Suggested Heavy Vehicle Air Suspension Contribution to Fatal Accident Statistics and Signatures

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Outline

- Introduction
- Methodology
- Observed signatures / statistics
- Postulated vehicle behaviour
- Confluence
- Implications
- Recommendations
- Conclusions
Bogie drive air suspension
Chronology (Aust.)

- Late 1960s  Initial trials
- 1977     PMs : nil air, Trailers 11%, 2% air tandems / tris
- 1983     Dynamic wheel load rpt
- 1987 / 88 Expected widespread introduction
- 1990 (1988) High NSW HV fatality rpt
- 1995     Mel / Syd HV urban accident rpt
- 1998     Operation / driver problems surface
- 1999     Safety / productivity
- 2000     Safety / productivity: vehicle dynamics rpt
- 2008 > productivity ; ongoing fatalities
Typical air suspended prime mover wrecks for sale
Motivation

- Vast handling and operation characteristics differences
- Is there an identifiable accident signature difference?
- Hitherto speed, fatigue & maintenance
- Where’s the evidence Arnie?
- Mounting accident history / data base
- Restrict attention to articulated vehicles
- Became aware of the VicRoads Crashstats (inc. HVs)
Accident Classifications (DCAs) Examined

- Fatal single vehicle on non Melbourne roads
- 120 Head on - non overtaking (prime mover initiated)
- 170 - 174 off carriageway on straight
  - 170 to left +1 into parked vehicle/object
  - 172 to right
  - 174 out of control
- 180 - 184 off carriageway on bend
  - 180 right bend
  - 182 left
  - 184 out of control
Signatures evident (all other factors ignored)

- Narrow windy roads
- Few accidents occur on straights proper
- In and post long sweeping curves
- At or near entry of a subsequent alternate lock curve
- Accident site a short distance from a major route turn or in a grade evident
Examples

Sept 2009  ATRF09 Auckland NZ  McTS
Examples Cont’d
Vehicle details

- Less than 2 years old
- Less than 5 years old
- Other details
Cornering Physics < B

Phase pre B Air Spring Conditions

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Sept 2009  
ATRF09 Auckland NZ  
McTS
Phase B to C Air Spring Conditions

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Cornering Physics B - C
Phase C to D Air Spring Conditions

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Cornering Physics D to E

Phase D to E or F Air Spring Conditions

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Cornering Physics > F

Phase post F  Air Spring Conditions

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Air suspension simplified system variable response to a LS RH curve - 2 HG RHCVs
Air suspension simplified air pressure response to a LS RH curve - 2 HG RHCVs
Driven air suspension simplified air pressure response to a LS RH curve with/out torque application - 2 HG RHCVs
Implications

- Air suspensions exhibit
  - High sensitivity to payload CoG height and speed\(^2\)
  - Variable roll resistance whilst cornering
  - Asymmetrical roll resistance post each curve
  - A ‘memory’ steer effect post each curve
  - Extent is significant post long sweeping curves
  - High risk of loss of control
Implications Cont’d

- Within curve
- Rollover risk (> Pwr)
- Single RHCV - RR <

- Post curve
- Memory steer - RR >
- Darting risk

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Implications Cont’d

- Increased risk of multi vehicle accidents
  - HV exits curve high in lane
  - Driver/s may over correct
A semi-trailer carrying scrap car parts has overturned on the F6 at Gwynneville causing traffic problems in the area.

Police say the fully loaded wheat truck flipped and collided with a car on a sweeping bend on the Dungowan Road east of Tamworth.

It is believed a freightliner semi-trailer truck travelling west lost control on a sweeping right bend and rolled.
A man was badly injured when a milk truck overturned at a notorious Princes Hwy black spot.
Brevity demands

- Strong evidence of statistical / behaviour confluence
- Inadequate time to discuss risk of loss of control associated with power / torque application
- Generally applying power reduces roll resistance
Overriding Implication: Summary

- Standard air suspensions are complex adverse active systems
- Standard driven air suspensions are even more complex adverse active systems
- Possess considerable opportunity for improvement
Desired minimum outcomes

- Formally report if HV accidents involve AS’d vehicles or not
- Report the ASn details
- Apply the identified accident scenarios to future accidents and develop (public) data base
- Apply accident scenarios to past accidents and identify statistics and publish findings
- Expand description of accident site ‘lead in’ route to include signature
- Effect audit of HV fleet
Additiona benefits / outcomes

- Introduce improved driver information / training
- Enforce hardware improvements asap
- Assist identify highway ‘black spots’
- Utilize findings for improved road design
- Eliminate inherent deficiencies before introducing electronic vehicle stability and ABS
Conclusion

• Road safety enhancements will result by improved:
  • understanding of,
  • hardware systems for, and
  • accident reporting requirements for air suspended HVs
HV Road Safety

THANKS

Via the Chair - Any Questions?
ABS & ESC
STOP
Effect improvements before proceeding