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## Ride Evaluation – Heavy Trucks and Equipment

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### ABSTRACT

With the use of digital audio tape recorders and piezo accelerometers, a practical field-ready method of determining occupant loading has been developed for heavy truck and equipment ride evaluation. The primary objective is to measure the accelerations transferred to the occupant through the seat. These accelerations can then be compared to occupant threshold limits to assist the engineer in determining ride quality.

### INSTRUMENTATION

The acquisition of acceleration data in a field setting involves the following considerations and equipment:

**Power Sources:**

All equipment must be powered by either the test vehicle or by portable energy sources. All necessary equipment needed to acquire and record data can be found with DC power inputs or with their own specific, ready made, battery packages. Many systems are available that will provide the engineer in the field with a full work day of data acquisition.

**Accelerometers:**

Based on Newtonian Mechanics, the forces acting on truck operators are equal to the product of their mass and their accelerations. Therefore, the determination of acceleration is critical to the evaluation of ride quality. Accelerations are

TYPICAL ACCELEROMETER AND RECORDER LOCATIONS

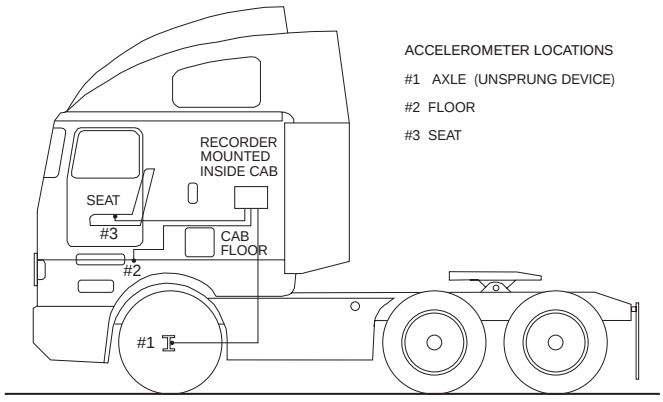


Fig. 1 Instrumentation on Truck Cab

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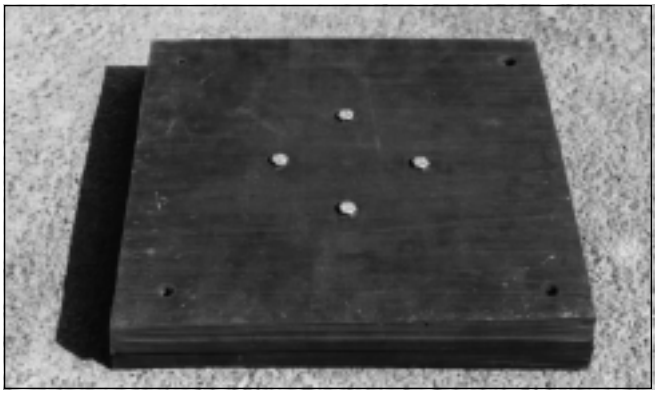
The full text of this SAE Paper, No. 933049, entitled "An Experimental Method for determining Occupant Loading in Heavy Trucks and Equipment" is available by contacting the authors at Triodyne Inc.


Photograph 1– Accelerometer

measured by small devices called accelerometers which can be attached to the seat or other vehicle components of interest, (Photo 1). Acceleration magnitudes are recorded as multiples of the acceleration due to gravity alone (G); e.g., a 5G acceleration. Accelerometers such as shown in Photo 1 are available that are nearly massless and have frequency responses adequate for the desired measurements. The test engineer must take into account that the seat accelerations are nearly static compared to impact types of accelerations seen in other types of testing. Occupant acceleration testing also demands equipment that will measure high frequency vibration.



Photograph 2 – Sit Pad

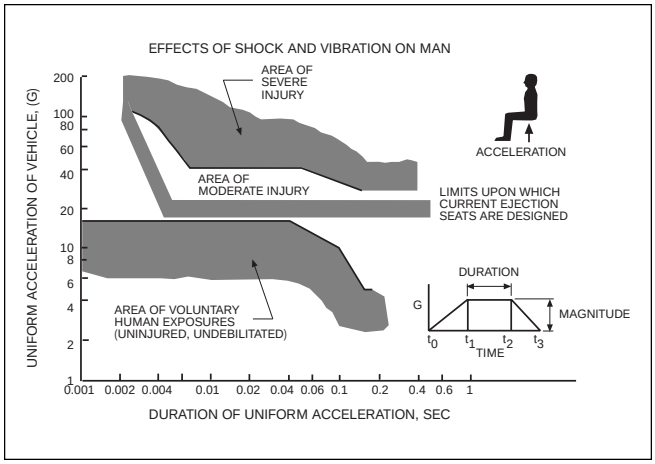



Fig. 2 Biomechanics Chart
(Eiband, M.: NASA Memo 5-10-59E)

Photograph 3 – DAT Recorder

**Whoopi-Cushion (Sit Pad):**
The pad is a cushion with an accelerometer inserted inside (Photo 2). This instrument allows the test engineer to collect seat accelerations by merely sitting on it while driving. The data then flows into a recording system.

**Recording System:**
Because the acceleration recorders will be located within the test vehicles, they must be rugged and insensitive to the motions of the compartment. Currently, the most desirable portable recording system is a digital audio tape (DAT) recorder (Photo 3). DAT's have no detectable adverse response to cab accelerations and can easily be powered by battery. Another advantage of the DAT system is that it easily records voice memos. An audio track of the entire test run can be recorded by using a standard microphone. Data may then be duplicated or played back at a later time. In the field, comparisons can be made if the recorder has a scaled indication of input and output signals. This will verify that the data is being recorded properly. Used with a computer a DAT system can filter and scale the data into engineering units and produce a hard copy of the results.

## BIOMECHANICS

Once data have been acquired, acceleration versus time can be compared to the occupant threshold limits found in Fig. 2. Locating the field data points on Fig. 2 will allow the engineer to determine whether or not the ride quality is acceptable.

## CONCLUDING REMARKS

The ability to go out in the field and conduct tests for ride evaluation purposes is invaluable. This ability removes the doubt associated with computer programs and subjective methods currently in use. The values gained in the field are the actual in-service values for the various components. This direct evaluation method gives the test engineer immediate results which can be used in the study of component interaction or the effects of ride quality on driver fatigue.