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## Heavy vehicle modifications — key requirements

manufacturer's specification. There are some modifications in the grey zone such as beacon lights installed on the cab roof or the status lights on trailer refrigeration units.

**What are the heavy vehicle standards?** These are technical rules and mass and dimensional limits that are in (a) the Australian Design Rules (ADRs), the Heavy Vehicle National Law and its Regulations (or state law for Western Australia and Northern Territory) and any state/territory registration requirements that get published in a government gazette. Requirements in mandated codes of practice should also be assumed to be HV standards. There are other technical standards that may be applicable to plant equipment that may be installed onto a heavy vehicle. These arise from the occupational work health and safety regulations in the state/territory jurisdictions. For example, vehicle loading cranes, DG tanks and some tip truck hydraulic systems must satisfy work-safety technical standards. Large air tanks could be prescribed pressure vessels. The AVE cannot issue these approvals.

**Can the manufacturer's dealer approve modifications?** No. A dealer is legally required to obtain an approval certificate for modifications conducted to new vehicles before first registration. For example, if you purchase a tray truck or a new tip-truck and tip-trailer from an OEM truck dealer, approval certificates should be provided. These requirements were not enforced until a couple of years ago. This has created a significant increase in demand for AVE services.

**When should the AVE get involved?** Before work starts. This seems obvious but is commonly not done. Getting an AVE at short notice when work is finished is likely to be difficult. Great frustrations will occur for the

owner. The AVE should oversee the modification, do some calculations, and check the plans or sketches beforehand. That way, the work will proceed smoothly.

**What documents are required?** There should be dimensioned plans, drawings or sketches. The modifier should keep a technical file that fully describes the modification, identifies applicable technical standards, and justifies the design against vehicle standards. The technical file should be available to the AVE but need not be provided. Take many photos when the modification work is being done!

**Are there any general strength requirements in VSB 6?** Yes. Code J, Body Attachments and Code H, Chassis Modifications specify a general Factor of Safety for strength members of at least 3. For point loads such as tip-body pivots, the Factor of Safety should be at least 6. The Factor of Safety is based upon maximum static loads and referenced to the yield strength(s) of the structural materials. Permanent distortion occurs at yield strength. An unwritten law for chassis and subframe design is: Make only gradual changes to strength in a highly stressed region. Strength transition avoids stress concentration.

**Body attachment requirements:** Most rigid trucks have a tray, body or tank attached. There are no technical standards in the design rules (ADRs) or in VSB 6 for the tray, body or tank. Because of this the body does not require an approval. For example, there is no approval code for the structural integrity of a body or a tank. The attachment of the body does need an AVE approval, because these are rules relevant to dimensions, lights and general safety. A key consideration is the strength of the chassis ladder in conjunction with the body subframe. Calculations are needed to show

that the chassis ladder is adequately strong. VSB 6 does not explicitly consider dynamic loads. It is assumed that a static Factor of Safety of 3 will be adequate to cope with these undetermined dynamic loads. The AVE should question this assumption. Twisting of the chassis ladder just behind the cabin can be excessive because there is often a short unreinforced section of the chassis ladder between the stiff subframe and the stiff cabin cross member and transmission mounts. 'Torsional stiffness' mainly arises from structural elements positioned above or below the chassis ladder. VSB 6 provides guidance that the forward body-chassis attachments should be flexible so that the twist is spread. No requirement to calculate torsional stiffness exists in VSB 6, but a successful design will transition the torsional stiffness. Another problem is that fatigue failure sometimes occurs in chassis ladders. Fatigue failure can occur at much lower stress levels than yield stress.

**Can U-bolts still be used?** A question that often comes up is whether bodies and trays can be attached using U-bolts. VSB 6 allows U-bolts if a 'strength tube'

is used to prevent the c-section of the chassis rails from distorting. Also, two diagonal brackets are needed on each rail to prevent the body from rocking back and forward. I prefer to see bodies attached by side plates with a forward flexible (external) bolt-down mount. Can high-strength chassis rails be safely extended? Cutting, extending and rewelding a high strength chassis rail can be done by a specialist modifier. The rail should be cut on an angle and the join should be away from any crossmember. The inserted chassis rail section should be the same steel as the original rail and the rails will need to be pre-heated and then welded by an accredited welder. An added rail reinforcement will always be needed and this should overlap the join by at least 500mm. Don't forget to transition its strength!

**What about the pulling forces applied by a towbar or drawbar?**

A truck or trailer with a heavy-duty towbar also needs a heavy-duty chassis ladder at the back, or for a trailer drawbar, strength at the front. The design needs to allow for the additional pulling loads. A guide to these is the test forces for towbars and drawbars

specified in ADR 62. Calculations are required. For trucks, the rear suspension rail reinforcement will probably need to go right back to the towbar.

**How can brake system modifications be proven?** Brakes are complicated! Changes of brake set-up including using non-genuine linings could be a modification! VSB 6 provides little guidance about how to certify significant brake system changes. If an axle is added or substituted, brake calculations are needed. Continued compliance with the design rules must be proven. The ARTSA brake calculator provides a tool that could be used — see my July 2023 article. Changes to advanced (smart) brake systems will probably require help from the brake supplier's specialist. The AVE probably can't do this work.

Operators need to have a basic understanding of the legal requirements for two reasons – 1. to stay legal and 2. to avoid insurance disputes. If a HV has been modified, there should be modification plate affixed to it. Keep it safe!

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Chassis compliance details can be found under VSB Section 6.