Impact Network Fluidity

PHMSA has suggested speed restrictions that would substantially impair railroad service without providing substantial safety benefits. Consequently, consistent with the railroads' agreement with Secretary Foxx, PHMSA should go no further than applying a 40 mph speed restriction to HTUAs.

A. Network Fluidity Must be Preserved.

The backdrop for PHMSA's speed limit alternatives is a railroad network that in key places is at or near capacity. An onerous speed limit has the potential to affect significantly the fluidity of the railroad network, to the detriment of freight railroads and their customers, as well as passenger railroads that operate over freight tracks. Indeed, a fluid rail network is also in the public interest from safety, security, and environmental perspectives.

While it is good news for the economy and the railroad industry that railroad business is on the rebound from recession levels, network fluidity has declined. Figure 1 shows rebounding railroad traffic; Figures 2 and 3 show that the network fluidity is suffering due to a number of factors such as a change in the commodity mix.[10] Figure 2 shows that average train speeds over the last year on the major railroads declined and Figure 3 shows that terminal dwell time increased. Figure 4 shows the change in commodity mix.

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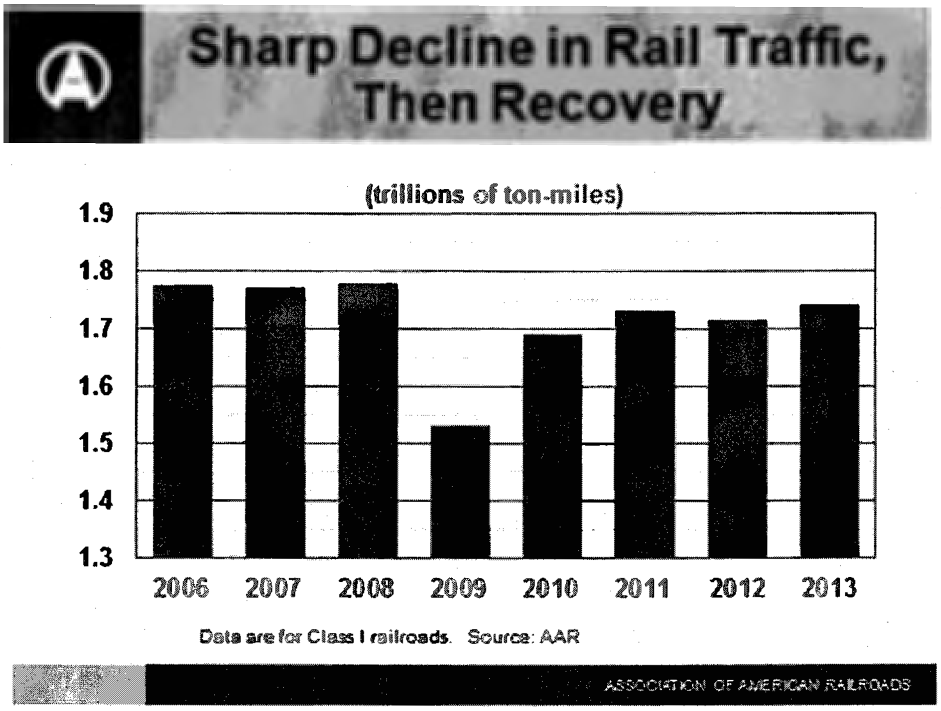
[10] Figure 1 is based on data from the seven Class I railroads. Figures 2 and 3 are based on data from six of the seven Class I railroads.

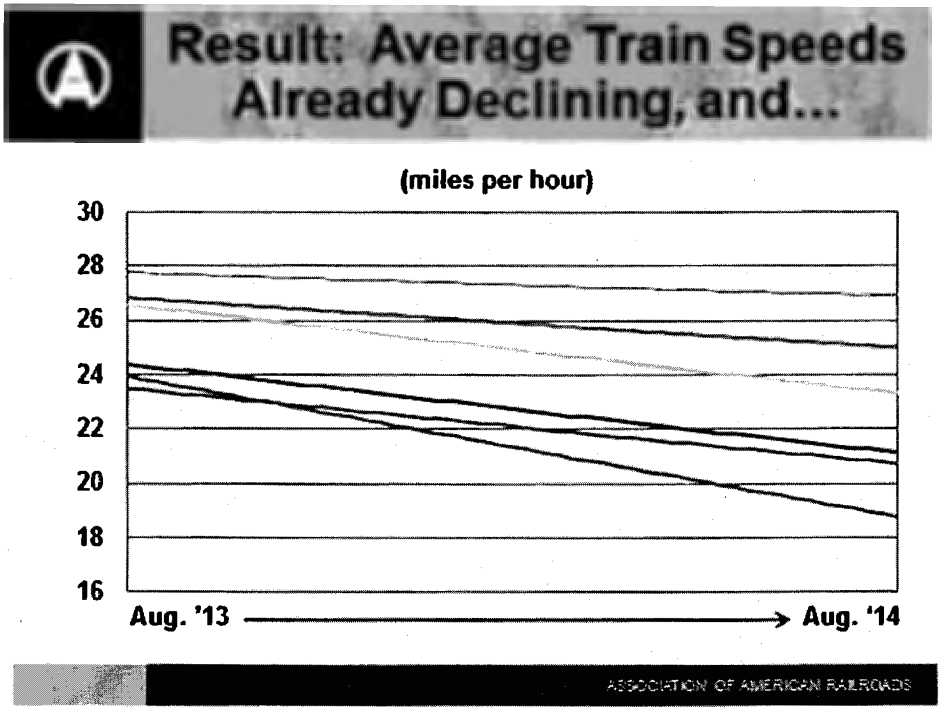
Figure 1. Rail Traffic Has Rebounded



Sharp Decline in Rail Traffic, Then Recovery

Data are for Class I railroads. Source: AAR

Figure 2. Average Train Speeds Are Declining



Result: Average Train Speeds Already Declining, and...

Figure 3. Dwell Time Is Increasing

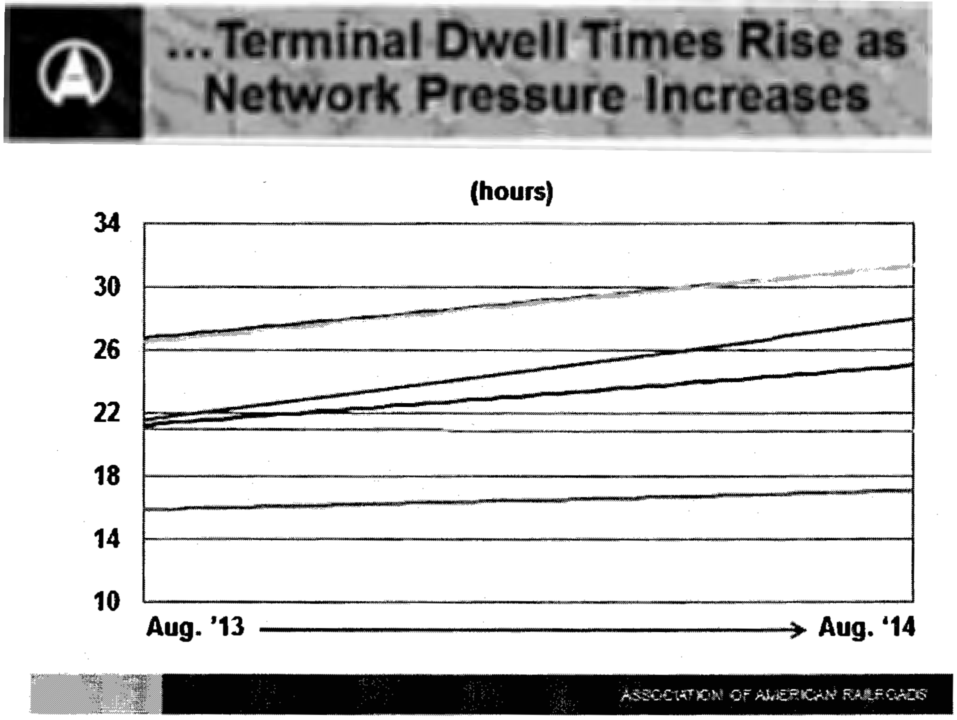
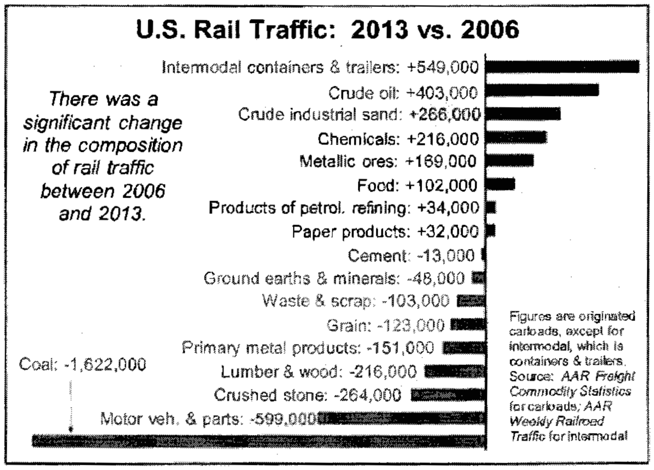


Figure 4. The Traffic Mix is Changing



There was a significant change in the composition of rail traffic between 2006 and 2013.

Figures are originated carloads, except for intermodal, which is containers & trailers. Source: *AAR Freight Commodity Statistics* for carloads; *AAR Weekly Railroad Traffic* for intermodal

Onerous requirements to reduce the speed of trains for flammable liquids would affect not only those trains, but other freight and passenger trains as well. The impact on railroad capacity can be compared to traveling on a 2-lane highway. Slowing down one car or truck affects trailing vehicles. Similarly, slowing down one train affects trailing movements, except that the impact on railroad traffic is much worse because the opportunities to pass are much more constrained than on a highway. Trains can pass only at widely-spaced locations on a railroad, whether single or double-tracked. Research on rail capacity has shown, and rail operators have long understood, that reducing speeds reduces network capacity and that heterogeneity in speed exacerbates this effect.[11]

In publishing the NPRM, PHMSA acknowledges its analysis of speed restrictions does "not estimate any effects from speed restrictions on other types of rail traffic throughout the rail network (e.g., passenger trains, intermodal freight, and general merchandise)."[12] This is a glaring omission. The *primary and unavoidable* cost of any speed restriction is a decrease in network fluidity and capacity. Decreased network fluidity results in increased operating costs for all trains that must travel slower because of the slower network. Decreased network fluidity also leads to increased capital costs, as railroads are forced to invest to expand corridors where capacity is constrained because of speed restrictions. Furthermore, decreasing the capacity and efficiency of the railroad network means that significant volumes of railroad traffic will be diverted to the highways. The result would be more highway traffic, more pollution, and an overall decrease in transportation safety.

PHMSA asks if a 40 mph speed restriction is necessary.[13] PHMSA does not need to regulate the speed of flammable liquid trains. There is no demonstration of

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[11] C. Martland, "Railroad Train Delay and Network Reliability," AAR Report R-991 (March 2008); M. Dingler et al., "Effect of train-type heterogeneity on single-track heavy haul railway line capacity," Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit, DOI:10.1177/0954409713496762 (2013); S. Sogin et al., "Analyzing the Incremental Transition from Single to Double Track Railway Lines," Proceedings of the International Association of Railway Operations Research 5th International Seminar on Railway Operations Modelling and Analysis, Copenhagen, Denmark (May 2013); S. Sogin et al., "Comparison of capacity of single- and double-track rail lines," Transportation Research Record: Journal of the Transportation Research Board 2374: 111-118 (2013).

[12] 79 Fed. Reg. 45,047.

[13] 79 Fed. Reg. 45,047.

a need to do more than the railroads have already done. Circular OT-55 restricts the speed of Key Trains to 50 mph and as discussed earlier, the Class I railroads have voluntarily committed to reducing the speed of Key Crude Oil Trains with at least one legacy DOT-111 tank car to 40 mph in HTUAs. However, AAR does not oppose a speed restriction based on the voluntary actions already taken as long as the restrictions apply on a temporary basis until legacy DOT-111 cars are replaced or retrofitted and network fluidity is maintained. AAR does oppose speed restrictions that would adversely affect network fluidity without providing a significant safety benefit.

Operating restrictions that could adversely affect the railroad's ability to transport goods should be viewed in the context of other restrictions that affect the fluidity of the railroad network. For example, the PTC regulatory scheme also requires reduced train speeds when problems occur with the PTC system.

Reduced network fluidity and capacity are not in the public interest. Railroads not only offer economic advantages, they also are an environmentally superior mode of transportation. An onerous speed limit could result in the diversion of traffic to other modes or prevent additional traffic from being transported on the railroad network.

B. Application of a Speed Limit to Every HHFT as Defined Would Severely Impact the Railroad Network.

In assessing the potential impact of the additional speed restrictions suggested by PHMSA in the NPRM, there is an initial methodological problem. It appears that PHMSA intends for additional speed restrictions to apply only to unit trains: "this rule primarily impacts unit train shipments of ethanol and crude oil."[14] It also appears that PHMSA intended for the speed restrictions to be short-term measures that would be lifted once legacy DOT-111 cars are replaced or retrofitted.

However, PHMSA suggests the application of speed restrictions to high-hazard flammable trains (HHFTs), defined as any train with 20 or more cars containing a flammable liquid. Seemingly contrary to PHMSA's intent to address unit trains, these requirements would apply to manifest trains transporting blocks of flammable liquids that amount to less than 20 tank cars individually, but together exceed the 20-car threshold. There are a considerable number of such trains. In fact, several Class I railroads report that 20 to 60 percent of their trains

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[14] 79 Fed. Reg. 45,017.

containing 20 or more tank cars of flammable liquids are manifest trains, not unit trains.[15]

It appears unlikely PHMSA intended to apply a 40 mph speed limit to any manifest train with 20 or more tank cars containing flammable liquids. In focusing on unit trains, PHMSA clearly is concerned about potential accidents where a significant number of flammable liquid cars are grouped together.

Applying a 40 mph limit to any HHFT, as the term is defined, could dramatically impact the fluidity of the railroad network. Consequently, AAR proposes to limit applicability of a 40 mph speed limit in HTUAs to a train with a single block of 20 or more loaded tank cars containing a flammable liquid when at least one of the tank cars is a legacy DOT-111 tank car. To avoid the theoretical problem of a large number of flammable liquid cars in a train separated so that the 20-car threshold is not met, AAR proposes there be an overall threshold of 35 loaded tank cars, including at least one legacy DOT-111 tank car, whether or not those 35 tank cars are in a single block. Thirty-five tank cars is the threshold PHMSA has used for providing routing information for crude oil shipments to State Emergency Response Commissions.[16]

Using a 20-car block threshold for application of the 40 mph speed limit, subject to an overall threshold of 35 tank cars, is consistent with PHMSA's focus on unit trains. AAR recognizes, however, that the commitment to Secretary Foxx to operate Key Crude Oil trains at 40 mph in HTUAs (if the trains contain a legacy DOT-111 tank car) is not limited to whether the 20 cars are in a block. AAR's members have no intention of going back on that commitment. Therefore, for crude oil only, AAR would not oppose a 40 mph limit within HTUAs if 20 loaded tank cars are in a train and at least one of those cars is a legacy DOT-111 tank car, regardless of whether the 20 cars are in a single block.

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[15] PHMSA implies the NPRM only applies to crude oil and ethanol ("this rule primarily impacts unit train shipments of ethanol and crude oil; because ethanol and crude oil are most frequently transported in high volume shipments"). 77 Fed. Reg. 45,017. Other flammable liquids are transported in trains with twenty or more flammable-liquid cars.

[16] 79 Fed. Reg. 45,041 ("a 1,000,000 gallon threshold for a unit train would require notification . . . for unit trains composed of approximately 35 cars of crude oil").

C. An Expanded 40 MPH Speed Restriction Could Dramatically Impair Railroad Service.

A 40 mph speed restriction expanded beyond HTUAs could be devastating to network fluidity. Freight and passenger service alike would be affected.

Large railroads use a simulation program called "Rail Traffic Controller" (RTC) to measure track capacity and train performance. This software contains two basic types of files: one set represents infrastructure (track, signals, grades, curves, speed limits, etc.); the other set represents trains (type, frequency distribution, lengths, trailing weights, locomotive consists, priority, speed limits, schedule times, etc.). The dispatch logic in the simulation model replicates the logic that train dispatchers use when controlling the flow of trains across a railroad district: this logic has been repeatedly tested against observed reality to ensure that model results accurately predict the consequences that can be expected in day-to-day operations if changes are made to any of the many independent variables that can affect the railroad. Thus, the model can quantify the impact of adding or extending sidings, of adding more double or triple track main line, of increasing train lengths, of adding passenger trains to a freight route, of changing the signal system, or of changing operating practices or rules.[17] One caveat with respect to RTC modeling is that the model assumes perfect dispatching and operations with low variability. Thus, RTC modeling can be somewhat overly optimistic with respect to network fluidity.

In the short time available for modeling, specific corridors were analyzed for the potential impact of a nationwide 40 mph speed restriction. BNSF analyzed segments on its northern and southern transcontinental routes, from Aurora, Illinois, to Vancouver, Washington, and from Kansas City to Los Angeles. On both these routes trains operate at speeds up to 70 mph. A 40 mph speed limit for HHFTs would result in following trains slowing down until the HHFT reached an "overtake" permitting the faster train to pass.

The modeling revealed the severe impact on network fluidity from a 40 mph nationwide speed restriction. On the Aurora – Vancouver segment, one Amtrak schedule would be 22 minutes slower than at present. The impact on freight trains would be greater; intermodal trains would lose more than 1.5 hours and other

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[17] The railroads recognize that they have unique modeling capability. Should PHMSA so desire, they would be pleased to explain in more detail their modeling capabilities and conduct additional modeling for PHMSA. The railroads' modeling was limited by the short time available.

freight trains would lose almost three hours. The potential impact on the Kansas City – Los Angeles route would be even greater. Currently, ethanol constitutes the primary flammable liquid traffic on the KC – LA route. BNSF believes crude oil will begin to move on this route, increasing the number of trains subject to the 40 mph restriction. Furthermore, the Kansas City – LA route is more susceptible to delays from a 40 mph restriction because a greater number of trains are subject to the 40 mph restriction and because there are twice as many trains on that route as on the northern route. BNSF estimates that overall, a nationwide 40 mph speed restriction could result in an 8 percent loss of capacity on the BNSF network, up to a 65 percent loss of capacity on some subdivisions and routes.

Union Pacific ran over 300 simulations on seven corridors using RTC. These simulations found impacts ranging as high as 5 mph on overall train speed (not just HHFTs). On many subdivisions, because of the impact on network fluidity all capacity for additional trains would be lost; on other subdivisions, much of the "excess" capacity that exists today would be lost.[18]

It should be noted that a speed limit could have impacts other than network fluidity. Both CSXT and the Alaska Railroad have noted they would need to establish new crew change points because on certain routes their crews will not be able to make an entire trip to long-standing, previously-established crew change points.

D. PHMSA Should Apply the 40 mph Speed Restriction Only to HTUAs.

Given the dramatic effect speed restrictions can have on railroad service, they should be imposed with caution. It is not in the public interest to make railroad service less efficient and more expensive.

The 40 mph speed restriction for HTUAs for Key Crude Oil Trains, as set forth in Secretary Foxx's February 20 letter, addresses the cities with the largest populations that have been identified as facing the most risk. There is nothing in the record showing a need to expand speed restrictions beyond HTUAs.

PHMSA's own analysis supports applying the proposed 40 mph speed restriction for HHFTs to HTUAs only. Table 6 in the NPRM contains PHMSA's analysis of the 20-year costs and benefits of the various tank car and speed restriction options set forth in the NPRM.[19] Using the midpoint of the benefit

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[18] Union Pacific used the Train Performance Simulator along with RTC to model the impact of speed restrictions.

[19] *See* 79 Fed. Reg. 45,022.

range for each option in the table, the most effective option from the perspective of PHMSA's cost-benefit analysis, regardless of the tank car standard chosen, is the HTUA option.

Consequently, AAR does not oppose applying the 40 mph speed restriction for HHFTs to HTUAs, consistent with existing DOT policy (and subject, of course, to limiting the trains subject to the speed restriction as discussed in section II.B above).

E. PHMSA's Analysis of the Proposed Benefits of Speed Restrictions Is Inconsistent with Other Analysis.

PHMSA asserts that "a 40-mph speed limit, from 50-mph, will reduce the severity of a HHFT accidents [*sic*] by 36 percent, due to the reduction in kinetic energy by 36 percent."[20] PHMSA made similar claims with respect to ECP brakes, which AAR debunks later in these comments. In the short time available, AAR did not have time to undertake analysis of this claim. However, work by the University of Illinois calls into question the accuracy of this assertion, or at least its significance.

In 2011, the University of Illinois published the results of a regression analysis of the relationship between track class, train derailment speed, and accident severity for mainline derailments on Class I railroads.[21] The methodology used by the University of Illinois permits an analysis of the relationship between speed and the number of cars derailing. AAR asked the University of Illinois to use its methodology to examine the effect of reducing train speed from 50 mph to 40 mph. The University of Illinois found that the reduction in train speed reduces the number of cars derailed, not necessarily releasing contents, from an average of 12.4 to 11.1.

AAR suggests that reducing the average number of cars derailed in an accident by 1.3 does not justify significantly reducing the ability of the nation's railroads to provide the service their customers expect. Expanding the speed limit restriction beyond HTUAs cannot be justified.

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[20] 79 Fed. Reg. 45,047.

[21] X. Liu at al., "Analysis of Derailments by Accident Cause: Evaluating Railroad Track Upgrades to Reduce Transportation Risk," Transportation Research Record: Journal of the Transportation Research Board, No. 2261, pp. 178-185 (2011).

III. ECP Brakes Should Not be Mandated

AAR strongly opposes any requirement to use ECP brakes. ECP brakes would be extremely costly without providing an offsetting benefit. Furthermore, PHMSA's speculation about safety benefits associated with ECP brakes amounts to nothing more than that; the analysis in the rulemaking docket is substantially flawed.

This is the second time within a decade that DOT has sought to impose ECP brakes on the railroad industry. As FRA admitted in proposing ECP brake regulations in 2007, the agency "has been an active and consistent advocate of ECP brake system implementation."[22] However, underlying the drive for ECP brakes is the lack of safety justification.

In the 2007-2008 ECP rulemaking proceeding, FRA could not justify requiring ECP brakes on a cost-benefit basis and thus did not mandate their use. Instead, FRA offered the industry incentives in the form of regulatory relief.[23] Significantly, FRA recognized that ECP brakes were limited in the effect they could have on accidents. FRA stated that "at speeds greater than those on class 1 track (maximum train speed of 10 mph) or track class 2 (maximum speed 25 mph), the engineer will not have enough reaction time to prevent a collision, even with ECP brakes."[24]

In its Regulatory Analysis for its 2008 ECP rule, FRA postulated $190 million in safety and environmental benefits over a 20-year period. In contrast, FRA estimated the costs would be $1.7 billion, a cost/benefit ratio of almost 9 to 1.[25] FRA assumed that business benefits would more than compensate for the costs of ECP brakes, but industry to this day has not identified business benefits that would justify transitioning to ECP brakes. Note that FRA's estimated costs were based on a limited number of trains using ECP brakes as a result of the incentives FRA offered.

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[22] 72 Fed. Reg. 50,820 (Sept. 4, 2007).

[23] *See* the final rule at 73 Fed. Reg. 61,512 (Oct. 16, 2008).

[24] FRA, "Electronically Controlled Pneumatic Brake Systems -- Final Rulemaking -- Regulatory Analysis, www.regulations.gov,, Document No. FRA-2006-26175-0065, p. 32 (June 2008).

[25] FRA, "Electronically Controlled Pneumatic Brake Systems -- Final Rulemaking -- Regulatory Analysis, www.regulations.gov, Document No. FRA-2006-26175-0065, pp. 4, 5, (June 2008).

Although the fundamental economics of ECP brakes has not changed, a scant six years later, DOT is again raising the issue of requiring ECP brakes. Apparently, the rationale for this proceeding is not that ECP brakes would help avoid accidents. Rather, the rationale is that the consequences of accidents would be mitigated by resulting in fewer cars being punctured.

The shift in rationale for ECP brakes, however, has led to the same result – DOT cannot justify an ECP mandate. The discussion of ECP brakes in the NPRM is faulty with respect to both costs and benefits.

A. <u>Analysis Does Not Support the Purported Benefits of ECP Brakes.</u>

FRA's conclusions about the effectiveness of ECP brake systems are based on modeling analysis by Sharma & Associates, Inc.[26] Based on Sharma's work, PHMSA concludes that ECP brakes would "have 36 percent fewer car puncture [*sic*] compared to the same train without ECP brakes."[27] The estimate of a 36 percent reduction in accident severity is based on the reduction in the kinetic energy of the tank cars trailing the point of derailment. However, as will be shown, ECP brakes would have a minimal impact on the severity of a derailment.

Sharma's estimated reduction in the kinetic energy upon which PHMSA bases its premise of the effectiveness of ECP brakes is based on a very limited set of simulations and looks only at derailments that occur at the head end of a train. Sharma states that, "given that this is based on a limited simulation set, the results could be optimistic, and should be taken with a grain of salt…it is anticipated that the percent improvement due to ECP would likely drop to about 25%..."[28] There is no indication of how the 25 percent estimate was derived, but the wide range of reported estimates for potential reduced accident severity with ECP brakes suggests a more complete analysis with validation against actual events is necessary to understand the actual potential benefit.

Another problem with the Sharma analysis is the bias resulting from limiting the analysis to trains with 80 cars. The result is likely a bias that overestimates the effect of ECP brakes. When conventional brake systems are used, the longer the

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[26] Sharma & Associates, "Objective Evaluation of Risk Reduction from Tank Car Design & Operations Improvements," <u>www.regulations.gov</u>, Document No. PHMSA-2012-0082-0209 (July 2014) (hereinafter Sharma & Associates).
[27] "Calculating Effectiveness Rates for Emergency Brake Signal Propagations Systems," <u>www.regulations.gov</u>, Document No. PHMSA-2012-0082-0210, p. 3 (July 2014) (hereinafter referred to as Calculating Effectiveness Rates).
[28] Sharma & Associates, p. 13.

train the longer the period for all the train brakes to be applied. Additionally, the deceleration effects of other cars blocking the motion of a car and the ground will be comparatively less for a longer string of cars since the residual mass behind the point of derailment will be larger.[29]

AAR's Transportation Technology Center, Inc., undertook its own modeling of the effect of ECP brakes, with an independent review by Applied Research Associates, Inc. (ARA).[30] TTCI used the Train Operations and Energy Simulator (TOES$^{\text{TM}}$) model that has been in use for nearly 30 years, has been validated many times over, and is considered an industry standard for train dynamics modeling. TTCI's study examined several of the derailments cited in the NPRM, as well as other similar types of derailments to develop and validate a methodology for estimating the potential reduction in accident severity. TTCI's methodology uses output from TOES to model the contribution of the braking system and other forces acting on the train in dissipating the energy in the train.

TTCI's analysis considered a number of factors that do not appear to be analyzed by PHMSA or Sharma, including:[31]

- *The magnitude of the force applied to the cars trailing the point of derailment.* There is a considerable amount of force that works to decelerate the mass of the cars trailing the point of derailment due to the blockage resulting from the derailment itself, which significantly limits the potential contribution from any braking system. In addition, as Sharma acknowledges, friction from the ground needs to be taken into account. However, Sharma does not adequately take friction provided by the ground into account. Sharma uses coefficients of friction between 0.27 and 0.33.[32] ARA demonstrates that those coefficients are far too low and differ from

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[29] S. Kirkpatrick, Applied Research Associates, Inc., "A Review of Analyses Supporting the Pipeline and Hazardous Materials Safety Administration HM-251 Notice of Proposed Rulemaking, p. 6 (Sept. 29, 2014) (Attachment A) (hereinafter referred to as Kirkpatrick).

[30] J. Brosseau, "Analysis and Modeling of Benefits of Alternative Braking Systems in Tank Car Derailments," Transportation Technology Center, Inc., R-1007 (September 2014) (Attachment B) (hereinafter referred to as Brosseau).

[31] *See* Brosseau, pp. 1, 2.

[32] Sharma & Associates, p. 5.

previously published work, including research conducted by DOT's Volpe Center.[33]

- *The potential for a derailment to occur anywhere within the train.* The maximum potential benefit of a given braking system is when the derailment occurs at the head end of the train. Extensive statistical analysis of FRA data shows that the point of derailment is in the first 10 positions of the train in only 25 percent of derailments; in the remaining 75 percent of derailments the point of derailment is distributed evenly throughout the remainder of the train.[34] Recognizing that the benefit will vary depending on the point of derailment in the train, derailments that occur at various points in the train must be considered in order to assess the potential benefit of alternate braking systems. Modeling only derailments that occur near the front of the train overstates the effects of brakes on derailment severity, thereby overestimating the effect of ECP brakes.
- *The variability in the response of a train to various types of derailments.* There are a wide variety of types of derailments and derailment causes and, while certain types of derailments will result in a pile up of cars at the point of derailment, others will have far less dramatic results. Both the point of derailment and the distribution of the number of cars derailed are strongly affected by the derailment cause.[35] The effect of a braking system on derailments in which a pileup does not occur is more difficult to quantify, but should be recognized in an assessment of the potential reduction in accident severity.

TTCI's approach was validated using event recorder data from remote distributed power locomotives involved in derailments such as the Aliceville, Alabama, derailment cited in the NPRM. The event recorders provided accurate rear-of-train speed profiles to validate TTCI's approach. The speed profiles and

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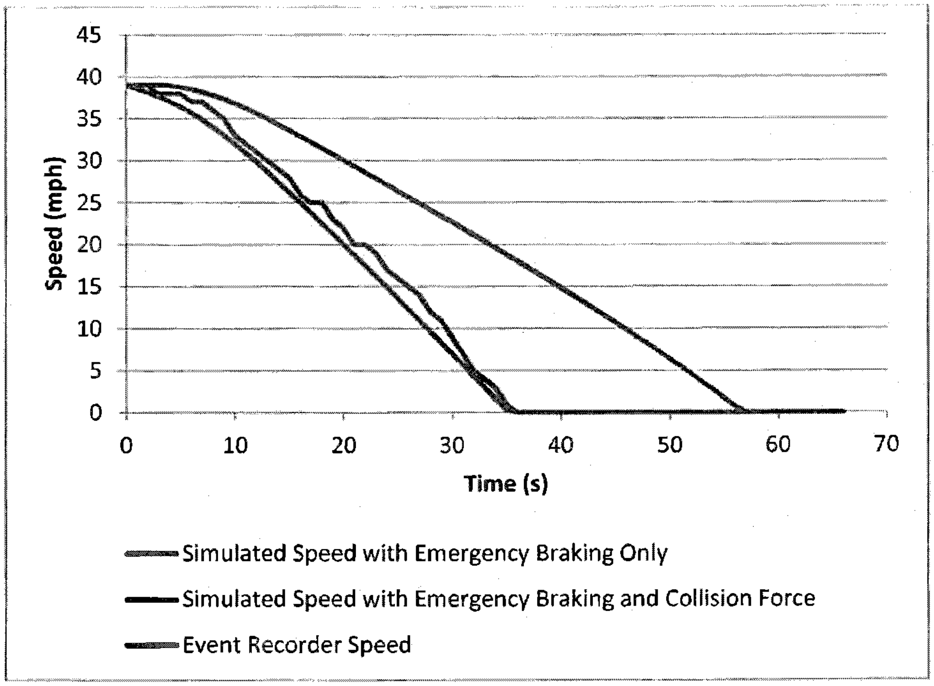
[33] Kirkpatrick, pp. 3, 4.

[34] X. Liu et al., "Probability Analysis of Multiple-Tank-Car Release Incidents in Railway Hazardous Materials Transportation," Journal of Hazardous Materials, Vol. 276, pp. 442-451 (2014) (hereinafter referred to as Liu); R. Anderson and C. Barkan, "Derailment Probability Analyses and Modeling of Mainline Freight Trains," Proceedings of the Eighth International Heavy Haul Conference, Rio de Janeiro, pp. 491–497 (June 2005.)

[35] Barkan et al., "Railroad Derailment Factors Affecting Hazardous Materials Transportation Risk," Transportation Research Record: Journal of the Transportation Research Board, No. 1825, pp. 64-74 (2003); Liu, pp. 442- 451.

stopping distances modeled compare well to the data from these actual derailments, as shown in Figure 4 below, which compares the speed profile from the event recorder of the remote distributed power locomotive in the Aliceville, Alabama, derailment with the simulated speed accounting only for emergency braking and the simulated speed accounting for emergency braking and the collision force. Figure 4 shows that TTCI's simulated speed, taking into account emergency braking and the collision force, closely tracks the speed shown by the event recorder.

Figure 4. Simulated Train Speed v. Recorded Speed[36]



TTCI's model concludes that if ECP brakes had been used in Aliceville, the energy in the derailment would have been reduced by only 12 percent, as compared to the distributed power that was actually used on that train. The model predicts that only 1.5 fewer cars would have reached the point of derailment with ECP brakes.

TTCI conducted 420 simulations that covered the following parameters:[37]

- Train speed at derailment – speeds of 30, 35, 40, 45, and 50 mph were included.

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[36] Brosseau, p. 5.

[37] Brosseau, pp. 2, 3.

- Point of derailment within the train – derailments occurring at the head-end, 1/4-way through the train, 1/2-way through the train, and 3/4-way through the train were included.
- Track grade – grades of 1% uphill, 1% downhill and flat (0%) were included.
- Brake system – conventional (head-end), conventional with end-of-train device (ETD), rear-end distributed power (DP), mid-train DP with ETD, DP at 2/3 with ETD, ECP, and ECP with rear-end wired DP were included.

The result of the modeling and analysis effort can be seen in Table 1, which compares the average percent reduction in energy and the average reduction in number of derailed cars utilizing ECP brakes as compared to other braking systems.

Table 1. Effect of ECP Brakes vs.
Conventional Systems on Derailments[38]

Braking System Compared to ECP Brakes	**Average % Reduction in Energy Consumed in Derailment From ECP Brakes**	**Average Reduction in Number of Cars Derailed Using ECP Brakes**
Conventional Brakes (Head-end)	13.3%	1.6
Conventional Brakes with ETD	11.6%	1.3
Rear-end Distributed Power	12.8%	1.5
Mid-train Distributed Power	10.5%	1.2
Distributed Power at 2/3	10.8%	1.2

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[38] Brosseau, p. 3.

As Table 1 indicates, the study estimates that ECP brakes will reduce the number of derailed cars by fewer than two cars, on average, compared to other braking systems. This analysis investigates only derailments that result in a significant blockage at the point of derailment and, therefore, likely overestimates the overall potential benefit, considering other types of derailments. For example, braking systems would not be expected to have as much of an effect where no pileup occurs.

Of course, the number of cars derailing is not the same as the number of cars releasing. The conditional probability of release (CPR), the probability of a release if a tank car is in an accident, will depend on the specific specification selected by PHMSA. For example, if the CPR is 5 percent that means there will only be a 5 percent chance of a release from the 1.2 to 1.6 cars derailing due to the absence of ECP brakes, everything else being equal.

Sharma does acknowledge its work is preliminary. In fact, Sharma says that it expects the anticipated improvement from ECP brakes would drop with further simulations and, again, states that its results "should be taken with a grain of salt."[39] These statements certainly add to the suspicion that it is inappropriate to impose a huge expense on industry on the basis of the preliminary analysis done to date.

B. PHMSA Has Substantially Understated the Costs of ECP Brakes.

PHMSA's assessment of the costs of ECP brakes is based on a flawed 2006 study.[40] The 2006 study's estimates significantly understate the costs of ECP brakes.

To begin, ECP brakes would have to be installed as an overlay system, i.e., rolling stock equipped with ECP brakes must be equipped to operate with conventional air brakes and in ECP mode. Freight trains can operate in ECP mode only if all the equipment in a train can operate in ECP mode. Indeed, PHMSA proposes to require railroads to operate in ECP mode only when a train consists solely of tank cars equipped with ECP brakes (under Option 1). Consequently, a tank car equipped with ECP brakes also must be equipped to operate in conventional air brake mode.

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[39] Sharma & Associates, p. 13.

[40] Booz Allen Hamilton, "ECP Brake System for Freight Service: Final Report," www.regulations.gov, Document No. FRA-2006-26175-0015 (May 2006) (hereinafter referred to as Booz Allen).

Clearly, from an operational perspective, were tank cars required to have ECP brakes they also would need to be equipped with conventional braking capability. For example, a railroad might not have an ECP-equipped locomotive available to pick up a block of ECP-equipped tank cars. Or an ECP-equipped tank car might have to be set out from a train and there might not be an ECP-equipped locomotive available to pick the tank car up. The operational challenge of having separate ECP and conventional braking fleets would be daunting, adversely affecting the velocity of the railroad network.

In its cost-benefit analysis, PHMSA confusingly used both stand-alone and overlay numbers. For the cost of equipping a new tank car, PHMSA used the 2006 report's stand-alone estimate, $3,000; PHMSA ignored the report's estimate that an overlay system would cost an additional $1,500. For the cost of retrofitting a car, PHMSA used the 2006 report's overlay estimate, $5,000.[41]

Furthermore, the estimates are far too low. AAR estimates the cost would be $9,665 per car, for both tank cars and buffer cars.[42] Attachment C, enclosed, contains spreadsheets with AAR's calculations. PHMSA estimates 66,000 tank cars would have to be retrofitted.[43] Assuming, *arguendo*, that PHMSA's estimate of the number of cars needing retrofitting is correct, PHMSA has underestimated the cost of retrofitting tank cars with ECP brakes by approximately $176 million.[44]

PHMSA also underestimates the cost of equipping locomotives with ECP brakes. Locomotives, too, would need to be dual equipped. PHMSA estimates the cost to be $79,000 per locomotive. AAR estimates the cost per locomotive to be $88,300. The significance of this difference is magnified by the discrepancy in the number of locomotives that would need to be equipped. PHMSA estimates that only 900 locomotives would be equipped with ECP brakes and that all locomotives

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[41] Booz Allen, pp, III-1, III-2.

[42] AAR does not differentiate between new cars and retrofitted cars insofar as the cost of applying ECP brakes is concerned.

[43] Pipeline and Hazardous Materials Safety Administration, "Draft Regulatory Impact Analysis - Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains; Notice of Proposed Rulemaking, www.regulations.gov, Document No. PHMSA-2012-0082-0179, pp. 91-93 (July 2014) (hereinafter referred to as Regulatory Impact Analysis).

[44] Apparently, PHMSA omitted to include in its cost calculations the 15,450 new cars that would be needed to replace the tank cars PHMSA postulates would be used exclusively in Canadian oil sands service.

will be equipped in the first year.[45] The railroads expect that they would need to equip most, if not all, of their line-haul locomotives with ECP brakes, a number approaching 20,000, in order to maintain operational flexibility. The difference between PHMSA's and AAR's estimate for equipping locomotives is approximately $1.7 billion.

In addition to underestimating equipment costs, PHMSA underestimates training costs by approximately $215 million. First, PHMSA uses labor rates (cost per hour worked, including fringes) too low for engineers and conductors. PHMSA uses $49.97 for engineers and conductors; AAR estimates the labor rates for engineers and conductors are $73.10 and $62.16, respectively. Second, PHMSA did not account for the training of any carmen. All 9,849 carmen on the Class I railroads would need training. Third, PHMSA assumed only 4,500 engineers and the same number of conductors would need to be trained. To ensure network fluidity, all 27,143 engineers and 41,015 conductors on the Class I railroads would need training.[46] Thus, PHMSA underestimated training costs by $215 million.

Without even considering buffer cars, PHMSA has underestimated the cost of ECP brakes by over $2 billion. That also does not include any additional maintenance expenses for ECP brakes. Precisely identifying the railroads' experience with maintaining ECP systems is problematic because the industry does not use ECP-specific job codes for repairs. However, the railroads' experience is that ECP brake systems require more maintenance than conventional braking systems. AAR estimates that over a 5-year period ECP brakes cost an extra $87 per car to maintain.[47] AAR also expects that over a longer period of time ECP brakes will incur maintenance costs that conventional systems will not, specifically the replacement of batteries, cabling, connectors and other ECP specific hardware. None of these costs were considered by PHMSA.

PHMSA has not accounted for two other unquantifiable factors that could have a significant adverse impact on the railroads. A mandate to install ECP brakes on a large amount of rolling stock in a short period of time might strain

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[45] Regulatory Impact Analysis, p. 154.

[46] Employment numbers from 2013.

[47] AAR estimates $11 in maintenance costs for pneumatic brakes, based on its car repair billing database, which includes parts and labor. For ECP brakes, AAR has more limited data, but based on the experience of one railroad that has been using them for several years, AAR estimates the maintenance cost of ECP brake parts is $98 (excluding labor).

supplier capabilities, leading to quality control issues. Costs, too, might skyrocket as a mandate to install ECP brakes could cause ECP suppliers to increase prices. In addition, the railroads are installing PTC on the locomotives that would need to be equipped with ECP brakes. Whether there might be any adverse interactions between these two electronic systems is unknown.

IV. A Vast Expansion in the Number of Trains Subject to Routing Analysis Could Also Impair Network Fluidity

PHMSA proposes to require routing analyses pursuant to Part 172, Subpart I, and require railroads to adjust their routes accordingly. As is the case with speed restrictions, adjusting the routing for too many trains when there is no significant safety advantage would also impair network fluidity.

The Class I railroads have voluntarily been applying the routing requirements to Key Crude Oil Trains as described in Secretary Foxx's February 20, 2014 letter. Applying the routing requirements to other trains containing flammable liquids would significantly expand the number of movements subject to the routing requirements. There are large numbers of these trains. Forcing all these trains onto the same corridors would clog the railroad network, reducing fluidity on those corridors and preventing additional growth in railroad traffic.[48]

PHMSA could limit the adverse impact on network fluidity by restricting the scope of trains subject to the routing provisions as suggested in section II.B.

V. AAR Supports Enhanced Tank Car Standards

As discussed earlier, AAR has been at the forefront in arguing for more stringent tank car standards. AAR is very supportive of bringing this aspect of the NPRM to a rapid conclusion. Below, AAR discusses its perspective on each of the tank car features discussed in the NPRM. However, before doing so there are several important overarching issues that need to be addressed.

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[48] PHMSA asks how the routing of crude oil has changed as a result of railroads voluntarily applying the routing regulations to crude oil shipments. 79 Fed. Reg. 45,042. The railroads have shifted crude oil traffic as a result of the routing analysis. The result undoubtedly would be the same should the routing regulations apply to other flammable liquids.

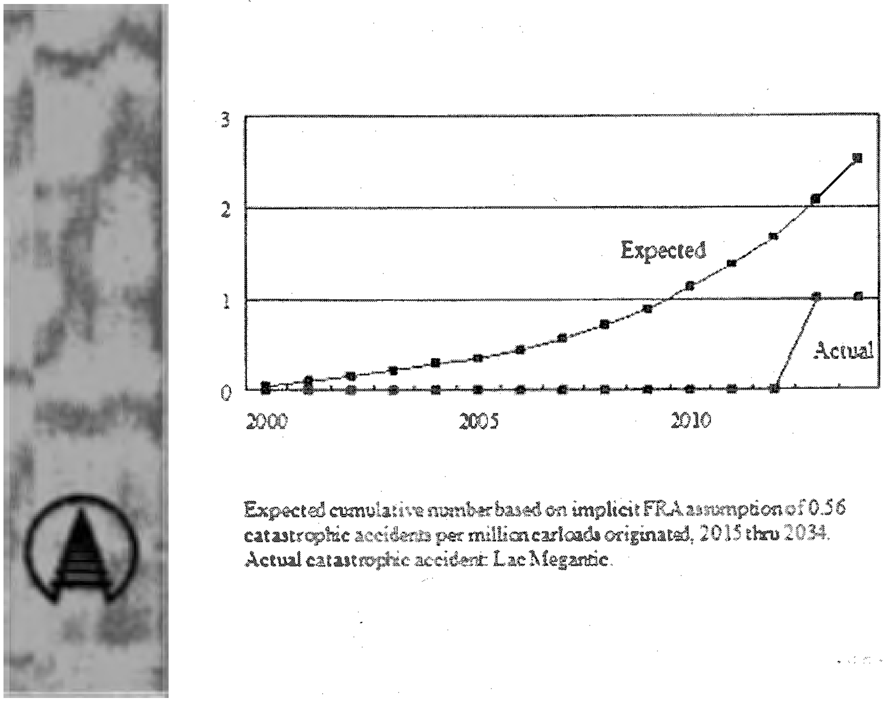
A. The Cost-Benefit Analysis Is Seriously Flawed.

1. There Is No Support for the Projection of Catastrophic Accidents.

PHMSA's speculation that over the next 20 years the U.S. could experience nine events that would have costs exceeding $1.15 billion and one exceeding $5.75 billion is just that – mere speculation. There simply is no basis for such an assumption. Other than Lac-Mégantic, there has been no accident in the catastrophic category.

The railroads' record over the last 15 years does not support PHMSA's speculation. Were the projection of 10 catastrophic accidents over the next 20 years accurate, the catastrophic accident rate would be 0.56 catastrophic accidents per million carloads. If that rate were accurate, there should have been multiple catastrophic accidents in recent years. Figure 5 shows PHMSA's speculation is not borne out by experience.

Figure 5. "Expected" vs. Actual Catastrophic Accidents



Expected cumulative number based on implicit FRA assumption of 0.56 catastrophic accidents per million carloads originated, 2015 thru 2034.
Actual catastrophic accident: Lac Megantic.

2. The Base Case Assumption for PHMSA's Cost-Benefit Analysis Is Flawed.

Another problem with the cost/benefit analysis is that it uses different "base cases" for costs and benefits. PHMSA assumes as its base case for cost purposes that the enhanced CPC-1232 car will be used for all HHFT service by the end of 2018. Then PHMSA calculates that the incremental cost of an Option 1 car is only

$5,000, the difference between the Option 1 tank car and an enhanced CPC-1232 car.

However, for the purpose of calculating benefits, instead of using the enhanced CPC-1232 car as the base case as of the end of 2013, PHMSA uses the existing fleet. In other words, PHMSA measures improvement in puncture resistance using the existing fleet of cars as the base case, most of which are legacy DOT-111 cars.[49]

The difference in base case assumptions makes a very large difference in assessing potential benefits. PHMSA estimates that using Option 1 tank cars instead of the existing fleet would result in a 51 percent reduction in the number of cars releasing flammable liquids in accidents. However, if a fleet composed entirely of enhanced CPC-1232 cars is used as the base case, the improvement from a fleet of Option 1 tank cars shrinks to 10 percent and over 20 years, the present value of the non-ECP benefits from the Option 1 tank car, for low-consequence accidents, drops from $544 million to $164 million; for high-consequence events, the purported benefits drop from $2.4 billion to $1.3 billion.[50] Correction of this base case error results in a reduction in total safety benefits from $3.3 billion to $1.7 billion.

3. PHMSA's Methodology for Assessing Tank Car Performance Is Flawed.

Two different approaches to assessing tank car performance are contained in documents PHMSA put in the regulatory docket. The RIA compares the three tank car options offered in the NPRM by examining the ratio of head puncture velocity and shell puncture force, i.e., this ratio was used to determine the reduction in lading loss. A paper by Sharma and Associates uses derailment simulation to estimate the fraction of impacts that fall above and below the tank's ability to resist the impact force.[51] Both approaches are problematic.

If PHMSA's assessment is based on the ratio of head puncture velocity and shell puncture force, it has erroneously assumed a linear relationship between those parameters and the probability of an accident-caused release. That would only be true if the distribution of the impact force were uniform, which DOT's own analysis shows is not the case.[52] As a result, PHMSA has overestimated the

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[49] *See* Regulatory Impact Analysis, pp. 80, 82, 90, 94,120-126.

[50] *See* Regulatory Impact Analysis pp. 120, 186. This reduction in benefits for high-consequence events is calculated using PHMSA's "effectiveness ratio."

[51] *See* Sharma & Associates.

[52] Sharma & Associates, Figure 5, p. 7.

expected number of cars releasing for a given speed, based on Figure 10 in the Sharma and Associates report.

Furthermore, this approach seems to assume that the quantity lost in a derailment is solely a factor of train speed.[53] As discussed further in the section on ECP brakes, more significant is whether derailed cars strike others that are immobilized, like hitting a wall, so that all of the energy goes into damaging the car instead of moving it aside.

If PHMSA's assessment is based on derailment simulations and the distribution of impacts, which appears to be the case at least for the assessment of ECP brakes, flaws in both the simulation of the derailments and in the derivation of release probabilities undermine the credibility of the findings. The most significant problems with the derailment simulations are as follows.

First, although the Sharma Report indicates that the simulation was done in three dimensions for the first 50 cars, the simulation restricted the movement of the couplers and body bolsters to two dimensions, effectively restricting the entire simulation to two dimensions. There can be no override collisions or rollovers unless the tank first separates from the couplers and bolsters, which is uncommon. The distribution of impact loads is therefore artificially restricted by a major modeling assumption that is unacceptably unrealistic. A two-dimension simulation simply does not account for enough of the relevant physics to produce a reliable distribution of impacts.[54]

Second, the derailment modeling does not adequately account for the effect of compressibility of the lading, and therefore all cars are effectively assumed to be empty insofar as the deformation resistance of the tank is concerned (the modeling does account for the weight of a full load). The result of modeling empty cars is to omit the high loads that occur when a loaded tank deforms enough to go shell-full and experiences a spike in both internal pressure and impact forces. As a consequence, the calculated collision force distribution will be incorrect in the analyses. In particular, the distribution would be skewed toward lower force levels.[55]

Third, there is no support for the assumed distribution of impact sizes. The authors claim that it works to validate the observed fractions of cars failing. As

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[53] Calculating Effectiveness Rates, pp. 4 et seq.

[54] *See* Kirkpatrick, pp. 1, 2.

[55] Kirkpatrick, pp. 4, 5

questionable as this claim is, even if it were true it is possible that many distributions would lead to the observed fraction of cars losing lading, and there is no guarantee that in the next analysis this assumed distribution would yield an accurate result unless it reflects reality at least to some degree.

Fourth, Sharma attempts to validate its simulation model primarily by comparing the model's outputs—i.e., the number of cars derailed per train and the number of cars punctured or releasing product, all as functions of train speed — with the equivalent numbers from twelve actual accidents that occurred in the period 2002-2012.[56] The effort at validation fails for a number of reasons.

Sharma did not compare the model's hazmat release or puncture output to a full, representative sample of FRA accident data.[57] In particular, by selecting for comparison only twelve accidents that had at least one car releasing hazardous materials, Sharma increased the average CPR by two or three times.[58] In other words, Sharma "validated" its model against a small, hand-picked set of train accidents that includes a disproportionate number of accidents with an average number of cars releasing product two to three times worse than the average for the full database. Thus, the Sharma simulation model substantially exaggerates, perhaps by a significant amount, the propensity of the tank car fleet to release hazardous material in a derailment. Selection of a biased sample such as this violates a fundamental statistical principle that one use a representative sample of the data. This is a critical flaw that seriously undermines the validity of the results. Sharma, itself, states that "[v]alidation of the model against known historical derailment data is a critical element of the overall methodology."[59]

Sharma does not explain how it selected these twelve accidents for comparison, but they appear to be among the accidents with the highest number of hazardous materials cars derailed and releasing product during that period,

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[56] Sharma & Associates, p. 11, Table 2.

[57] Sharma & Associates, p. 13, Figure 10.

[58] AAR's analysis of FRA accident data for the relevant 14-year period, 2000 through April 2014, shows 339 hazmat cars releasing product out of a total of 1,828 hazmat cars damaged or derailed in all accidents at train speeds on main track of 30 mph to 50 mph, for an average CPR of 18.5 percent. However, when only accidents with at least one car containing hazardous materials releasing product under the same circumstances are considered, the CPR increases to 43.0 percent, 2.3 times greater.

[59] Sharma & Associates, p. 2.

especially with respect to ethanol.[60] In these twelve accidents an average of 21 freight cars derailed, 13 of which were hazmat cars, and 9 hazmat cars released product. Sharma's model produced roughly similar results, from which it concluded that the model was valid.

That the twelve accidents chosen for validation are not representative is clear from FRA's database. The average train speed in the twelve accidents was 38 mph; the average mainline speed at derailment in FRA's full accident database from 2003 to 2012 is 26 mph. The twelve accidents averaged 27 freight cars derailed; FRA database shows an average of 11. These are measures of the severity of an accident. Clearly, DOT has introduced a selection bias by looking only at an extreme set of circumstances.

Sharma also attempts to validate its analysis by plotting the number of derailed cars against train speed, claiming that the simulations match actual derailment data. Sharma states that it used FRA's database. However, AAR cannot replicate Sharma's derailment data from FRA's database.[61] Sharma declares its model validated using this approach because it finds its simulation data points fall in the middle of the FRA data set at two train speeds, 30 and 40 mph. No means, medians, or other measures of central tendency and no distributions are provided for the actual FRA data, only for the model simulations. Thus, leaving aside AAR's puzzlement regarding the actual derailment data, there is no way to tell how close Sharma comes to replicating actual derailments.

4. Other Problems with PHMSA's Approach to Assessing the Impact of Tank Car Features on Accidents.

PHMSA's approach to attributing losses to different tank car components is too simplistic. In analyzing the losses of commodities from the twelve accidents studied, PHMSA simply assumes that where there is a loss of a hazardous material from multiple components, which is true of many of the twelve accidents PHMSA chose for analysis, the loss comes equally from each component.[62] That there is no way to determine how much lading each component allowed to escape is no excuse

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[60] Sharma refers to twelve accidents, while Calculating Effectiveness Rates refers to eleven accidents. The reason for the inconsistency is not apparent.

[61] *See* Sharma & Associates, pp. 10, 12 (Figure 8).

[62] Calculating Effectiveness Rates, Table 2, pp. 8, 9.

for making an assumption that bears no relationship to reality. For example, top-fitting failures often lead to smaller losses than other component failures.[63]

Compounding the problem with PHMSA's simplistic approach to attributing releases to tank car components is the small sample size of 11.[64] In an accident, the quantity lost is affected in part by the randomness of where (how high) on the tank a failure occurs and how far the car rolls over, which impacts how much of the lading is above any damaged or open fittings, etc. Given the randomness of such events, a small sample will tend to lead to mistaken conclusions.

5. PHMSA Should Have Used a CPR Analysis.

AAR does not understand why PHMSA engaged in problematic analyses about the effectiveness of tank car options when a superior alternative is on the record – CPR analysis using the Railway Supply Institute - AAR Tank Car Safety Research and Test Project (RSI-AAR Project) database. The RSI-AAR Project database contains detailed data on the outcome of tens of thousands of tank car derailments. Each car entered into the database goes through a very careful analysis of DOT Hazardous Materials Incident Reports forms (Form DOT F 5800.1), Chemtrec reports, railroad tank car damage assessment reports, and information about the tank specification. The outcome of the analysis provides a detailed engineering review of damage mechanisms associated with the features of the car in the context of the accident environment that far exceed any derived information from a mere DOT 5800.1 form. The scope of the RSI-AAR Project database assures that virtually all accident environments are taken into account, with appropriate relative frequencies. Using the database to assess the effectiveness of safety benefits of car features that have been in the fleet for an extended period of time, such as thicker tanks, jackets, head shields, and protective housings for top fittings, will be much more precise than modeling. Simply put, CPRs based on the database are the most reliable method available for comparing tank car features and their effects on safety.[65]

The problem with PHMSA's inability to assess the amount of lost commodity from specific tank car components does not affect CPR analysis using

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[63] *See* RSI-AAR Project's Report RA-05-02, "Safety Performance of Tank Cars in Accidents: Probabilities of Lading Loss," (January 2006) (hereinafter referred to as RA-05-02).

[64] Sharma used 12 in Sharma & Associates, PHMSA used 11 in Calculating Effectiveness Rates.

[65] *See* RA-05-02.

the RSI-AAR Project database. Due to the size of the database, there are sufficient numbers of accidents in which all product is released from one component to enable calculations of CPRs for individual components.

Furthermore, the RSI-AAR Project has calculated the CPR for releases greater than 100 gallons to eliminate minor releases from the analysis of alternative tank car features. The railroad and tank car industries use this metric to evaluate tank car designs. When applying CPR for releases greater than100 gallons, it becomes apparent that PHMSA has underestimated the benefits of enhanced tank cars.

In its paper for this docket, Sharma identifies perceived shortcomings with CPR analysis based on the RSI-AAR Project database.[66] Sharma's assertions are without merit insofar as the issues raised in this proceeding are concerned.

First, Sharma observes that database cannot be used to analyze CPR for innovative designs and alternate operating conditions. However, most of the tank car features at issue in this proceeding are designs that have been used and for which there is ample data. Regarding alternate operating conditions, it appears that Sharma is referring to ECP brakes. AAR has shown in these comments that Sharma's analysis of the effectiveness of ECP brakes is deeply flawed.

Second, Sharma states that "risk numbers seem to change with the version of the data/model being used." It is standard practice to refine models and used updated data. AAR explains the changes that Sharma is referring to in footnote 72, below.

Third, Sharma states that CPR analysis "may not have good representation from all potential hazards, particularly low probability-high consequence hazards." AAR does not understand this critique. The database represents the accidents that have occurred over more than 40 years. Sharma evidently is critiquing the database for not containing data on accidents that have not occurred.

Sharma and PHMSA have avoided CPR analysis in favor of much weaker analyses. The public does not stand to benefit from such an approach.

B. Canada and the U.S. Must Harmonize Their Tank Car Standards.

Before turning to the particulars of PHMSA's proposal, AAR wishes to emphasize the importance of PHMSA and Transport Canada coordinating their tank car standards. Transport Canada issued proposed regulatory requirements for

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[66] Sharma & Associates, p. 1.

tank cars transporting flammable liquids on July 18, 2014.[67] PHMSA's proposed regulatory program bears little resemblance to Transport Canada's proposal.

It is critical that Canadian and U.S. tank car standards be very similar, if not identical. The rail network between Canada and the U.S. is seamless. There are myriad trains crossing the border in both directions each day. In particular, there is significant crude oil traffic crossing the Canada/U.S. border.

It is not in the public interest – from either a safety or economic perspective – for Canada and the U.S. to implement tank car standards that will frustrate commerce at the border. Indeed, both countries have recently committed to harmonizing transportation regulations governing hazardous materials. The U.S.-Canada Regulatory Cooperation Council, formed in 2011, was created for the purpose of increasing regulatory cooperation between Canada and the U.S.[68] That same year the Council released a Joint Action Plan identifying specific objectives. One of those objectives is to "work to better align Canadian and U.S. standards on the containment of dangerous goods."[69] Another objective addresses rail safety more broadly, seeking to "align rail safety standards."[70]

If Canada and the U.S. do not align their standards, costs and service could be impacted. An inability to use tank cars authorized in one country to transport flammable liquids in the other could unnecessarily require more tank cars to be built because of an inability to optimize the combined countries' fleet. Potentially, separate Canadian and U.S. fleets could result in shortages of tank cars.

Furthermore, failure to align the standards could result in legacy cars used in one country or the other. That would raise public policy concerns in the country where the legacy cars were used.

Thus, for PHMSA and Transport Canada to proceed along the different paths they have proposed would be antithetical to Administration policy in both countries. AAR urges PHMSA and Transport Canada to coordinate their tank car standards going forward.

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[67] *See* http://www.tc.gc.ca/eng/tdg/clear-modifications-menu-261.htm.

[68] Information on the Council is available at http://www.trade.gov/rcc/.

[69] http://www.trade.gov/rcc/documents/Alignment-of-Dangerous-Goods-Means-of-Containment.pdf,

[70] http://www.trade.gov/rcc/documents/Rail-Safety-Standards.pdf,

C. The Specifications Should Apply to All Cars in Flammable Liquid Service.

As stated in its comments in response to the advance notice of proposed rulemaking, AAR supports requiring the replacement or retrofitting of *all* tank cars in flammable liquid service. PHMSA proposes that the upgraded tank car standards should apply only to cars used in HHFTs. If all tank cars used in flammable liquid service are not required to be retrofitted or replaced, the 40 m.p.h. speed restriction would last in perpetuity since shippers of flammable liquids in blocks of fewer than 20 tank cars arguably might not be required to upgrade their tank cars under the NPRM, yet the NPRM requires railroads to abide by the speed restriction anytime the total number of flammable liquid cars in a train is at or above 20 tank cars.

It would be unprecedented for PHMSA to adopt tank car specifications dependent on the amount of cars in a train. Not only would such an approach be burdensome to the railroads operationally, it would have disparate impacts on shippers and tank car owners. Furthermore, PHMSA would be forgoing the safety benefits of the forthcoming enhanced tank car specifications for a significant portion of the flammable liquid tank car fleet.

Indeed, AAR does not understand how conditioning the tank car specification on whether a tank car would be in an HHFT would work. How would the shipper know if a tank car would be in an HHFT? As proposed, even if a shipper were to tender one tank car, that tank car could end up in a train with 20 or more flammable liquid cars.

D. AAR Supports More Stringent Tank Car Specifications

Separately, AAR is jointly filing comments with the American Petroleum Institute proposing tank car standards. These comments supplement that filing from AAR's perspective.

There are two key considerations in determining the appropriate tank car specifications, CPR and avoidance of a thermal rupture of the tank car. Industry's measure of CPR addresses the chance that there will be a release due to a puncture or a tear should there be an accident and is based on over four decades of data on how tank car features impact the probability of release. The features directly relevant to CPR include shell thickness, jackets, head shields, and top and bottom fittings protection.

The industry uses modeling instead of CPR to analyze the potential for a heat-induced rupture. Industry's tank car database does not contain enough information to address the ability of a tank car to withstand a thermal rupture. The two features most relevant to considering the probability of a heat-induced rupture occurring are the type of thermal protection and the start-to-discharge point and capacity of a pressure relief device.

Following is a discussion of AAR's views of the tank car standard that should apply to the transportation of flammable liquids.

1. The AAR/API Proposals Respond to Secretary Foxx's Request.

On April 9 and July 11, 2014, Secretary of Transportation Anthony Foxx wrote AAR the enclosed letters (Attachment D), asking that the AAR Tank Car Committee, which has representatives from the railroads, shippers, tank car lessors, and tank car manufacturers, reach consensus on a revised tank car design and a retrofit program for the purposes of this rulemaking proceeding. To honor the Secretary's request, AAR discussed the tank car issues with various parties, taking into account all the factors that must be considered in setting tank car specifications.

AAR is pleased to state that it has been able to reach agreement with the American Petroleum Institute (API) on shell thickness and jackets for tank cars. AAR and API suggest that PHMSA adopt a requirement for a ½" shell for new cars for flammable liquid service, plus a 1/8" jacket. A ½" shell combined with a 1/8" jacket (including thermal protection, a full-height head shield, bottom-outlet handle protection, an appropriately-sized pressure relief device, and top fittings protection) provides a low CPR.

For existing tank cars, AAR and API suggest distinguishing between jacketed and non-jacketed cars. Jacketed cars have a relatively low CPR already. AAR suggests that they be retrofitted with an appropriately-sized pressure relief device and bottom-outlet handle protection when shopped or requalified after the effective date of the rule. Non-jacketed cars should be retrofitted to meet the requirements of a CPC-1232 car with a jacket. Such a car would be equipped with a 1/8" jacket, thermal protection, a full-height head shield, an appropriately sized pressure relief device, bottom-outlet handle protection, and valve protection. Such a car would also have a low CPR.

2. AAR Supports an Increase in Shell Thickness for New Tank Cars.

Shell thickness requirements need to be viewed from the perspective that what is feasible for new cars might be infeasible for existing cars. The shell on existing cars, of course, cannot be made thicker. Furthermore, it is not only shells that provide protection against punctures – jackets play a valuable role as well. The thicker the shell/jacket combination, the more an object has to penetrate to create a puncture.

A thicker shell is not always better if it diminishes tank car capacity in a way that is counterproductive. In addition to assessing the overall protection against releases afforded by shell thickness and jackets, tank car specifications need to take into account the need to transport commodities. It is axiomatic that the thicker the shell (or the shell and jacket combined), the lower the CPR. However, at some point extra thickness provides diminishing safety benefits while making rail transportation inefficient and uneconomical by requiring more tank cars to move product. That is not in the national interest. For example, the transportation of crude oil by rail is a critical component of the nation's effort to achieve energy independence. Indeed, in the NPRM PHMSA acknowledges the role railroads play in the transportation of crude oil and ethanol.[71]

Table 2 shows the CPRs for the jacketed and non-jacketed legacy DOT-111 and CPC-1232 cars, and a tank car identical to the jacketed CPC-1232 car but with a ½" shell. The CPR for releases of more than 100 gallons is shown as well as the overall CPR since minor leaks are not the concern addressed by the NPRM.

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[71] *See* 79 Fed. Reg. 45,017.

Table 2.
Conditional Probability of Release for Tank Car Configurations[72]

Car Category	**Tank Car Features**	**CPR (%)**	**CPR >100 gal. (%)**
Legacy DOT 111	7/16" shell	26.6	19.6
	7/16" shell, JKT	12.8	8.5
CPC-1232 DOT 111 without JKT	½" shell, HHS, TFP	13.2	10.3
CPC-1232 DOT 111 with JKT	7/16" shell, JKT, FHS, TFP	6.4	4.6
CPC-1232 DOT 111 with ½" Shell & Jacket	½" shell, JKT, FHS, TFP	5.2	3.7

JKT – jacketed; HHS – half-height head shield; FHS – full-height head shield; TFP – top-fittings protection

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[72] The CPRs in this table are significantly lower than the CPRs published in RA-05-02. For example, the recalculated CPR for the current DOT-111 tank car without a jacket is 25 percent lower than was calculated in 2006. There are three reasons. One, RA-05-02 used data from accidents that occurred from 1965-1997. The CPRs in Table 2 are based on more recent data, from 1980-2010. More recent data are more likely to be representative of accidents occurring today. Two, Table 2 CPRs were calculated utilizing more factors than were used in RA-05-02, including train speed, derailment severity, tank diameter, and commodity transported. Three, the techniques used for the newer analysis allowed for better handling of some of the complexities of the data that could have masked important relationships in the RA-05-02 analysis.

In addition to looking at CPR for individual cars, the University of Illinois has been examining the possibility of assessing the probability of multiple car releases in an accident. Based on preliminary work, the University of Illinois has posited the frequency with which releases from multiple cars could be expected in an accident from a unit train transporting flammable liquids, assuming all cars in a train were of the same type.[73] Figure 6 below shows that the tank car specification could significantly affect the interval between accidents with multiple car releases. For example, Figure 6 posits that a 20-car release could be expected at an interval of approximately 12 years with a legacy non-jacketed DOT-111 car, while the estimated interval is almost 13 times greater (169 years) with a jacketed ½" car. The interval for the jacketed CPC-1232 car is also significantly lower than for the legacy non-jacketed DOT-111 car, approximately 88 years, 7 times lower than the interval for a legacy non-jacketed DOT-111 car. Significantly, the preliminary analysis is based on historical operating practices and accident rates and does not account for measures taken (other than tank car improvements) to reduce the probability of a release occurring.

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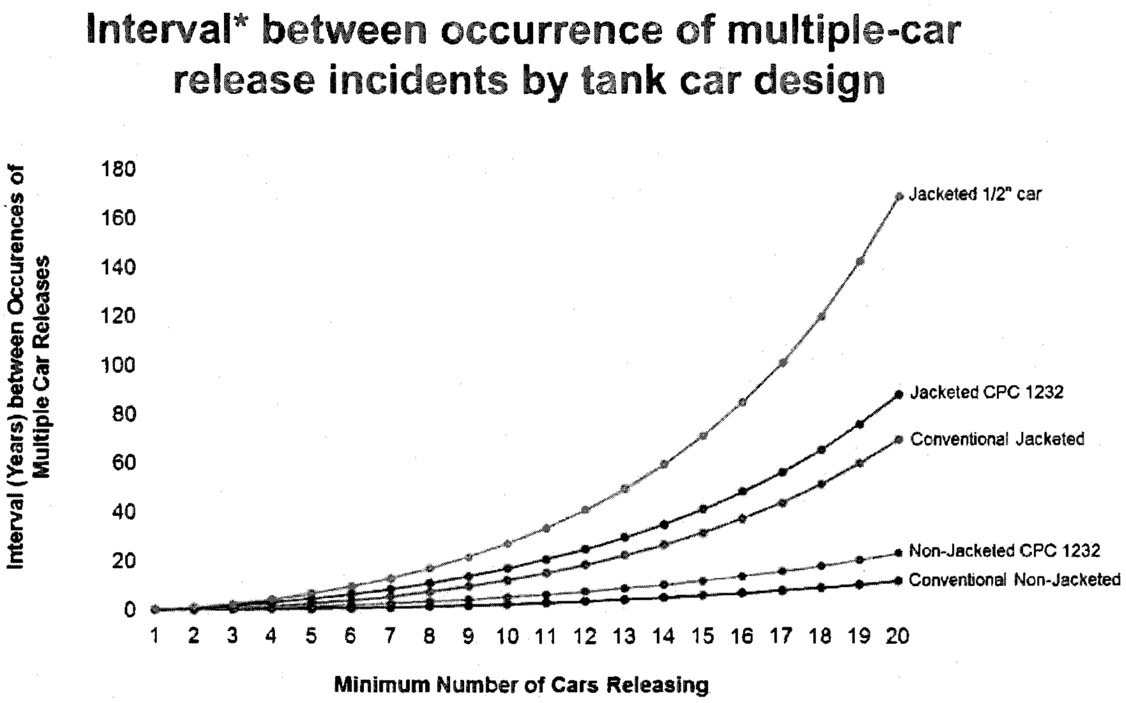
[73] For the purposes of the preliminary analysis, the University of Illinois assumed trains transport flammable liquids in unit trains with five locomotives and 80 tank cars.

Figure 6. Interval Between Multiple-Car Releases
From Flammable Liquid Unit Trains



* Assuming no change in 2012 levels of crude oil and alcohol tank car traffic (ca. 550,000 carloads)
Ceteris paribus, the estimated intervals will be reduced in proportion to increases in traffic

3. <u>AAR Supports Enhanced Top-Fittings Protection, But Not the 9 MPH Standard.</u>

The NPRM discusses two types of top-fittings protection, a performance standard requiring that the protection be required to withstand a rollover accident at a speed of 9 mph and AAR's design standard set forth in Appendix E, paragraph 10.2.1, of AAR's Specifications for Tank Cars. Heretofore, the performance standard has only been required for cars transporting toxic-by-inhalation hazardous materials.

AAR opposes requiring the performance standard for top-fittings protection. First, there would be a logical inconsistency in requiring that the performance standard be met for flammable liquids, but not other hazardous materials transported in pressure tank cars, e.g., flammable gases. If DOT wants to consider requiring the performance standard for hazardous materials other than TIH commodities, it should institute a separate rulemaking proceeding addressing other categories of hazardous materials, not just flammable liquids.

Second, the performance standard cannot be justified on a cost-benefit basis. The benefit is marginal. In fact, the RIA's analysis of the benefits of the performance standard is flawed.

PHMSA exaggerates the benefits of top fittings protective systems by assuming the systems will result in a significant reduction in the quantity lost in the event of a release, as well as assuming systems will reduce the likelihood of a release at all. While the protective system should reduce releases, the quantity released is unlikely to be affected to any significant degree by top fittings protection once there is a breach. There may be some reduction in quantity lost if in certain cases the damage is minimal enough that there is a very small opening for the release, but there is no basis for assuming that release quantities would be halved, as PHMSA assumes.[74]

Furthermore, AAR questions FRA's conclusions about the relative effectiveness of the performance standard. PHMSA observes that the performance standard is based on dynamic loads; standard top fittings protection is based on static loads. PHMSA then states that

> stresses imparted in the tank shell during the dynamic loads are three times those encountered during the static load. Therefore, DOT assumes the effectiveness of top fittings for the Option 1 tank car is three times that of the other tank car options.[75]

PHMSA's conclusion about the relative effectiveness of the proposed 9 mph standard is likely incorrect and overstates the relative effectiveness of the 9 mph standard. Unfortunately, there is not enough information in the docket to definitively evaluate PHMSA's modeling. To begin, it is unclear what is meant by "stresses imparted into the shell;" does this mean into the nozzle, and if so, how? Also, assuming that peak stress correlates well with effectiveness is incorrect. This assumption might arise from comparing the Sharma rollover tests to the rollover protection survival requirement. That would be inappropriate because the Sharma tests tipped the car and the motion was stopped by the fittings striking the ground, which differs from the regulatory assumption of a car beginning on the ground and continuously rolling.[76] In other words, the Sharma tests did not replicate the tank rollover

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[74] *See* "Calculating Effectiveness Rates, p. 11.

[75] Regulatory Impact Analysis, p. 118.

[76] *See* Robert Trent et al., "Survivability of Railroad Tank Car Top Fittings in Rollover Scenario Derailments," DOT/FRA/ORD-06/11 (December 14, 2005);

protection scenario the proposed regulation would require that top fitting protection survive and there is no evidence of a correlation between the Sharma test and the regulatory rollover scenario. Additionally, even if the three times estimate on stress magnitude were accurate, over what period of time is the stress magnitude maintained? The dynamic loading damage of a structure will be dependent on both the magnitude and duration of the load. The associated risk of dynamic loads cannot be evaluated without specifying both the load magnitude and duration. Furthermore, are any assumptions made about the motion of the lading, which differs in the tip-over case from the rolling car case?

There also is a significant question whether tank shells 7/16" or ½" thick can support top fittings complying with the performance standard. Indeed, PHMSA acknowledges this issue in discussing top fittings protection.[77]

PHMSA is not proposing top fittings protection on existing cars because of a concern that the costs outweigh the benefits.[78] AAR suggests that instead of requiring full top fittings protection, PHMSA require protection of the valves for retrofitted cars. The requirement for top fittings protection is set forth at 49 C.F.R. section 179.100-12. That section requires protection not only for the valve itself, but also the nozzle to tank connection, which requires significant modification and welding at the connection. A valve protection standard would only protect the valve and fitting and would not require significant modifications at the connection, thus addressing PHMSA's concern about the cost of top fittings protection.

Specifically, AAR suggests the retrofit standard have the following features for valve protection:

• Protective housing of cast, forged, or fabricated approved material must be bolted to fittings plate with not less than twenty 1/2" studs. The shearing value of the bolts attaching protective housing to the fitting plate must not exceed 70% of the shearing value of the bolts attaching the fittings plate to the fittings nozzle. Housing must have steel sidewalls not less than 1/2" in thickness that can be securely closed. Housing cover, if applied, must be at least 1/8" thick, hinged on one side, and equipped with a stop that prevents striking loading and unloading

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Robert Trent et al., "Survivability of Railroad Tank Car Top Fittings in Rollover Scenario Derailments—Phase 2," US DOT Report Number DOT/FRA/ORD-09/20 (October 2009).

[77] *See* 79 Fed. Reg. 45,056.

[78] 79 Fed. Reg. 45,059.

connections. The design of the protective housing and cover must not restrict the flow capacity of a pressure relief device below the minimum flow rating requirement as designed.

- Except when protected in accordance with 2.6.1.1 of AAR's Manual of Standards, the height profile of valve protection mounted on a tank nozzle must not exceed the dimensions in the AAR *Specifications for Tank Cars*, Appendix E.

- The service equipment must not project more than 1" about the fittings plate or be designed so that if the service equipment is sheared off of the fittings plate, a positive mechanical seal is maintained.

4. AAR Supports Requiring Thermal Protection and Pressure Relief Devices.

PHMSA proposes to require that tank cars transporting flammable liquids contain standard thermal protection systems, addressed in 49 C.F.R. § 179.18(a). These thermal protection systems enable a tank car to withstand a pool fire for 100 minutes and a torch fire for 30 minutes without release of product, except through the pressure release device.

Subsection 179.18(a) was promulgated with flammable gases in mind. Flammable liquids are very different from the perspective of trying to avoid thermal ruptures.

The RSI-AAR Project has modeled the survivability of different tank car configurations in a pool fire, using the "Analysis of Fire Effects on Tank Cars" (AFFTAC) model. AFFTAC modeling shows the use of thermal blankets on flammable liquid cars can result in a tank car containing flammable liquid withstanding a pool fire for 800 minutes or more without release of product, except through the pressure relief device.

Given the safety concern over flammable liquid accidents and its achievability as a standard, requiring survivability for 800 minutes in a pool fire should be required. PHMSA should require thermal blankets when flammable-liquid tank cars are built or retrofitted with jackets, given the significantly enhanced capability to withstand pool fires provided by thermal blankets. More specifically, PHMSA should require a thermal blanket with thermal conductivity no greater than 2.65 BTU per inch, per hour, per square foot, and per degree Fahrenheit at a temperature of 2000 F, ± 100F. Modeling has shown that a thermal blanket meeting this specification would provide at least 800 minutes protection in a pool fire. Blankets made of such materials are available; in fact, some are used on flammable-gas tank cars.

PHMSA should also require appropriately sized pressure relief devices for tank cars transporting flammable liquids. By "appropriate size," AAR means sizing the device in conjunction with the thermal protection on a tank car to allow the release of only enough of the commodity to protect against a thermal tear.

E. Shippers Should Not be Permitted to Avoid Compliance With More Stringent Tank Car Standards Through Reclassification As Combustible Liquids.

In the preamble, PHMSA states it intends to permit shippers to avoid complying with more stringent tank car standards by reclassifying flammable liquids as combustible liquids (this "rule does not cover unit trains of materials that are . . . reclassified as a combustible liquid").[79] As AAR stated in its ANPRM comments, it should be unacceptable to permit a shipper to downgrade the tank car required for its commodity by choosing to reclassify a flammable liquid as a combustible liquid. Reclassification should be prohibited for rail transportation.[80]

F. AAR Supports an Aggressive Retrofit/Phase-Out Schedule.

AAR urges PHMSA to adopt an aggressive phase-out schedule for cars that cannot meet retrofit requirements. The phase-out program must take into account factors such as manufacturing capacity, the demand for new tank cars, shop capacity for any retrofits that will be undertaken, and the number of DOT-111 cars that need to be phased out of flammable liquid service. As suggested in the joint filing by AAR and API, given PHMSA's focus on unit trains, it would make sense to make retrofitting tank cars in crude oil and ethanol service a priority since those commodities account for almost all the unit train service for flammable liquids. Input is needed from shippers and tank car manufacturers to determine the precise parameters of a phase-out program.

Having urged PHMSA to adopt an aggressive retrofit/phase-out schedule, AAR recognizes the uncertainty with respect to demand for rail transportation of flammable liquids and the capacity of tank car shops to manufacture and retrofit tank cars. PHMSA should explicitly recognize that its retrofit schedule might need to be adjusted and work with AAR's Tank Car Committee, which includes representatives from the railroads, shippers, and the tank car industry, as well as

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[79] 79 Fed. Reg. 45,059.

[80] The option to reclassify is set forth in 49 C.F.R. §§ 173.120(b)(2) and 173.150(f)(1). In addition, 49 C.F.R. § 172.102, Special Provision B1, would have to be amended to provide the correct reference for the new packaging requirements for flammable liquids in the 100 °F – 140 °F range.

representatives from DOT and Transport Canada, to monitor compliance with the rule and the demand for transportation of flammable liquids.

G. <u>AAR Supports Using Legacy Cars in Canadian Oil Sands Service.</u>

PHMSA states it expects some existing tank cars used for crude oil service to be transferred to Alberta oil sands crude oil service without retrofitting because that oil is a combustible, rather than a flammable, liquid.[81] AAR strongly supports the use of existing tank cars without retrofitting for undiluted oil sands crude oil.

Oil sands crude oil, or bitumen, can be transported in diluted or undiluted form. When bitumen is diluted with natural gas liquids for transportation purposes (dilbit), it often is a packing group I or II flammable liquid. Bitumen is diluted to facilitate transportation.

However, an option that AAR expects will be selected with increasing frequency is to transport undiluted bitumen in tank cars with heating coils. The heating coils can be used at destination to liquefy the bitumen for unloading. AAR understands that, as PHMSA states, undiluted bitumen is a combustible liquid or is not a regulated commodity at all and thus under the NPRM could be transported in unmodified tank cars.

PHMSA should ensure, in promulgating a final rule, that undiluted bitumen can be transported in tank cars without retrofitting. Undiluted bitumen does not present the flammability hazard of other crude oil, ethanol, or other flammable liquids. This would enable industry to concentrate on upgrading tank cars used to transport flammable liquids that present genuine flammability concerns.

VI. Other Issues

A. <u>Flammable Gases Should Not Be Included In this Rule.</u>

PHMSA asks if the HHFT restrictions should apply to flammable gases.[82] Expanding the speed restriction to additional commodities would further strain the railroad network. Furthermore, there is no basis in the rulemaking record for applying speed restrictions to these commodities.

PHMSA's HHFT concept is to apply speed restrictions where upgraded cars are not used. However, flammable gases are already transported in pressure cars so it seemingly would make no sense to apply the HHFT restrictions to flammable

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[81] Regulatory Impact Analysis p. 81.

[82] 79 Fed. Reg. 45,040.

gases. Frankly, AAR does not understand PHMSA's question with respect to flammable gases.

B. PHMSA Should Not Mandate More Track Inspections In this Rule.

PHMSA seeks public comment on whether there should be changes to the track integrity regulations for HHFT routes. On January 24, 2014, FRA promulgated regulations prescribing specific requirements for rail inspection frequencies, rail flaw remedial actions, minimum qualifications for the operators of rail flaw detection equipment, and requirements for rail inspection records.[83] On May 26, 2014, the Rail Safety Advisory Committee (RSAC) accepted a new task to examine rail integrity. The task statement specifically directs RSAC to consider "whether additional track and rail inspection requirements should be required on high risk routes."[84]

PHMSA should defer to RSAC. The RSAC working group considering whether additional track integrity requirements are warranted consists of track experts from industry, labor, and the government. It is in the RSAC deliberations, not this proceeding, where any additional track integrity issues should be considered.

C. Commodity Sampling and Testing Should Not be Required During Transportation.

Proposed paragraph 173.41(a)(2) would require "[s]ampling at various points along the supply chain to understand the variability of the material during transportation." Surely PHMSA is not suggesting that during transportation tank cars be opened for sampling. Railroad facilities are not equipped for sampling, lacking, among other things, measures undertaken at fixed facilities to protect workers. If sampling is necessary, it should take place at origin and destination.

D. The Term "High-Hazard Flammable Train" is Pejorative and Misleading.

AAR urges PHMSA to use a less perjorative and misleading name than "high-hazard flammable trains" to describe trains transporting flammable liquids. Names matter. The phrase "high-hazard" stirs a feeling of apprehension. Using "high-hazard flammable train will make it more difficult to have a productive public dialogue about the transportation of flammable liquids. PHMSA does not use such terminology with respect to other hazardous materials, including toxic-by-

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[83] 79 Fed. Reg. 4,234 (Jan. 24, 2014).

[84] Task 14-02, https://rsac.fra.dot.gov/tasks.php.

inhalation hazardous materials. By using such a term here, PHMSA is implying that these commodities are more hazardous than any others.

The railroad industry has used the term "Key Train" for hazardous materials trains the industry has agreed should be subject to certain voluntary operating restrictions, including a 50 mph speed limit. Secretary Foxx used the term "Key Crude Oil Train" in his February 20, 2014, letter. Consequently, AAR suggests that PHMSA use the term "Key Flammable Liquid Train" in lieu of HHFT.

VII. Conclusion

It is important to the railroads, their business partners, and the general public that PHMSA move expeditiously to finalize tank car standards for the transportation of flammable liquids. In doing so, however, it should not impose counterproductive burdens on industry.

With respect to speed limits, it is important that PHMSA avoid restrictions that will substantially degrade the capacity and efficiency of the railroad network. Continuing the philosophy of Secretary Foxx to apply a 40 mph speed restriction in HTUAs would achieve PHMSA's safety objectives without drastically affecting the railroad network.

Were PHMSA to require ECP brakes, it would represent the second time in less than a decade that the federal government has chosen to impose a technology on the railroads where the costs far exceed the benefits. In the case of positive train control, DOT had no choice but to mandate PTC following the direction of Congress. Here, DOT would be doing so of its own volition. DOT should be concerned about the cumulative impact on the railroads of burdening the industry with regulatory mandates that cost billions without providing offsetting safety or business benefits. In any event, an ECP mandate cannot be justified, legally or as a matter of public policy.

Thank you for considering these comments.

Respectfully submitted,

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September 30, 2014

Attachment A

A Review of Analyses Supporting the Pipeline and Hazardous Materials Safety Administration HM-251 Notice of Proposed Rulemaking

Technical Report
September 29, 2014

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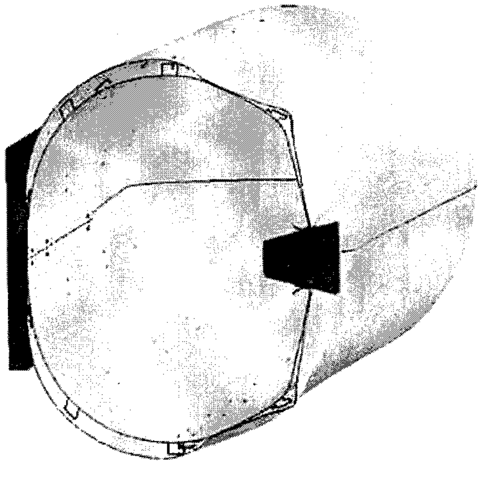
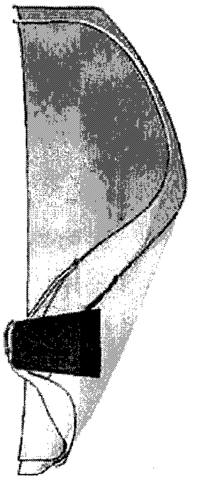




A Review of Analyses Supporting the Pipeline and Hazardous Materials Safety Administration HM-251 Notice of Proposed Rulemaking

The recent notice of proposed rulemaking (HM-251 NPRM) released by the Pipeline and Hazardous Materials Safety Administration's (PHMSA) included documentation of, or made reference to, analyses that were used to inform the rulemaking process. The objective of this document is to review and comment on these analyses in the areas of expertise by the author.

1 Review of Reference Document 1

One of the principal documents provided in the HM-251 NPRM was the July 2014 Letter Report, "Objective Evaluation of Risk Reduction from Tank Car Design & Operations Improvements" [1]. This is a significant document in that it describes the analytical methodology applied to assess the effectiveness of the tank design modifications, train speed operational restrictions, and various train braking systems.

The development of an analytical methodology to evaluate risk reduction from tank car design and rail operational improvements is complex. The authors developed an approach where they performed a series of derailment simulations to determine a distribution of impact forces in derailments. The simulations were limited to a set of twelve derailments performed at each of two different derailment speeds (30 and 40 mph). The calculated distribution of impact forces was compared to an assumed distribution of impactor threats and existing assessments of tank puncture resistance to calculate tank puncture probabilities. This model could then be adapted to assess proposed modifications to the tank car design and/or train operational conditions. The set of derailment simulations could be repeated with the modified model and the ratio of expected tank car releases between the original and modified simulations is used as the effectiveness of the proposed change.

The overall concept of approach in Reference 1 is appropriate, and it is consistent with the methodology of the Advanced Tank Car Collaborative Research Program (ATCCRP) TWP-11 project efforts. However, the key requirement of this approach is to capture enough of the actual derailment and impact physics to make the results realistic and representative of the real world derailment environment. In many of these areas, the methodologies applied in Reference 1 fall short. Below we address some of the significant issues identified that bring in to question the validity of the results. In general, we address issues in the order that they appear in Reference 1.

Item 1 - The Sharma study states that "The first fifty tank cars were modeled in three dimensions (3-D)," however, "the bolsters and couplers are constrained to move in the horizontal plane." This essentially constrains the derailment to 2-D motions and prevents 3-D motions such as tanks rolling over or lifting over other tanks. It also limits the derailment scenarios to be only on flat level ground and does not represent derailment conditions on slopes, elevated rail berms, running along, or crossing over, rivers or ravines, etc.

Item 2 – As a train car derails, it begins to slow down much more rapidly as the forward motion is resisted by the forces of the wheels, trucks, and other components plowing through or sliding over ballast, soil, or other ground conditions. These complex, and variable, mechanisms are commonly reproduced in derailment simulations using friction forces and that is the approach applied in Reference 1. In general, this is a reasonable approach to model these effects without introducing a much greater level of complexity to the analyses. However, the ground friction coefficient values of 0.27, 0.30, and 0.33 used in Reference 1 seem very low compared to other studies and the expected resistance levels of plowing through ballast or soft soil. Below are the similar frictional force level used in comparable derailment modeling efforts:

- Edward Toma developed a detailed two-dimensional train derailment model for his PH.D Thesis project [2]. In his model, he developed a velocity dependent ground friction model that had a coefficient of friction of 0.7 for low velocities and increasing with speed as shown in Figure 1. He noted that "A ground reaction force 0.3 times the local normal force is also unrealistically low." An example demonstrating the Toma derailment model performance for the 1979 Mississuaga, Ontario derailment is shown in Figure 2.
- The derailment simulations describe in Reference 3, which were performed in collaboration with the Volpe Transportation Systems Center, used a baseline frictional coefficient of 0.5 for the derailed cars and varied the value of the frictional coefficient in the range of 0.2-1.4. In a similar study they adjusted the range of frictional coefficients to 0.25-0.75 [4].
- Finite element based derailment simulations performed by Kirkpatrick, et. al., [5] used a post-derailment frictional coefficient of "approximately 1.0 for most analyses". A comparison of the calculated derailment behaviors with that model are shown in Figure 3.

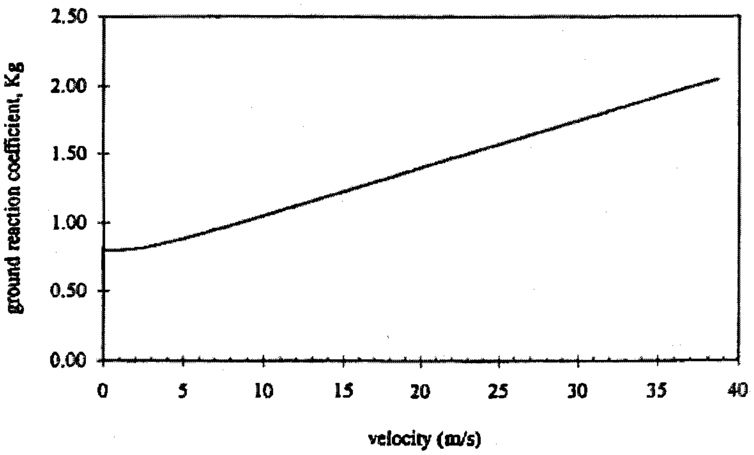
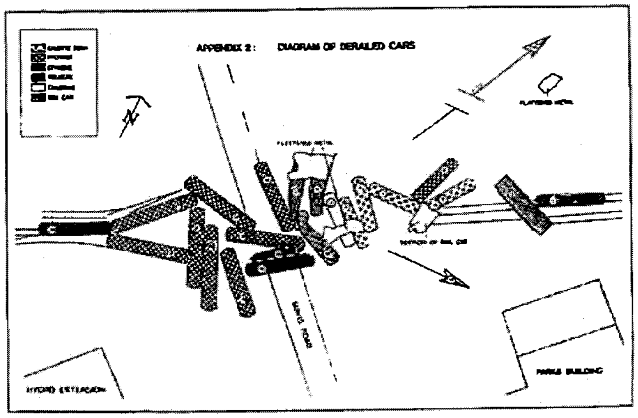
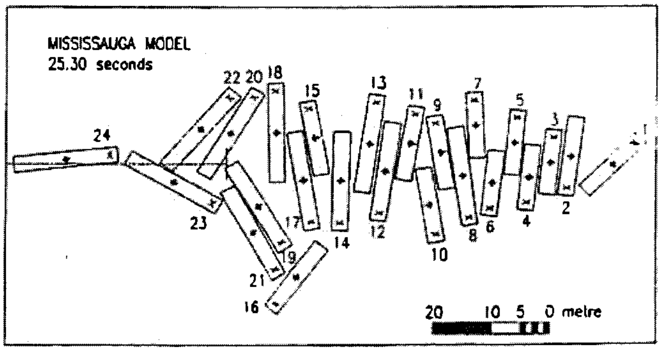


Figure 1. Ground reaction force model developed by Toma [1].



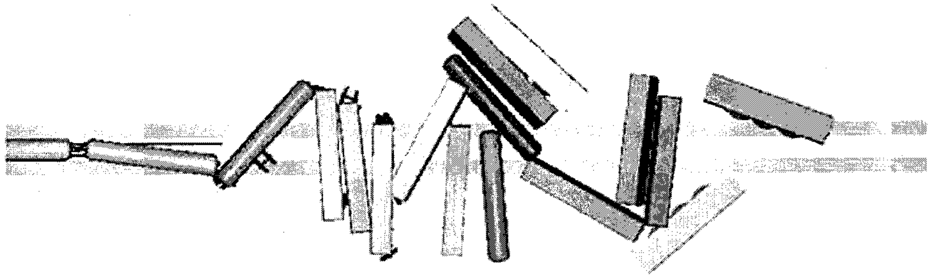
a) Mississuaga derailment diagram



b) Calculated Mississuaga derailment outcome

Figure 2. Derailment predictions using the model developed by Toma [1].

a) Aerial photograph of the Minot ND Derailment [6].



b) Calculated derailment response.

Figure 3. Derailment simulation using the model developed by Kirkpatrick, et al. [5].

The lower friction values used in Reference 1 may be an indication that the derailment simulations do not accurately capture the impact forces between cars or the interaction of the derailed cars with the remainder of cars in the train (the "blockage force" in Reference 7). If the model is not accurately modeling the magnitude of the blockage force, the subsequent evaluations of the operational improvements will not be accurate if based on the outcomes of such modeling.

Item 3 – The tank cars used in the derailment simulations were DOT-111 tank cars. The weight of the lading was included in the analyses by increasing the density of the commodity tanks to include the lading weight in the tank shell. However, the additional effect that the compressibility of the lading has on the tank deformations and impact forces was not included in the model. This can be seen in the damage observed in some of the tank cars that include large dents that would not be possible without rupturing the tank to relieve the pressure build up in the lading.

We believe that this approximation could have a significant influence on the calculated impact forces. In particular, the approximation could significantly under predict the impact forces for many impact conditions. Consider the comparison of two analyses with identical impact conditions shown in Figure 4 [9]. The identical tanks were impacted with a 6x6 inch impactor (286,000 lbs) at a speed of 16.2 mph corresponding to an initial 2.5 MJ impact energy from Reference. The tank in both analyses is a DOT 111 tank car design constructed with a 7/16-inch-thick A516-70 steel tank shell. The only difference is that one of the tanks includes the effect of a 3% outage with the internal pressure calculated by a control volume that calculates the compression of the gas in the outage as the tank is dented and approaches a shell full condition. In the second analyses the tank remains unpressurized as if the tank were empty (although the weight of the lading was still smeared into the tank shell to maintain the inertial effects). This second analyses corresponds to the modeling approach used for the tanks in Reference 1.

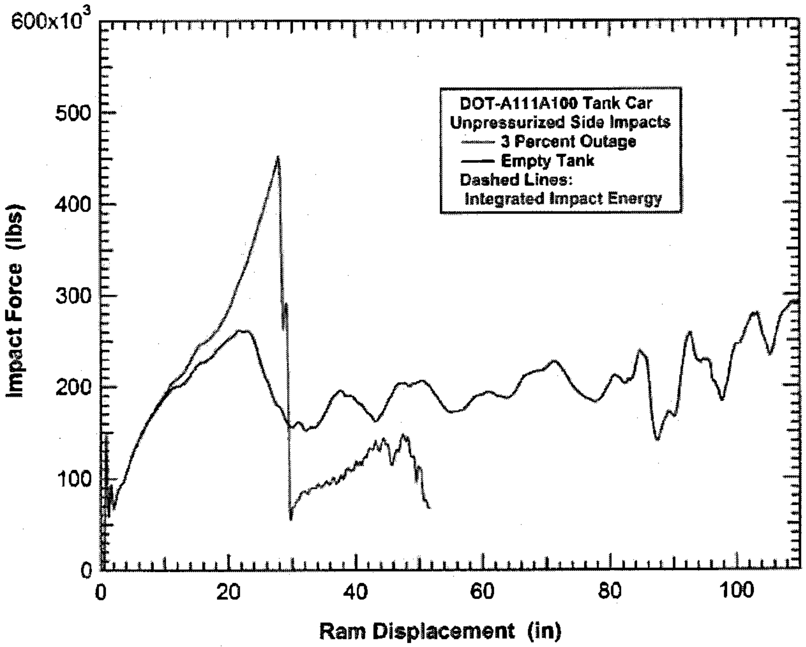


Figure 4. Force-deflection curves for different tank outage volumes.

In the first analysis (red curve), the impact forces begin to rise rapidly after approximately 20 inches of ram displacement to the point where the tank is punctured at a force of approximately 450 kips. With a larger impactor that did not puncture the tank, the forces would have continued to rise rapidly to significantly higher levels. The second impact response of the "empty tank", modeled without the lading compressibility effects, deforms the tank in excess of 100 inches without the impact force ever exceeding 300 kips (blue curve). Thus, not including the lading compressibility effect could significantly bias the analysis of the force distribution in Reference 1 toward a lower impact force distribution.

A consequence of this bias in the analysis toward smaller impactor forces is that the assumed impactor size distribution would also need be skewed toward smaller impactors. Without assuming that small impactors are much more common in the derailment impacts, the predicted number of tank punctures in this methodology, as shown in the Dynamic Model Validation section of the report, would be lower and not in agreement with the limited set of derailments included in the comparison. Having a model that is biased toward small impactors could influence the following evaluation of the tank design modifications since the impact and failure behaviors of large and small impactors are not identical.

Item 4 – The impact force histogram in Reference 1 was evaluated based on the derailment simulations with a unit train consisting entirely of the baseline DOT-111 tank car design. As a result, the force histogram is accurate only for that design of tank car. If the car design was modified to include a thicker tank shell, the tanks would as a result have a higher structural stiffness. A consequence of the higher stiffness would be an increase in the impact forces for a given impact condition. Similarly, the stiffness of other impacting car types was not considered for a revenue train with a mix of car types.

The change to the force histogram was not included in the assessment of the effectiveness of improved tank car designs. By considering only the improved puncture resistance, without evaluating the corresponding increase in impact forces, Reference 1 would overestimate the effectiveness of the design change in preventing releases.

Item 5 – The analyses in Reference 1 only considered derailments of a string of 80 cars. By considering only longer train section, it could bias the result toward a scenario where changes to the train braking system will have the greatest influence. With a longer string of cars and conventional air-brake systems there will be a longer propagation time for the brakes to be fully applied. In addition, the effects of the derailment blockage forces on the deceleration will be smallest (while still significant) for a longer string of cars since the residual mass of the cars on the rail will be larger. Thus an analysis of the Electrically Controlled Pneumatic (ECP) brake improvement will be overstated by this analysis since it did not include a real world distribution of derailment points with the trains.

Item 6 – The prediction of the number of cars punctured in the derailments will be controlled by three factors: 1) the impact force distribution, 2) the tank puncture resistance capability, and 3) the impactor size distribution. The first two of these can be addressed by modeling. However the third can be obtained only by 2 methods. The first would be an extensive forensic investigation of a large number of real world derailments where the impact conditions are reconstructed and an attempt to characterize each of the impactors and their characteristic size. This would be a very time consuming and expensive effort. The second is to assume a distribution and modify it until it results in the correct number of punctures in the analysis. This is the approach used in Reference 1. They state that "there is no hard basis for the specific sizes assumed herein."

I believe that their assumed impactor size distribution is skewed toward smaller impactors. I think this is a result of the lower impact force levels obtained from neglecting the lading compressibility effects in the derailment simulations (Item 3). The fact that the punctures are dominated by these smaller impactors at lower force levels has the potential to significantly influence the prediction of the effectiveness of tank car design improvements.

The authors of Reference 1, when discussing the assumed impactor distribution, also state that "these assumptions are consistent with engineering expectations, and further more, appear to be consistent with validation against real life observations." The engineering expectations of this reviewer would not include approximately half of all impactors having a size of seven inches or less and fewer than 10% of impactors greater than 13 inches. I would have expected that tank to tank impacts in unit trains would be common and the effective size of a tank shell or tank head impactor would be much greater than 13 inches. In addition, the match against the limited set of real world derailments provided does not validate the assumed size distribution. It is possible that significantly different impactor size distributions might also have been consistent with this limited "validation". Unless there is a reason to think that this is close to the true size distribution, assessments of the effectiveness of other risk reduction options could be in error.

Item 7 – The analyses show a significant variance in number of cars derailed at each speed considering the variation of parameters used in the analyses. For example, the 40 MPH derailment simulations indicate that a range of between 16 and 35 cars were derailed in the twelve analyses performed (Figure 8 in Reference 1). However, the only parameters that can lead to this level of variation are:

- "Three values of coefficient of friction between tanks and ground, representing multiple terrain conditions: 0.27, 0.30, and 0.33." Note that this is a 10 percent variation above and below the mean value.
- "Two values of lateral force to initiate derailment: 50 and 70 kips."
- "Two values of track stiffness, representing variations in track quality: 30 and 40 kips/in."

Although the Federal Railroad Administration (FRA) data in Figure 8 of Reference 1 shows a scatter of derailed cars at 40 mph to vary from 1 to 43 cars, this variability is understandable given the wide range of derailment scenarios possible. A single car may derail from a broken wheel or axle but remain coupled to the cars ahead and behind the derailment point so that it is the only car that derails. Alternatively the other factors such as terrain or grade, the point in the train where the derailment initiates, ground conditions, etc. could result in significantly more or less cars being derailed at a given derailment speed.

From the parameter variation described in Reference 1 (listed above) we believed that the track interaction was the most significant factor that would influence the variability seen in number of cars derailed. To better understand the derailment mechanics, we attempted to identify the response with only 16 cars derailed and believe it is the top row center case shown in Figure 4 of Reference 1. We have reproduced the final state for that scenario in Figure 5 adding numbers counting the cars we believe to be derailed.

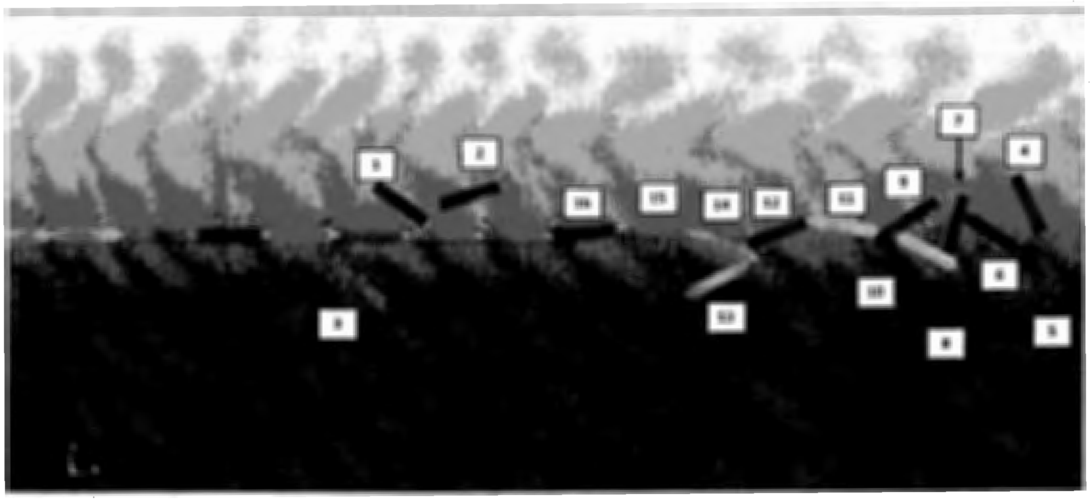


Figure 5. Derailment simulation for Scenario 2 at 40 mph from Reference 1.

Obviously the simulation was performed with the train moving from left to right in Figure 5. However the final state indicates that Cars 1, 2, and 3 have derailed and came to rest at a position that is behind a point where other cars are still on the rail. This indicates that the simulations do not include any feature for a mechanism such as a broken rail where every car passing beyond that point is automatically derailed. In these simulations, cars can be pushed out of the way of the remaining cars without damaging the track so that subsequent cars are only derailed when their lateral forces exceed the "track quality" strength values.

These mechanisms of broken rails or track torn up by the initial derailing cars are common and important mechanisms that can influence the derailment behavior and number of cars derailed. Broken-rail derailments are among the highest in severity as measured by the number of cars derailed, and therefore a bias created by leaving this mechanism out could underestimate the number of cars derailing. Such a bias could make it look like the model validates but actually mask a bias somewhere in the other direction (such as the track strength and ground friction effects). The interaction of these biases leaving us uncertain which aspects of these predictions are close enough to rely on.

Item 8 – An important aspect of a model used to support important regulatory changes such as those proposed in the HM-251 NPRM is that the model is sufficiently validated to provide confidence in the results. The efforts to validate the analysis methodologies are provided in Section 4 of Reference 1. There are two components of the model that are discussed in this section: 1) the dynamic derailment model, and 2) the analyses of the number of punctures.

The validation of the derailment dynamics model is primarily based on comparing the number of cars derailed in the simulation to the data from the FRA-RAIRS database and the result that "the derailment simulations of number of cars derailed are consistent with the spread seen in actual derailment data." This observation about the consistent results is subjective. The model certainly does not reproduce the character of the significant number of derailments up to 50 mph that include only 1-5 cars derailed. Even if the number of cars derailed were to match the FRA-RAIRS data distribution, it would not necessarily be sufficient evidence to validate the model. This is particularly true in light of other deficiencies observed in the derailment kinematics such as described in Item 6.

Similarly the comparison of the number of cars derailed to a limited set of hazardous material derailments (Table 2 and Figure 9) is not helpful for validation. First, the simulations do not correspond to the same range of initiating events and number of cars involved in those accidents. More importantly, the set of cases selected for the comparison do not represent the full range and distribution of derailment mechanisms observed in the real world.

The validation of the puncture estimates is obtained by comparing the mode estimates to the 12 hazardous material derailments included in Table 2. There are multiple problems with this validation. First, it is not really a validation since the results are completely controlled by the assumed impactor size distribution for which they have no physical basis (Item 6). At best it is a check on assumptions rather than a validation of modeling results. Secondly, it is a validation of a match to 12 specific derailments which are not representative of the real world distribution of accidents and releases. Finally, not all of the accidents selected were unit trains and not all of the tank punctures in these derailments were unpressurized DOT-111 tank cars. Thus the validation is comparing to data from derailment scenarios that are different from the parameters used in the model predictions.

Item 9 – The couplers and draft gear provides the interaction between cars in the initial portion of the derailment behavior and the failure of the coupled connections is required to set up any potential side impact collisions in the subsequent derailment pile-up. In real world derailments, the coupled connections can fail from multiple mechanisms including opening of the coupler connections, failure of a coupler knuckle, failure of a coupler shaft, and ultimately failure of the connection between the draft gear and the tank car sill. Capturing the behavior of the draft gear and the failure of the coupled connections under various loading scenarios is significant for reproducing correct derailment mechanics in a model.

Reference 1 states that: "The cars were modeled with deformable TC128 material, and connected with discrete draft gear and coupler models. The couplers models allowed a 7 degree swing in each direction, with the knuckles modeled to resist rotation and fail when the rotation exceeds 13.5 degrees." No information was provided to determine the corresponding forces in the coupled connections required to exceed the 13.5 degree failure criterion. In addition, there is no information on the connections of the draft gear to the sill or the energy absorbing characteristics in the draft gear. As a result, it is impossible to evaluate these characteristics of the model with the information provided.

Item 10 – The interaction of the trucks, wheels, and rails of the tank car can be significant for certain types of derailment behaviors. In Reference 1, the trucks and rails are not explicitly modeled. Rather, their effect is included by applying a constraint condition at each bolster location until a derailment criterion is met. It is believed that this derailment criterion is controlled by "Two values of track stiffness, representing variations in track quality: 30 and 40 kips/in."

We believe that the approach being applied for these track interaction effects is insufficient to model many types of derailment behaviors. However, there is insufficient information being provided to properly evaluate the model.

Item 11 – The letter report provided as Reference 1 does not provide a complete summary of the work performed in support of the NPRM. Many of the previous items listed in this document describe areas of the modeling methodology where insufficient information is provided to fully understand the methodologies applied (e.g. wheel-rail interactions, breaking force application, etc.) Similarly, the results of analyses performed in support of the HM-251 are not fully documented. For example, the technical supplement on calculating the effectiveness of alternative tank car options references analyses performed for 50 mph derailments (Table 3 of Reference 10). Including these higher speed analyses in Reference 1 would have provided more information that could be used in the evaluations of the model results. Similarly, the conclusions on the effectiveness of ECP brakes were made based on a preliminary set of 6 analyses. However, the specific conditions of those six analyses were not presented. As a result, we are not able to evaluate if these six analyses are biased toward scenarios that might have a less severe outcome (e.g. all analyses using the higher strength track condition or lower derailment initiating force).

2 Review of Reference Document 2

A second principal documents provided in the PHMSA HM-251 NPRM was the Draft Regulatory Impact Analysis, "Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains; Notice of Proposed Rulemaking" [11]. A full evaluation of this reference was beyond the scope of the effort described in this document. However, one specific observation is made here.

Item 12 – Table TC 31 lists the effectiveness of newly constructed tank car options relative to the baseline DOT-111 tank car. One notable conclusion is that the Option 1 tank car design has a top fittings configuration that is three times more effective than the baseline. The rollover protection for the Option 1 tank car is based on protecting against dynamic load conditions described in 179.102-3. Below the table, they state that: "Modeling indicates the stresses imparted in the tank shell during the dynamic loads are three times those encountered during the static load. Therefore, DOT assumes the effectiveness of top fittings for the Option 1 tank car is three times that of the other tank car options."

There are several issue related to these claims. These include:

- There is no description of (or reference provided for) the analyses used to evaluate either the static baseline analysis or the dynamic loading that produced three times higher stresses in the tank shell. As a result we are not able to evaluate the analyses or confirm the stresses are three times as large.
- The higher stresses were indicated to be in the tank shell. However, if that is not the point at which failure initiates, the higher stresses may not be a concern.
- There is no basis for assuming that a threefold increase in stress levels would correspond to a three times increase in effectiveness. This would only apply for a linear system and the tank car damage and failure behaviors are very nonlinear.
- A three times peak dynamic stress level is not equivalent to a three times static stress level. The magnitude has to be evaluated using the duration at which the stress is above a threshold level compared to the characteristic time required for the associated damage mechanism. For example a dynamic stress magnitude that is three times that of the static stress, but only applied for 1 millisecond, would probably be a less effective evaluation of the top fittings protection than the lower baseline static load level.

Item 13 – The proposed action on braking is based on simulations of braking performance: "The simulations were performed using the Train Energy & Dynamics Simulator (TEDS) program, developed by Sharma & Associates to study the dynamics and energy levels under a variety of operating conditions." The analyses use the assumptions, "Each train includes three locomotives at 415,000 lbs., 100 cars at 263,000 lbs., train length 6,164 ft." Again, there are issues with this approach. These include:

- The TEDS simulations of braking performance do not include the impact forces between cars or the interaction of the derailed cars with the remainder of cars in the train (the "blockage force" in Reference 7). This blockage force has been shown to be a significant factor in the deceleration of the train and in some derailments is greater than the total emergency braking force of the cars behind the derailment point. Neglecting this effect will significantly overestimate the effectiveness of ECP braking.
- The analyses of 100 car trains assume that the derailments all initiate at the front of a long train (not seen in actual derailment data). This scenario is also the case that will produce the largest difference in the different braking systems since it will have the longest propagation times (delay times) for the brake signal to reach each car. Thus the assumption will overstate the effectiveness that would be seen in real world derailment conditions.

3 References

1. Sharma & Associates, Inc., "Objective Evaluation of Risk Reduction from Tank Car Design & Operations Improvements," Letter Report, July 2014.
2. Toma, E. E., "A Computer Model of a Train Derailment", Ph.D. Thesis, M.E. Dept., Queens University, Ontario, Canada, October 1998.
3. C.R. Paetsch, A.B. Perlman, and D.Y. Jeong, "Dynamic Simulation of Train Derailments", Proceedings of IMECE2006, 2006 ASME International Mechanical Engineering Congress and Exposition, Paper Number IMECE2006-14607.
4. D.Y. Jeong, M.L. Lyons, O. Orringer, A.B. Perlman, "EQUATIONS OF MOTION FOR TRAIN DERAILMENT DYNAMICS," Proceedings of the 2007 ASME Rail Transportation Division Fall Technical Conference, Paper Number RTDF2007-46009.
5. S.W. Kirkpatrick, B.D. Peterson, and R.A. MacNeill, "Finite Element Analysis of Train Derailments," ICrash2006, Proceedings of the International Crashworthiness Conference, July 4-7, 2006, Athens, Greece.
6. Derailment of Canadian Pacific Railway Freight Train 292-16 and Subsequent Release of Anhydrous Ammonia Near Minot, North Dakota, January 18, 2002, NTSB Railroad Accident Report No. NTSB/RAR-04/01, March 2004.
7. Joseph Brosseau, "Analysis and Modeling of Benefits of Alternative Braking Systems in Tank Car Derailments," Transportation Technology Center, Inc., Draft technical Report, September 2014.
8. S.W. Kirkpatrick, "Detailed Puncture Analyses of Various Tank Car Designs," ARA Final Technical Report, Prepared for the Next Generation Railroad Tank Car (NGRTC) Project, January, 2009.
9. S.W. Kirkpatrick, "Analyses of Outage Volume Effects on Puncture Energy for Unpressurized DOT-111A100W Tank Cars," ARA Technical note, January, 2010.
10. Pipeline and Hazardous Materials Safety Administration (PHMSA), "Calculating Effectiveness Rates of Tank Car Options," HM-251 NPRM Technical Supplement, 2014.
11. Pipeline and Hazardous Materials Safety Administration (PHMSA), "Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains; Notice of Proposed Rulemaking," Docket No. PHMSA-2012-0082 (HM-251), Draft Regulatory Impact Analysis, 2014.

Attachment B

AAR RESEARCH

ANALYSIS AND MODELING OF BENEFITS OF ALTERNATIVE BRAKING SYSTEMS IN TANK CAR DERAILMENTS

R-1007

SEPTEMBER 2014

Work performed by:

TTCI

Transportation Technology Center, Inc.

A SUBSIDIARY OF THE ASSOCIATION OF AMERICAN RAILROADS

Analysis and Modeling of Benefits of Alternative Braking Systems in Tank Car Derailments

R-1007

by

JOSEPH BROSSEAU

Transportation Technology Center, Inc.,
a subsidiary of the Association of American Railroads
Pueblo, Colorado USA
September 2014

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5. Joseph Brosseau

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Washington, DC 20001

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11. Number of References

12. Supplementary Notes

13. Abstract

The Pipeline and Hazardous Materials Safety Administration (PHMSA) has issued a Notice of Proposed Rulemaking (NPRM) titled "Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains" [Docket No. PHMSA-2012-0082 (HM-251)], in which they have asked for comments by September 30, 2014. One component of the proposed rulemaking (section V.E.b) addresses Alternative Brake Signal Propagation Systems, including Electronically Controlled Pneumatic (ECP) brake systems. In this section, the NPRM describes simulations conducted by the Federal Railroad Administration (FRA) and concludes "that ECP brakes would reduce accident severity by 36 percent compared to conventional brakes with end-of-train (EOT) devices, and by 18 percent compared to locomotives with distributed power (DP) or another EOT device." Based on this conclusion, PHMSA proposes several requirements associated with ECP brake systems. The NPRM requests comments on the PHMSA estimates for reduced accident severity and to what extent simulation models other than that used by FRA validate these estimates. This paper addresses this request for comment.

14. Subject Terms
Electronically controlled pneumatic (ECP) brake systems

15. Availability Statement
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EXECUTIVE SUMMARY

The Pipeline and Hazardous Materials Safety Administration (PHMSA) has issued a Notice of Proposed Rulemaking (NPRM) titled "Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains" [Docket No. PHMSA-2012-0082 (HM-251)], in which it has asked for comments by September 30, 2014. One component of the proposed rulemaking (section V.E.b) addresses Alternative Brake Signal Propagation Systems, including Electronically-controlled Pneumatic (ECP) brake systems. In this section, the NPRM describes simulations conducted by the Federal Railroad Administration (FRA) and concludes "that ECP brakes would reduce accident severity by 36 percent compared to conventional brakes with end-of-train (EOT) devices, and by 18 percent compared to locomotives with distributed power (DP) or another EOT device." Based on this conclusion, PHMSA proposes several requirements associated with ECP brake systems. The NPRM requests comments on the PHMSA estimates for reduced accident severity and to what extent simulation models other than that used by FRA validate these estimates. This paper addresses this request for comment.

The simulation results and analysis presented in the NPRM and supporting documents indicate that the 36 percent reduction in accident severity estimate is based on the reduction in the kinetic energy of the tank cars trailing the point of derailment. A modeling and analysis effort was conducted by Association of American Railroads (AAR) and Transportation Technology Center, Inc. (TTCI) with independent review by Applied Research Associates, Inc., (ARA) to verify the statements in the NPRM. This effort considered a number of factors that do not appear to be considered in the analysis supporting the PHMSA estimate of reduced accident severity, including most notably, the magnitude of the force applied to the cars trailing the point of derailment caused by the derailment blockage and the potential for a derailment to occur anywhere within the train. The effort included analysis of actual derailments to develop and verify the methodology used and a parametric analysis to cover a broad range of operating conditions, derailment locations within the train, and braking systems.

The study estimates that ECP brakes will reduce the energy dissipated in a derailment by an average of 13.3 percent and will reduce the number of cars in a derailment by less than two cars, on average, compared to other braking systems. The conclusion of this effort is that the PHMSA estimate that ECP brakes would reduce accident severity by 36 percent is overstated and misrepresents the potential benefit of implementing ECP brakes in reducing the severity of accidents involving what PHMSA is calling "high-hazard flammable trains."

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1.0 INTRODUCTION AND SUMMARY

The Pipeline and Hazardous Materials Safety Administration (PHMSA) has issued a Notice of Proposed Rulemaking (NPRM) titled "Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains" [Docket No. PHMSA-2012-0082 (HM-251)], in which it has asked for comments by September 30, 2014. One component of the proposed rulemaking (section V.E.b) addresses Alternative Brake Signal Propagation Systems, including Electronically-Controlled Pneumatic (ECP) brake systems. In this section, the NPRM describes simulations conducted by the Federal Railroad Administration (FRA) and concludes "that ECP brakes would reduce accident severity by 36 percent compared to conventional brakes with end-of-train (EOT) devices, and by 18 percent compared to locomotives with distributed power (DP) or another EOT device."[1] Based on this conclusion, PHMSA proposes several requirements associated with ECP brake systems. The NPRM requests comments on the PHMSA estimates for reduced accident severity and to what extent simulation models other than that used by FRA validate these estimates. This paper addresses this request for comment.

The simulation results and analysis presented in the NPRM and supporting documents indicate that the 36 percent reduction in accident severity estimate is based on the reduction in the kinetic energy of the tank cars trailing the point of derailment. The estimated reduction in the kinetic energy is based on a very limited set of simulations and looks only at derailments that occur at the head end of a train. The NPRM supporting documentation states that, "given that this is based on a limited simulation set, the results could be optimistic, and should be taken with a grain of salt…it is anticipated that the percent improvement due to ECP would likely drop to about 25%..."[2] There is no indication of how the 25-percent estimate was derived, but the wide range of reported estimates for potential reduced accident severity with ECP brakes suggests a more complete analysis with validation against actual events is necessary to understand the actual potential benefit.

Based on this, a separate modeling and analysis effort was conducted by Association of American Railroads (AAR) and Transportation Technology Center, Inc., (TTCI) with independent review by Applied Research Associates, Inc. (ARA). This effort considered a number of factors that do not appear to be considered in the analysis supporting the PHMSA estimate of reduced accident severity, including:

- The magnitude of the force applied to the cars trailing the point of derailment. There is a considerable amount of force that works to decelerate the mass of the cars trailing the point of derailment due to the blockage resulting from the derailment itself, which significantly limits the potential contribution from any braking system.

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[1] Federal Register. Pipeline and Hazardous Materials Safety Administration (PHMSA) Notice of Proposed Rulemaking (NPRM), section V.E.b, item (3), page 45051, Department of Transportation, Federal Register/Vol. 79, No. 148, Friday, August 1, 2014/Proposed Rules.

[2] "Objective Evaluation of Risk Reduction from Tank Car Design & Operations Improvements," Section 5, page 13, submitted by Sharma & Associates to Federal Railroad Administration July 2014.

- The potential for a derailment to occur anywhere within the train. The maximum potential benefit of a given braking system is when the derailment occurs at the head end of the train; therefore, to accurately assess the potential benefit of alternate braking systems, derailments that occur at various points in the train must be considered.

- The variability in the response of a train to various types of derailments. There is a wide variety of types of derailments and derailment causes and while certain types of derailments will result in a pile up of cars at the point of derailment, others will have far less dramatic results. The effect of an alternate braking system in these other derailments is more difficult to quantify, but should be recognized in an assessment of the potential reduction in accident severity.

The AAR/TTCI study made use of the Train Operations and Energy Simulator (TOES^{TM}) model that has been in use for nearly 30 years, has been validated many times over, and is considered an industry standard for train dynamics modeling.[3,4,5] The study investigated several of the derailments cited in the NPRM, as well as other similar types of derailments, to develop and validate a methodology for estimating the potential reduction in accident severity. The methodology uses output from TOES to model the contribution of the braking system. The additional force acting to decelerate the train from the derailment blockage was then added to the TOES result to estimate the total energy dissipated in the derailment and number of cars reaching the point of derailment. Event recorder data from remote DP locomotives involved in derailments (such as the Aliceville, AL, derailment cited in the NPRM) provided accurate rear-of-train speed profiles to determine the magnitude of the blockage force. The speed profiles and stopping distances modeled compare well to the data from these actual derailments.

With the derailment blockage collision force included in the analysis, simulations of the derailments were conducted with ECP brakes as well as conventional braking systems. For the example of the Aliceville, AL, derailment, ECP brakes would have reduced the energy in the derailment by 12 percent compared to the conventional braking with DP that was actually in place. The number of cars reaching the point of derailment would have been reduced by 1.5 cars.

---

[3] Klauser, Peter, David Mattoon, Som P. Singh, and O. Ahmad. August 1986. "The Train Energy and Operations Simulator (TOES): A New Approach to Train Action Simulation," AAR Report No. WP-124, Association of American Railroads, Washington, D.C.

[4] Andersen, David R., David W. Mattoon, and Som P. Singh. November 1991. "Revenue Service Validation of Train Operations and Energy Simulator (TOES) – Version 1.5 Part I: Conventional Unit Coal Train," AAR Report R-799/SD-036, Association of American Railroads, Technical Center, Chicago, IL

[5] Andersen, David R., David W. Mattoon, and Som P. Singh. December 1992. "Revenue Service Validation of Train Operations and Energy Simulator (TOES) – Version 2.0 Part II: Intermodal Train," AAR Report R-822/SD-042, Association of American Railroads, Technical Center, Chicago, IL.

Based on the methodology developed, an analysis of 420 simulations was conducted that covered a variety of parameters, including:

- Train speed at derailment – speeds of 30, 35, 40, 45, and 50 mph were included.
- Point of derailment within the train – derailments occurring at the head-end, 1/4-way through the train, 1/2-way through the train, and 3/4-way through the train were included.
- Track grade – grades of 1% uphill, 1% downhill, and flat (0%) were included.
- Brake system – conventional (head-end), conventional with end-of-train device (ETD), rear-end DP, mid-train DP with ETD, DP at 2/3 with ETD, ECP, and ECP with rear-end wired DP were included.

The result of the modeling and analysis effort can be seen in Table 1, which shows the average percent reduction in energy dissipated by the derailment and the average reduction in number of cars entering the derailment for ECP brakes as compared to other braking systems.

Table 1. Average Percent Reduction in Energy Dissipated in Derailment and Number of Cars Reaching Point of Derailment

Performance of ECP Brake System Compared To:	Average Percent Reduction in Energy Dissipated in Derailment	Average Reduction in Number of Cars Reaching Point of Derailment
Conventional Brakes (Head-end)	13.3%	1.6
Conventional Brakes with ETD	11.6%	1.3
Rear-end DP	12.8%	1.5
Mid-train DP	10.5%	1.2
DP at 2/3	10.8%	1.2

As Table 1 indicates, the study estimates that ECP brakes will reduce the number of cars in a derailment by less than two cars, on average, compared to other braking systems. This analysis investigates only derailments that result in a significant blockage at the point of derailment, and is therefore likely an overestimate of the overall potential benefit, considering other types of derailments. The conclusion of this effort is that the PHMSA estimate that ECP brakes would reduce accident severity by 36 percent is overstated and misrepresents the potential benefit of implementing ECP brakes in reducing the severity of accidents involving high-hazard flammable trains.

2.0 ANALYSIS OF ACTUAL DERAILMENTS AND VALIDATION OF METHODOLOGY

The objective of the analysis of actual derailments was twofold:

1. Estimate and account for the derailment blockage force and validate against actual derailment data.

2. Investigate the potential benefits of alternative braking systems using actual derailment data.

As discussed previously, the estimation and validation of the derailment blockage force was performed by matching the simulated speed profile of the rear of the train to event recorder data from actual derailments. One of the derailments cited in the NPRM, the Aliceville, AL, derailment, had remote DP unit event recorder data readily available. This derailment occurred near the head end of the train (first car). To provide further validation, two other derailments that resulted in a significant derailment blockage, but occurred elsewhere within the train, were analyzed:

- Brainerd, MN; 7/10/2011; 27 mph; Loaded unit coal train, 121 loads/0 empties, 20 cars derailed (car numbers 66-85)
- Wagner, MT; 2/13/2013; 37 mph; Loaded unit grain train, 104 loads/0 empties, 10 cars derailed (car numbers 88-97)

Event recorder data from the remote DP locomotive in the Aliceville, AL, derailment shows the train was traveling 39 mph at the time the emergency brake application was initiated and the rear end of the train stopped in 36 seconds. The TOES simulation was run with an emergency brake application occurring at the head end of the train followed immediately by an emergency brake application from the rear end of the train after being communicated to the remote DP locomotive via the DP radio link. The result of this simulation showed the rear end of the train coming to a stop in 57 seconds. Following the approach described previously, a derailment blockage force of 500,000 pounds was added to the result of the TOES simulation, and the computed time for the rear end to come to a stop was 36 seconds, matching the event recorder data. Figure 1 shows the speed versus time profile for each of these cases.

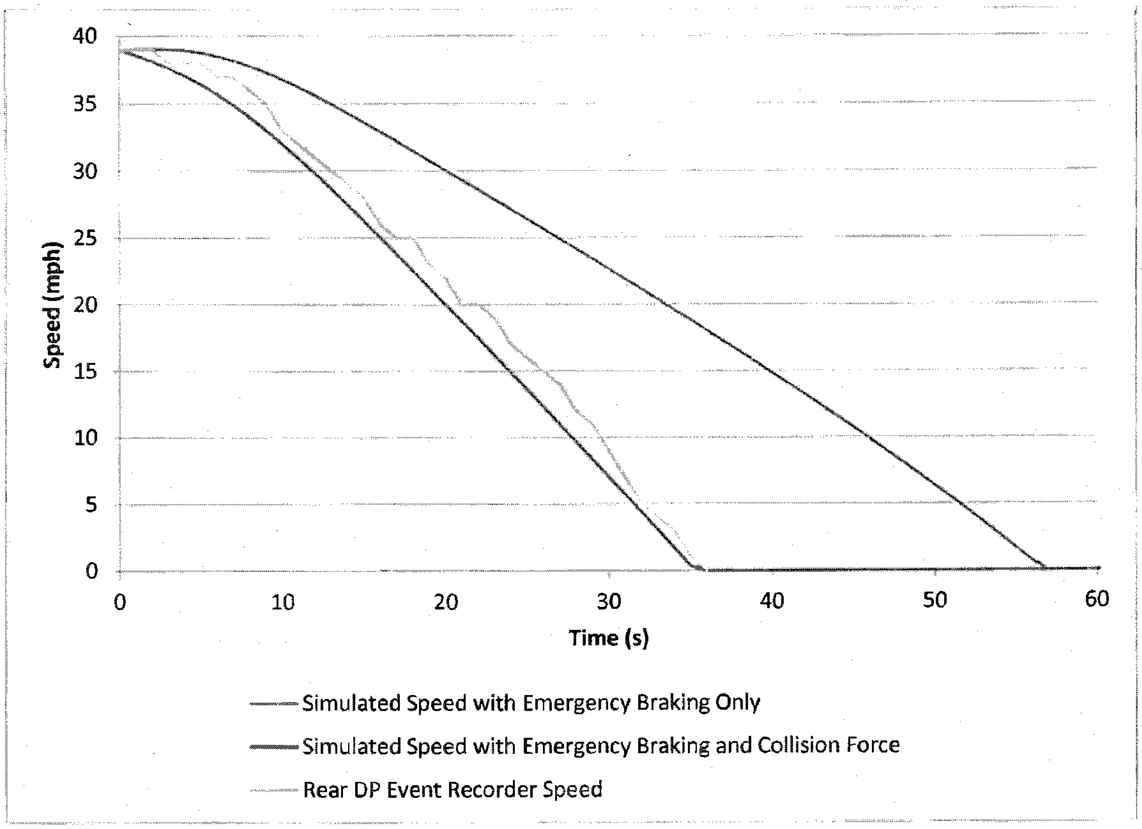


Figure 1. Comparison of Simulated and Actual Speeds for Aliceville, AL, Derailment

As Figure 1 shows, the addition of the derailment blockage force results in a very good speed match between the simulated and actual data.

The Brainerd, MN, derailment occurred more towards the center of the train and event recorder data showed the train traveling at 27 mph at the time the emergency was initiated at the rear end of the train. The train came to a stop in 22 seconds. Because the derailment occurred near the middle of the train, the simulation was run with a trainline emergency applied at the first car that derailed, which then propagated towards the rear end of the train. Only the cars trailing the point of derailment were included in the simulation. The result of the simulation showed the trailing cars of the train coming to a stop in 41 seconds. With the derailment blockage force added, the computed time for the train to come to a stop was adjusted to 22 seconds, matching the event recorder data. In this case, a 550,000-pound derailment blockage force was applied to match the stopping time from the event recorder data. Figure 2 shows the speed versus time profile from the event recorder data, the simulation with emergency braking only, and the simulation with the derailment blockage force considered for the Brainerd, MN, derailment.

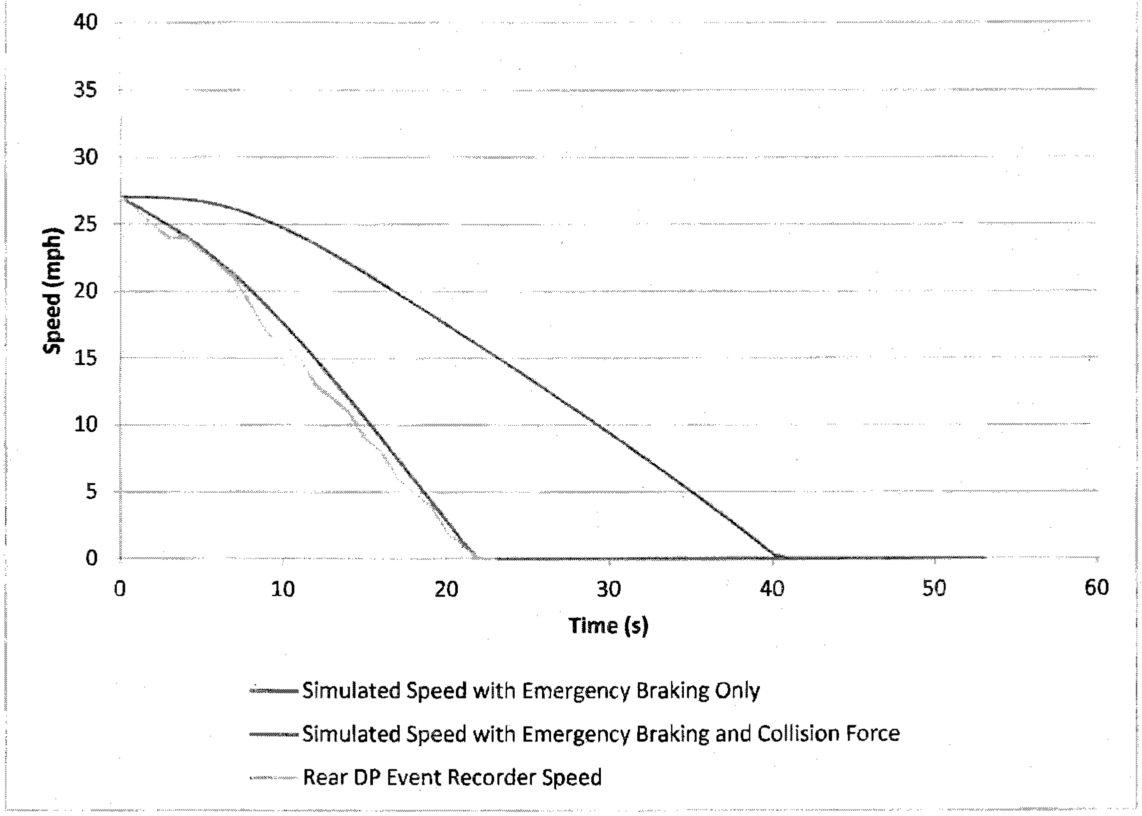


Figure 2. Comparison of Simulated and Actual Speeds for Brainerd, MN, Derailment

The Wagner, MT, derailment occurred near the end of the train. The event recorder data showed that the rear end of the train came to a stop in 11 seconds from an initial speed of 37 mph. In this case, because the derailment occurred toward the end of the train, the mass of the train trailing the point of derailment was much smaller than in the previous two cases, so the effect of the derailment blockage force on the deceleration of the rear end of the train was much greater, relative to the brake force. Again, a trainline emergency was initiated within the TOES simulation at the first car derailed, and the cars trailing the point of derailment were simulated. The simulated stopping time with the emergency brake application only was 49 seconds. A derailment blockage force of 650,000 pounds was added to align the stopping time with the event recorder data. Figure 3 shows the speed versus time profile from the event recorder data, the simulation with emergency braking only, and the simulation with the derailment blockage force considered for the Wagner, MT, derailment.

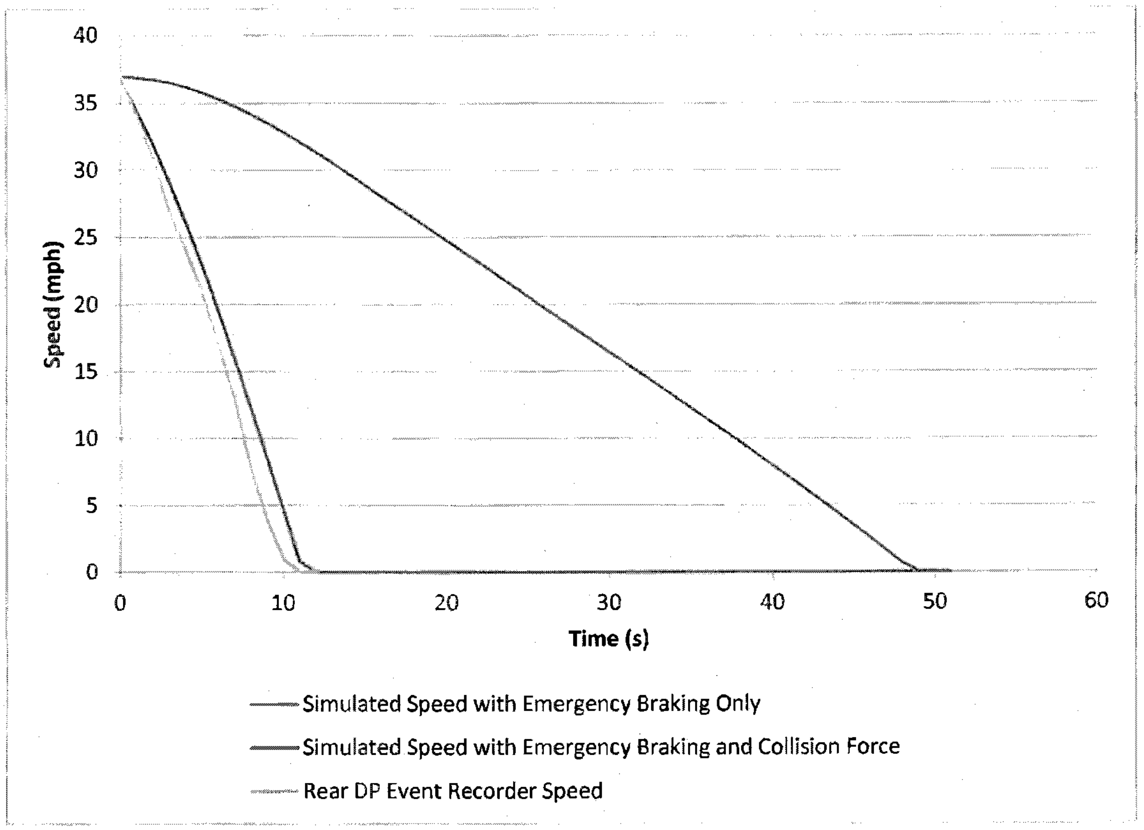


Figure 3. Comparison of Simulated and Actual Speeds for Wagner, MT, Derailment

Based on the analysis of these three derailments, it is clear that a significant amount of the energy dissipated in decelerating the portion of the train trailing the point of derailment is due to the force applied from the derailment blockage. From these cases, it can be seen that this force can vary, based on the particular accident in question, from 500,000 to 650,000 pounds. Before proceeding with applying this force to the analysis of other derailments for which remote DP event recorder data was not available, a sensitivity analysis was conducted to verify the impact of changing the derailment blockage force on the results of the analysis on alternative braking systems.

For the sensitivity study, the Aliceville, AL, derailment was considered. The simulation of the actual event, using DP located at the rear end of the train, was repeated once using conventional (head-end only) power, and again using ECP brakes. The previously determined derailment blockage force of 500,000 pounds was applied to each of these simulations, and the difference in energy dissipated in the derailment and number of cars reaching the point of derailment was determined. The derailment blockage force was then modified to 400,000 pounds and 600,000 pounds (+/- 20 percent) and the results recomputed to determine the sensitivity of the resulting analysis to this change. Table 2 shows the result of this analysis.

Table 2. Comparison of Results with Varying Derailment Blockage Force Assumptions

Blockage Force (lbs.)	Brake System	Energy Dissipated in Derailment (ft-lb)	Percent Reduction in Energy Dissipated in Derailment with ECP	Number of Cars Reaching Point of Derailment	Reduction in Number of Cars Reaching Point of Derailment with ECP
400,000	Conventional (Head-end)	182k	18%	21.7	2.8
	Rear-end DP	168k	12%	20.5	1.6
	ECP	148k	N/A	18.9	N/A
500,000	Conventional (Head-end)	165k	18%	19.9	2.5
	Rear-end DP	154k	12%	18.8	1.5
	ECP	136k	N/A	17.4	N/A
600,000	Conventional (Head-end)	151k	17%	18.4	2.3
	Rear-end DP	142k	11%	17.4	1.3
	ECP	126k	N/A	16.1	N/A

As Table 2 shows, changing the derailment blockage force had a noticeable effect on the magnitude of the energy dissipated in the derailment and the number of cars reaching the point of derailment. However, when the relative percent difference between the energy dissipated and number of cars reaching the point of derailment were considered, only a modest change is observed. Therefore, a conservative estimate of 500,000 pounds for the derailment blockage was assumed, which is a reasonable assumption for the analysis of the benefit of ECP brakes, relative to the other braking systems.

Having developed an estimate for the derailment blockage force in these types of derailments and validated it against actual event recorder data, an analysis was conducted to identify the potential benefits of alternative braking systems for some of the actual tank car derailments cited in the NPRM. Specifically, the following derailments were analyzed:

- Aliceville, AL; 11/7/2013; 39 mph; 90 loads/0 empties, 26 cars derailed (car numbers 1-26)
- Cherry Valley, IL; 6/19/2009; 78 loads/36empties, 19 cars derailed (car numbers 57-75)
- Vandergrift, PA; 2/13/2014; 112 loads/7 empties, 21 cars derailed (car numbers 67-87)

For each derailment, three simulations were performed:

1. Conventional braking – pneumatic brake signal propagating from the point of derailment only
2. DP with remote unit at the rear of the train -- pneumatic brake signal propagating initially from the point of derailment only, but also from the rear end after the signal reaches the locomotive at the head end
3. ECP – electronic brake signal applying to all vehicles simultaneously

The deceleration resulting from the 500,000-pound derailment blockage force was then added to the results of each simulation to determine the deceleration of the train in each case, per the previously established approach. The distance traveled during each time step was used to determine the number of cars that reached the point of derailment during that time step, and these were summed to determine the total number of cars that reached the point of derailment. The energy dissipated in the derailment at each time step was then determined using the mass of the cars that reached the point of derailment during that time step and the velocity of the train at that time step, using the formula $E = 1/2mV^2$. The total energy dissipated in the derailment was then determined by summing the energy dissipated in each time step over the time of the stop. The results of these calculations relative to ECP for each of the derailments are provided in Table 3.

Table 3. Percent Reduction in Energy Dissipated in Derailment and Number of Cars Reaching Point of Derailment for Actual Derailments Investigated

Derailment	Brake System	Percent Reduction in Energy Dissipated in Derailment with ECP	Reduction in Number of Cars Reaching Point of Derailment with ECP
Aliceville, AL	Conventional (Head-end)	18%	2.5
	Rear-end DP	12%	1.5
Cherry Valley, IL	Conventional (Head-end)	12%	1.1
	Rear-end DP	11%	1.0
Vandergrift, PA	Conventional (Head-end)	11%	0.9
	Rear-end DP	11%	1.0

The results shown in Table 3 indicate that, with the derailment blockage force accounted for, the reduction in energy dissipated in the derailment is far less than the 36 percent estimated in the NPRM. Additionally, the reduction in number of cars reaching the point of derailment when compared to DP was less than two cars in each case.

In the case of the Vandergrift, PA, accident, the derailment did not result in a large blockage and a compact pile of cars, as in the other two derailments. Rather, the majority of cars came to rest more or less in line, with many rolled onto their sides down a shallow embankment on the side of the track. This suggests the cars were dragged along as the train came to a stop, rather than running into each other with each car rapidly decelerating as it reached the point of derailment. Only four of the 21 cars that derailed were leaking product. The reduction in energy with alternative braking systems is much more difficult to quantify in derailments such as this. Although it seems reasonable to assume that the train may have come to a stop in less time with ECP brakes, it is impossible to predict whether this would have prevented any of the derailed cars from leaking product. It is important to note that when looking at the potential benefit of ECP brakes in reducing accident severity, there are certain types of derailments, such as the Vandergrift, PA, accident, where the benefit cannot be properly quantified. It should be recognized, therefore, that any benefit estimated from a modeling approach such as that described in this study cannot be universally applied to all potential derailments, and may be an overstatement of the overall benefit.

3.0 PARAMETRIC SIMULATIONS AND ANALYSIS

Although analysis of actual derailments provides a good basis for understanding the potential benefits of the various braking systems, it is limited in the extent it can be applied more generally to derailments under other operational conditions. To provide a more comprehensive understanding, a parametric analysis covering a number of key dimensions was conducted. A test matrix was developed with support from an industry technical advisory group. The following parameters were included in the study:

- Train speed at derailment – speeds of 30, 35, 40, 45, and 50 mph
- Point of derailment within the train – derailments occurring at the head-end, 1/4-way through the train, 1/2-way through the train, and 3/4-way through the train
- Track grade – grades of 1% uphill, 1% downhill, and flat (0%)
- Brake system – conventional (head-end), conventional with end-of-train device (ETD), rear-end DP, mid-train DP with ETD, DP at 2/3 with ETD, ECP, and ECP with rear-end wired DP

Although the range of values for the parameters selected does not cover the entire potential range of operating conditions, by selecting a range of reasonable values for each of the parameters, an understanding of the effect each has on the potential benefit of ECP brakes relative to the other braking systems can be developed. There are 420 combinations of the parameters listed. A TOES simulation was run for each combination of parameters in which an emergency brake application was initiated at the specified point of derailment within the train. The following assumptions were used in the TOES model:

- Car brake ratio: 10%
- Locomotive brake ratio: 29%
- Weight of cars: 263,000 pounds
- Weight of locomotives: 415,000 pounds
- Length of cars: 59 feet
- Length of locomotives: 73 feet
- Brake pipe pressure: 90 psi

- Emergency brake cylinder pressure: 77 psi
- Remote DP locomotive emergency brake cylinder pressure: 45 psi
- Number of cars: 100
- Number of locomotives: 3 (2 lead and 1 remote for DP cases)

In most cases, the assumptions were matched to those listed in the report on the analysis referenced in the NPRM.[2] Some of the assumptions were not listed in that report, and in these cases, reasonable assumptions were developed with the support of the railroad technical advisory group.

Using the same methodology developed and validated in the analysis of individual derailments in the first part of the study, the deceleration due to a derailment blockage force of 500,000 pounds was added to the resulting deceleration resulting from the TOES simulation for each case. From this data, the energy dissipated in the derailment and the number of cars reaching the point of derailment was determined. Finally, the reduction in energy dissipated in the derailment and number of cars reaching the point of derailment with ECP compared to each of the other braking systems was determined. Table 4 presents the average of these results for all simulations performed.

Table 4. Average Percent Reduction in Energy Dissipated in Derailment and Number of Cars Reaching Point of Derailment

Performance of ECP Brake System Compared To:	Average Percent Reduction in Energy Dissipated in Derailment	Average Reduction in Number of Cars Reaching Point of Derailment
Conventional Brakes (Head-end)	13.3%	1.6
Conventional Brakes with ETD	11.6%	1.3
Rear-end DP	12.8%	1.5
Mid-train DP	10.5%	1.2
DP at 2/3	10.8%	1.2

Table 4 indicates that the average percent reduction in energy dissipated in the derailment with ECP brakes is between 10.5 percent and 13.3 percent, which is far less than that estimated by the analysis referenced in the NPRM. Additionally, the average reduction in number of cars reaching the point of derailment is less than two cars.

- The maximum percent reduction in energy dissipated in the derailment with ECP was 25.3% for the 30 mph, 1% downhill grade, derailment at the head of the train, conventional (head end only) case.

- The maximum reduction in number of cars reaching the point of derailment with ECP was 4.1 cars for the 50 mph, 1% downhill grade, derailment at the head of the train, conventional (head end only) case.

- The minimum percent reduction in energy dissipated in the derailment with ECP was 4.9% for the 50 mph, 1% uphill grade, derailment at ¾-way through the train, DP at 2/3-way through the train case.
- The minimum reduction in number of cars reaching the point of derailment with ECP was 0.3 cars for the 30 mph, 1% uphill grade, derailment at ¾-way through the train, DP at 2/3-way through the train case.

Figure 4 shows the average percent reduction in energy dissipated in the derailment with ECP for each of the other brake systems, as a function of where in the train the derailment occurs.

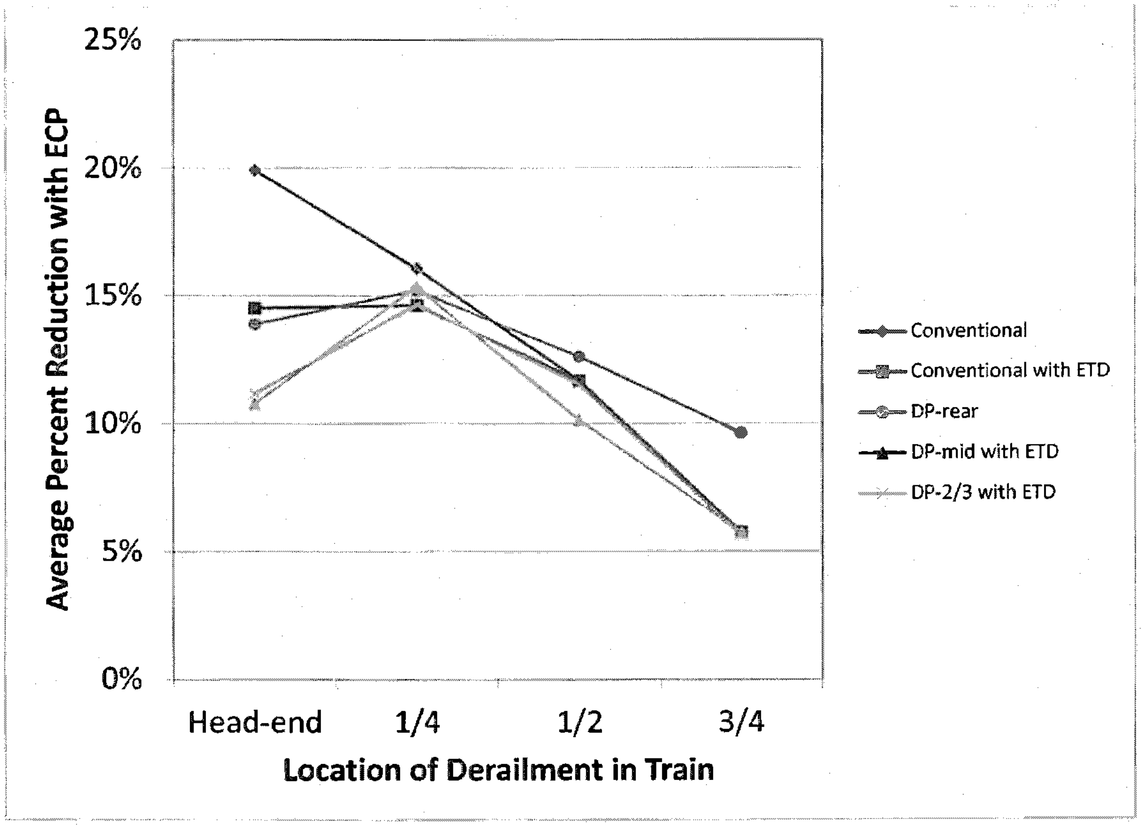


Figure 4. Average Percent Reduction in Energy Dissipated in the Derailment for ECP Compared to Other Braking Systems as a Function of Derailment Location within the Train

Figure 4 shows that the benefit of ECP relative to the other brake systems varies dramatically with where in the train the derailment occurs. In particular, the benefit of ECP relative to conventional (head end only) brakes is far better the closer to the head end of the train the derailment occurs. This illustrates the importance of considering derailments at various locations within the train in an analysis of the relative benefits of various brake systems.

4.0 CONCLUSIONS

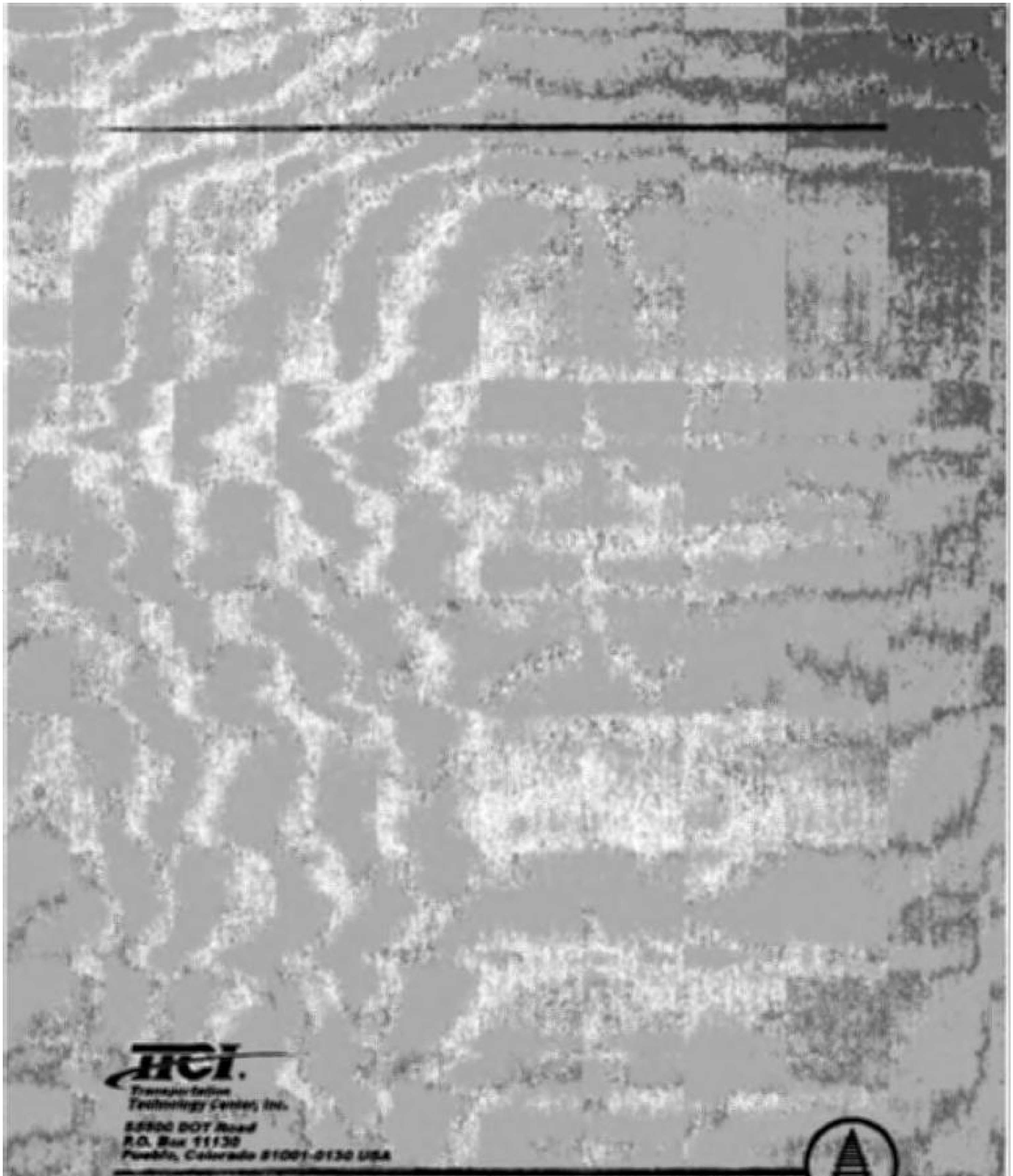
The objective of the analysis presented in this report was to evaluate the validity of the estimate of the benefit of ECP brakes cited in the NPRM in terms of reduction in energy dissipated in a tank car derailment relative to other braking systems. The independent modeling and analysis conducted shows that the NPRM estimate that ECP brakes provide a 36 percent reduction in energy dissipated in a derailment is clearly overstated. The maximum reduction in energy dissipated with ECP compared to conventional brakes was found to be 25.3 percent and the average percent reduction in energy dissipated with ECP compared to conventional brakes was found to be 13.3 percent.

The limited analysis referenced by the NPRM failed to consider the effect of the force applied to the cars trailing the point of derailment from the derailment itself. The analysis presented here shows that this blockage force has a considerable effect on the deceleration of the cars trailing the point of derailment, limiting the potential of the braking system to provide a significant benefit. The comparison of the modeling and post-accident analysis against remote DP units from the trailing end provides a compelling validation of this effect.

Additionally, the analysis cited in the NPRM considers only derailments which occur at the head end of the train. The parametric analysis demonstrates that considering only head-end derailments overstates the potential benefits of ECP, as the benefit over conventional brakes is greatest when the derailment occurs at the head end.

It is important to note that the severity of any derailment depends on many factors, and not necessarily the rate of energy dissipation in braking. The analysis referenced by the NPRM and the analysis presented here apply only to derailments where a significant blockage force is developed by the derailment, resulting in dramatic deceleration of cars into a compact pile. In these types of pile-up derailments, there is a very high probability of puncture, product release and fire. The probability of a pile-up type of derailment is largely unrelated to the braking system employed. The energy dissipated into the pile of cars is a much greater factor than the energy dissipated by the braking system. Other derailment scenarios, such as the Vandergrift, PA, incident, do not result in this pile of cars. In these cases, while ECP brakes will help to dissipate the energy in the train faster, the severity of the accident in terms of probability of puncture or product release is related more to other random factors than to energy dissipation alone.

Based on the results of the modeling and analysis presented here, the PHMSA estimate that ECP brakes would reduce accident severity by 36 percent is overstated and misrepresents the potential benefit of implementing ECP brakes in reducing the severity of accidents involving high-hazard flammable trains.



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Attachment C

Scenario #1: PHMSA/FRA Regulatory Impact Analysis July 2014:

▨ =Cited in Text

Exhibit 1A Tank Car Cost Estimates in the RIA

Discount Rate: 7%

	Incremental Costs of Option 1 Tank Cars		Retrofit Costs				
	$5,000	$5,000	$34,433	$25,333	$0	$33,844	$0
Addit Fuel & Maint Costs:	$256	$256	$1,019		$0	$641	$0

						Retrofitted Number of Cars					Retrofitted Car Costs							
	Option 1 New Cars for New Demand	Option 1 New Cars to Replace Retired or Transfer	Cost of Option 1 New Cars for New ($Millions)	Cost of Option 1 New Cars for Repl. ($Millions)	Total Cost of Option 1 New Cars ($Millions)	Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacketed CPC-1232s for Transfer	Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacket CPC-1232s for Transfer	Total Retrofit Costs	Added Fuel & Maint. Costs	Total Incremental Option 1 Tank Car Costs
NPV - 7%			$187.0	$31.8	$218.8						$1,319.5	$172.6	$0.0	$662.6	$0.0	$2,154.6	$642.1	$2,874.5
Sum	43,588	7,787	$217.9	$38.9	$256.9	43,805	7,787	5,600	22,380	9,850	$1,508.3	$197.3	$0.0	$757.4	$0.0	$2,463.0	$1,305.8	$4,025.7
RIA		7,787	$217.9	$38.9			7,787	5,600	22,380	9,850						$2,538.7	$1,520.0	$4,315.6
2015	20,300		$101.5	$0.0	$101.5												$5.2	$106.7
2016	5,822	2,596	$29.1	$13.0	$42.1	14,602	2,596	1,867	7,460	3,283	$502.8	$65.8	$0.0	$252.5	$0.0	$821.0	$27.0	$890.1
2017	5,822	2,596	$29.1	$13.0	$42.1	14,602	2,596	1,867	7,460	3,283	$502.8	$65.8	$0.0	$252.5	$0.0	$821.0	$48.8	$911.9
2018	5,822	2,596	$29.1	$13.0	$42.1	14,602	2,596	1,867	7,460	3,283	$502.8	$65.8	$0.0	$252.5	$0.0	$821.0	$70.6	$933.7
2019	5,822		$29.1	$0.0	$29.1												$72.1	$101.2
2020																	$72.1	$72.1
2021																	$72.1	$72.1
2022																	$72.1	$72.1
2023																	$72.1	$72.1
2024																	$72.1	$72.1
2025																	$72.1	$72.1
2026																	$72.1	$72.1
2027																	$72.1	$72.1
2028																	$72.1	$72.1
2029																	$72.1	$72.1
2030																	$72.1	$72.1
2031																	$72.1	$72.1
2032																	$72.1	$72.1
2033																	$72.1	$72.1
2034																	$72.1	$72.1
Source: RIA pages	p. 94 p.90 p. 93	p. 94 p.90 p. 93	p. 94 p. 82	p. 94 p. 82		p. 91 p.90 p. 84	p. 92 p.90 p. 81 p. 89	p. 92 p. 91 p. 89	p. 92 p.90 p. 85	p. 93 p. 91 p. 89					p.94	p 94	p. 91 p. 94	

Scenario #1: PHMSA/FRA Regulatory Impact Analysis July 2014:

ECP Additional Costs:

▨ =Cited in Text

Exhibit 18 Other Cost Estimates in the RIA

ECP Cost per Loco
$79,000
Locos w/ ECP:
900
% of Total Loco Fleet
3.71%

Trainers & Supervisors:	
Trainers:	$68,499
Per Supv.:	$7,090
#Supv.:	200
for Engr	$733,920
for Cond.	$146,784

	Engineers	Conductors	Carmen
#Empl.	4,500	4,500	
Cost/Hr	$49.97	$49.97	
Hrs/Empl	80	16	

Speed Restrictions in HTUAs Only:

Train Delay Hr. Cost:	$500
Days/Year:	364

	Locomotive Costs ($Millions)	Training Costs ($ Millions)					Total Non-Car ECP Costs	Total ECP Costs
		Supervisors	Engineers	Conductors	Carmen	Total Training		
RIA								$500.2
NPV - 7%	$66.4	$1.3	$16.8	$3.4	$0.0	$22.4	$88.8	$490.7
Sum	$71.1	$1.4	$18.0	$3.6	$0.0	$24.0	$95.1	$580.1
RIA	$71.1	$1.4	$18.4	$3.7	$0.0	$24.0	$95.1	
2015	$71.1	$1.4	$18.0	$3.6	$0.0	$24.0	$95.1	$155.95
2016								$135.56
2017								$135.56
2018								$135.56
2019								$17.47
2020								$0.00
2021								$0.00
2022								$0.00
2023								$0.00
2024								$0.00
2025								$0.00
2026								$0.00
2027								$0.00
2028								$0.00
2029								$0.00
2030								$0.00
2031								$0.00
2032								$0.00
2033								$0.00
2034								$0.00
Source: RIA pages	p. 154 p. 156 p. 157 p. 160	p. 157	p. 155 p. 156 p. 157	p. 155 p. 156 p. 157		p. 157	p. 157	p. 157 p. 169

	Hours of Delay per Day	Delay Cost ($Millions)		Total Costs ($Millions)
RIA		$22.9		$3,162.7
NPV - 7%		$22.9		$2,986.3
Sum	141	$25.6		$4,146.4
RIA		$25.6		$4,436.3
2015	74	$13.53		$215.3
2016	37	$6.65		$896.8
2017	30	$5.41		$917.3
2018				$933.7
2019				$101.2
2020				$72.1
2021				$72.1
2022				$72.1
2023				$72.1
2024				$72.1
2025				$72.1
2026				$72.1
2027				$72.1
2028				$72.1
2029				$72.1
2030				$72.1
2031				$72.1
2032				$72.1
2033				$72.1
2034				$72.1
	pp. 142 - 146	p. 144	p. 145	p. 188

Scenario #2: Option 1 Car with Corrections Versus a Regulation-Mandated Option 3 CPC-1232 Tank Car

Exhibit 2A AAR Incremental Tank Car Cost Estimates

Incremental Costs of Option 1 Tank Cars

Retrofit Costs

Discount Rate: 7%

			$9,665	$9,665		$37,098	$25,333	$0	$36,509	$0								
Addit Fuel & Maint Costs:			$256	$256		$1,019		$0	$641	$0								
						Retrofitted Number of Cars					Retrofitted Car Costs							
	Option 1 New Cars for New Demand	Option 1 New Cars to Replace Retired or Transfer	Cost of Option 1 New Cars for New ($Millions)	Cost of Option 1 New Cars for Repl. ($Millions)	Total Cost of Option 1 New Cars ($Millions)	Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacketed CPC-1232s for Transfer	Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacket CPC-1232s for Transfer	Total Retrofit Costs	Added Fuel & Maint. Costs	Total Incremental Option 1 Tank Car Costs
NPV - 7%			$361.5	$179.3	$540.8						$1,421.6	$161.0	$0.0	$714.8	$0.0	$2,297.4	$675.2	$3,363.0
Sum	43,588	23,237	$421.3	$224.6	$645.9	43,805	7,787	5,600	22,380	9,850	$1,625.1	$197.3	$0.0	$817.1	$0.0	$2,639.4	$1,375.0	$4,660.3
2015	20,300		$196.2	$0.0	$196.2												$5.2	$201.4
2016	5,822	0	$56.3	$0.0	$56.3	14,602			7,460		$541.7	$0.0	$0.0	$272.4	$0.0	$814.0	$26.3	$896.7
2017	5,822	15,450	$56.3	$149.3	$205.6	14,602		5,600	7,460	9,850	$541.7	$0.0	$0.0	$272.4	$0.0	$814.0	$51.5	$1,071.1
2018	5,822	7,787	$56.3	$75.3	$131.5	14,602	7,787		7,460		$541.7	$197.3	$0.0	$272.4	$0.0	$1,011.3	$74.6	$1,217.4
2019	5,822		$56.3	$0.0	$56.3												$76.1	$132.4
2020																	$76.1	$76.1
2021																	$76.1	$76.1
2022																	$76.1	$76.1
2023																	$76.1	$76.1
2024																	$76.1	$76.1
2025																	$76.1	$76.1
2026																	$76.1	$76.1
2027																	$76.1	$76.1
2028																	$76.1	$76.1
2029																	$76.1	$76.1
2030																	$76.1	$76.1
2031																	$76.1	$76.1
2032																	$76.1	$76.1
2033																	$76.1	$76.1
2034																	$76.1	$76.1

Scenario #2: Option 1 Car with Corrections Versus a Regulation-Mandated Option 3 CPC-1232 Tank Car

Exhibit 2B AAR Other Cost Estimates

ECP Additional Costs:

ECP Cost per Loco: $88,300
Locos w/ ECP: 20,000
% of Total Loco Fleet: 82.47%

Trainers & Supervisors:
Trainers: $68,499
Per Supv.: $7,090
#Supv.: 200
for Engr $733,920
for Cond. $146,784
for Carmen $733,920

	Engineers	Conductors	Carmen
#Empl.	27,143	41,015	9,849
Cost/Hr	$73.10	$62.16	$46.60
Hrs/Empl	80	16	80

Speed Restrictions in HTUAs Only
Train Delay Hr. Cost: $500
Days/Year: 364

	Locomotive Costs ($Millions)	Training Costs ($ Millions) Supervisors	Engineers	Conductors	Carmen	Total Training	Total Non-Car ECP Costs	Total ECP Costs
NPV - 7%	$1,650.5	$1.3	$148.3	$38.1	$34.3	$223.7	$1,874.2	$2,469.2
Sum	$1,766.0	$1.4	$158.7	$40.8	$36.7	$239.3	$2,005.3	$2,723.8
2015	$1,766.0	$1.4	$158.7	$40.8	$36.7	$239.34	$2,005.3	$2,123.06
2016								$144.07
2017								$233.66
2018								$189.23
2019								$33.76
2020								$0.00
2021								$0.00
2022								$0.00
2023								$0.00
2024								$0.00
2025								$0.00
2026								$0.00
2027								$0.00
2028								$0.00
2029								$0.00
2030								$0.00
2031								$0.00
2032								$0.00
2033								$0.00
2034								$0.00

	Hours of Delay per Day	Delay Cost ($Millions)	Total Costs ($Millions)
NPV - 7%		$22.9	$5,260.0
Sum	141	$25.6	$6,691.3
2015	74	$13.53	$2,220.3
2016	37	$6.65	$903.3
2017	30	$5.41	$1,076.5
2018			$1,217.4
2019			$132.4
2020			$76.1
2021			$76.1
2022			$76.1
2023			$76.1
2024			$76.1
2025			$76.1
2026			$76.1
2027			$76.1
2028			$76.1
2029			$76.1
2030			$76.1
2031			$76.1
2032			$76.1
2033			$76.1
2034			$76.1

Difference: Scenario #2 Minus Scenario #1 RIA

Exhibit 3A Difference Between RIA and AAR Tank Car Cost Estimates

Incremental Costs of Option 1 Tank Cars

Retrofit Costs

Discount Rate: 7%

			$4,665	$4,665		$2,665	$0	$0	$2,665	$0								
Addit Fuel & Maint Costs:			$0	$0		$0		$0	$0	$0								
						Retrofitted Number of Cars					Retrofitted Car Costs							
	Option 1 New Cars for New Demand	Option 1 New Cars to Replace Retired or Transfer	Cost of Option 1 New Cars for New ($Millions)	Cost of Option 1 New Cars for Repl. ($Millions)	Total Cost of Option 1 New Cars ($Millions)	Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacketed CPC-1232s for Transfer	Unjacketed for Use in U.S.	DOT111s for Transfer	Jacketed DOT111s for Transfer	Unjacketed CPC-1232s for Use in U.S.	Jacket CPC-1232s for Transfer	Total Retrofit Costs	Added Fuel & Maint. Costs	Total Incremental Option 1 Tank Car Costs
NPV - 7%			$174.5	$147.5	$322.0						$95.4	-$10.8	$0.0	$48.8	$0.0	$133.4	$33.1	$488.5
Sum	0	15,450	$203.3	$185.7	**$389.0**	43,805	7,787	5,600	22,380	9,850	$116.7	$0.0	$0.0	$59.6	$0.0	**$176.4**	$69.2	$634.6
2015	0		$94.7	$0.0	$94.7	0	0	0	0	0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$94.7
2016	0	-2,596	$27.2	-$13.0	$14.2	0	-2,596	-1,867	0	-3,283	$38.9	-$65.8	$0.0	$19.9	$0.0	-$7.0	-$0.7	$6.6
2017	0	12,854	$27.2	$136.3	$163.5	0	-2,596	3,733	0	6,567	$38.9	-$65.8	$0.0	$19.9	$0.0	-$7.0	$2.6	$159.2
2018	0	5,191	$27.2	$62.3	$89.4	0	5,191	-1,867	0	-3,283	$38.9	$131.5	$0.0	$19.9	$0.0	$190.3	$4.0	$283.7
2019	0		$27.2	$0.0	$27.2	0	0	0	0	0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$4.0	$31.1
2020																	$4.0	$4.0
2021																	$4.0	$4.0
2022																	$4.0	$4.0
2023																	$4.0	$4.0
2024																	$4.0	$4.0
2025																	$4.0	$4.0
2026																	$4.0	$4.0
2027																	$4.0	$4.0
2028																	$4.0	$4.0
2029																	$4.0	$4.0
2030																	$4.0	$4.0
2031																	$4.0	$4.0
2032																	$4.0	$4.0
2033																	$4.0	$4.0
2034																	$4.0	$4.0

Difference: Scenario #2 Minus Scenario #1 RIA

ECP Additional Costs:

Exhibit 3B Difference Between RIA and AAR Other Cost Estimates

ECP Cost per Loco
$9,300
Locos w/ ECP:
19,100
% of Total Loco Fleet
78.76%

Trainers: $0
Per Supv.: $0
#Supv.: $0
for Engr $0
for Cond. $0
for Carmen $733,920

	Engineers	Conductors	Carmen
#Empl.	22,643	36,515	9,849
Cost/Hr	$23.13	$12.19	$46.60
Hrs/Empl	0	0	80

Train Delay Hr. Cost: $0
Days/Year: 0

	Locomotive Costs ($Millions)	Training Costs ($ Millions) Supervisors	Engineers	Conductors	Carmen	Total Training	Total Non-Car ECP Costs	Total ECP Costs
NPV - 7%	$1,584.0	$0.0	$131.5	$34.8	$34.3	$201.3	$1,785.3	$1,978.5
Sum	$1,694.9	$0.0	$140.7	$37.2	$36.7	$215.4	$1,910.3	$2,143.7
2015	$1,694.9	$0.0	$140.7	$37.2	$36.7	$215.4	$1,910.3	$1,967.1
2016								$8.5
2017								$98.1
2018								$53.7
2019								$16.3
2020								$0.0
2021								$0.0
2022								$0.0
2023								$0.0
2024								$0.0
2025								$0.0
2026								$0.0
2027								$0.0
2028								$0.0
2029								$0.0
2030								$0.0
2031								$0.0
2032								$0.0
2033								$0.0
2034								$0.0

	Hours of Delay per Day	Delay Cost ($Millions)	Total Costs ($Millions)
NPV - 7%		$0.0	$2,273.8
Sum	0	$0.0	$2,544.9
2015	0	$0.0	$2,005.0
2016	0	$0.0	$6.6
2017	0	$0.0	$159.2
2018			$283.7
2019			$31.1
2020			$4.0
2021			$4.0
2022			$4.0
2023			$4.0
2024			$4.0
2025			$4.0
2026			$4.0
2027			$4.0
2028			$4.0
2029			$4.0
2030			$4.0
2031			$4.0
2032			$4.0
2033			$4.0
2034			$4.0

Attachment D

THE SECRETARY OF TRANSPORTATION
WASHINGTON DC 20590

April 9, 2014

The Honorable Edward R. Hamberger
President and Chief Executive Officer
Association of American Railroads
425 Third Street, SW
Washington, DC 20024

Dear Mr. Hamberger:

I want to thank you for the Association of American Railroads' (AAR) ongoing work and close collaboration with the U.S. Department of Transportation (DOT) to ensure the safe transport of crude oil by rail.

The AAR has been an important partner, working diligently to implement critically important safety measures, including speed restrictions, additional inspections, braking system technologies and resources for emergency responder training. Your actions have strengthened our efforts to bring immediate safety benefits to the communities situated along crude oil train routes.

I am writing now to follow up with you on an additional commitment from the Call to Action meeting I hosted earlier this year in which AAR agreed to reassemble the Rail Tank Car Standards Committee to reach consensus on additional changes proposed to the AAR rail tank car standard to be considered by DOT in the rulemaking process. In particular, I am writing to inquire about the progress of the tank car design committee.

I know you have convened the committee in the weeks since the Call to Action meeting, and I am now requesting a report on what conclusions, if any, the committee has reached. If you have been unable to reach consensus, I ask that you continue to convene the committee in an effort to do so, and in the meantime, provide me and our team with a status report updating us on the work of the committee thus far.

For our part, DOT is fully engaged in our rulemaking process for determining a new tank car standard. While the tank car design committee does not have an official role in that rulemaking process, AAR and those you have convened as members of the committee are important stakeholders in this conversation about the future of the tank car, and we would be interested to hear their views and recommendations.

Rail safety is a responsibility that we all share, and we will continue to seek a comprehensive approach to improving the safe shipment of crude oil by rail. Thank you and I look forward to your reply.

Sincerely,

Anthony R. Foxx

THE SECRETARY OF TRANSPORTATION
WASHINGTON, DC 20590

July 11, 2014

RECEIVED JUL 15 2014

The Honorable Edward R. Hamberger
President and Chief Executive Officer
Association of American Railroads
425 Third Street SW, Suite 1000
Washington, DC 20024

Dear Mr. Hamberger:

Thank you for your letter to the U.S. Department of Transportation (DOT) in which you provided an update on recent meetings of the Association of American Railroads (AAR) Rail Tank Car Committee (TCC). In your letter, you noted the request that I made in January 2014 as part of an industrywide "Call to Action." I asked that the TCC be recommissioned to reach consensus on additional changes proposed to the AAR rail tank car standard to be considered by DOT in the rulemaking process.

According to your letter, TCC has held two formal meetings and numerous informal meetings since the "Call to Action" to attempt to reach an agreement on a revised tank car design standard and a retrofit program for existing fleets, but has yet to reach consensus on either issue.

I sincerely appreciate the efforts put forth by the TCC to address my request. I am disappointed, however, that a consensus has not yet been reached on these very important issues. Accordingly, as I did in my April 9, 2014, letter to AAR, I urge TCC to continue to pursue consensus recommendations to inform the Department's tank car rulemaking initiative.

Since your letter is related to an open rulemaking proceeding, a copy of your letter and this response will be placed in the rulemaking's public docket (Docket Number PHMSA-2012-0082).

Sincerely,

Anthony R. Foxx