



CTR02007 TEST REPORT

Location of Test Laboratory:

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Test Method Used:

Dynamic Sled Test Messring SOP

Test Subject:

Seagrave Marauder II Cab

Date of receipt of test items:

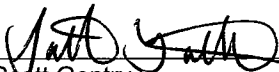
September 8, 2006

Date of Test:

October 2, 2006 – October 3, 2006

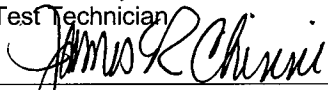
Seagrave Fire Apparatus
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Clintonville, WI 54929

Report Prepared By:



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Report Reviewed By:



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CTR02007 Pre-Test Photographs, Data Plots, Post-Test Photographs

Multimedia

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Purpose

The purpose of these dynamic sled tests was to evaluate the crashworthiness of the Seagrave Marauder II Cab. COE frontal strength and cab roof strength were evaluated utilizing SAE J2420₁ and SAE J2422₂ specifications and procedures. Additionally, performance measures from specification ECE R29₅ were referenced during the evaluation of the testing.

Procedure

Table 1, CTR02007 Test Matrix, shows the test specification followed and the vehicle under evaluation for each test run.

Table 1, CTR02007 Test Matrix

| Test # | Test Subject | Specification |
|--------|--------------------------|--|
| 001 | Seagrave Marauder II Cab | SAE J2422 Cab Roof Strength Dynamic Pre-Load |
| 002 | Seagrave Marauder II Cab | SAE J2422 Cab Roof Strength Quasi-Static Roof Load |
| 003 | Seagrave Marauder II Cab | SAE J2420 COE Frontal Strength Evaluation |

The dynamic impact portions of SAE J2420 and SAE J2422 require a platen to impact the vehicle. The platen used for the test series was manufactured as a specialty vehicle, a.k.a. cart, with a rigid vertical steel platen fastened to the front of the vehicle. The total weight of the cart with platen is 13,000 lbm. Table 2, Target Values, summarizes the target energy and load values for the test series.

Table 2, Target Values

| Test # | Description | Target Value |
|--------|-------------------------------------|---------------|
| 001 | Kinetic energy of cart at impact | 13,000 ft-lbf |
| 002 | Mass of steel plate resting on roof | 22,050 lbm |
| 003 | Kinetic energy of cart at impact | 32,600 ft-lbf |

Engineering data was collected during the dynamic loading tests using accelerometers and a data acquisition system. Table 3, Sensor Identification, show the locations of the accelerometers used during tests CTR02007-001 and CTR02007-003.

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Procedure (continued)

Table 3, Sensor Identification

| Channel Name | Description |
|-------------------------|--|
| CART FRAME ACCELERATION | Accelerometer mounted on cart frame midway between the wheelbase |
| CART X ACCELERATION | Accelerometer mounted on the back side of the platen |
| PLATEN ACCELERATION | Accelerometer mounted on the back side of the platen |

Pre-test and post-test photographs were taken to document the test set-up and the condition of the cab and chassis. The pre-test and post-test photographs may be found in the appendices of the test report.

CAPE data acquisition systems and post-processing software follow SAE J211₃ performance requirements and SAE J1733₄ coordinate systems. The test data plots may be found in the appendices of the test report. High-speed digital imagers were set up to capture the platen impacts of both dynamic load test runs. The video files and viewer software are included on the multimedia CD accompanying the test report.

Analysis

The speed of the cart at impact was controlled with the CAPE barrier facility controller. The target speed for each test was calculated from the target energy using equation 1.

$$v_{\text{cart}} = (KE * 2 / m_{\text{cart}})^{1/2} \quad [1]$$

The mass of steel plate utilized in the quasi-static roof load test, CTR02007-002, was calculated according to equation 2, using a nominal steel density, ρ , of 0.283 lbm/in³. L, w and t represent the length, width and thickness of the steel plate.

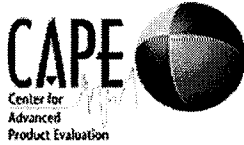
$$M_{\text{steel}} = \rho * L * w * t \quad [2]$$

Table 4, Target Speed Values, show the target speed for each dynamic load test.

Table 4, Target Speed Values

| Test # | Description | Target Value |
|--------|--------------------------------|--------------|
| 001 | Target speed of cart at impact | 5.5 mph |
| 003 | Target speed of cart at impact | 8.7 mph |

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Analysis (continued)

Table 5, Performance Criteria, shows the aspects of occupant protection evaluated post-test.

Table 5, Performance Criteria

| Item | Performance Measure |
|------|--|
| 1 | After undergoing each test, the cab of the vehicle shall exhibit a survival space accommodating a 50 th percentile male ATD in the median position without contact between the manikin and non-resilient parts for all seating locations. |
| 2 | None of the doors shall open during the tests. |
| 3 | The cab attachments may be distorted or fractured, however, the cab shall remain attached to the vehicle frame in at least one attachment location. |

Results

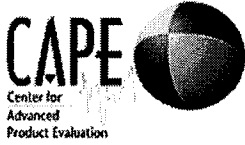
Note: These results apply only to the items tested.

Table 6, Performance Results, shows the vehicle's performance in relation to the occupant protection standards from Table 5, Performance Criteria.

Table 6, Performance Results

| Test # | Performance Measure | Performance Result |
|--------------|---------------------|--|
| CTR02007-001 | Survival Space | In all seating locations there was no encroachment into the occupant's survival space. |
| CTR02007-001 | Doors Opening | All doors remained shut. |
| CTR02007-001 | Cab Attachments | The cab remained attached to the chassis frame in at least one location. |
| CTR02007-002 | Survival Space | In all seating locations there was no encroachment into the occupant's survival space. |
| CTR02007-002 | Doors Opening | All doors remained shut. |
| CTR02007-002 | Cab Attachments | The cab remained attached to the chassis frame in at least one location. |
| CTR02007-003 | Survival Space | In all seating locations there was no encroachment into the occupant's survival space. |
| CTR02007-003 | Doors Opening | All doors remained shut. |
| CTR02007-003 | Cab Attachments | The cab remained attached to the chassis frame in at least one location. |

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Results (continued)

Table 7, CTR02007-001 Results

| Description | Units | Measurement |
|-------------------------|--------------|--------------------|
| Cart Impact Speed | kph (mph) | 9.3 (5.8) |
| Cart Delta V | kph (mph) | 9.8 (6.1) |
| Cart Stopping Distance | mm (in) | 343 (13.5) |
| Cart Kinetic Energy | kJ (ft-lbf) | 19.6 (14451) |
| Cart X Acceleration | g | 0.6 |
| Cart Frame Acceleration | g | 5.0 |
| Platen Acceleration | g | 7.0 |

Table 8, CTR02007-002 Results

| Description | Units | Measurement |
|------------------------------------|--------------|--------------------|
| Weight of mass resting on cab roof | kg (lbm) | 10,706 (23,603) |

Table 9, CTR02007-003 Results

| Description | Units | Measurement |
|-------------------------|--------------|--------------------|
| Cart Impact Speed | kph (mph) | 14.1 (8.8) |
| Cart Delta V | kph (mph) | 18.4 (11.5) |
| Cart Stopping Distance | mm (in) | 151 (5.9) |
| Cart Kinetic Energy | kJ (ft-lbf) | 45.7 (33693) |
| Cart X Acceleration | g | 1.2 |
| Cart Frame Acceleration | g | 13.1 |
| Platen Acceleration | g | 12.2 |

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References

1. SAE J2420, COE Frontal Strength Evaluation – Dynamic Loading Heavy Trucks, December 2003
2. SAE J2422, Cab Roof Strength Evaluation – Quasi-Static Loading Heavy Trucks, December 2003
3. SAE J211/1, Instrumentation for Impact Test—Part 1—Electronic instrumentation, December 2003
4. SAE J1733, Sign Convention for Vehicle Crash Testing, December 1994
5. ECE Regulation 29, Protection of Occupants of the Cab of a Commercial Vehicle, August 1999



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Multimedia Overview

Included with the test report is a CD containing the report text, data plots, and test photographs. Inserting the CD into a CD-ROM and opening Windows Explorer may access the electronic data files. The electronic data is broken into the following folders: report, data, photos-pre, and photos-post. The report is in adobe .pdf format and may be viewed by double clicking on the CTR02007 Report.pdf icon. The data plots are stored in the data folder. These plots are in .wmf format and may be viewed by double clicking on the index.html file located in the respective data folder. The photographs are in their respective folders of photos-pre and photos-post. The photographs are in .jpg format and may be viewed by double clicking on the index.html file in the respective photos folder. The video files and the video viewer software are located in the Video-tiff folder on the CD. This folder contains the application file lmgExpV.exe that launches the SAI Viewer software.

In the event of any problems please contact CAPE at the following phone number.

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