PBS in Australia under the National Heavy Vehicle Law (NHVL)

Presentation to IPWEAQ

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Principal Engineer
National Heavy Vehicle Regulator (NHVR)
Conventional Australian Articulated Vehicles

Tri axle semi (19m, 42.5t)

B-double (26m, 62.5t)

A-triple road train (53.5m, 122.5t)

A-double road train (36.5m, 79t)
Performance Based Standards (PBS)

- Specify what a vehicle must do, for example: a vehicle must be able to fit within the available road space.
- Vehicle options can be optimised for specific freight tasks as PBS vehicles can be operated outside of the prescriptive standards (different dimensions: length, width, internal, extra mass, improved flexibility).
What is PBS?

• PBS aims to maximise the safe use of higher productivity vehicles by matching the right vehicles to the right roads
• World’s most progressive heavy vehicle design scheme
• HVNL PBS requirements – Alternative to HVNL prescriptive requirements
• Nationally agreed Safety and Infrastructure Standards
• 4 access levels (Level 1-4)

Source: Byford
PBS Development

- 1990’s Public Forums held
- 1999 PBS Commenced its development
- 2005 Interim Regulation Panel used PBS
- Oct 2007 Current form of PBS agreed
- Oct 2007 1st PBS Review Panel meeting
- Sep 2016 42nd PBS Review Panel meeting
- Jan 2013 PBS incorporated into Heavy Vehicle National Law
## Prescriptive vehicle comparison

<table>
<thead>
<tr>
<th>Prescriptive Vehicle</th>
<th>PBS Vehicle</th>
<th>PBS length limits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vehicle</strong></td>
<td><strong>Length</strong></td>
<td>Assessed Vehicle Performance*</td>
</tr>
<tr>
<td>General access</td>
<td>&lt; 19m</td>
<td>Level 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B-Double</td>
<td>&lt; 26m</td>
<td>Level 2</td>
</tr>
<tr>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double road train</td>
<td>&lt; 36.5m</td>
<td>Level 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple road train</td>
<td>&lt; 53.5m</td>
<td>Level 4</td>
</tr>
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</tr>
</tbody>
</table>

*Assessed against PBS Performance Standards that represent 85 percentile performance of comparable prescriptive vehicles*
PBS Performance Standards

- Vehicle Powertrain Standards
  - Startability
  - Gradeability
  - Acceleration Capability
- Vehicle Stability Standards
  - High Speed Dynamic Performance
  - High Speed Transient Off Tracking
  - Rearward Amplification
  - Tracking Ability On A Straight Path
- Vehicle Manoeuvrability
  - Static Rollover Threshold
  - Directional Stability Under Braking
  - Yaw Damping Coefficient
- Vehicle Ride and Handling
  - Low Speed Swept Path
  - Frontal Swing
  - Tail Swing
  - Steer Tyre Friction Demand
- Infrastructure Standards
  - Pavement Vertical Loading
  - Pavement Horizontal Loading
  - Tyre Contact Pressure Distribution
  - Bridge Loading

Source: NTC
Safety Standards

**Startability**
Ability to commence forward motion on specified grade

<table>
<thead>
<tr>
<th>Level</th>
<th>Grade (%)</th>
<th>Speed (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>15%</td>
<td>80</td>
</tr>
<tr>
<td>L2</td>
<td>12%</td>
<td>70</td>
</tr>
<tr>
<td>L3</td>
<td>10%</td>
<td>70</td>
</tr>
<tr>
<td>L4</td>
<td>5%</td>
<td>60</td>
</tr>
</tbody>
</table>

**Gradeability**
Ability to maintain forward motion on specified grade and achieve a minimum speed on a 1% grade

<table>
<thead>
<tr>
<th>Level</th>
<th>Grade (%)</th>
<th>Speed (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>20%</td>
<td>80</td>
</tr>
<tr>
<td>L2</td>
<td>15%</td>
<td>70</td>
</tr>
<tr>
<td>L3</td>
<td>12%</td>
<td>70</td>
</tr>
<tr>
<td>L4</td>
<td>8%</td>
<td>60</td>
</tr>
</tbody>
</table>

**Acceleration Capability**
Ability to accelerate from rest or to increase speed on a road

<table>
<thead>
<tr>
<th>Level</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>20</td>
</tr>
<tr>
<td>L2</td>
<td>23</td>
</tr>
<tr>
<td>L3</td>
<td>26</td>
</tr>
<tr>
<td>L4</td>
<td>29</td>
</tr>
</tbody>
</table>
Safety Standards

Tracking ability on a straight path

The total swept width while travelling on a straight path

- $L_1 \leq 2.9$ m
- $L_2 \leq 3.0$ m
- $L_3 \leq 3.1$ m
- $L_4 \leq 3.3$ m

Low Speed Swept Path

The maximum width of the swept path in a prescribed $90^\circ$ low speed turn

- $L_1 \leq 7.4$ m
- $L_2 \leq 8.7$ m
- $L_3 \leq 10.6$ m
- $L_4 \leq 13.7$ m
Frontal Swing

The maximum lateral outswing of the front outside corner of the prime mover and trailer

- \( L_1 \leq 0.7 \text{m} \)
- \( L_2 \leq 0.7 \text{m} \)
- \( L_3 \leq 0.7 \text{m} \)
- \( L_4 \leq 0.7 \text{m} \)

Tail Swing

The maximum lateral outswing of the outside rear corner of the truck or trailer as the turn commences

- \( L_1 \leq 0.3 \text{m} \)
- \( L_2 \leq 0.35 \text{m} \)
- \( L_3 \leq 0.35 \text{m} \)
- \( L_4 \leq 0.5 \text{m} \)
**Safety Standards**

**Steer Tyre Friction Demand**

The maximum steer tyre friction used in a prescribed low speed turn

- \( L_1 \leq 80\% \)
- \( L_2 \leq 80\% \)
- \( L_3 \leq 80\% \)
- \( L_4 \leq 80\% \)

**Static Rollover Threshold**

The steady state level of lateral acceleration that a vehicle can sustain during turning without rolling over

- \( L_1 \geq 0.35\text{g} \)
- \( L_2 \geq 0.35\text{g} \)
- \( L_3 \geq 0.35\text{g} \)
- \( L_4 \geq 0.35\text{g} \)

Note – 0.4g for DG
Safety Standards

Rearward Amplification

Measures the “whip crack” effect of a lane change manoeuvre

\[ \begin{align*}
L1 & \leq 5.7 \times SRT \\
L2 & \leq 5.7 \times SRT \\
L3 & \leq 5.7 \times SRT \\
L4 & \leq 5.7 \times SRT
\end{align*} \]

High Speed Transient Off-Tracking

The lateral distance that the last axle on the rear trailer tracks outside the path of the steer axle in a sudden evasive manoeuvre

\[ \begin{align*}
L1 & \leq 0.6 \text{m} \\
L2 & \leq 0.8 \text{m} \\
L3 & \leq 1.0 \text{m} \\
L4 & \leq 1.2 \text{m}
\end{align*} \]
Safety Standards

Yaw Damping Coefficient

The rate of decay of the “sway” from the rearmost trailer after a single pulse steering movement

L1  >=0.15
L2  >=0.15
L3  >=0.15
L4  >=0.15

Direction Stability under Braking

The ability of a vehicle to remain stable, controllable and kept within its lane during heavy braking
Infrastructure Standards

Pavement Vertical Loading

The degree to which vertical forces are applied to the pavement

Bridge Loading

The maximum effect on a bridge measured relative to a reference vehicle

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3/4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$M = 3L + 12.5$</td>
<td>$M = 3L + 12.5$</td>
<td>$M = 3L = 12.5$</td>
</tr>
<tr>
<td>$M &lt; 42.5$</td>
<td>$M &lt; 46.5$</td>
<td>$M &gt; 46.5$</td>
</tr>
<tr>
<td>$M = L + 32.5$</td>
<td>$M = 1.5L + 29.5$</td>
<td></td>
</tr>
<tr>
<td>$M &gt; 42.5$</td>
<td>$M &gt; 46.5$</td>
<td></td>
</tr>
</tbody>
</table>
Infrastructure Standards

Pavement Horizontal Loading

The degree to which horizontal forces are applied to the pavement

Tyre Contact Area

The degree to which tyre contact pressure is distributed over the pavement
The PBS Process

- Accredited PBS Assessors assess design/concept
- Design/concept reviewed by an independent advisory Performance Review Panel (PRP)
- NHVR issues Design Approval (DA) for approved design/concept
- Accredited PBS Certifiers confirm built vehicle complies with DA
- NHVR issues Vehicle Approval (VA) for certified vehicles
- Access by Permit or Notice
# Four levels of road access

<table>
<thead>
<tr>
<th>PBS road class</th>
<th>Equivalent prescriptive access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 access (L1)</td>
<td>![Level 1 Access Diagram]</td>
</tr>
<tr>
<td>Level 2 access (L2)</td>
<td>![Level 2 Access Diagram]</td>
</tr>
<tr>
<td>Level 3 access (L3)</td>
<td>![Level 3 Access Diagram]</td>
</tr>
<tr>
<td>Level 4 access (L4)</td>
<td>![Level 4 Access Diagram]</td>
</tr>
</tbody>
</table>
Matching vehicles to the roads

Vehicle performance

Level 1

Level 2

Level 3

Level 4

Access to the road network
Route assessment

- Managing road characteristics in accordance with aspects of vehicle performance that relate to access

- Road and bridge widths
- Overtaking provision
- Entry length onto main roads and highways
- Approach visibility
- Vertical (overhead) clearance
- Off-road truck parking
- Roadside infrastructure

- Acceleration performance
- Turning performance
- Road space requirements
The route assessment process

A particular route or set of routes is defined

Road/route data is collected or collated

Route assessment guidelines are applied

The access Levels are determined

Lane width
Shoulder width
Grade
AADT volume
Intersections

Level 1
Level 2
Level 3
Level 4
Route assessment tools

- Ministerial Guidelines for Granting Access
- PBS Scheme – Network Classification Guidelines
- PBS Network Classification Guidelines for Local Government
- ARRB Online Restricted Access Vehicle Route Assessment Tool (RAVRAT)
Vehicle Comparisons

Truck and 4 axle dog trailer
Maximum length 19m
Maximum mass 50.5t
General access under notice

PBS truck and 4 axle dog trailer
Maximum length 20m
Maximum mass
• Level 1 – 50.5t
• Level 2 - 56t GML, 57.5t CML

19m B-double
Maximum length 19m
Maximum mass under notice
• General access – 50.5t
• B-double routes - 56t GML, 57.5t CML
# ATA Truck Impact Chart


<table>
<thead>
<tr>
<th>Vehicle</th>
<th>GCM</th>
<th>Trips per 1000 tonnes</th>
<th>ESAs per 1000 tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 axle truck</td>
<td>23t</td>
<td>74</td>
<td>347</td>
</tr>
<tr>
<td>Prime mover triaxle semi (GML)</td>
<td>43t</td>
<td>42</td>
<td>304</td>
</tr>
<tr>
<td>Prime mover triaxle semi (HML)</td>
<td>46t</td>
<td>37</td>
<td>268</td>
</tr>
<tr>
<td>3 axle truck and 4 axle dog trailer (19m)</td>
<td>50.5t</td>
<td>30</td>
<td>234</td>
</tr>
<tr>
<td>PBS 3 axle truck and 4 axle dog trailer – Level 2 (GML)</td>
<td>56t</td>
<td>26</td>
<td>259</td>
</tr>
<tr>
<td>19m B-double (GML)</td>
<td>56t</td>
<td>28</td>
<td>278</td>
</tr>
<tr>
<td>PBS 3 axle truck and 4 axle dog trailer – Level 2 (CML)</td>
<td>57.5t</td>
<td>25</td>
<td>249</td>
</tr>
<tr>
<td>19m B-double (CML)</td>
<td>57.5t</td>
<td>25</td>
<td>249</td>
</tr>
<tr>
<td>BAB Quad - HML</td>
<td>130.5t</td>
<td>12</td>
<td>162</td>
</tr>
</tbody>
</table>
Impacts on community

- Community acceptance and support for PBS and High Productivity Vehicles (HPVs) is critical
- Most people unaware that PBS vehicles are operating within their communities
- Reduction in “freight exposure” means less truck movements
- Benefits of lower noise, emissions, hours of operation and accidents
- A potential benefit of up to 10% reduction in road maintenance costs
Questions