

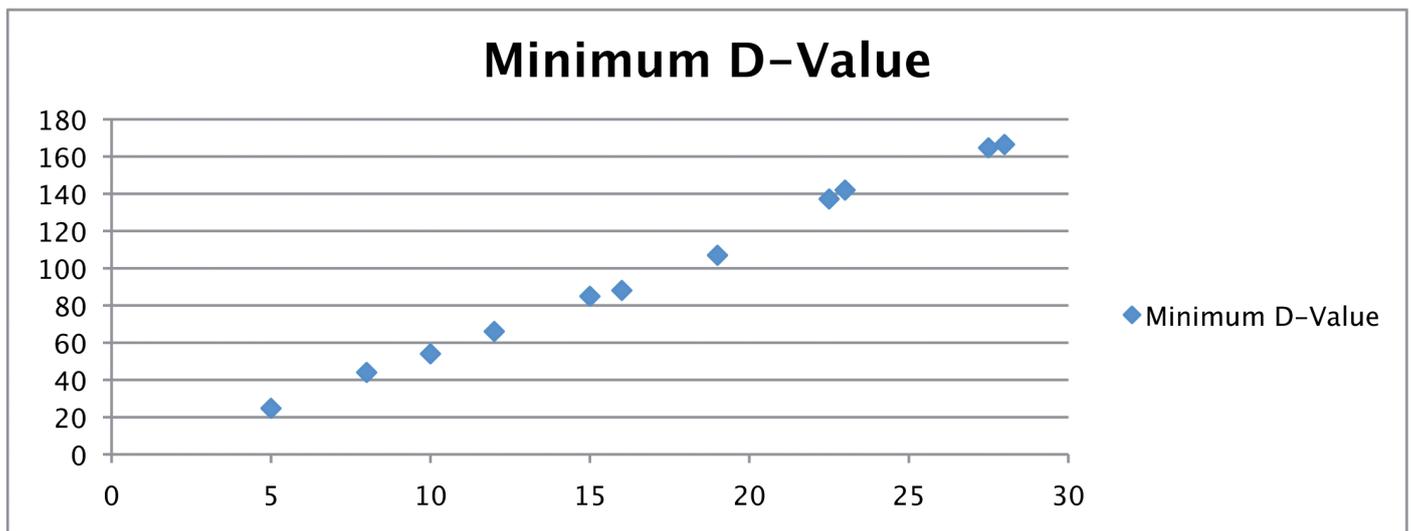


Towing ratings of vehicles and couplings

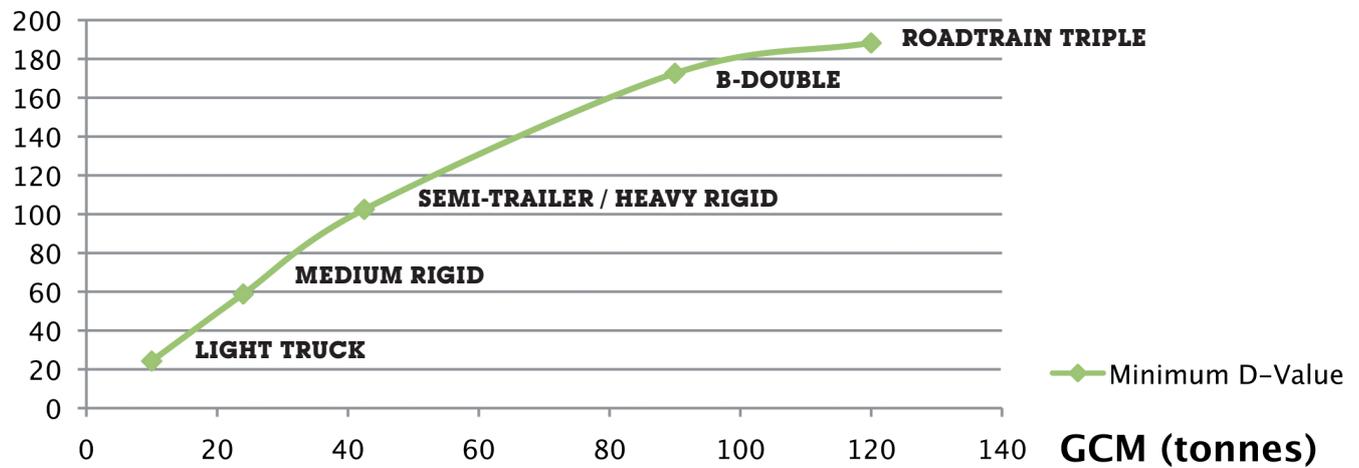
Manufacturers of commercial vehicles must establish a gross vehicle mass rating and a towing rating. The gross vehicle rating (GVM) is the total weight of the laden vehicle that the manufacturer certifies complies with the Australian Design Rules (ADRs). The manufacturer declares the GVM, having considered the axle and chassis ratings and the test weight at which compliance with the braking rule, ADR 35, has been confirmed. Sometimes vehicle manufacturers declare a relatively low GVM for marketing reasons, such as keeping a vehicle in a particular registration category (e.g. less than 4.5 tonnes). You will find the GVM on the compliance plate. The towing rating is another important

rating that the vehicle manufacturer must declare. The towing rating is declared by using the engine and power train capacity, the strength of the towbar and the rating of the mechanical coupling. There are no start-ability and grade-ability specifications, or engine capacity requirements in the ADRs, but these may be in state road agency permit conditions applicable to multi-combination vehicles. Some state permit-requirements are not obligations on the vehicle manufacturer. The compliance plate does not contain the towing rating or the Gross Combination Mass (GCM – which is the sum of the GVM and the towing rating). This can be found on the manufacturer's heavy vehicle information plate which, by ADR requirement, must be affixed to every heavy truck. A trailer information plate is also required. This states the Aggregate Trailer Mass (ATM), which is the total maximum permissible weight of the laden trailer. For a trailer, the difference between the ATM and the Gross Trailer Mass (GTM) is the maximum vertical static weight that the trailer can impose on to the towing vehicle.

The problem is that the towing rating (or GCM) that is on the information plate, may over-estimate these ratings in many instances. There are two reasons for this: firstly the ratings do not take account of the start-ability and grade-ability requirements that might be permit conditions. Secondly, the rating of the mechanical coupling/towbar/drawbar might not have been considered. Incidentally, you can usually find the manufacturer's declared GCM for a truck or ATM for a trailer at http://rvcs-prodweb.dot.gov.au/pls/wwws/pubrvcs.Notify_Search. Search on the vehicle make and model and then look at the Road Vehicle Descriptor (RVD) or approval letter. It is common practice for vehicle manufacturers to deliver new vehicles to dealers without the mechanical tow coupling being installed. The dealer arranges for the installation, considering the intended application and the customer's preference. Coupling installers need to consider the strength of the towbar/drawbar and the rating and certification of the coupling before



Minimum D-Value (kN)



installation. These strength ratings must exceed the towing rating, otherwise the vehicle towing rating should be down-rated to match the coupling/towbar/drawbar ratings.

Mechanical couplings must be certified to comply with ADR 62, Mechanical Couplings. The coupling manufacturer is required to obtain a specific approval for the mechanical tow coupling, which is called a Component Registration Number (CRN). If the supplier cannot quote a coupling CRN, then beware. The CRN can be checked out at the RVCS website quoted above.

The coupling CRN is issued at the tow rating that the coupling manufacturer has established by tests. Unfortunately, the RVCS website does not state the ratings. The coupling supplier should be able to quote the D-value (which is a horizontal force rating), the S-value (which is the maximum vertical load) and maybe the V-value, which is the vertical rating for fixed drawbar applications.

The D-value is established by fatigue tests at 60 per cent of the declared pulling level. So, if the D-value is 200kN, then the coupling manufacturer has had fatigue testing done at 60 per cent of 200 kN. The oscillating test force is about $0.6 \times 200 / 9.8061 \sim 12$ tonnes pulling force. Surprisingly, rule ADR 62 does not require an ultimate strength test.

The minimum D-value for a towing application depends on the mass of each

vehicle part. The minimum D-value is calculated using the formula:

$$\text{Minimum D-value} = 9.8061 \times M_{\text{towing}} \times M_{\text{towed}} / (M_{\text{towing}} + M_{\text{towed}})$$

To work this out, the gross masses M of both the towing and the towed vehicles need to be known. The graph below estimates the minimum D-value for a range of configuration types.

The coupling S-value is the maximum static weight (in kilograms) that can be rested on the coupling. For some couplings, such as a fifth wheel, the coupling mechanism does not feel the weight because the skid plate takes it. For hook couplings (pintles and automatic pin couplings) and ball couplings, the coupling mechanism does take the weight. A vertical dynamic rating, as well as a D-value, is needed if the vertical load bears on the coupling mechanism. The vertical dynamic load rating of a coupling mechanism is called the V-value. It is determined by fatigue testing above and below the S-value weight. A coupling that is intended for a fixed-drawbar

“Installers need to consider the strength of the towbar/drawbar before installation”

application should have a V-value rating. The minimum V-value rating is $9.806 \times S$ -value. If no V-value has been certified, then the maximum towing load is 3.5 tonne.

If a fifth wheel is mounted onto a turntable, there is a complication. The CRN number is issued for the fifth wheel, or maybe for the fifth wheel in combination with the turntable, but not for a turntable alone. It is not technically legal to mount supplier A's fifth wheel onto supplier B's turntable because they have never been fatigue tested together. An engineer who might be required to certify the towing rating of a vehicle must determine the minimum certified rating taking account of the towbar (or drawbar) strength, the coupling D-value and V-value ratings, the CRN number status and the vehicle manufacturer's towing rating. Often, the assessed GCM rating is less than the vehicle manufacturer's declared value. For example, a medium rigid truck that has a 70mm towball coupling with $D=75$ kN and no V-value, has a 3.5 tonne towing rating irrespective of the OEM's towing rating and the implied GCM in the graph.