Modifications can dramatically reduce the strength of a vehicle's structure, and additional strengthening may be required to restore the structural integrity. This fact sheet is intended as a guide for those who wish to undertake structural alterations to a motor vehicle or are building a one-off new construction vehicle. An example of a structural alteration would be the changing of a vehicle's wheelbase measurement, or the removal of a vehicle roof section.

As these modifications can dramatically reduce the strength of the vehicle structure, additional strengthening may be required to restore the structural integrity. Subsequent strengthening may result in extra stiffness in certain areas but overstressing in others. Consequently, it becomes necessary to demonstrate that the modified vehicle's beam and torsional strengths are adequate when compared to the original vehicle. This specification contains a very simplified test procedure in terms of vehicle structural analysis and, as such, the results of testing may be taken only as a guide to the structural integrity of the vehicle. For this reason absolute values should not be derived from the results.

It remains the modifier's responsibility to ensure that the structure and safety of the vehicle are not prejudiced by the modifications. Any subsequent structural failure of the vehicle in service as a direct consequence of the modifications shall be the responsibility of the modifier.

Test procedures

Loading
The unmodified vehicle shall be weighed prior to testing to determine its unladen mass. The gross vehicle mass (GVM) is to be determined by adding the unladen mass to the payload capacity of the vehicle. In the case of a passenger carrying vehicle the payload shall be 68kg for each seating position.

Jig
The vehicle to be tested shall be safely supported for loading up to the specified values. It shall be mounted through the hubs, with its springs and dampers made incompressible or replaced by spacers. Figure 1a indicates the preferred mounting of the vehicle for beam and torsion tests. Rear supports must be able to resist the up thrust for the torsion test. Other methods of supporting the vehicle will be considered as long as the support points are not located within the wheelbase.

Further information
Call 1300 882 248
Visit sa.gov.au
Email dpti.vehiclestandards@sa.gov.au
Beam test procedure
Step 1 - With vehicle mounted securely, load the vehicle in accordance with Step 3 to settle the apparatus and check that it functions correctly. No readings of deflection need be taken for this preload.
Step 2 - Remove loading required in Step 1 and 'zero' all gauges.
Step 3 - A load equivalent to twice the payload (i.e. 68kg x 2) shall be applied at each seating position.
Step 4 - Record deflections.
Step 5 - Remove load.
Step 6 - Record deflections again.

Torsion test procedure
Step 1 - reload the vehicle, as per Step 1 of the beam test procedure. (If this test follows immediately after the beam test, the preload will not be necessary).
Step 2 - 'zero' all gauges.
Step 3 - Apply a turning moment of 25% of GVM x wheel track.
Step 4 - Record deflections.
Step 5 - Remove loading.
Step 6 - Record deflections again.

Test data, loadings, etc. are to be recorded on the standard test reporting forms supplied in this Fact Sheet.

Data recording
A graphical plot of the average of the deflection of the left and right hand sides at each measuring location along the wheelbase with the applied load, and again with the load removed, shall be provided for each vehicle.
A plot of the vehicle's angular deflection at each measuring location along the wheelbase with the load applied, and after the load has been removed, shall also be provided.
Beam deflection plots are to be reduced to a zero datum line through points 'R' and 'F' to eliminate the contribution of jig movement, etc. in absolute values. Angular deflections are to be similarly reduced by subtracting the rotation measured in the plane 'RR-LR' from each absolute rotation value.

Acceptable criteria - guidelines
These figures are generally accepted but the Vehicle Standards Section may vary these standards for any vehicle or modification type for which they are shown to be inappropriate.

Convertible Vehicles
Beam strength criterion:
The average deflection of left and right hand sides from the datum line 'RF' (under the maximum applied load) at any measuring position for the modified vehicle shall not be greater than 1.5 times the deflection recorded for the unmodified vehicle.
Torsional strength criterion:
The reduced angular deflections (under the maximum applied load) at any measuring position for the modified vehicle shall not be 1.5 times the angular deflection recorded for the unmodified vehicle at the same measuring position.

Extended wheelbase sedans
The beam and torsional deflection of the modified vehicle should increase approximately in proportion to the increase in wheelbase.

Note: All hinged panels are to be ajar at all times. Fuel tank to be filled to 75% capacity.
Beam and torsion test reporting forms

Test conducted by: ........................................................................................................

Signature: .......................................................... Date: ....................................

Vehicle Standards Section

Date: ........................................................

File reference No: ........................................ Test No: ....................................

BEAMING TEST

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Deflection-Load applied (mm)</th>
<th>Deflection-Load removed (mm)</th>
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<tbody>
<tr>
<td></td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
<td>R</td>
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<td>0</td>
</tr>
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<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Deflections reduced to datum line through points R and F.
Beam test reporting form

Loading Details

**Beaming Deflection**

- **Vehicle Mass**: .......................................................... kg
- **Number of Seating Positions**: .............................................
- **Total Load Applied**: ........................................................ kg
- **GVM (or Vehicle Tare Mass + Load)**: ................................... kg

**Torsion**

- **Vehicle Track - Front**: ....................................................
- **Rear**: .............................................................................
- **Load Applied**: ................................................................. kg
- **Moment Arm (from vehicle centre line)**: ............................ m
- **Applied moment**: .......................................................... Nm

**Make** .......................................................... **Model** .......................................................... **Year of Manufacture** ..........................................................