SURFACE VEHICLE RECOMMENDED PRACTICE

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Occupant Restraint Dynamic System Evaluation - Frontal Impact Heavy Trucks

RATIONALE

This revision replaces the analytical expression for frontal deceleration pulse, with two curves that are based on measurements taken during multiple flat frontal barrier crashes of heavy trucks. Moreover, this revision updates ATD references to 49 CFR 572, includes data processing according to SAE J1727, updates photographic instrumentation to more modern laboratory practices and updates formatting. Seat positioning section 4.4 was added. In addition, the content of SAE J2418 and SAE J2419 have been combined into one recommended practice.

1. SCOPE

This SAE Recommended Practice describes the test procedures for conducting frontal impact restraint tests for heavy truck applications. Its purpose is to establish recommended test procedures that will standardize restraint system testing for heavy trucks. Descriptions of the test set-up, test instrumentation, photographic/video coverage, and the test fixtures are included.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J211-1 Instrumentation for Impact Test - Part 1: Electronic Instrumentation

SAE J211-2 Instrumentation for Impact Test - Part 2: Photographic Instrumentation

SAE J1727 Injury Calculation Guidelines

SAE Engineering Aid 23 "Users' Manual for the 50th-Percentile Hybrid-III Test Dummy," June 1985.

SAE CRP-9 "Heavy Truck Crashworthiness (Statistics, Accident Reconstruction, Occupant Dynamics Simulation)," March 1995.

SAE CRP-13 "Heavy Truck Crashworthiness – Phase III" (Testing and Analysis for Recommended Practice Development) April 1997.

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SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/J2418_201508

2014-01-2423 "Sled Test Development and Occupant Protection Evaluation Based on the Frontal Crash Response of Heavy Trucks," SAE Technical Paper

2007-01-4289 "Heavy Truck Frontal Crash Protection System Development," SAE Technical Paper

2003-01-3101 "2003 Chevrolet Kodiak and GMC TopKick Airbag Sensing System Development," SAE Technical Paper

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

Code of Federal Regulations, title 49, Part 571.208 Occupant Crash Protection

Code of Federal Regulations, Title 49, Part 572 Anthropomorphic Test Devices.

3. ANTHROPOMORPHIC TEST DEVICES

For the dynamic tests described in the following sections, restraint systems should be evaluated with the aid of an anthropomorphic test device (ATD). The ATD should be of a type that will closely represent the size, weight, and articulation characteristics of a 50th percentile male in a seated position. An example of such a test device is the Hybrid-III 50th percentile male ATD, described in 49 CFR 572 subpart E.

Applicable measurement capabilities of the Hybrid-III 50th percentile male ATD are described in 49 CFR 571.208.

ATDs of other sizes (i.e., 95th-percentile male, 5th-percentile female, etc.) may also be used to evaluate restraint performance for various occupant sizes.

4. DYNAMIC SLED TESTS

For component-level restraint system tests, only the subject seat and associated restraint system hardware are installed on the test sled fixture. No other interior cab component need be installed. Proper restraint anchorage geometry, relative to the seat, should be maintained. Tethers should be set according to the manufacturer's specifications. The primary purpose of component-level tests is to evaluate restraint component performance and occupant excursion when subjected to vehicle deceleration from representative frontal crashes.

For system-level restraint system tests, all interior cab components that are potential occupant contact surfaces (i.e., steering wheel, dashboard, engine tunnel etc.) shall be installed on the test sled fixture. Proper geometry, relative to the seat and restraint system should be maintained. Wherever practicable, actual cabs with actual interior components should be mounted to the test sled. If not, components with performance characteristics near those expected for production should be installed on the test sled fixture. Seat tethers should be set according to the manufacturer's specifications. The primary purpose of system-level tests is to evaluate restraint system performance, occupant excursion and occupant interaction with interior components when subjected to vehicle deceleration from representative frontal crashes.

4.1 Test Fixture

For the frontal impact tests, a sled fixture mounted on a uni-directional tracking system is required. Typical sled fixture systems are of the deceleration and acceleration types. For the deceleration system, the sled fixture is gradually accelerated to a desired speed and then decelerated through the desired pulse via energy-absorbing methods (i.e., honeycomb, extruded steel rods, etc.). For the acceleration system, the programmed pulse is applied as acceleration to the sled fixture, which is initially at rest.

4.2 Frontal Impact Sled Pulse Specification

For frontal impact restraint tests, a sled deceleration pulse is applied to the seat/restraint system longitudinal axis. Wherever possible, vehicle-specific deceleration pulses should be used. Vehicle-specific deceleration pulses may be used from full scale vehicle crash tests, provided pulse measurements were made inside the cab, near the seat attachment to the cab floor. If a vehicle-specific pulse is not known, then a generic sled pulse corresponding to the following curves should be used.[1] For tests of components and systems intended for use in cab-over-engine (COE) heavy trucks, a velocity change of 35.2 ±1.6 kph is recommended using the generic COE pulse shown in Figure 1. For tests of components and systems intended for use in conventional heavy trucks, a velocity change of 53.3 ±1.6 kph is recommended using the generic conventional pulse shown in Figure 2.

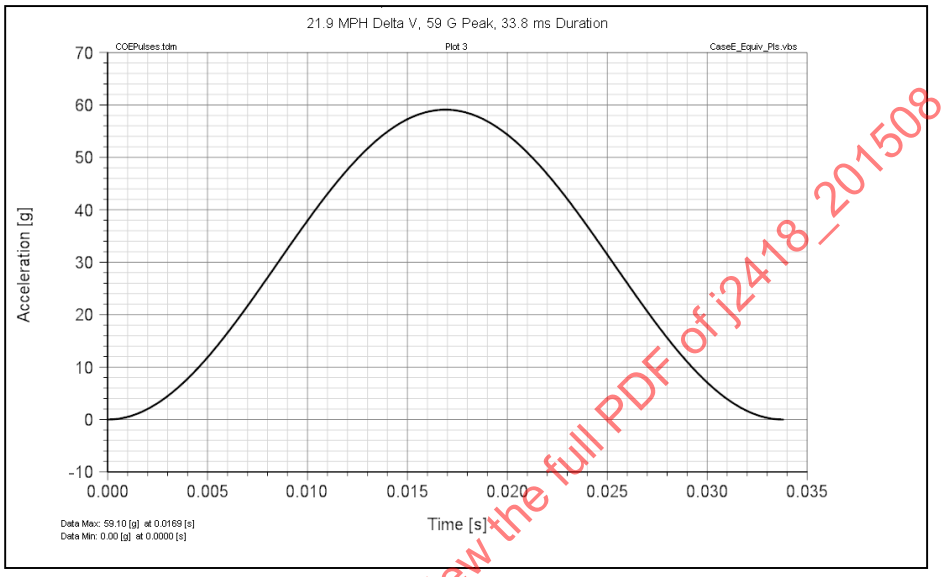

Figure 1 - Generic cosine pulse representing COE heavy trucks

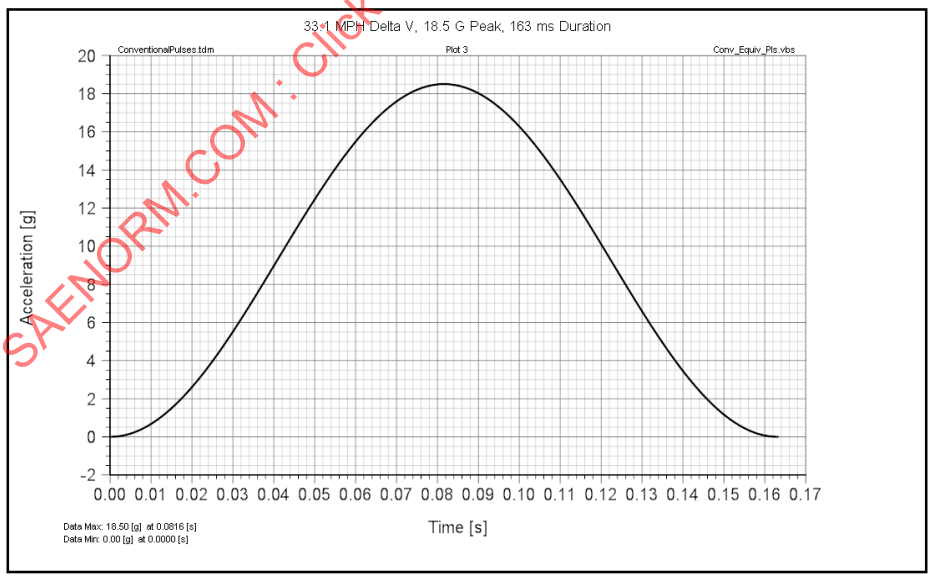

Figure 2 - Generic cosine pulse representing conventional heavy trucks

[1] Reference 2014-01-2423 Figures 11 and 13 and Table 1, Test Matrix Input Parameters