

A Brief Survey of Vehicle Seat Test Specifications

John M. Davis
Team Corporation

Copyright © 2000 Team Corporation

ABSTRACT

This document offers a brief overview of some of the vehicle seat vibration test specifications in use today. Specifications for automobile and off-highway vehicles are reviewed and guidelines for test equipment selection presented.

INTRODUCTION

The vehicle seat is primary point of contact between the vehicle operator and the vehicle. As such there is great emphasis on the comfort and durability of the seating system. Seating system manufacturers use a variety of test methods to evaluate and compare the comfort and durability of their products.

While many manufacturers develop vibration test specifications and methods that are proprietary, there are some general test specifications. These specifications are often used in addition to the manufacturer's internal specifications or in lieu of internal specifications when none are available.

For purposes of review, it is convenient to examine test specifications for passenger vehicles and off-highway vehicles separately.

SEAT VIBRATION TEST SPECIFICATIONS FOR PASSENGER VEHICLES

Major passenger vehicle manufacturers have, without exception, developed unique seat testing criteria for their unique vehicle platforms. These specifications are proprietary and are not available for general distribution.

An anonymous overview of one of these specifications does offer some insight into the typical frequency range and test amplitudes used by passenger car manufacturers.

Typical passenger car specifications include vibration in a minimum of three linear degrees of motion. Increasingly manufacturers are requiring seats to be tested under more realistic 6 degree of motion conditions.

The three degree of motion tests vary and amplitude and may be characterized as Normal Road, Rough Road, and Severe Road. Typical power spectral density curves for each road condition are shown in Figures 1-3.

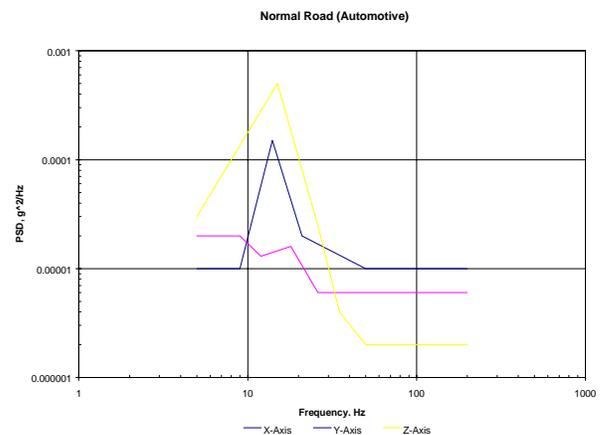


Figure 1: "Normal Road" power spectral density for passenger vehicles.

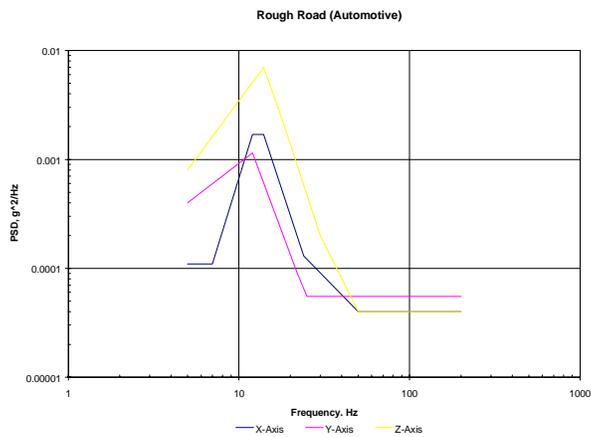


Figure 2: "Normal Road" power spectral density for passenger vehicles.

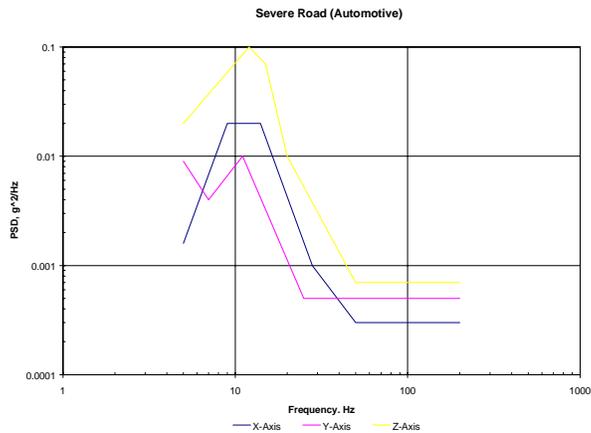


Figure 3: "Normal Road" power spectral density for passenger vehicles.

Tables 1-3 below summarize the PSD's in terms of equipment requirements for G_{rms} , peak velocity and peak to peak displacement.

Normal Road	X	Y	Z
G_{rms}	0.051	0.037	0.064
V_p (in./sec.)	0.411	0.320	0.879
D_{p-p} (inches)	0.012	0.013	0.028

Table 1: Equipment requirements for "Normal Road" PSD.

Rough Road	X	Y	Z
G_{rms}	0.142	0.137	0.253
V_p (in./sec.)	1.648	1.813	3.682
D_{p-p} (inches)	0.049	0.072	0.127

Table 2: Equipment requirements for "Normal Road" PSD.

Severe Road	X	Y	Z
G_{rms}	0.515	0.404	0.989
V_p (in./sec.)	7.482	5.525	15.702
D_{p-p} (inches)	0.256	0.239	0.582

Table 3: Equipment requirements for "Normal Road" PSD.

SEAT VIBRATION TEST SPECIFICATIONS FOR OFF-HIGHWAY VEHICLES

Unlike their passenger car counterparts, the off-highway vehicle industry has produced more generalize, "global" specifications for seat vibration. Chief among these is ISO 7096:1994(E), *Earth-moving machinery – Laboratory evaluation of operator seat vibration*.

In ISO 7096, seat vibrations are defined as spectra whose frequency content and amplitude vary with the type of vehicle and, in some cases, the vehicle activity. These spectra are defined as Classes I through IV and are defined in detail in the ISO specification.

Figures 4 below depicts the PSD's for the four classes defined in ISO 7096. Table 4 presents the equipment requirements based on the four classes.

ISO 7096 Spectra for Earth-moving Machinery

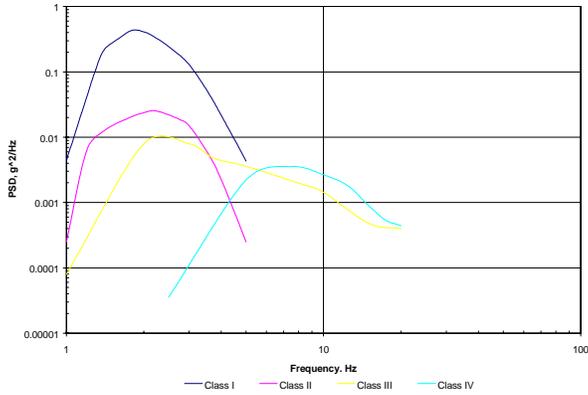


Figure 4: PSD's for off-highway equipment (per ISO 7096:1994(E))

ISO7096	I	II	III	IV
G_{rms}	0.749	0.205	0.196	0.143
V_p (in./sec.)	68.919	17.947	10.100	3.900
D_{p-p} (inches)	12.402	3.184	1.371	0.205

Table 4: Equipment requirements for ISO 7096 PSDs.

FUTURE DIRECTIONS FOR SEAT TESTING

Vehicle and seat manufacturers are demanding more realistic testing of seating systems. Increasingly new test specifications require multiple degrees of motion simultaneously, the use of vehicle motions recorded in the field, and thermal testing combined with vibration.

At least one major passenger vehicle manufacturer is requiring seats to be tested in concert with other vehicle systems with which the seat interacts. This further expands the scope of seat testing.

CONCLUSION

Although differing greatly in amplitude and frequency range, most of the seat vibration specifications for passenger and off-highway vehicles can be performed on a single piece of test equipment.

With the single exception of the ISO7096 Class I requirement, all of the other PSD profiles can be performed on the Team CUBE™ multi-axis vibration test system.

The Team CUBE™ also offers full 6 degree of motion capability to accommodate changing test requirements. Finally, the easy integration of the Team CUBE™ to environmental and acoustic chambers makes it ideal for the new generation of combined-environment seat test specifications.

REFERENCES

1. ISO-7096:1994(E) *Earth-moving machinery – Laboratory evaluation of operator seat vibration.*

CONTACT

For further information, please contact:

Team Corporation
 11591 Watertank Road
 Burlington, Washington 98233
 U.S.A.

Telephone: +1 (360) 757-8601
 Facsimile: +1 (360) 757-4401
 E-mail: sales@teamcorporation.com
 WWW: <http://www.teamcorporation.com>