

University of Washington Ergonomics Program

Whole Body Vibration Exposures: Comparison of a passive and active vibration cancelling semi-truck seat.

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Injury Rates per 100 FTE for Trucking Industry Groups
Compared to All Industries in Washington State

Occupational Injury and Illness in the
Trucking Industry by the Injury Type

The Estimated Average Cost per
Claim and Total Cost for All Claims

Injury Group Type	Last work time claims	
	avg. estimated cost per claim	avg. total cost \$
Vehicles	\$ 46,300	45
Falls from Elevation	\$ 36,700	49
MSD	\$ 29,600	265
Struck by	\$ 27,100	68
Other	\$ 21,500	104
All types combined	\$ 29,500	643

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Sources and Controls for Vehicle Vibration

chassis suspension

cab suspension

seat suspension

tires

Comparison of Seat Suspension Technologies

	Static	Mechanical	Air-Ride	Air or Oil Active	ElectroMech Active
Uses	Many	Many	Many	Ag Construction	Goods Transportation
Cost	Low	Moderate	+Moderate	High	+High
Pros	Low Profile	+ WBV	++ WBV Less Weight Dependent	+++ WBV	+++++ WBV Not Weight Dependent Fast Response
Cons	- WBV	Amplify WBV Weight Dependent	Amplify WBV	Slow Response Currently Off-Road	Currently On-Road

Shortcomings of Air-Ride Suspensions

ideal trajectory

road bumps

actual trajectory

Spring Limitations

spring force F_{s1} on driver

ideal force F_{i1} desired

spring expands pulling driver down

spring compresses pushing driver up

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Air-Ride vs EM-Active Seat

Truck Exposure Measurement Study

16 subjects

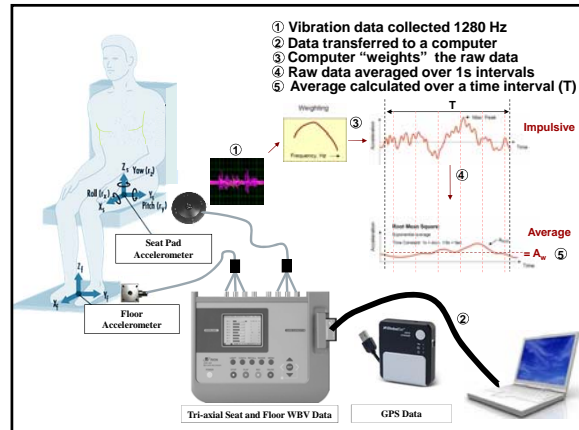
- > Mean age 49 years
- > Mean experience 28 years
- > Mean weight 102 kg (260 lbs)

Drove two loaded flatbed semis

- > Identical trailers and loads
- > Electromechanically (EM-Active) Seat
- > Conventional Air-Ride (Passive) Seat
- > Seats swapped mid-study

Measured WBV at seat and floor

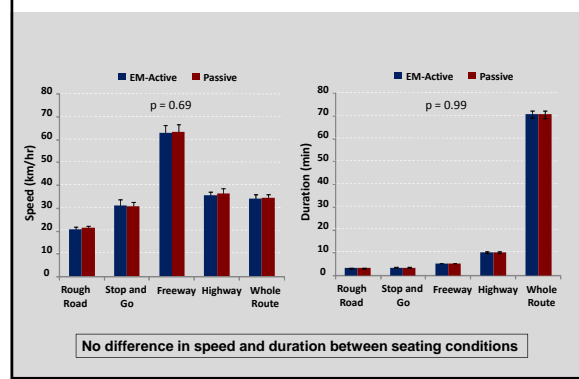
- > Average vibration
- > Normalized to 8 hours of driving - A(8)
- > Differences between seats
- > Difference between seat and floor



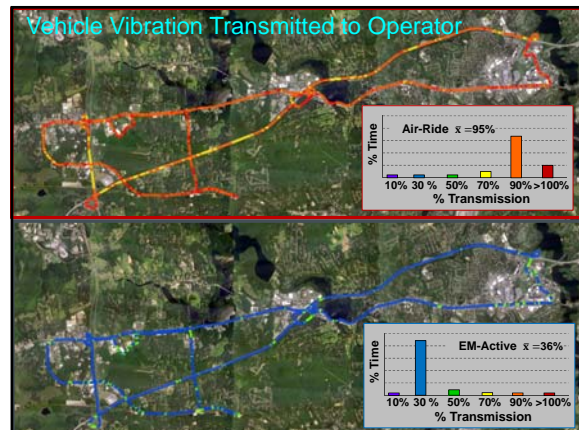
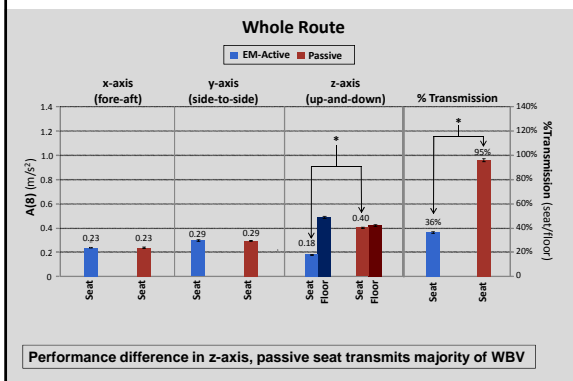
Standardized Route (Framingham, MA, USA)

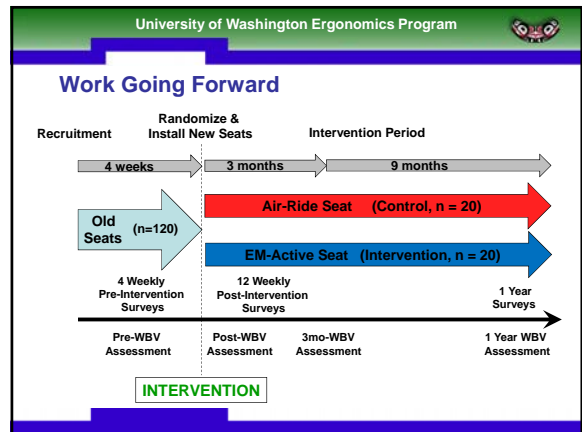
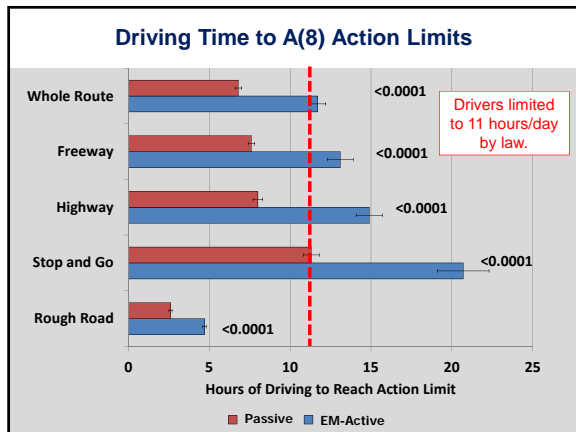


Vehicle Speed and Driving Duration



Vibration Transmitted to Operator





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