Committee on the Review of Department of Transportation Testing of Electronically Controlled Pneumatic (ECP) Brakes

DETAILS

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TRB
TRANSPORTATION RESEARCH BOARD

October 26, 2016

The Honorable Anthony Foxx
Secretary
U.S. Department of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Foxx:

In response to a request from Congress in the Fixing America's Surface Transportation (FAST) Act, the National Academies of Sciences, Engineering, and Medicine have formed the Committee on the Review of Department of Transportation (DOT) Testing of Electronically Controlled Pneumatic (ECP) Brakes. The committee is preparing a letter report that addresses the first phase in the statement of task (Appendix A). This report will review the plan prepared by DOT to test the assumptions that the department has identified in its comparison of the emergency braking performance of railroad tank car ECP brakes with that of other braking systems.[1] Completion of the letter report is expected by the end of this year.

The FAST Act also requires the Secretary of Transportation to incorporate the results of the testing mentioned above into a determination of whether the ECP braking system requirements in the Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains; Final Rule (May 8, 2015) are justified. The Secretary's determination is to be made by December 2017. The committee understands that the need to meet the congressional deadline has motivated DOT to begin implementing its test plan before it receives the committee's letter report. After receiving that report, DOT would consider additional tests that might be needed in response to the committee's recommendations.

At the committee's information-gathering session held on October 14, DOT representatives presented an informative overview of the substantial analyses that were conducted in developing DOT's current requirement for ECP brakes and the department's plan for additional analysis and testing. After considering the information presented at the session and the accompanying written materials, the committee has questions about whether the proposed tests target the most important assumptions in assessing the emergency performance of alternative unit train braking systems. The committee is gathering additional information and carrying out an analysis that will be explained in its forthcoming letter report, which will undergo an independent external review in accordance with the National Academies' study process. Because the committee is concerned that conducting additional tests without consideration of its advice might result in the inefficient use of limited resources, the committee recommends that DOT suspend its testing activities until the committee's report has been issued. The committee believes that such an approach will help ensure that the most important assumptions involved in the comparison of braking systems are identified and tested.

I would be happy to discuss this matter with you at the earliest time we are both available.

Sincerely,

Louis J. Lanzerotti
Committee Chair

cc: Trevor Dean, DOT/FRA
Kevin Kesler, DOT/FRA

[1] DOT's plan is presented in Appendix B.

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Appendix A

Review of Department of Transportation Testing of Electronically Controlled Pneumatic Brakes

Project Scope

In the first phase of this project, an ad hoc committee will review a test and analysis plan prepared by DOT and comment in a letter report on whether the proposed tests will provide objective, accurate, and reliable results to test the assumptions that DOT has identified in its comparison of the emergency braking performance of railroad tank car electronically controlled pneumatic (ECP) brakes to conventional brakes or braking systems such as distributed power and two-way end-of-train devices. The committee will provide a written explanation detailing the need for any additional or alternative testing. The key question is whether ECP brakes would reduce the incidence and severity of spills of crude oil or ethanol from derailments compared with the alternative braking systems examined.

In the second phase of this project, the committee will review the conduct of DOT's tests, reports of test results, and, based on DOT's test results and analysis, provide its findings and conclusions addressing the performance of ECP brakes relative to other braking technologies or systems tested by DOT. The committee's reviews and letter reports will be limited to these tasks; the committee will not make recommendations about which braking systems should be required of railroads in revenue service.

Appendix B

Analysis and Test Plan to
Assess the Effectiveness of ECP Brakes in Reducing the Risks
Associated with High-Hazard Flammable Trains

Version 0.9 ***with notes on status***

September 19, 2016
[The plan and brief notes on status were provided by Kevin Kesler, Federal Railroad Administration, on October 11, 2016.]

1. INTRODUCTION

Section 7311(b) of the Fixing America's Surface Transportation Act (FAST Act) directs the Secretary of the Department of Transportation (DOT) to conduct tests to provide data to inform a review of the costs, benefits, and effects of Electronically Controlled Pneumatic (ECP) brakes that were used in the Regulatory Impact Analysis (RIA) for the "Enhanced Tank Car Standards and Operational Control for High-Hazard Flammable Trains" final rule (HHFT Rule; 80 FR 26643) published on May 8, 2015. DOT developed this analysis and test plan to provide the necessary data to allow the Secretary to determine if ECP brakes are justified. The plan involves additional analysis (including computer simulation) and full-scale, physical tests.

DOT has contracted with the Transportation Research Board (TRB) of the National Academy of Sciences to provide independent oversight of the planned analysis and test work. TRB has formed a committee of experts to:

1. Familiarize itself with the analysis and testing that DOT relied upon for the HHFT Rule;
2. Review the detailed test and analysis plan DOT proposes and, in a letter report, confirm it meets the FAST Act's requirement to "objectively, accurately, and reliably measure the performance of ECP brake systems relative to other braking technologies or systems, such as distributed power and 2-way end-of-train devices" or recommend changes;
3. Review and oversee the testing procedures used by DOT or its contractors;
4. Review the test reports provided by DOT following the completion of testing and hold an open meeting to discuss the results; and
5. Provide a final letter report to DOT analyzing results of the testing and making findings and conclusions.

The output from the analysis and testing described in this plan will be a series of reports describing methods and results. DOT will use the results, once confirmed by the TRB committee, to update the discussion of ECP brakes in the RIA for the HHFT Rule.

DOT has contracted with suppliers to conduct the analysis and testing specified in this plan. Some of the tests are to be conducted at the Federal Railroad Administration's (FRA's) Transportation Technology Center in Pueblo, Colorado, due to the unique testing infrastructure available at the facility.

2. ANALYSIS PLAN

2.1 Coefficient of Friction-(*Post derailment tank car kinetic energy dissipation)*

The HHFT RIA used results of computer models of tank cars sliding along the ground after derailment until they came to rest or collided with another tank car. DOT will test the sensitivity of the benefits of ECP brake benefits to different values of coefficient of friction between the tank car and the ground. The range of values of coefficient of friction used in this sensitivity test will be based [on] the results of full-scale tank car sliding tests on different ground conditions (specified later in this plan).

Plan to measure force required to drag tanks with various loads across various surfaces.

2.2 DOT-117 Puncture Resistance

The HHFT RIA used a histogram of impact forces and the puncture resistance of different types of tank cars to calculate the number of punctures and to determine the benefits of ECP brakes. As part of meeting the FAST Act requirements, DOT will use a histogram of impact forces calculated using the structural properties (stiffness, mass, etc.) of a DOT-117 tank car and then applied to the calculated puncture resistance of the same type of car.

DOT will calculate the puncture resistance, stiffness and other required properties of a DOT-117 tank car from a finite element model of the car. DOT will validate the model from full-scale impact tests (specified later in this plan).

Test complete. Model was validated. Puncture predicted at 13 to 14 mph. Preliminary test results showed "near puncture" at 13.6 mph. Currently no plans for a second puncture test.

2.3 Curved Track

DOT will calculate the benefits of ECP brakes on curved track that is representative of the distribution of curves on the rail network. ***Using LS Dyna simulations with a revised initial condition at derailment to reflect negotiating a curve.***

2.4 Derailment Initiation

The HHFT RIA used the results of modeling with derailment initiated by a lateral force applied to the leading truck of the first car to be derailed. As part of meeting the FAST Act requirements, DOT will analyze alternative derailment initiation events to determine additional scenarios to the lateral force that was modeled for the HHFT RIA. Initiation events will include broken rails, broken wheels, bearing burn offs, wide gage, and track buckles. DOT will model the additional scenarios if they are found to be significantly different in nature to an applied lateral force.

2.5 End-of-Train Device vs. Distributed Power

DOT will compare the sequence of events in a derailment of a train fitted with an end-of-train device to that of a train outfitted with distributed power at the front and rear. The events will include brake pipe pressure changes throughout the train, emergency brake applications and locomotive engineer responses. ***DOT will develop and model scenarios that describe these events.***

2.6 Model Validation

DOT, with support of its contractors, will model a sample of previous derailments. DOT will compare the results from the modeling to what happened in real life. The comparison will include, but not be limited to, the number of punctures, distances traveled by cars from derailment to rest, the ratio of cars derailed to those that stay on the track, the ratio of head to side impacts and punctures. ***In progress with preliminary results presented [to the committee on October 14, 2016].***

3. TEST PLANS

The following are high level specifications for the planned tests. The contractor conducting each test will develop a detailed test plan as an early contract deliverable.

3.1 Coefficient of Friction-(*Post derailment tank car kinetic energy dissipation)*

The contractor will perform a full-scale test to determine the coefficient of sliding friction between a tank car and the ground. The contractor will perform testing with the tank car on its side. The contractor will repeat the test on a variety of different ground conditions including those representing wet, dry and frozen agricultural land, and ballast. ***Plan for testing at TTCI [Transportation Technology Center, Inc.]. Will pull an empty and partially loaded tank car across the ground with a bulldozer or equivalent.***

3.2 DOT-117 Puncture Resistance

The contractor will conduct full-scale impact tests to provide data to validate the computer model of a DOT-117 tank car. The tests will be conducted against the crash wall at FRA's Transportation Technology Center in Pueblo, Colorado. The contractor may perform two tests: one that does not cause puncture and one that does. ***Test complete….preliminary results appear to validate simulations.***