Moving Freight with Better Trucks

Auckland, Taupo, Palmerston North, Dunedin, Christchurch

November 2010

Anthony Germanchev
Heavy Vehicles – Team Leader
Australian Road Research Board
Australian experience - vehicle testing
Testing / simulation

Left screen shows a vehicle undergoing a full ‘lane change manoeuvre’ during an ARRB testing program. The driver must follow the yellow markers.

Left screen shows the same manoeuvre using computer simulation. The four white lines represent the maximum “off-tracking” permitted for each level. Note this vehicle does not exceed Level 1 (0.6m).
Left screen shows a vehicle undergoing a full ‘lane change manoeuvre’ during an ARRB testing program. The driver must follow the yellow markers.

Left screen shows the same manoeuvre using computer simulation. The four white lines represent the maximum “off-tracking” permitted for each level. Note this vehicle does not exceed Level 1 (0.6m).
Safety assessment via simulation
40 vehicle configurations across 10 OECD countries
**Classification of vehicles**

**Workhorse vehicle:** < 50 tonnes and < 22 metres, the vehicle most commonly used for long haul transport.

**Higher capacity vehicle:** < 70 tonnes and < 30 metres, typically operated under restricted access conditions.

**Very high capacity vehicle:** $\geq 72$ tonnes and $\geq 30$ metres typically operates under permit conditions and often in rural or remote areas.
Workhorse vehicles (22 in total)

- Australia (1)
- Belgium (1)
- Canada (2)
- Denmark (3)
- Europe (4)
- Mexico (3)
- South Africa (2)
- United Kingdom (3)
- United States (4)
Higher capacity vehicles (13 in total)

- Australia (1)
- Belgium (1)
- Canada (1)
- Denmark (2)
- Germany (1)
- Netherlands (3)
- South Africa (2)
- United States (2)
Very high capacity vehicles (5 in total)

- Australia (1)
- Canada (1)
- Mexico (1)
- United States (2)
Benchmarking measures

• Tracking ability on a straight path (TASP)
• Low speed swept path (LSSP)
• Static rollover threshold (SRT)
• High speed transient off-tracking (HSTO)
• Rearward amplification (RA)
• Load transfer ratio (LTR)
• Yaw damping coefficient (YDC)
Offtracking (HSTO) during lane change

Vehicle path
Australia B-triple (AU3)
Static Rollover Threshold

Minimum safe level
SRT = 0.35

Danmark B-double (DK5)

Lateral acceleration (g)

Time (sec)
Static Rollover Threshold

The graph illustrates the static rollover threshold (g) for various models and categories, categorized into workhorse (green), high capacity (purple), and very high capacity (yellow). The red line represents the threshold for better performance.
Low speed swept path

![Graph showing low speed swept path levels](image)

- **AU1-w**
- **ZA1-w**
- **BE1-w**
- **DK1-w**
- **DK2-w**
- **EU1-w**
- **EU2-w**
- **UK1-w**
- **UK2-w**
- **CA1-w**
- **CA2-w**
- **MX1-w**
- **MX2-w**
- **US1-w**
- **US2-w**
- **US3-w**
- **AU2-hc**
- **ZA3-hc**
- **BE2-hc**
- **DK4-hc**
- **DE1-hc**
- **NL1-hc**
- **NL2-hc**
- **CA3-hc**
- **US4-hc**
- **US5-hc**
- **CA4-vhc**
- **CA6-vhc**
- **US6-vhc**
- **US7-vhc**

**Levels:**
- **Level 1**
- **Level 2**
- **Level 3**

Legend:
- **Workhorse**
- **High capacity**
- **Very high capacity**

Better performance marks are indicated by green arrows.
Load transfer ratio

Better performance

- Workhorse
- High capacity
- Very high capacity
Results summary

Low speed swept path
• Highest correlation with vehicle category
• Only measure where none of the very high capacity vehicles passed the Level 1 requirements
• Manoeuvrability would prevent very high capacity vehicles from accessing the entire road network (i.e. inner urban and city areas)
Results summary (cont)

Static rollover threshold

• Very high capacity and higher capacity vehicles were able to achieve better performance than workhorse vehicles in most instances.

• Typically the very high and higher capacity vehicles comprise more axles for the increase in capacity and have coupling types that improve roll stability.
High speed dynamic performance

• The results were similar for all vehicle categories, indicating that very high capacity vehicles can perform equally or better than some common workhorse vehicles.

• One vehicle from each of categories (including workhorse) that reached critical instability (experiencing wheel lift off or rollover) during this manoeuvre.
Compliance regimes can be enhanced by exploiting technological innovations such as GPS tracking for route access compliance, advanced weigh-in-motion systems to monitor truck loading without the need to stop vehicles at the roadside and the use of remote checking of onboard diagnostic systems.
OECD key findings

Higher capacity vehicles can result in fewer vehicle-kilometers travel and have the potential to improve fuel efficiency and reduce emissions.
OECD key findings

The capacity of the road network is not uniform and road infrastructure and trucks need to be developed in concert.

Optimising the use of higher productivity trucks will involve limiting their access to the network where their use is compatible with strength and geometry of the infrastructure.
Key HV events in Australia

Event 1
• Industry Round Table on Heavy Vehicle Road Freight Transport Outlook
• ARRB Research Report (ARR 377)

Event 2
• Report on HVTT11 International Heavy Vehicle Symposium
• ARRB Research Report (ARR 376) http://www.arrb.com.au
Event 1

- Industry Round Table on Heavy Vehicle Road Freight Transport Outlook
- December 2009
- Theme: Innovation, Access & Partnership, focused on increasing the uptake of HPFV or PBS vehicles.
- Participants: 27 invited from government and industry
- All sectors represented
Sectors represented

- State, territory and federal governments – as regulators, road agencies and/or policy-makers
- Freight customers – users of freight and logistics services
- The freight transport industry – as suppliers of freight and logistics services by any mode
- Local government – as local road agencies and as representatives of community interests
Why is the uptake of high productivity vehicles so low?

Topics
• Policy development
• Regulatory enhancements
• Technology and operational practices
• Advocacy and communication
The white board
Findings from roundtable

- An industry champion
- Improved resources at Local Government
- ‘Green’ savings - reducing environmental impacts
- Greater national consistency
- Engaging the community
- Co-ordinated information and education
Findings from roundtable

- Greater national consistency
- Engaging the community
- Co-ordinated information and education
- Reduce uncertainty – more questions than answers
HVT11 - Summary

- 70 technical papers relating to heavy vehicles
- More than 160 international experts attended
- focusing on the key drivers of change and how these can influence future developments (technology) and government policy
Dr Peter Sweatman discussed the pressures to innovate or not to innovate. Freight growth, safety, environment, energy and climate change were encouraging innovation whereas public perception and funding were factors seen to be inhibiting innovation.
Fuel use and emission reductions

- Reductions in fuel use and emissions were likely to flow from improved engine and drive-train efficiencies, reduced aerodynamic drag and use of regenerative braking (hybrids).

- Major gains in fuel consumption could be achieved including up to 35% by changing logistic patterns i.e. using a tractor-semi-trailer instead of two rigids or using longer vehicles.
Further efficiency gains

- Greater fuel savings (up to 50%) can be achieved by reducing traffic congestion via the following measures:
  - using higher capacity vehicles for the same freight task
  - eliminating night-time curfews on freight deliveries
  - optimising traffic control
  - reducing accidents and delays due to road maintenance
PBS in Australia – Success or Failure?

• The Record:
  – Complex Technical and Policy Framework in place
  – 300 PBS vehicles on the road (Nov 2010)
  – Teething problems

• Some key issues:
  – Too expensive
  – Too restrictive
  – oo exclusive
  – Clumsy system for access approvals
Performance Based Standards improved

- PBS – Improvements?
  - Approve vehicles for general use developed to PBS standards
  - Approval for modular systems of components instead of just single vehicles
  - Classify the road network or have a better system for generating routing approvals (eg. National Bridge database and calculation system)
+13% efficiency

Renault trailer at Lyon Word Truck Forum, May 2009
Simulation example +16% efficiency

Travel speed for all vehicles: 100 km/h

Payload: 30 t

1.5 l/t·100km

1.25 l/t·100km
ARRB Group Ltd

Anthony Germanchev
Heavy Vehicles Team Leader

+613 9881 1620
anthonyg@arrb.com.au
ARRB will be hosting the following conference in 2011:

15 - 18 May 2011, Gold Coast Australia

ARRB Workshops

Auckland
• 4-5 April 2011 - Managed Freeways workshop
• 12 April 2011 - An Introduction to Geotechnical Investigation and Design workshop
• Early 2011 Basic Geometric Road Design workshop

Christchurch
• 7-8 April 2011 - Managed Freeways workshop
• 14 April 2011 - An Introduction to Geotechnical Investigation and Design workshop
• Early 2011 - Basic Geometric Road Design workshop