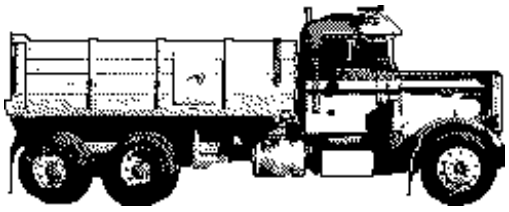
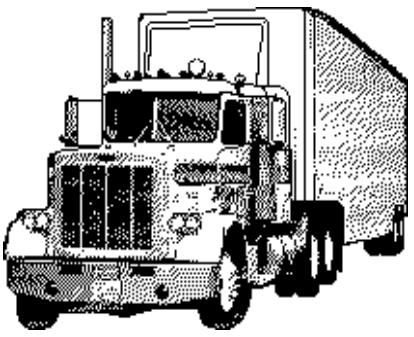
Section H

CHASSIS FRAME





HEAVY VEHICLE MODIFICATIONS

1. SCOPE

This Section relates to modifications made to the chassis frames of heavy vehicles. In addition to modifications made directly to the chassis frame, it lists, and where appropriate details, requirements for modification of other parts of the vehicle made necessary by frame modification.

Any wheelbase, GVM or other chassis related change could alter other characteristics of the vehicle in various ways. The primary aim of this Section is, therefore, to ensure that compliance with basic safety standards is maintained for the complete vehicle.

Adherence to the Section, for changes beyond the limits of the vehicle manufacturer's recommendations does not ensure that other problems will not arise.

2. GENERAL INFORMATION

As the chassis frame forms the backbone of a heavy vehicle, its principal function is to safely carry the maximum load for all designed operating conditions. It must also absorb engine and driveline torque, endure shock loading and accommodate twisting on uneven road surfaces. To achieve a satisfactory performance, the construction of a heavy vehicle chassis is the result of careful design and rigorous testing. Consequently, a modification to the chassis frame should only be attempted after consultation with the vehicle manufacturer or engineer experienced in commercial vehicle chassis modifications to ensure that the proposed modification will not be detrimental to the vehicle's safety or performance.

Because various manufacturers have individual design concepts and different methods of achieving the desired performance standards for the complete chassis, not all chassis components are interchangeable between various makes and models of vehicles.

Due to the complexity of the variation in chassis design and because the major application of this section is for medium to heavy goods vehicles (NB and NC category vehicles), the information supplied is orientated to suit the type of chassis used on these vehicles.

It should be noted that this 'ladder' type of frame construction is designed to offer good downward support for the body and payload and at the same time provide torsional flexibility, mainly in the region between the gearbox cross member and the cross member ahead of the rear suspension. This chassis flexing is necessary because a rigid frame is more likely to fail than a flexible one that can 'weave' when the vehicle is exposed to arduous conditions. A torsionally flexible frame also has the advantage of decreasing the suspension loading when the vehicle is on uneven surfaces.

3. ADR's AFFECTED

No checklist of ADR's can be provided as nearly all chassis modifications are carried out as a result of other vehicle modifications, which themselves affect the vehicle's continuing compliance with ADR's. It is then necessary to review every ADR that is applicable to the vehicle and determine whether the modified vehicle is capable of complying. This should be done before any chassis modification is commenced.

4. AFFECTING MODIFICATIONS

The more common reasons for chassis modifications are:

- Increased or decreased wheelbase;
- Increased front and rear overhang;

- Increased GVM; e.g. additional axles;
- Special body requirements e.g. low load height;
- Increased localised loading due to special equipment such as hoists, cranes or large fuel tanks.

5. GENERAL REQUIREMENTS

5.1 Using This Section

As this section only specifies the chassis requirements, it should be used in conjunction with other relevant sections of this National Code of Practice to ensure that the complete vehicle is modified to a satisfactory standard.

5.2 Preferred Approach

It is recommended that the specifications of the modified vehicle should remain within the options offered by the first manufacturer. Should a modified vehicle be different to the standard manufacturer's specifications, the chassis must at least satisfy the minimum requirements in 5.3 below.

5.3 Minimum Requirements

The following minimum requirements apply to all frame modifications:

- All additional material used for modifying the frame rails should be of the same dimensions and material specifications (It is recommended that original manufacturer's frame rail material be used if available).
- All fabricated sections of the chassis frame rail and components must have suitable radiused bends and be free from cracks, notches and imperfections.
- Holes should not be drilled in the flanges of the frame rail unless it is the practice of the vehicle manufacturer. All attachments should be fastened to the web of the chassis.
- All holes must be drilled. Flame cut holes are not allowed.
- Hole centres are to be no closer than 50mm or three times the diameter of the largest hole, whichever is the lesser.
- Hole diameters must not exceed the bolt diameter by more than 1.0mm.
- Holes should not be elongated.
- For additional or relocated cross members, the original manufacturer's design maximum spacing, strength and attachment strength should be maintained.
- It is recommended that attachments to the frame rail be fastened by bolting and not by welding.
- All bolts for structural purpose must be 'high tensile', ISO Metric Grade 8.8 or 10.9 (or SAE Grade 5 or 8) using the original manufacturer's practice as a guide for bolt diameter selection. Bolts used to secure suspension hangers and brackets to frame rails must be ISO Metric 10.9 (or SAE Grade 8). Fitted bolts are preferable but not essential. 'Huck' bolts may be used for fastening chassis components. Note: It is recommended that the use of countersunk bolts be avoided.

- All structural bolts should be fitted with suitable washers or doubling plates with self locking nuts. Spring type washers are not allowed on structural members.

- All bolts and locknuts that are removed should be replaced with new bolts and locknuts of the correct size and grade, except when a vehicle is modified from new – i.e. before going into service - in which case new locknuts only may be needed. Note that manufacturer's re-useability limitations on nuts must be observed.

- All bolts must be tightened to the correct torque.

- All modified frame rails should be straight and square prior to assembly. Bowed frame rails should not be straightened by assembly of the frame.

5.4 Frame Rail Reinforcement

The following requirements apply to frame rail reinforcements:

- Reinforcements should not be terminated within a distance 2H from the centre of a spring hanger (H = the frame rail depth) unless contrary practice is adopted by the vehicle manufacturer. Typical details for terminating reinforcement are shown in Figure 1.

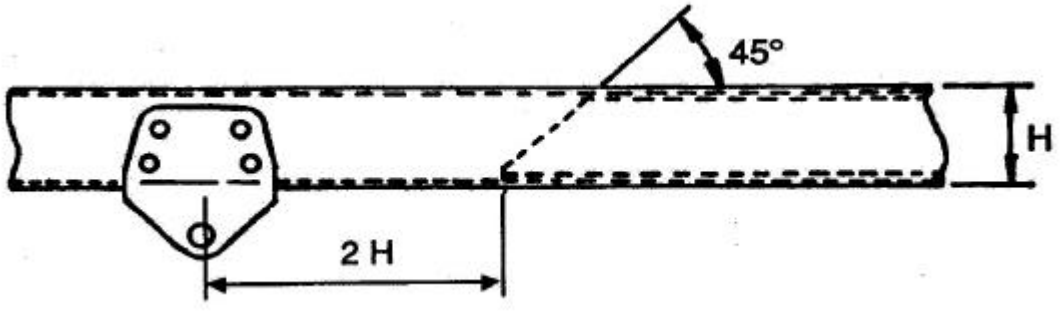


Figure 1

- The reinforcement section should extend a distance of at least 2H past a frame rail join.

- It is preferable that additional reinforcement should extend at least a distance of 2H forward of the rearmost front spring hanger bracket and rearward past the rearmost rear spring hanger bracket by a distance of 2H. Note: Allowance must be considered for associated components that would be displaced by the reinforcement section.

- Each end of a reinforcement should be tapered at 45 degrees, or alternatively, a ‘frog-mouth’ tapering may be used. Typical frog-mouth details are shown in Figure 2.

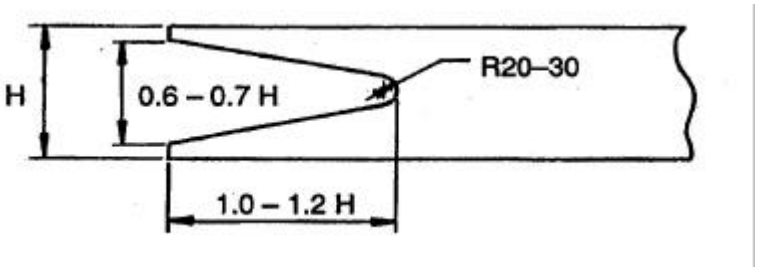


Figure 2

- The thickness of each reinforcement must not exceed the thickness of the main frame rail.
- The reinforcement section should be either angle or channel. Reinforcements may be located inside or outside the main chassis frame rail.
- All reinforcements must be securely attached to the main frame rail. It is recommended that reinforcements be fastened by bolting. Existing bolt holes should be used where possible.
- Inside radius Ro of outer reinforcement curvature must be smaller than outside radius ri of chassis frame curvature (Outside radius ro of inner reinforcement curvature must be larger than inside radius Ri of chassis frame curvature). (Refer to Figure 3).

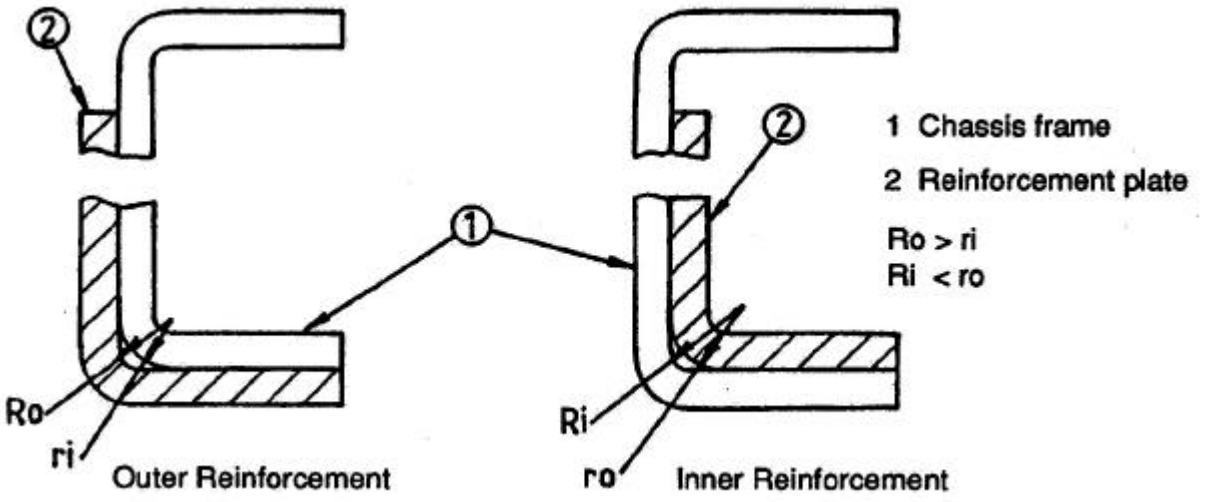


Figure 3

- Multi-Section Reinforcement. When a chassis is to be upgraded over its entire length, it is often difficult to fit a full length reinforcement section due to the installation of other chassis components. A satisfactory method of overcoming these difficulties is by the use of multiple sections of reinforcement. When this method of chassis reinforcement is utilized such reinforcements must be securely attached to each other by either overlapping and bolting or by butt welding.

5.5 Cutting of Frame Rails

The following requirements apply to modifications that involve frame rail cutting:

- When modification of a chassis involves cutting a frame, regardless of the reason (i.e. to drop, taper, lengthen or shorten the rails), primary consideration must be given to restoring its structural integrity upon completion of the modification.

- To provide structural equivalency in the modified frame to that of the unmodified frame, the following two basic situations should be considered:
    - the load distribution on the frame is unchanged or improved, as in wheelbase shortening and frame dropping operations; and
    - the wheelbase is increased either by lengthening the frame between the wheels or by adding an axle behind the rear axle. The load distribution may increase the bending moment on the frame beyond values for which the unmodified frame is considered to be adequate.
- If the load distribution is unchanged, restoration of the equivalent resisting bending moment in the modified frame should produce satisfactory results. However, consideration should be given to the location of any chassis joint in highly stressed areas, the method of joining and the reinforcement of the joint.
- Where the load distribution is changed, additional loading beyond that contemplated in the original design may be compensated for, by calculating the new bending moment for the modified vehicle and in conjunction with the nomogram, determine the required section modulus for the modified vehicle.

  (refer to Appendix 1- Calculation of Chassis Strength in this Section)
- It is recommended that all cutting and bevelling of frame members should be performed with metal cutting wheels or by using plasma cutting techniques.

NOTE: Heat from oxyacetylene cutting or excessive grinding will reduce the strength of a heat treated rail.

5.6 Frame Cut-Outs

When a different type of engine is being installed into a chassis, it is often necessary to alter the cut-outs in the frame rail to suit the new engine. The frame cut-outs for any such modification should be kept to an absolute minimum to avoid excess stress in the frame rail. All frame cut-outs and reliefs should satisfy the following conditions:

- The profile of all cut-outs should have a smooth transition to the original frame profile. The minimum requirements that would be considered to be a smooth transition would be:
    - The taper in the chassis flange to be no greater than 1 in 5, i.e. flange width should progressively decrease 10 millimetres over a 50 millimetre length of frame rail.
    - All internal and external corners of a frame rail cut-out should have a minimum radius of 100mm.
- No frame cut-outs should be positioned behind the rearmost front suspension hanger bracket unless adequately reinforced, where necessary.
- Frame cut-outs that remove more than 50% of the frame rail flange will require additional reinforcement.
- All edges of a cut-out should be dressed smooth by fine grinding or finishing in the longitudinal direction of the rail. There must be no nicks, blow holes, punch marks or any other imperfection which would be likely to initiate propagation of a crack in the frame rail.
- There should be no superfluous holes in the frame rail adjacent to any cut-outs.

- Cut-outs in the upper and lower flanges should not be positioned within close proximity of each other on the same frame rail unless the frame rail is adequately reinforced.

5.7 General Precautions - Welding of Frame Rails

When welding is to be performed on a chassis, the following points should be observed:

- Before performing any welding on a vehicle's frame, the material specifications of the frame rail should be known so that the correct welding rods and welding procedure may be used. The vehicle manufacturer's recommendations should be followed.

- Never attach the earth terminal to components such as axles, springs, engine, driveline, etc. Arcing on these components may cause serious damage to bearings, springs, etc. (Parabolic leaf springs are particularly sensitive to surface damage.)

- Pipes and conduits made of a synthetic material, e.g. in the brake system and electrical system, should be protected against welding spatter and not be exposed to temperatures exceeding 80 degrees Celsius.

- Special attention should be paid to air suspension and parabolic leaf springs. Every care must be taken to protect these components against welding spatter and high temperatures. Spring leaf fracture can be caused even by momentary exposure to welding spatter.

- Fuel tanks and pipes in the vicinity of welding should be removed.

- Disconnect the alternator, batteries, regulator and, if fitted, electronic components for the anti-lock braking system (ABS) engine management systems.

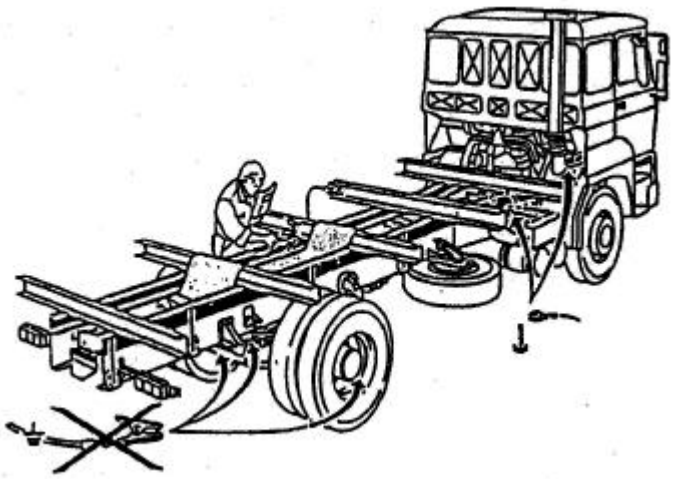


Figure 4

5.8 Welding Requirements

The following points are essential requirements for performing all welding on frame rails:

- Remove all paint, dirt and grease from the areas to be welded.

- The choice of welding rods, heat treatment, surface preparation should be in accordance with the vehicle manufacturer's recommendations, or alternatively, in accordance with Australian Standard AS 1554 *Structural Steel Welding* Category SP.
- The surfaces to be welded should be positioned to the correct gap prior to welding.
- All welding must be in accordance with the Australian Standard AS 1554 *Structural Steel Welding* Category SP.
- Do not cool welds with water.
- The minimum length of any weld should be 30mm.
- Stitch welds should be 30 - 50mm length of welds with a 30 - 50mm space between welds.
- Transverse welding on chassis rail flanges is strictly forbidden for purposes other than repairing or joining of frame rails.
- Chassis frame welding is to be performed from both sides, where feasible, to ensure full penetration.
- All welds must be ground flush (up to 10% increase in frame thickness is permissible but not recommended).
- Undercutting is not allowed.
- All grinding should be in the direction of the frame rail length, as shown in Figure 5.

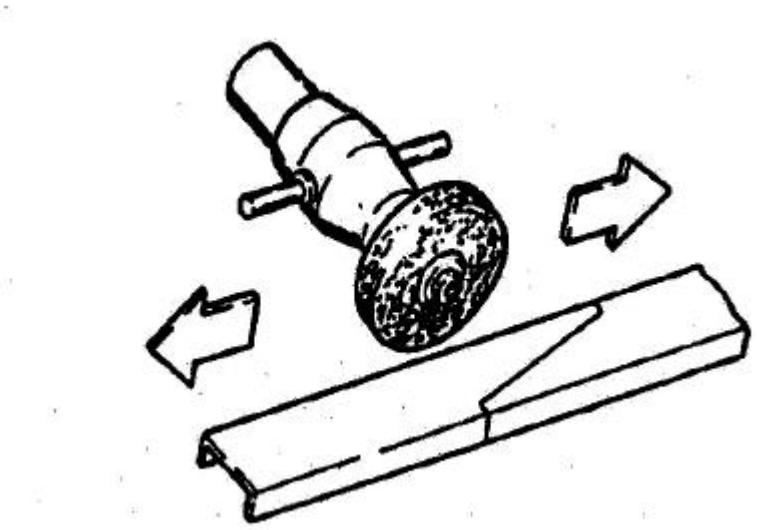


Figure 5

- All grinding to be finished with fine grit grinding or sanding.
- No undercutting of welded joints is allowed. See Figure 6.

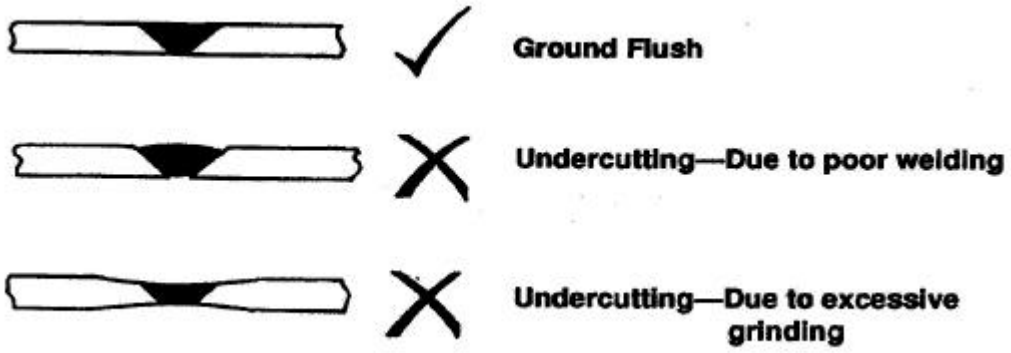


Figure 6

Unused holes in critical areas should be filled with fitted filler bolts. As a non-preferred alternative, such holes may be plug welded on non heat treated frame rails but this technique should be limited to situations where it is necessary to re-drill in close proximity to the original hole. It is recommended that holes be welded from both sides of the frame rail. When only one side of the frame rail is accessible, a suggested method is as follows:

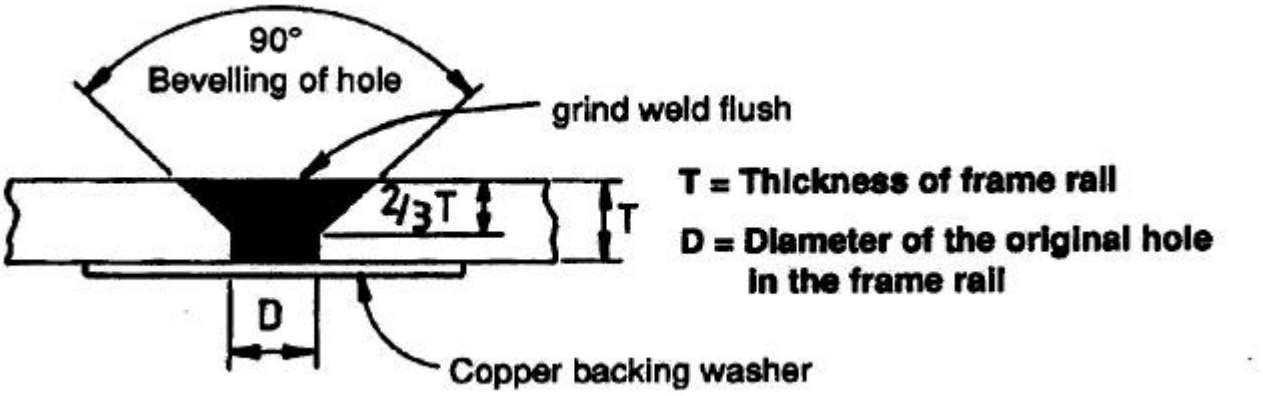


Figure 7

- If weld filling holes with a diameter (D) greater than 20mm, a disc welded into the hole to eliminate excessive welding is required. It is necessary to weld from each side of the frame rail and then dress the welding as per above.

- No welds are permitted within 15mm of the edge or bend radius of a chassis flange (unless otherwise stated by the manufacturer), except when joining chassis rails.

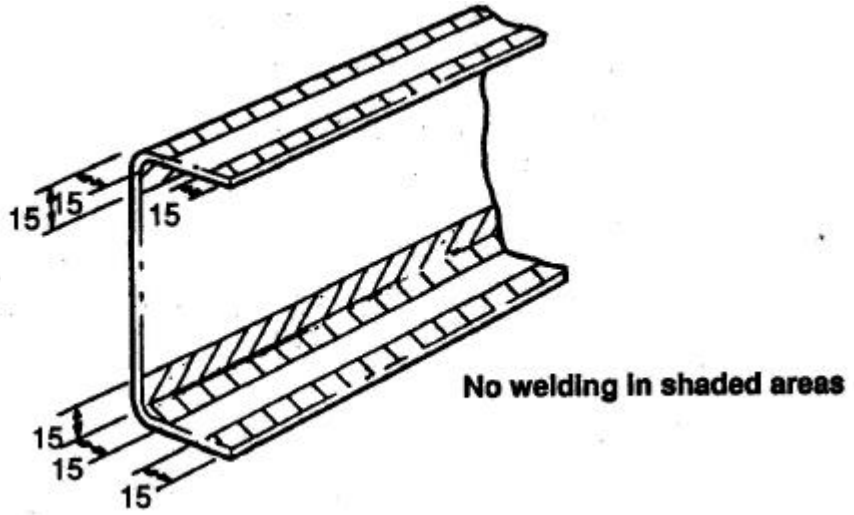


Figure 8

5.9 Welding Heat Treated Frame Rails

The following requirements apply to modifications involving the welding of heat treated frame rails:

- The vehicle manufacturer's recommendations should be sourced prior to performing any modifications on a heat treated frame rail.

- Welding of heat treated frame rails is not recommended but should it be necessary to weld this type of frame rail then the proper choice of welding rod, weld preparation and allowance for the reduction in the allowable tensile yield strength must be made. Note: A commonly used heat treated alloy steel used for frame rails has a normal tensile yield strength of 760 MPa. When welding any of these alloys where preheat treatment cannot be accomplished, the allowable stress adjacent to the weld will probably not exceed 250 MPa. Improper choice of welding rod may result in even lower values.

- Do not plug holes in a heat treated frame rail unless absolutely necessary for fitting of chassis components because the reduction in strength due to the loss of heat treatment greatly exceeds any advantage which may be gained by plugging the holes.

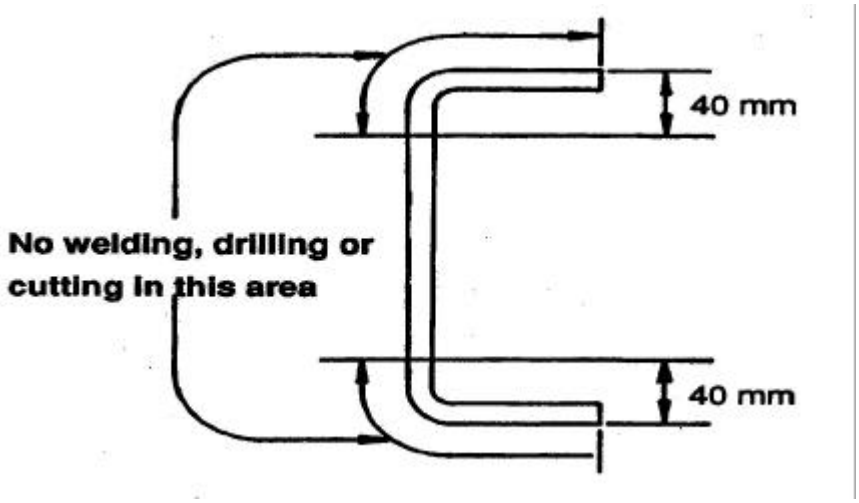


Figure 9

- Heat treated frame rails must not be welded in areas of maximum stress. These highly stressed regions are the upper and lower flanges together with 40mm of the web adjacent to the flange.

5.10 Cross members

The following requirements apply to the selection and fitting of cross members:

- As the chassis of a medium to heavy goods vehicle must have a satisfactory vertical load carrying capacity while still being torsionally flexible to accommodate uneven road surfaces, it is necessary to ensure that all additional cross members are suitably designed to be compatible with the vehicle's chassis design. The most convenient method of ensuring that the correct type of cross member is installed is by utilization of original manufacturer's components. These components should be installed in accordance with the manufacturer's specifications and recommendations. Caution: The original manufacturer's cross member may not always be capable of being installed without major disassembly of the cross member or the vehicle.

- If original type cross members are not available, then alternative cross members may be fitted provided that the following requirements are satisfied:

- It is recommended that all cross members should be of either 'channel' or 'hat' section construction. Note: Large section RHS or pipe cross members as illustrated in Figure 10 are not recommended because of their inherent torsional rigidity.

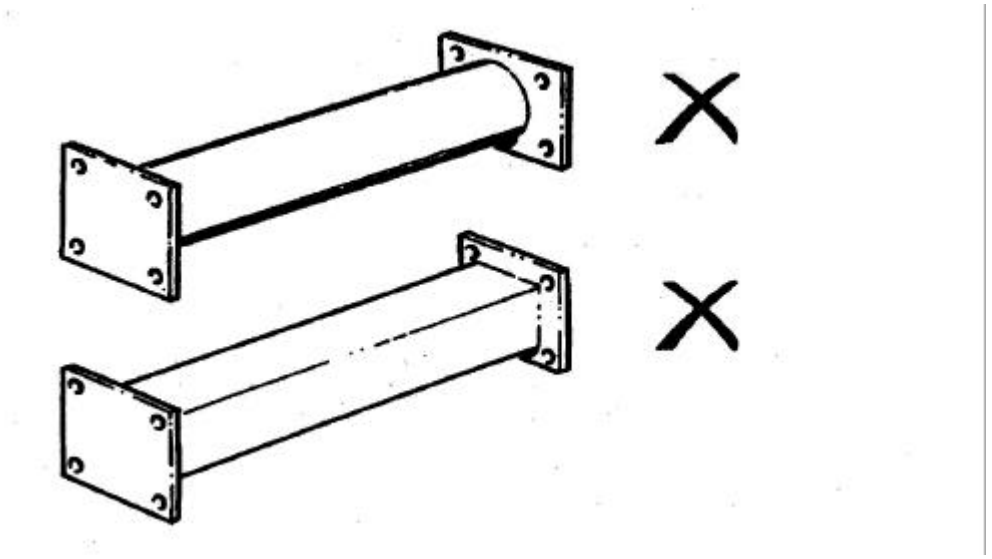


Figure 10

- The torsional stiffness of an additional or replacement cross member should be of similar torsional stiffness to that specified by the manufacturer of a vehicle.

- The vertical load capacity and transverse strength of a cross member must not be less than that of an original manufacturer's cross member for the same application.

- The thickness of material used in construction of a cross member should be no greater than the web thickness of the frame rail to which the cross member is mounted.

- The centre of a hole in a cross member gusset must be of at least three times the diameter of the hole from the edge of the gusset.

- There should be no welding within 40mm from the edge of a cross member gusset.
- The minimum attachment requirement for a cross member should be equivalent to other equivalent original equipment cross members.
- All nuts must be of the self locking type.
- It is recommended that flat washers or load distribution plates be utilised under all nuts and/or bolts.
- Cross members should only be attached to the web of the frame rail. Note: End of Frame cross members may be flange mounted.
- The length of the cross member must be the same as the internal frame width, i.e. the distance from the outside edge of each gusset must equal the internal distance between the mounting faces of the frame rail. Note: Manufacturers often fit spacer shims between the cross member gussets and the frame rail to adjust the length of a cross member to give the correct chassis width when optional reinforcements are not fitted.
- For cross members spacing requirements, refer to 'Minimum Requirements' - Paragraph 5.3.

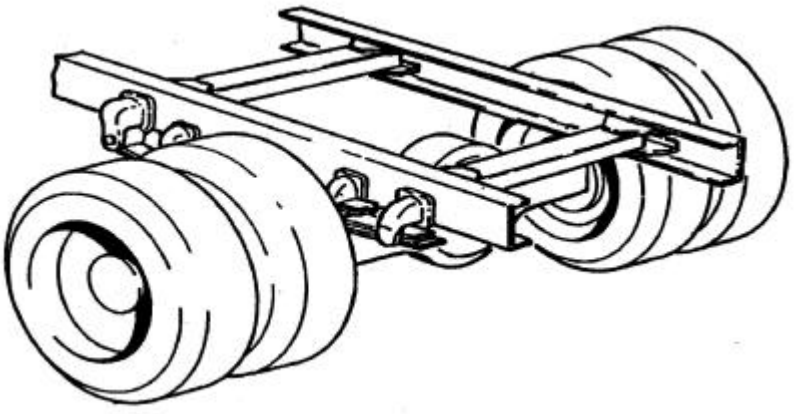
5.11 Types of Cross members

The types of cross member that are fitted to a vehicle can be divided into four basic categories, namely:

- Rear Suspension Cross members.
- Intermediate Cross members.
- End of Frame Cross members.
- Special Cross members.

Rear Suspension Cross members. For a satisfactory service life, it is necessary to correctly support the rear suspension. To achieve this, each rear suspension hanger bracket should be attached to a cross member. This prevents excessive flexing of the frame rail at these highly stressed areas. The gussets on suspension cross members must be designed so that the attachment bolt holes align with the attachment bolt holes for the spring hanger.

A typical single axle rear suspension is shown in Fig 11.



For a '2-spring' type bogie rear suspension, a 'butterfly' type cross member should be installed. Typical suspensions which require a butterfly cross member would be single point and walking beam type suspensions. A typical example for this cross member type is shown below.

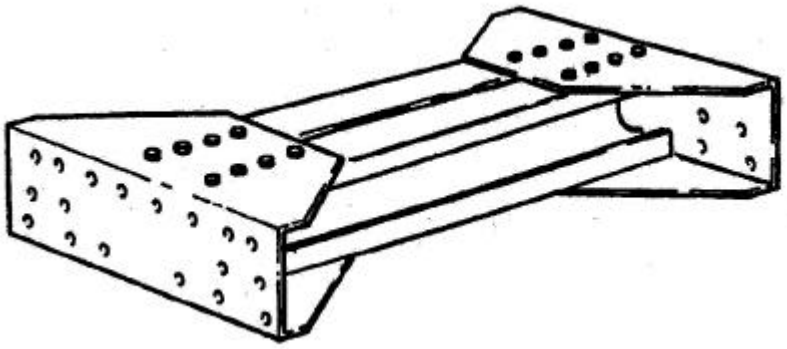


Figure 12

For a '4-spring' type bogie rear suspension, individual cross members are required to be mounted between each pair of spring hangers, as shown in Figure 13.

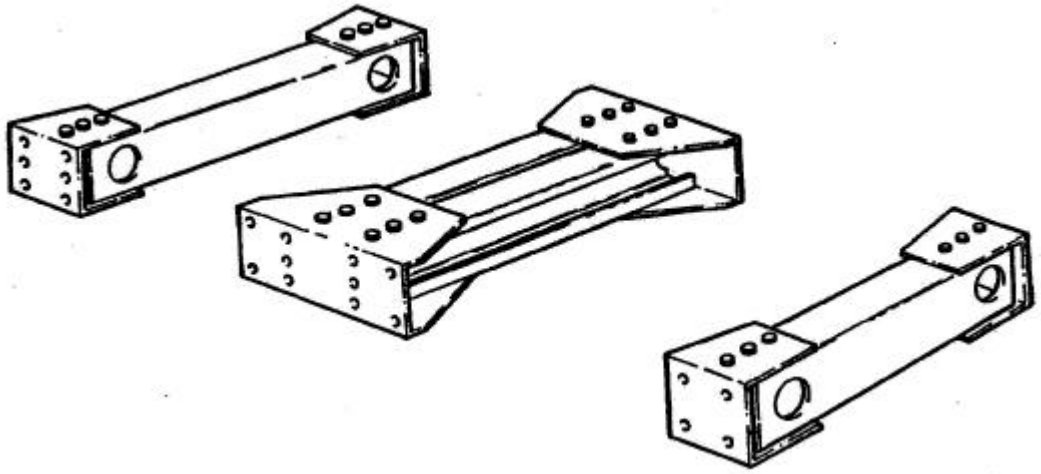


Figure 13

Intermediate Cross members. All of the intermediate cross members of a chassis should be similar to avoid stress concentration in the region of the cross member with greater torsional stiffness. Some typical intermediate cross member designs are illustrated in Figures 14, 15 and 16.

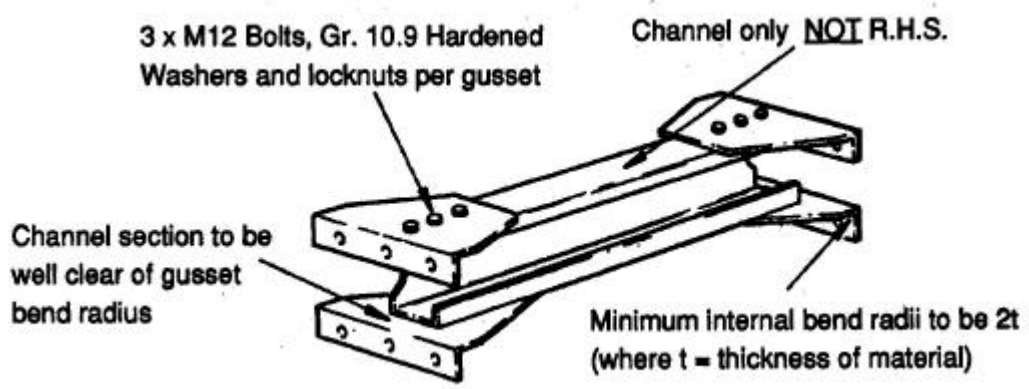


Figure 14

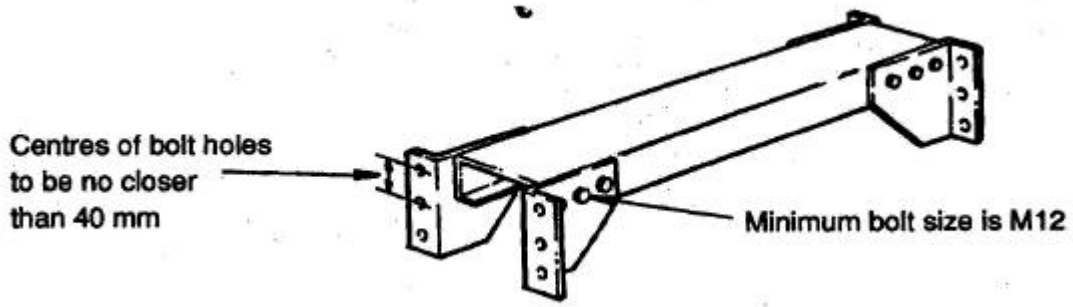


Figure 15

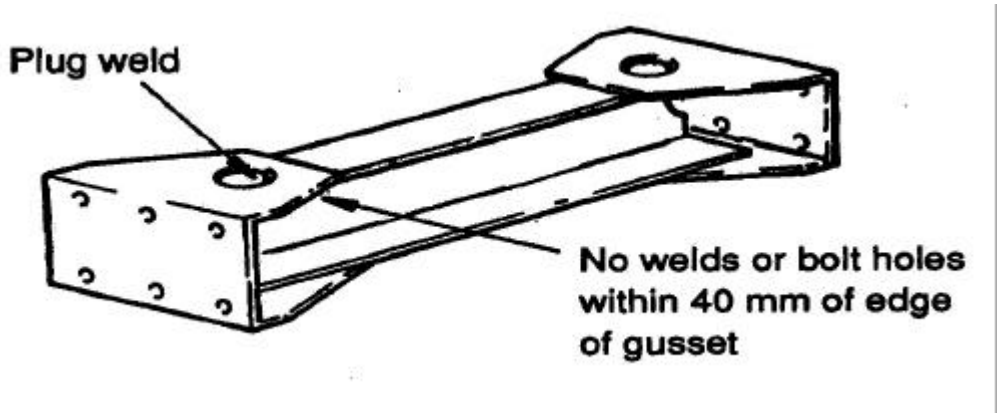


Figure 16

End of Frame Cross membe r. As the cross members in the rear chassis overhang are of similar design to the other intermediate cross member, it would follow that the End of Frame (EOF) cross member must also be of similar construction. The significant difference between an EOF cross member and an intermediate cross member is that it is frequently used for mounting a tow coupling or that it may be a low profile design to suit a tapered chassis rail.

If the cross member is to be used for mounting a tow coupling, then the cross member and its installation must be designed and manufactured to satisfy the requirements of ADR 62/..; *Mechanical Connections Between Vehicles.* It should be noted that tow members with a high D-value require substantial reinforcement and bracing. Two typical EOF tow members are illustrated in Figure 17 and Figure 18.

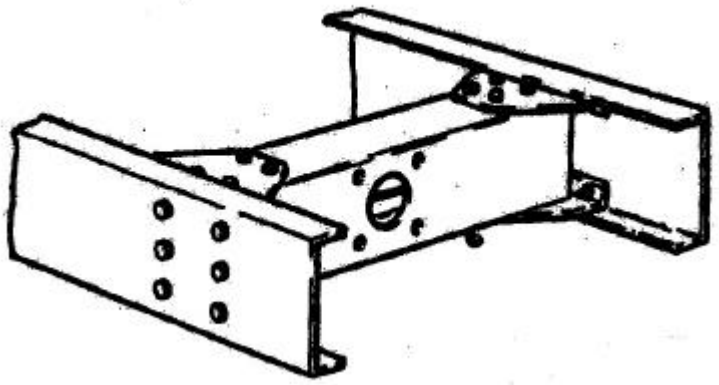


Figure 17

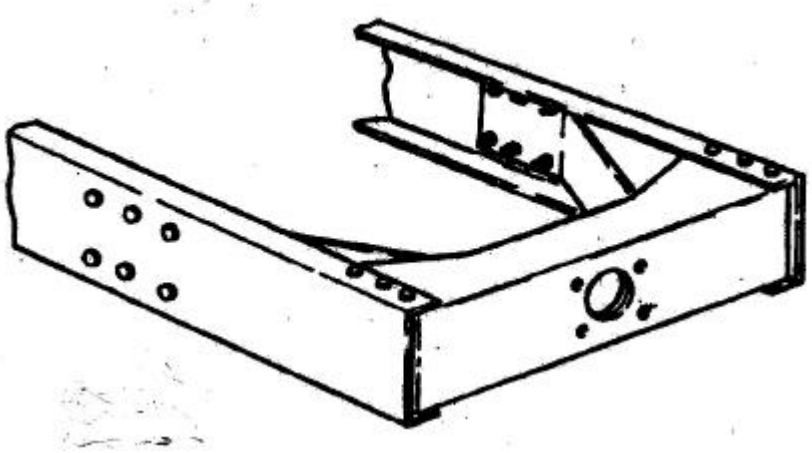


Figure 18

For additional details on design and installation of tow couplings please refer to Section P - Tow Couplings/Fifth Wheels.

Special Cross members. In addition to the previously discussed types of cross members, there are many other types of cross members that are commonly used in vehicle chassis construction. These cross members are designed for specific applications and can often be a variation of a standard intermediate cross member. A typical example of this is the cross member that supports the tailshaft centre bearing. This cross member may be a standard intermediate cross member, which is positioned at the correct location on the chassis, and has a suitable centre bearing mounting bracket attached. Alternatively, an additional non frame stiffening cross member should be installed. Other applications such as engine support or cabin support will normally require a specific design to achieve the desired strength and torsional stiffness while still maintaining satisfactory clearance from other components. It is recommended that for these specialised cross members, only the original manufacturer's components should be used because of the complicated nature of their design.

6. ALTERATIONS WITHIN FIRST MANUFACTURER'S OPTIONS

6.1 Preferred Approach

It is recommended that the specifications of a modified vehicle should remain within the options offered by the first manufacturer. If the proposed frame modifications will render the vehicle identical to a model that is available from the manufacturer and providing that all frame joins (if applicable) are satisfactorily welded and reinforced, then no additional evaluation of the frame modifications would be required.

6.2 Items to be checked

Items that must be checked to confirm that a vehicle is within the standard manufacturer's specifications are listed in the Modification Codes and Checklists H3 and H4.

7. CHANGE IN WHEELBASE OR FRAME LENGTH

To achieve a desired wheelbase, it is preferable to shorten a longer wheelbase vehicle then to lengthen a short wheelbase vehicle. This has the advantage of eliminating joins in the frame rail and also the longer wheelbase vehicle would have any additional reinforcements that have been deemed necessary by the manufacturer. When feasible, it is recommended that the wheelbase of a vehicle be a standard manufacturer's option.

7.1 Increase in Wheelbase or Frame Lengthening

Where a modification involves increasing the wheelbase or chassis frame length, the following requirements must be met:

- If possible, an increase in wheelbase should be achieved by moving the complete rear axle assembly along the frame. Cutting of the frame should only be performed when relocation of the rear axle assembly is not feasible, e.g.:
    - rear overhang has a tapered frame rail section. When the rear axle is relocated, the associated cross members and reinforcements must also be relocated to give the correct suspension arrangement. If additional frame rail length is required, then this should be achieved by extending the rear overhang.
- The maximum stress levels in an extended frame must be checked to ensure that the allowable limits are not exceeded. Refer to 'Calculation of Chassis Strength' in Appendix 1 of this Section. If the wheelbase exceeds that which was available from the manufacturer, then it would be highly probable that the frame will require additional reinforcement. All frame reinforcements must be in accordance with this Section, or as per manufacturer's recommendations.
- All joins in the frame rail should be well clear of highly stressed regions of the frame. Hence, all joins should be positioned at least twice the frame rail depth (H) from a cross member or spring hanger bracket and no holes are allowed within 50mm of a frame rail join. Refer Figure 19 for details.

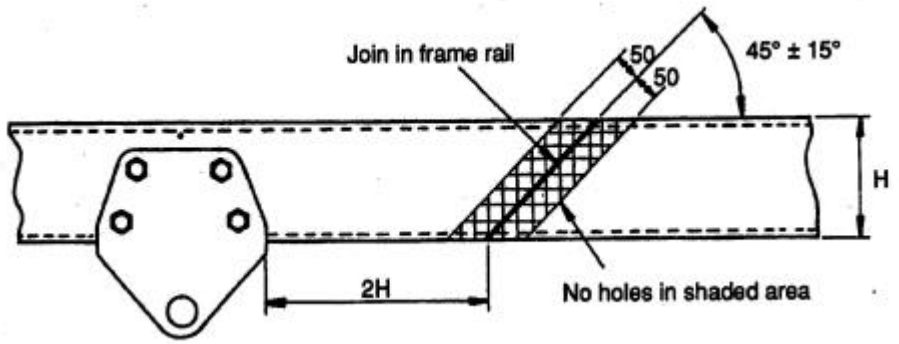


Figure 19

- The preferred method of making joins in the frame rail for heavy duty and highly stressed applications is at 45 degrees +/-15 degrees as shown in Figure 19. Other acceptable methods of chassis frame joint design are shown in Figures 20, 21, 22 and 23 below.

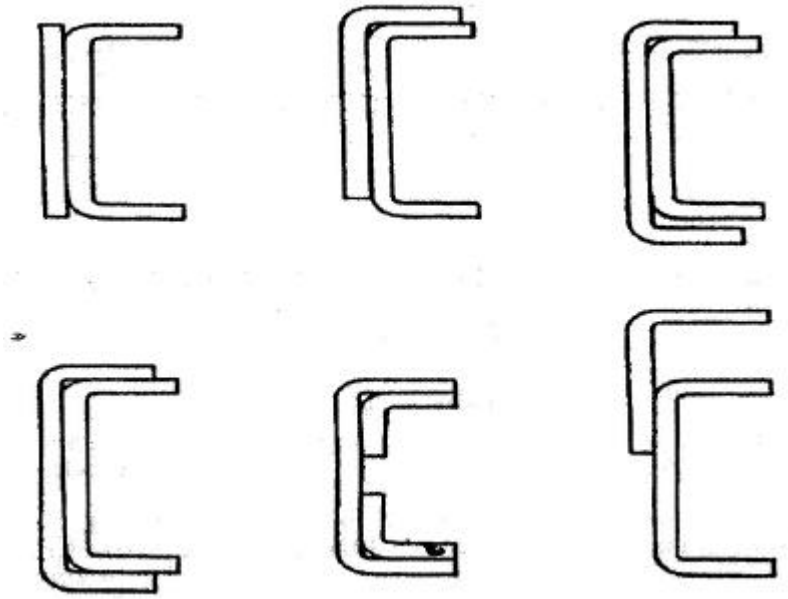
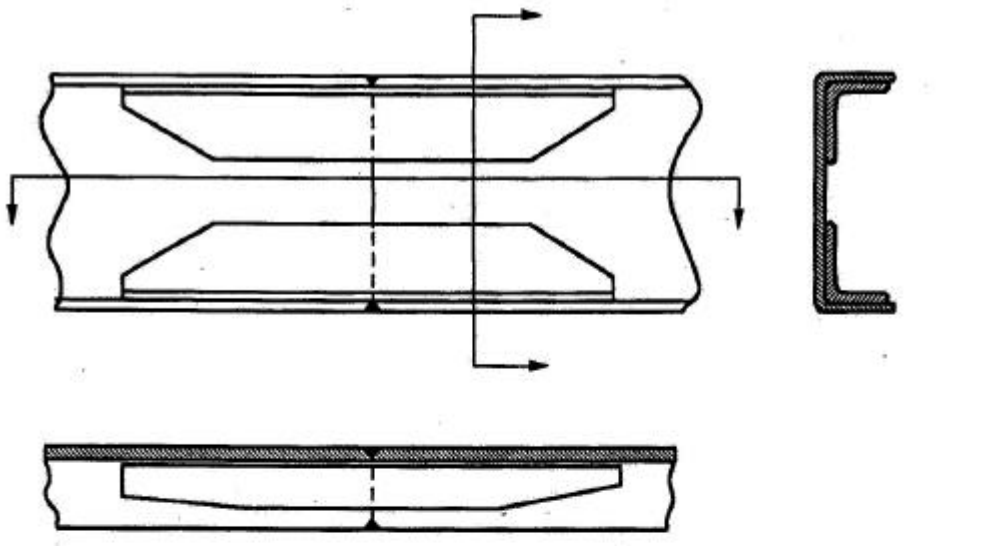
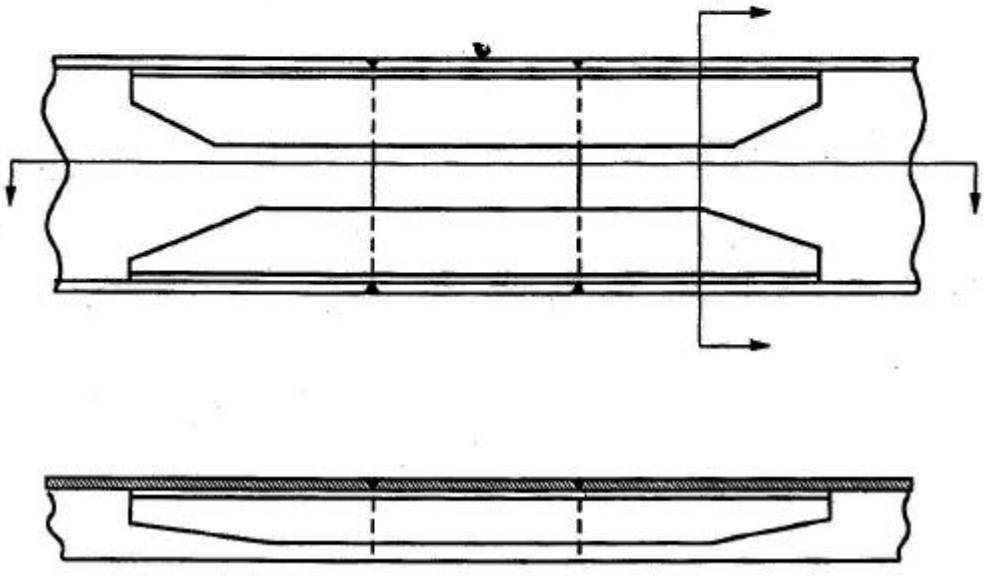


Figure 20 – Cross Sections of Typical Reinforcement Methods



Typical Shortening Method



Typical Lengthening Method

Figure 21

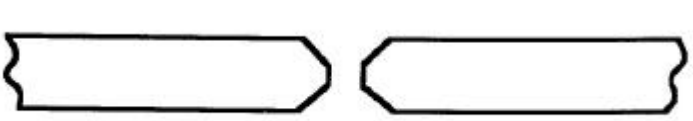


Figure 22 – Preparation for Weld

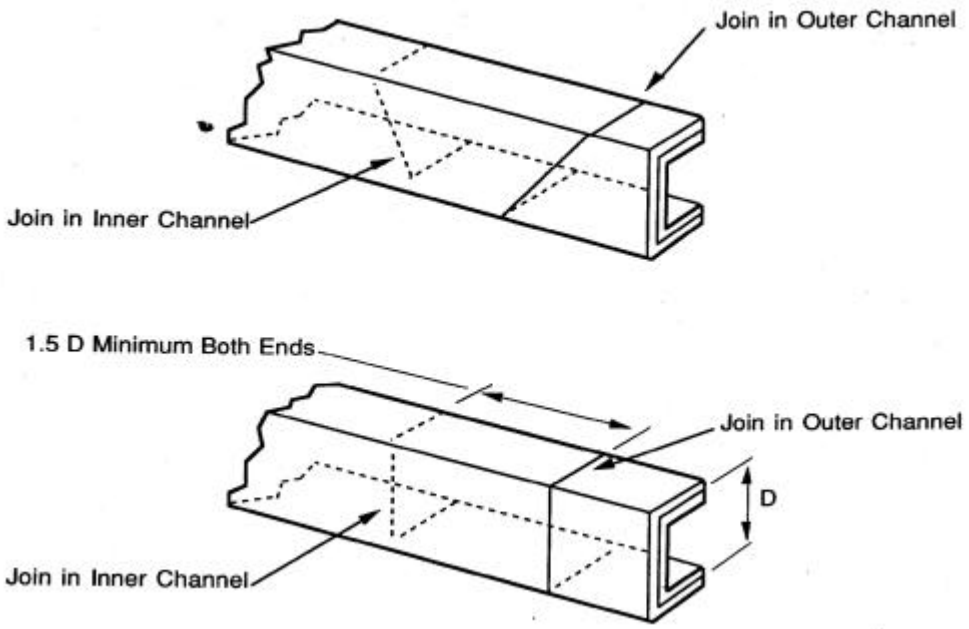


Figure 23 – Types and Locations of Joins

- For multi-section frame rails, inner and outer rail joins must have a minimum spacing of 300mm.
- The additional section of frame rail must have a continuous weld over the entire junction with the original frame rail, using welding techniques as described in this Section.
- Non-reinforced butt joins in frame rail are only allowed if the join is within 200mm from the end of the frame and if the additional section does not support a cross member or tow coupling.
- The extended chassis frame rails should not exceed the overall dimensional limits as outlined in the ADR's.
- Tailshaft alteration should be in accordance with Section C of this National Code of Practice.
- Alteration to air and hydraulic lines must use piping of the same internal bore as that of the manufacturer's original and must not introduce restrictions at joins or fittings.
- When extending electrical wiring harnesses, all electrical joints must be waterproof and electrically sound.
- It should be noted that increasing the wheelbase will also increase the turning circle of the vehicle and the requirements of ADR 43/04 must be met

7.2 Frame Shortening

In any modification involving frame shortening, the following requirements must be met:

- A reduction in a vehicle's wheelbase should be achieved by moving the complete rear axle assembly forward along the frame if the vehicle has a constant depth chassis rail. When the rear axle is relocated, the associated cross members and reinforcements must also be relocated to give the correct suspension arrangement.

- It may also be necessary to reduce the rear overhang to maintain compliance with ADR 43/….

- The shortened wheelbase should not be less than the shortest optional wheelbase from the manufacturer for that model. If the shortened wheelbase is less than that available from the manufacturer and is also less than 3000mm, then the vehicle must be tested to show compliance with ADR 35/… (Sections 8.3 to 8.8 of ADR 35/01, Sections 35.5.3 to 35.5.8 of ADR 35/00).

- It should be noted that a short wheelbase vehicle may not be permitted to be registered at the maximum axle ratings due to the restrictions from applying the bridge loading formula.

8. FRAME REPAIR

8.1 Need to Review Design

As a cracked or broken frame rail is a result of the chassis being overstressed, this indicates that additional reinforcement will be required in the region of the crack.

8.2 Factors Affecting Cracking

Frame cracking may be due to any of several factors some of which are listed below:

- Holes drilled in frame rail flanges or too close to other holes.

- Incorrect welding procedures (i.e. undercutting, no preheat, slag inclusions, transverse welding of flanges etc.).

- An abrupt change of section (i.e. a square end on a reinforcement or body sub-frame).

- Overloading of chassis (i.e. vehicle loaded beyond its designed capacity).

- Insufficient reinforcement.

- Over length wheelbase.

- Incorrect cross members (i.e. torsionally stiff cross members).

- Suspension too stiff (i.e. suspension capacity greater than frame capacity).

- Incorrect body mounting (i.e. rigidly mounted tanker).

- Excessive frame cut-outs; even a grinding notch on a flange can propagate a crack.

- Accident damage.

8.3 Procedures to be Avoided

Unless otherwise stated by the manufacturer:

- Cracked heat treated (high tensile) frame rails should not be repaired.
- Bent heat treated (high tensile) frame rails should not be straightened but should be replaced.

8.4 Eliminating Cause of Failure

Prior to repairing a frame rail crack, the reasons for its occurrence must be established and the cause/s eliminated. This may involve major reinforcement of the frame rails due to inadequate rail strength or it may only involve tapering an existing reinforcement section or replacement of a cross member. Some common places for frame cracking are:

- Just behind the rearmost front spring hanger bracket. This is due to this region of the frame rail having numerous stress raisers i.e. numerous holes for mounting engine support brackets, cab mounts, spring hangers, fuel hangers, fuel tanks, battery box etc., the change in section due to the start of the body sub-frame, the input of torque reaction from the engine and the loads from the spring hanger. When repairing a crack in this region (assuming that the cause has been eliminated (Note: Chassis frame rail reinforcement must not be terminated within this area), the end of the crack should be drilled to prevent the crack from travelling any further and then the crack should be rewelded in accordance with this Section. An additional reinforcement must be fitted. This reinforcement should extend forward of the rearmost front spring hanger bracket by a distance equal to twice the frame rail height (2H), accommodate the engine and cab mounting brackets and extend rearward past the start of the body sub-frame by at least 3H. The reinforcement should be installed in accordance with this Section.

- Cross member gussets. (Gussets must not be repaired and must be replaced with new gussets of the same style.) The thickness of a gusset may be increased provided that it does not exceed the web thickness of the frame rail or manufacturing component specifications. A satisfactory method of overcoming gusset cracking is utilization of a 'load distribution plate' under the gusset bolts. Refer to Figure 24 for a typical example.

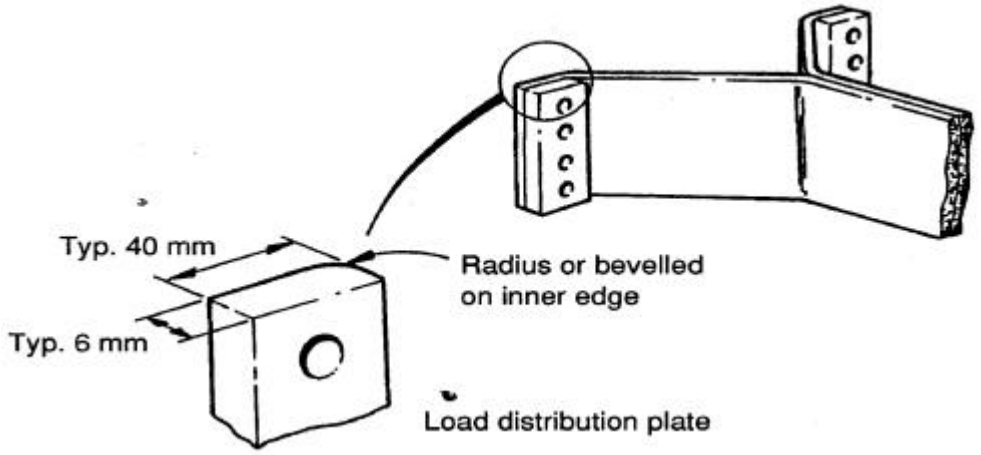


Figure 24

8.5 Gusset Failure in Rear Suspension Area

If gusset failures are in the region of the rear suspension or end of frame, it may be necessary to fit a rear suspension liner (reinforcement) to reduce some of the cross member loads. Alternatively, thicker cross member end plates may be fitted.

8.6 Chassis Rail Straightening

Prior to straightening a bent chassis rail, all chassis components in the region of damage must be removed and thoroughly examined for cracks and damage. Components should be replaced when damage is evident. In particular:

- The straightened frame rail must not show any evidence of buckling, indentation, cracking or elongation of holes and should be straight and square over its entire length.
- Cross members and other chassis components should not be used to assist in straightening the frame rail. Only minimal bowing may be present prior to assembly.

9. SUSPENSION CHANGES

9.1 General

This chapter is only applicable to frame changes due to fitting of an alternative suspension and should be used in conjunction with Section F - Suspension.

It is recommended that only manufacturer's optional suspensions be used and that the installation be in accordance with the manufacturer's specifications. This includes the size of the frame rail, additional reinforcements, type of cross members and attachment arrangements.

A replacement suspension must be the correct width to suit the frame for which it is intended.

9.2 Non O/E Optional Suspension

If a non O/E optional suspension is to be fitted, then the suspension manufacturer's installation instructions must be followed. In addition to this, a full analysis of the chassis and associated componentry must be undertaken. Items to be checked:

- The design of the cross members must be suitable for the proposed suspension. (Refer Chapter 5.10 – Cross members of this Section.)
- If the suspension rating is less than the original, rerating must be in accordance with Section S.
- All suspension brackets must be fitted with a full complement of the correct grade and size of bolts.
- Axle bump stops should be attached to the web of the frame rail, unless the practice of the original manufacturer is to do otherwise (Flange attachment should not be used).
- It is recommended that a rear suspension liner be used to distribute the loads from the spring hangers evenly into the chassis.

10. ADDITIONAL AXLES

10.1 Frame Strength

The fitting of an additional axle is usually to facilitate an increase in the vehicle GVM. The chassis frame rail must be of sufficient strength to accommodate the proposed increase in GVM. Please refer to Chapter 11 - Increase in GVM/GCM of this Section. (Note: An example of a frame analysis for fitting of an additional rear axle is given in Appendix 1 - Calculation of Chassis Strength).

10.2 Suspension Requirements

The fitting of an additional axle will necessitate the use of an alternative suspension. Please refer to Chapter 9 - Suspension Changes of this Section.

11. INCREASE IN GVM

11.1 General

For a vehicle to qualify for an increase in GVM and/or GCM, the total vehicle must be capable of safely performing and operating at the proposed increased rating. The chassis is one of the critical components to be assessed before justifying an increase in rating.

11.2 Manufacturer's Standard Configuration

A vehicle in standard manufacturer's specification cannot be granted an increase in GVM/GCM above the manufacturer's ratings unless specifically approved by the vehicle manufacturer. Refer Section S of this National Code of Practice.

11.3 Beyond Manufacturer's Standard

When modifications such as additional axles or replacement axles with a greater load carrying capacity than original are fitted, the vehicle frame must be analysed to ensure that it is of sufficient strength to accommodate the proposed increase in GVM/GCM. Refer to Appendix 1 - Calculation of Chassis Strength.

A very simplified way to look at the frame requirements for each of these ratings is to associate the bending strength of the chassis with the load carrying capacity (i.e. GVM) and the torsional strength of the chassis (capability of accommodating engine torque to pull the load, not carry it) with the GCM rating. From this, it may become obvious that major rework of a vehicle's chassis is necessary to stiffen the vehicle's frame because vehicles with high GCM rating would normally be fitted with larger cross members as well as larger frame rails. The engine and driveline are also critical components in GCM rerating.

11.4 GVM Dependent on Frame Rail Size

The GVM, however, is mainly dependent on the frame rail size and this is somewhat more readily upgraded. However, the GVM rating cannot exceed the GCM rating:

- For normal highway applications, the maximum stress at maximum static load for a modified frame should give a Factor of Safety of three on the yield strength of the frame rail material. For 'off-highway' and special application vehicles, an engineering evaluation should be performed to establish the required increase in this Factor of Safety to maintain satisfactory levels of performance.

- Alternatively, the maximum stress in a vehicle's chassis frame should not exceed the stress calculated from the most adverse case vehicle produced by the manufacturer with that same frame rail (i.e. the model with the highest GVM rating and longest wheelbase utilising the same frame rail).

12. RECORDING

It is not feasible in this Section to cover every aspect of analysis that might be necessary in frame modification. However, in the Appendices of this document are:

- Appendix 1 - Calculation of Chassis Strength, showing an example of the level of detail analysis expected of the certifying officer in establishing that a frame modification is satisfactory. The Certifying Officer should hold on file the calculations made, using this Appendix as a guide.

- Appendix 2 - Chassis Modification Calculation Sheet, giving a summary of the analysis performed using the guidelines in Appendix 1. This form, completed in full, should be completed and retained by the Certifying Officer .

- Appendices H1, H2, H3 and H4 which:

    - Summarise the scope of modification work that may be certified under each of these Modification Codes.

    - Include lists of Sections of the National Code of Practice covering other areas of the vehicle which may have been affected by the modification and which should be analysed to determine whether they, too, require re-certification.

    - Include check lists appropriate to the particular Modification Code that should be completed.

- Appendix 3 – Trailer Chassis Frame Modification, detailing standards for chassis modifications that are particular to trailers.

- Appendix H5 which outlines specific requirements pertaining to trailer chassis modifications with should be addressed by the Modifier and includes a checklist appropriate to Modification Code H5 that must be completed.

It is suggested that analysis work records, sketches and other vehicle data, together with copies of the Calculation Sheet and completed Check Lists, be retained by the Certifying Officer for at least the period specified in Part A of this National Code of Practice.

HEAVY VEHICLE MODIFICATIONS

Appendix 1 - Sheet 1

CALCULATION OF CHASSIS STRENGTH

1. DETAILED EXAMPLE OF CALCULATION OF BENDING STRESS IN CHASSIS FRAME RAIL AND REQUIRED REINFORCEMENT

The following example demonstrates a method for calculation of stress in a chassis frame rail and reinforcement required to give the chassis rail an adequate factor of safety, based on the maximum laden mass (GVM) of the vehicle.

Unless otherwise stated by the manufacturer of the vehicle, the minimum factor of safety for chassis frame rails of highway vehicles is three (3); i.e. the maximum stress in the frame rail, when under maximum static load conditions, must be less than one-third of the yield stress of the frame rail material. The minimum factor of safety for chassis frame rails of off-highway vehicles and tippers is five (5).

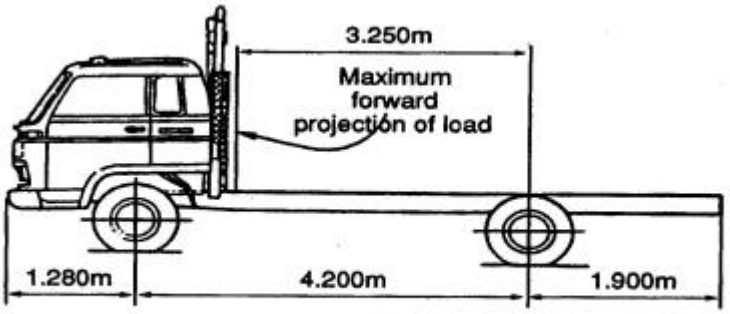
To enable the calculations to be performed, the value of certain parameters must be known. These parameters are:

- Wheelbase of vehicle, WB (m).
- Rear overhang, measured from the centre line of the rear axle or bogie to the rear end of frame, ROH (m).
- Distance from the forward end of the load (i.e. back of the cab) to the rear axle or centre line of bogie, CA (m).
- Tare mass over front axle, TF (kg).
- Tare mass over rear axle(s), TR (kg).
- Maximum allowable mass over front axle(s), MF (kg).
- Maximum allowable mass over rear axle(s), MR (kg).
- Gross Vehicle Mass, GVM (kg).
- Allowable yield stress of the chassis rail material, YS (MPa).
- Chassis rail section modulus, Z (m^3). (Section moduli for common chassis rails are given in Table 1, and the formula for calculation of Z for channel section is given at the end of this appendix.)

EXAMPLE

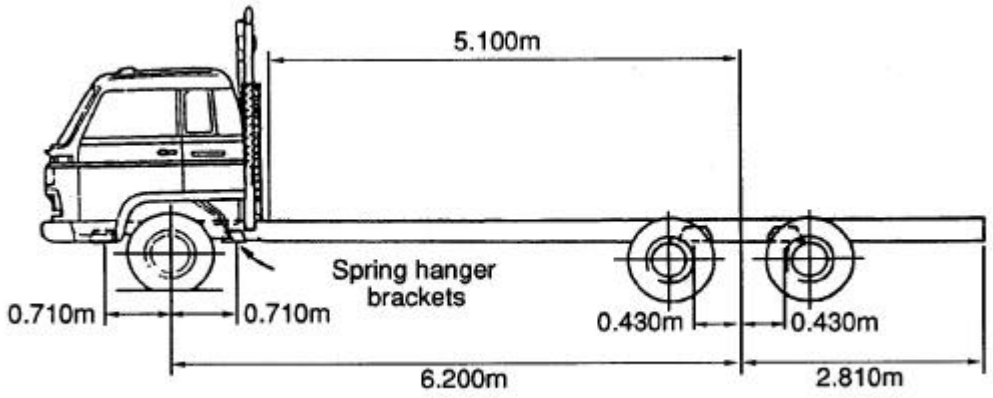
Standard Vehicle: Cab-over 4 x 2 body truck or tray back
GVM:15,000kg
Maximum allowable mass over front axle, MF : 6,000kg
Maximum allowable mass over rear axle, MR : 10,500kg
Wheelbase : 4.200m
Chassis rail material : Single channel 254 x 75 x 8mm
Yield strength, YS = 250MPa
Section modulus, Z = 213.03 x 10^{-6} m^3
Tare mass over front axle, TF: 2,650kg
Tare mass over rear axle, TR: 1,870kg

Appendix 1 – Sheet 2



Modifications

The existing rear axle and suspension assemblies will be removed. The chassis will be cut at 5.200m behind the centre line of the front axle. The section of chassis cut off will be replaced with a section 3.810m in length. A tandem rear axle and suspension assembly will be installed with the wheelbase at 6.200m. The rear axle and suspension assembly have a ground rating of 16,500kg. Rear overhang will be 2.810m.



- A tray of length 7.910m will be fitted.
- GVM will be increased to 22,500kg. (For the sake of this example, it will be presumed the remainder of the vehicle's components, i.e. engine, brakes, tyres, etc. will accommodate the increase in GVM.)

Tare mass over front axle, TF: 2,950kg

Tare mass over rear axle, TR: 3,000kg

The vehicle will be loaded to the maximum allowable load, i.e. 6,000kg over the front axle and 16,500kg over the bogie.

A tray body of length 7.910m with a mass of 1,500kg extends from 5.100m ahead of the bogie to the end of the chassis. For ease of calculation, the mass of the tray body will be considered as part of the payload.

Appendix 1 – Sheet 3

Maximum payload mass over axle = Maximum allowable mass over axle – Tare mass over axle

Front Axle: PF = MF – TF = 6,000 – 2,950 = 3,050kg.

Rear Axle: RF = MR – TR = 16,500 – 3,000 = 13,500kg.

These payload masses will be considered to be evenly distributed between the spring hangers of the respective suspension assemblies.

Total Payload Mass, P = PF + RF = 3,050 + 13,500 = 16,550kg.

This payload mass will be presumed to be uniformly distributed over the length of the tray.

From the bending moment diagram, the maximum being moment, Bmax = 5,957kg.m, and is situated at the rear suspension spring hanger bracket.

A large bending moment, 5,579kg.m, also occurs at a point 2.559m behind the centre line of the front axle.

Stress $= \frac{\text{Bending Moment}}{\text{Section Modulus}}$

$= \frac{BM}{Z}$

Maximum bending moment, Bmax = 5,957 kg.m

= 5,957 x 9.806 Nm

= 58,414 Nm

Assuming equal bending moment for each chassis rail

Bending moment per rail $= \frac{58,414}{2}$

= 29,207 Nm

Therefore, maximum stress, max $= \frac{29,207 \text{ Nm}}{213.03 \times 10^{-6} \text{ m}^3}$

$= 137.1 \times 10^{6} \text{ N/m}^2$

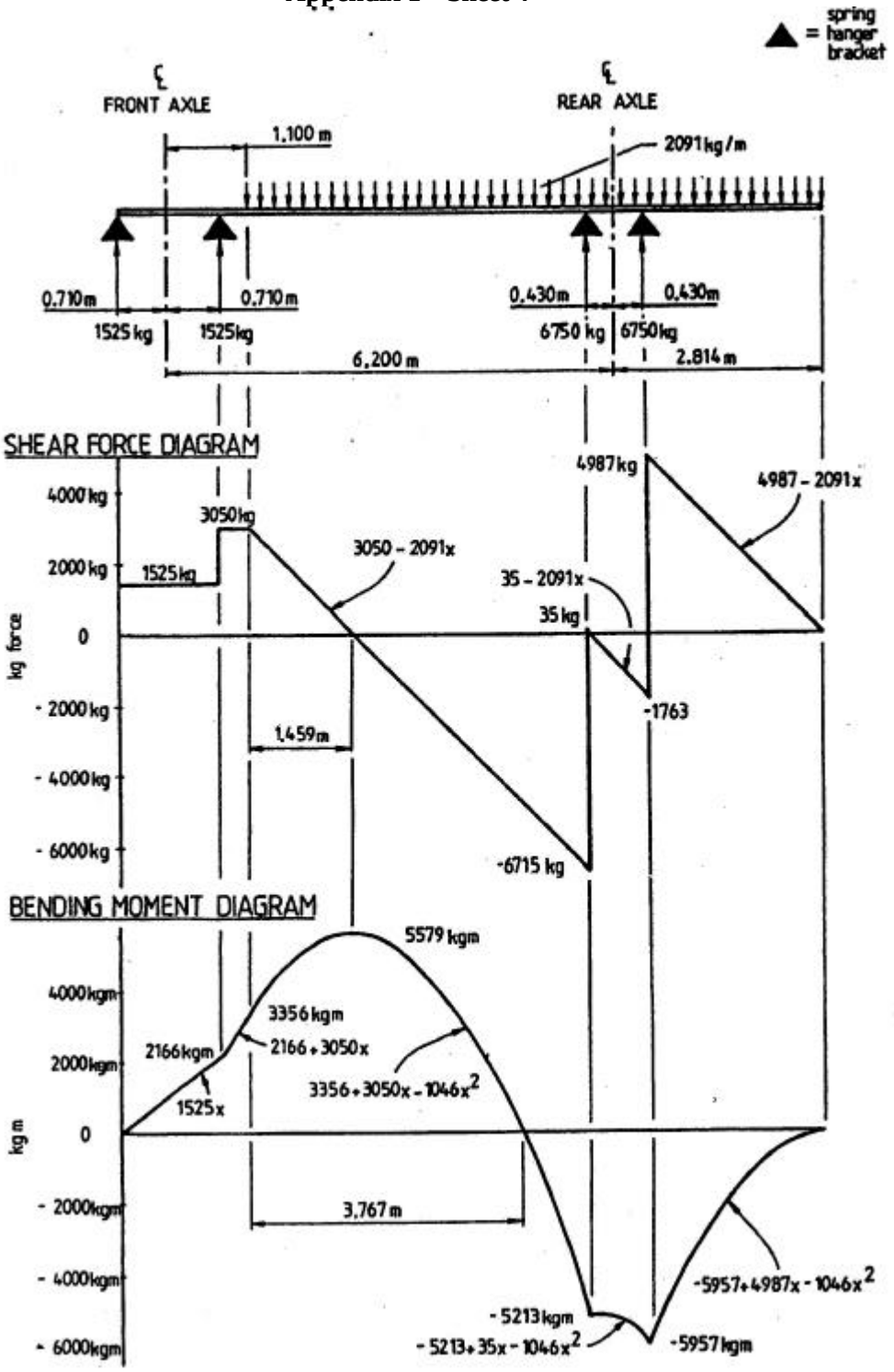
= 137.1 MPa

For chassis rail material with a *yield* stress of 250 MPa and using a factor of safety of 3, the maximum allowable stress is:

$\frac{250}{3}$ = 83.3 MPa

Therefore, without reinforcement, the maximum allowable stress would be exceeded.

Appendix 1 – Sheet 4



To achieve a maximum level of stress below the maximum allowable stress, the chassis rail section modulus, Z, must be increased.

The minimum value of section modulus will be:

$$Z = \frac{29{,}207 \text{ Nm}}{83.3 \times 10^6 \text{ N/m}^2}$$

$$= 350.62 \times 10\text{-}^6 \text{m}^3$$

From Table 1, this section modulus may be achieved by reinforcement by:

- channel, Figure 4 ($433.44 \times 10^{-6} \text{m}^3$),
- outer channel glove, Figure 5 ($421.97 \times 10^{-6} \text{m}^3$),
- or internal angles, Figure 6 ($379.36 \times 10^{-6} \text{m}^3$).

By calculation (see formula at the end of this section), a full internal channel reinforcement of dimensions 234 x 66 x 7 mm will give a total section modulus of:

$$213.03 \times 10^{-6} + 154.86 \times 10^{-6} = 367.89 \times 10^{-6} \text{m}^3$$

Therefore a full internal channel reinforcement section of these dimensions will provide the chassis with sufficient resistance to the bending moment. From the distribution on the bending moment diagram, it can be seen that the reinforcement should extend from ahead of the rear front spring hanger bracket through the end of the frame.

2. QUICK CALCULATION FOR REQUIRED CHASSIS RAIL REINFORCEMENT WITH WHEELBASE ALTERATION

This appendix describes a method by which the required channel rail section modulus and hence, reinforcement, for a vehicle that has had a wheelbase alteration may be found. Note that the method is based on the following assumptions:

(i) No change in the vehicle's original GVM as given by the manufacturer is involved.

(ii) The yield strength of the chassis rail material after alteration will be 250 MPa.

(iii) The Section Modulus x Frame Yield Strength, known as the Resisting Bending Moment, RBM, of the modified chassis will be equal to the Resisting Bending Moment of the original chassis.

The method is based on the formula:

$$\text{Final Section Modulus} = \frac{\text{Final Wheelbase}}{\text{Original Wheelbase}} \times \frac{\text{Original Section Modulus x Original Yield Strength}}{\text{Final Yield Strength}}$$

$$ZF = \frac{WBF}{WBO} \times \frac{Zo \times YSo}{YSF}$$

Note that the Final Yield Strength, YSF, will always take the value of 250 MPa.

EXAMPLE

Find the required Final Section Modulus for a vehicle that has had a wheelbase extension from 4.500m to 5.500m. The original chassis rail section modulus is 154.6 x 1 $0^6 m^3$ for each rail, and the chassis material yield strength is 750 MPa.

$$ZF = \frac{BF}{WBO} \times \frac{Zo \times YSo}{YSF}$$

$$= \frac{5.500}{4.500} \times \frac{154.6 \times 10^{-6} \times 750}{250}$$

Therefore, required section modulus for a single rail is: $ZF = 566.9 \times 10^{-6} m^3$

An alternative to using the above formula is to use the attached nomogram.

Using the nomogram, the section modulus needed after a change in wheelbase may be found by following these steps.

1. Locate the point on line A representing the original wheelbase.

2. Locate the point on line B representing the wheelbase after modification.

3. Draw a straight line from the point on line A through the point on line B and mark the intersection of this line and line C on line C.

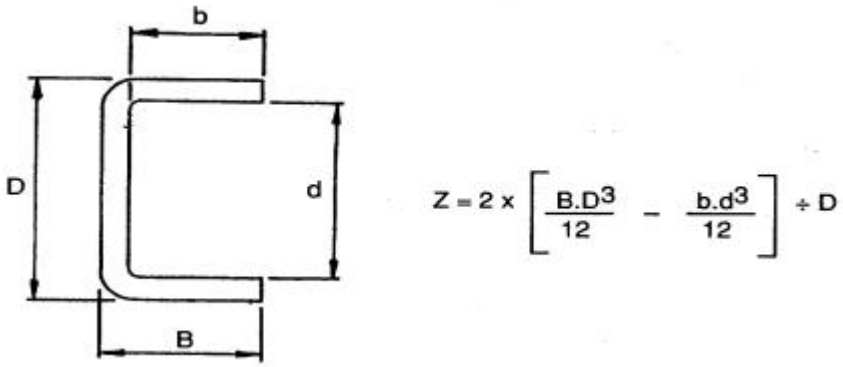
4. Locate the point on line D representing the original chassis rail RBM as calculated from the manufacturer's data.

5. Draw a straight line from the point on line C through the point on line D and mark the intersection of this line and line E on line E.

6. Read the section modulus from the scale on line E at the point described by 5 above. This is the section modulus required for the modified chassis.

After determining the required section modulus, the reinforcement necessary for the modified chassis may be determined by calculation of the section modulus of various reinforcement sections, or from Table 1.

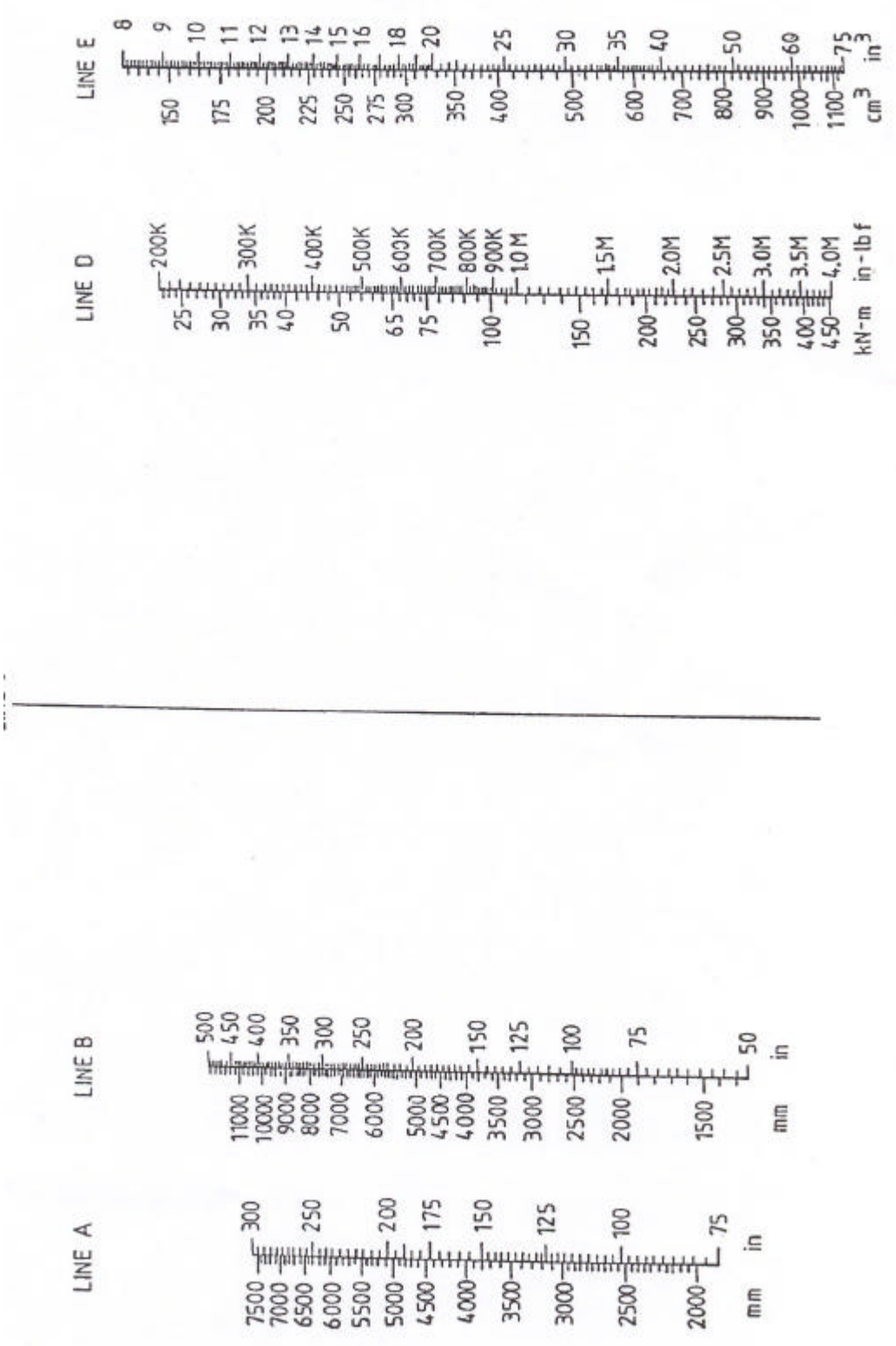
Formula for calculation of section modulus, Z.



Section Modulus Nomogram

HEAVY VEHICLE MODIFICATIONS

Appendix 1 – Sheet 7



HEAVY VEHICLE MODIFICATIONS

Appendix 1 – Sheet 8

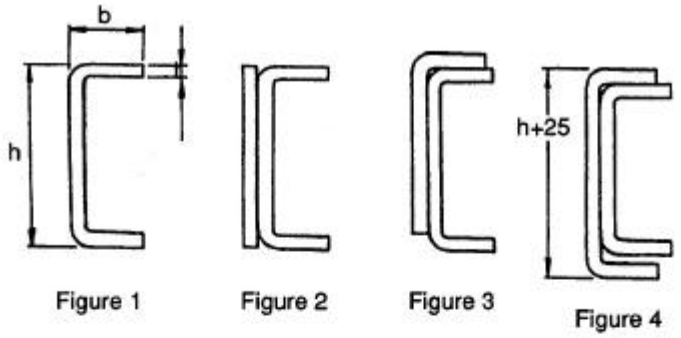


Figure 1 Figure 2 Figure 3 Figure 4

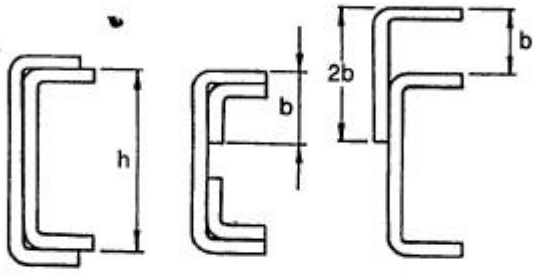


Figure 5 Figure 6 Figure 7

Note: Calculations for section moduli have been based on thickness of reinforcement equals chassis rail thickness, t

SECTION DEPTH h (mm)	MATERIAL THICKNESS t (mm)	SECTION MODULUS (x $10^{-6}m^3$) (Z)						
		Figure 1	Figure 2	Figure 3	Figure 4	Figure 5	Figure 6	Figure 7
200	6.4	128.31	173.05	186.81	260.55	253.02	230.89	191.73
225	6.4	151.58	206.97	223.68	273.66	298.08	273.17	228.11
250	6.4	175.34	243.68	263.83	353.96	345.77	317.25	253.51
300	6.4	228.60	326.92	350.68	460.48	449.50	410.17	317.25
200	7.9	155.35	209.92	228.60	317.91	307.91	274.16	242.69
225	7.9	183.54	252.69	272.84	373.62	363.14	325.61	276.12
250	7.9	213.03	298.41	320.37	433.44	421.97	379.36	314.30
300	7.9	277.76	400.66	427.70	563.72	549.79	492.92	391.98

Note: Flange Width, b = 75mm

Table 1 – Section Moduli

HEAVY VEHICLE MODIFICATIONS

Appendix 2

Chassis Modification Calculation Sheet Report No.

Vehicle Make & Model	Body Type	Weld Process
Chassis Material	**Reinforce Material**	**Weld Material**
Yield Stress:	**Yield Stress:**	\

Compiled: _____

Date: _____

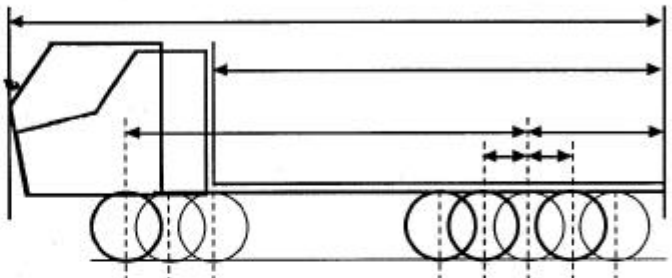
Reference: _____

_____

Modification: _____

_____

Turning Circle (m): _____



DATA	TOTAL	FRONT AXLE(S)	REAR AXLE(S)
Tare weight:			
Body & payload:			
Axle(s) cap:			
Tyres cap:			
Current regulatory limit:			
CALCULATIONS			
Load reactions:			
Section modulus (distribution):			
Bending moment–max:			
Critical stresses:			
Factor of safety on yield:			
Location of welded joints:			
Stress at welded joints:			

REMARKS: _____

_____

_____

Signed: _____ Date: _____ Res. No. _____

HEAVY VEHICLE MODIFICATIONS

Appendix H1

Modification Code H1

WHEELBASE EXTENSION OUTSIDE THE FIRST MANUFACTURER'S OPTION

Modifications that are covered under this Modification Code are:

1. Extension of existing chassis frame.
2. Re-location of axle/suspension assemblies.
3. Replacement of original chassis frame with one of greater length.

Modifications that are **not** covered under this Modification Code are:

1. Fitting of components that are not compatible with original vehicle componentry.
2. Frame modifications that do not meet the requirements of this National Code of Practice.

NOTE: The modified vehicle/modifications must continue to comply with all applicable ADR's, Australian Standards or Regulations/Acts.

Outlined below are areas of the vehicle that may have been affected by the modifications and that may require recertification, testing and/or data to show compliance for the modified vehicle.

DETAIL	REQUIREMENTS
Design	Manufacturer's Recommendations and National Code of Practice (Section H)
Chassis Frame Alteration	Modification Code H5
Body Mounting	Modification Code J1
Tail Shaft Modification	Modification Code C1
Extension of Brake Lines	Modification Code G1
Relocation of Axles	Modification Codes D1 and F1
Exhaust	Modification Code A4
Turning Circle	ADR 43/..

HEAVY VEHICLE MODIFICATIONS

Appendix H2

Modification Code H2

WHEELBASE REDUCTION LESS THAN FIRST MANUFACTURER'S OPTION

Modifications that are covered under this Modification Code are:

1. Reduction of existing chassis frame length.

2. Relocation of axle/suspension assemblies.

3. Replacement of original chassis frame with one of shorter length.

Modifications that are **not** covered under this Modification Code are:

1. Fitting of components which are not compatible with original vehicle componentry .

2. Frame modifications that do not meet the requirements of this National Code of Practice.

NOTE: The modified vehicle/modifications must continue to comply with all applicable ADR's, Australian Standards or Regulations/Acts.

Outlined below are areas of the vehicle that may have been affected by the modifications and that may require recertification, testing and/or data to show compliance for the modified vehicle.

DETAIL	REQUIREMENTS
Chassis Frame Alterations	Modification Code H5
Body Mounting	Modification Code J1
Tail Shaft	Modification Code C1
Brake Line Relocation	Modification Code G1
Relocation of Axles	Modification Codes D1 and F1
Exhaust	Modification Code A4

HEAVY VEHICLE MODIFICATIONS

Checklist H1/H2

WHEELBASE ALTERATIONS OUTSIDE THE FIRST MANUFACTURER'S OPTIONS

(Y=Yes, N=No)

delete if not applicable

1.0 Frame

1.1	Are all the dimensions of the frame rail (including all sections of a multi channel frame) identical to that offered by the manufacturer for the equivalent model?	Y	N
1.2	Are the dimensions of the additional reinforcement identical to those stated in the calculations?	Y	N
1.3	Are the material specifications and tensile yield strength of the original frame rail, frame rail extension and additional reinforcement compatible?	Y	N
1.4	Is the modified chassis frame of sufficient strength for the proposed application?	Y	N
1.5	Is the stress at maximum load less in the modified frame than in a standard unmodified vehicle with the same chassis rail and an equal or longer wheelbase?	Y	N
1.6	Is the type of additional reinforcement as per manufacturer's recommendations or as per this National Code of Practice?	Y	N
1.7	Is the location and attachment of the additional reinforcement as per manufacturer's recommendations or as per this National Code of Practice?	Y	N
1.8	Are all the additional cross members of the same design, material specifications, dimension and equivalent attachment as that offered by the manufacturer for the original vehicle?	Y	N
1.9	Is the spacing of the cross members on the modified chassis less than the manufacturer's standard cross member spacing for that model vehicle or alternatively this National Code of Practice?	Y	N
1.10	Are the chassis modifications in accordance with this National Code of Practice or alternatively the manufacturer's recommendations?	Y	N

2.0 Vehicle Specifications

2.1	Is the axle configuration (i.e. 4x2, 6x4 etc.), axle type, suspension type and installation, brake system, tyre size and GVM/GCM ratings the same as that offered by the manufacturer for an equivalent model?	Y	N
2.2	Has the vehicle been shown to comply with the requirements of applicable Code G checklists of this National Code of Practice?	Y	N

3.0 Welding

3.1	Is the welding in accordance with this National Code of Practice or the manufacturer's recommendations?	Y	N
3.2	Is all the welding performed by a suitably qualified tradesperson?	Y	N

HEAVY VEHICLE MODIFICATIONS

4.0 Driveline

4.1 Is the design and installation of the driveline capable of transmitting the maximum drive line torque and rotating at the maximum driveline speed without causing any undue vibration or reduction in working life of any component? Y N

5.0 Heat Treated Frame Rail

5.1 When establishing the size of additional reinforcement has allowance been made for the reduction in material strength due to welding? Y N

6.0 General

6.1 Does the modified vehicle comply with all the requirements of the applicable ADR's? Y N

6.2 Does the modified vehicle satisfy the requirements of the State or Territory Regulations? Y N

6.3 Is the quality of workmanship to a satisfactory standard? Y N

7.0 Records

7.1 Have all of the modification details and all calculations applicable to the modification been recorded in accordance with this Modification Code? Y N

If the answer to the question 2.1 on Vehicle Specifications is 'NO', then the modification may be acceptable, provided that the additional analysis that justifies the change in vehicle specification, proves satisfactory.

Vehicle Chassis No/VIN:. .....

Vehicle Modifier:.....

Examined by:.....

Company (if applicable):.....

Certifying Officer No:……Modification Certificate No::.....…….

Modification Plate No:…….

Signed:…….....Date:.....

HEAVY VEHICLE MODIFICATIONS

Appendix H3

Modification Code H3

WHEELBASE ALTERATIONS WITHIN FIRST MANUFACTURER'S OPTION

Modifications that are covered under this Modification Code are:

1. Wheelbase extension or reduction within first manufacturer's options.
.
2. Relocation of axle/suspension assemblies.

3. Replacement of original chassis frame with one of greater length.

Modifications that are **not** covered under this Modification Code are:

1. Fitting of components that are not compatible with original vehicle componentry .

2. Frame modifications that do not meet the requirements of this National Code of Practice.

3. Wheelbases outside the range offered as an option by the original manufacturer.

NOTE: The modified vehicle/modifications must continue to comply with all applicable ADR's, Australian Standards or Regulations/Acts.

Outlined below are areas of the vehicle that may have been affected by the modifications and that may require recertification, testing and/or data to show compliance for the modified vehicle.

DETAIL	**REQUIREMENTS** .
Chassis Extension	Manufacturer's Recommendations, National Code of Practice
Cross Members	Manufacturer's Specifications
Body Mountings	Modification Code J1
Tail Shaft	Manufacturer's Specifications
Brake Line Relocation	Manufacturer's Specifications
Relocation of Axles	Modification Code D1
Exhaust	Modification Code A4

HEAVY VEHICLE MODIFICATIONS

Checklist H3

WHEELBASE ALTERATIONS WITHIN FIRST MANUFACTURER'S OPTIONS

(Y=Yes, N=No)
delete if not applicable

1.0 Frame

1.1	Are the nominal dimensions of the frame rail section the same as that offered by the manufacturer for the equivalent model?	Y	N
1.2	Are the dimensions of the reinforcement(s) identical to those stated in the calculations?	Y	N
1.3	Are the material specifications and tensile yield strength of the frame rail extension equivalent to that of the original frame rail?	Y	N
1.4	Is the modified chassis frame of sufficient strength for the proposed application?	Y	N
1.5	Is the material thickness of frame rail greater than the material thickness of the reinforcement?	Y	N
1.6	Is the location and attachment of the additional reinforcement as per manufacturer's recommendations or as per this National Code of Practice?	Y	N
1.7	Are all the additional cross members of the similar design, material specifications, dimension, location and attachment as that offered by the manufacturer for the equivalent model?	Y	N

2.0 Vehicle Specifications

2.1	Is the axle configuration (i.e. 4x2, 6x4 etc.), axle type, suspension type and installation, brake system, tyre size and GVM/GCM ratings the same as that offered by the manufacturer for an equivalent model, or are the variations in vehicle specifications covered by codes stated on the Certificate of Modification?	Y	N
2.2	Is the wheelbase within the range as offered by the manufacturer for the equivalent model?	Y	N

3.0 Welding

3.1	Is the welding in accordance with this National Code of Practice or the manufacturer's recommendations?	Y	N
3.2	Is all the welding performed by a suitably qualified tradesperson?	Y	N
3.3	When establishing the size of additional reinforcement, for heat treated frame rail, has allowance been made for the reduction in material strength due to welding?	Y	N

4.0 General

4.1	Are the modifications in accordance with this National Code of Practice or the manufacturer's recommendations?	Y	N
4.2	Is the quality of workmanship to a satisfactory standard?	Y	N
4.3	Have modification details and calculations applicable to the modification been retained in accordance with this Modification Code?	Y	N

NOTE: If the answer to any relevant question is “NO”, the modification is not acceptable.

HEAVY VEHICLE MODIFICATIONS

Vehicle Chassis No/VIN:. .....

Vehicle Modifier:.....

Examined by:.....

Company (if applicable):.....

Certifying Officer No:…… Modification Certificate No:.....……..

Modification Plate No:……

Signed:……Date:…….

HEAVY VEHICLE MODIFICATIONS

Appendix H4

Modification Code H4

CHASSIS FRAME ALTERATION

Modifications that are covered under this Modification Code are:

1. Chassis frame alteration.

2. Cross member alteration.

Modifications that are **not** covered under this Modification Code are:

1. Change in original wheelbase.

2. Fitting of components that are not compatible with original vehicle components.

3. Frame modifications that do not meet the requirements of this National Code of Practice.

NOTE: The modified vehicle/modifications must continue to comply with all applicable ADR's, Australian Standards or Regulations/Acts.

Outlined below are areas of the vehicle that may have been affected by the modifications and that may require recertification, testing and/or data to show compliance for the modified vehicle.

DETAIL	**REQUIREMENTS** .
Chassis Member Alterations	Chassis strength must be maintained. Reinforcements must comply with the requirements of this National Code of Practice.
Body Mounting	Modification Code J1
Brake Line Relocation	Modification Code G1
Relocation of Axles	Modification Code D1

HEAVY VEHICLE MODIFICATIONS

Checklist H4

CHASSIS FRAME ALTERATION

(Y=Yes, N=No))
delete if not applicable

1.0	**Frame**		
1.1	Are all holes in the chassis drilled or reamed?	Y	N
1.2	Are all holes in the web of the chassis rail, except where the original manufacturer's specifications allow holes in the flange of the chassis rail?	Y	N
1.3	Are all holes spaced at least three times the diameter of the largest hole apart?	Y	N
1.4	Were the modified chassis rails straight and square prior to assembly?	Y	N
1.5	Are all cross members designed, positioned, and attached as per the manufacturer's specifications or as per this National Code of Practice?	Y	N
1.6	Do reinforcement sections terminate at a distance of greater than 2H from all spring hangers and joins in the frame rail, where H = depth of the chassis rail?	Y	N
1.7	Are the ends of reinforcement sections suitably tapered?	Y	N
1.8	Does the thickness of the frame rail material exceed the thickness of the reinforcement section?	Y	N
1.9	Do the profiles of all frame cutouts have a smooth transition to the original frame profile, and are all edges dressed smooth?	Y	N
1.10*	Are all frame cutouts positioned forward of the rearmost front suspension hanger bracket?	Y	N
1.11*	Do all frame cutouts remove less than 50% of the frame rail flange ?	Y	N
1.12*	Are all frame cutouts in the upper and lower flanges a suitable distance apart?	Y	N
1.13	Is the chassis of sufficient strength for its application?	Y	N
2.0	**Welding**		
2.1	Is all welding performed in accordance with the manufacturer's recommendations or this National Code of Practice?	Y	N
2.2	Is all welding performed by suitably qualified tradesman?	Y	N
3.0	**Vehicle Specifications**		
3.1	If a suspension change has been carried out, has the suspension been installed in accordance with the suspension manufacturer's recommendations?	Y	N
3.2	If an additional axle has been fitted, has it been installed in accordance with the axle manufacturer's recommendations?	Y	N

HEAVY VEHICLE MODIFICATIONS

4.0 General

4.1	Are the modifications in accordance with this National Code of Practice or the manufacturer's recommendations for modifications of this nature?	Y	N
4.2	Does the modified vehicle comply with all the requirements of the applicable ADR's?	Y	N
4.3	Does the modified vehicle satisfy the requirements of the State or Territory Regulations?	Y	N
4.4	Is the quality of workmanship to a satisfactory standard?	Y	N
4.5	Have all of the modification details and all calculations applicable to the modification been recorded in accordance with this Modification Code?	Y	N

*If the answer to the questions 1.10, 1.11 or 1.12 on frame cutouts is 'NO, then the modification may be acceptable, provided that the chassis is shown to be suitably reinforced in the appropriate regions.

Vehicle Chassis No/VIN:. ....

Vehicle Modifier:..... . .....

Examined by:..... .....

Company (if applicable):..... .....

Certifying Officer No:…… Modification Certificate No:.....……..

Modification Plate No:……

Signed:…….....Date:.....

HEAVY VEHICLE MODIFICATIONS

Appendix 3

TRAILER CHASSIS FRAME MODIFICATION

1. SCOPE

This section relates to modifications made to the chassis frames of heavy trailers. It provides guidelines for the trailer modifier and specifies minimum requirements the trailer modifier should ensure are met when performing modifications to trailer chassis.

This Code is applicable in modifications where the registration category of configuration of the trailer to be modified is not changed, for example, kingpin to suspension centre dimension extension, suspension substitution, tandem axle to tri-axle.

This modification scheme does **not** apply to a trailer that, after modification, requires a change in the registration category of the trailer, for example, semi-trailer to dog trailer, pig trailer to dog trailer, semi-trailer to a dolly, etc. Such trailers are regarded as newly manufactured and must be issued with a new Vehicle Identification Number (VIN) and fitted with a new Compliance Plate issued by the Federal Office of Road Safety.

As Section H5 is concerned only with the chassis modifications, it must be read in conjunction with other relevant Sections of this Code of Practice to ensure the trailer is modified in a satisfactory manner. The Certifying Officer should ensure that the modified trailer meets the requirements of the registering authority legislation and the ADR's.

2. GENERAL INFORMATION

The trailer chassis must adequately support and secure the load being carried and have a satisfactory working life under all designed operating conditions. It must be able to transmit the prime mover tractive force and sustain braking and suspension forces, whilst accommodating shock loads and twisting from uneven road surfaces. The chassis, however, must not be so flexible as to upset trailer and load-carrying stability.

A satisfactory trailer chassis is the result of careful design, extensive testing and service experience. Modifications therefore should not be undertaken without consultation with the trailer manufacturer or an Engineer experienced in commercial heavy trailer design and modification, to ensure that the modification is not detrimental to the trailer's safety or performance.

To simplify the analysis of the modifications, it is recommended that the modified trailer should, where possible, remain within the options offered by the first manufacturer.

The modifier must consider the intended application of the trailer, in terms of the type of load and the road surface.

Loads may be identified by different categories: uniformly distributed load (for example, a cattle trailer), point load (for example, a container trailer), or a combination of these loads (a general goods-carrying flat deck).

Road surfaces may range from exclusively off-road to exclusively on-highway, or any combination of these.

Factors that influence the designed slope and camber of the trailer include the turntable and suspension height, the location of the load support and securing features and the proposed method of loading. For example, when compared to flat-top general goods type semi-trailers, container-type semi-trailers generally must have less slope to facilitate side loading and unloading by forklift, and less camber to ensure the containers are supported at the twist-lock locations.

Particular care must be taken when modifying 'monocoque' type trailers (for example, some cattle trailers) or tanker trailers. The design of this type of trailer uses the body sidewall structure (that is, the trusses or the tank) to contribute to the strength and rigidity of the chassis, or to replace the chassis completely. Any change to this structure could radically alter the strength and torsional characteristics of the trailer and must be substantiated by engineering examination.

Because of the various trailer manufacturers' design philosophies and methods of manufacture, the manner of modification will differ somewhat between trailers of different makes or types. The modifier, however, must always ensure that the method and nature of the modification is suitable for the application and operating conditions of the specific trailer.

3. ADR's AFFECTED

No ADR's are affected directly as a result of chassis modifications. However, it is likely that trailer compliance with certain ADR's will require examination, for example, ADR 38/.. Trailer Brake Systems. It is necessary to review all ADR's applicable to the trailer to determine where compliance may be affected.

In addition, the modifier must ensure the trailer mass rating and other traffic regulations pertaining to the trailer (for example, dimensional requirements) are met.

This should be done **before** any modifications are commenced.

4. AFFECTING MODIFICATIONS

The most common trailer chassis modifications are:

- Increasing or decreasing wheelbase.
- Additional axles/suspension change/increased mass rating.
- Increasing overall length.
- Adding container twist locks.

5. GENERAL REQUIREMENTS

It is recommended that the specifications of the modified trailer remain within the options offered by the original manufacturer. In this manner, the design process, sourcing of components, and evaluation of the modification is simplified. However, given the nature of trailer manufacturing, there are generally no 'standard option' trailers, and the modifier must normally demonstrate the integrity of the design by calculation.

If the proposed modifications render the trailer **identical** to a specification offered by the original manufacturer, including chassis design, kingpin to suspension centre dimension, and suspension and axle configuration, then, provided all work is appropriately executed, no additional evaluation of the modifications would be required.

The modified trailer chassis must satisfy the minimum criteria given below.

5.1 Chassis Components

All additional material used in modifying the chassis rails must be of the same dimensions and material specification. It is recommended that the original manufacturer's frame material and components be used if available.

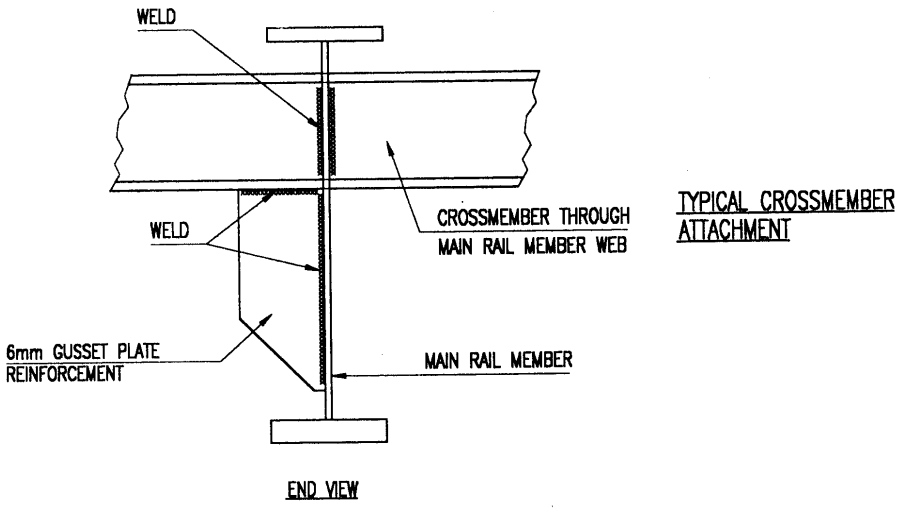
All changes in section must have a smooth transition, typically not less than 1 in 4.

Cross member design and spacing must be adequate to support the nature and magnitude of the load. The maximum intermediate cross member spacing must not exceed that which is specified by the original manufacturer, unless it can be demonstrated by an Engineer's calculations that the chassis strength and torsional rigidity is satisfactory.

New cross members should be of a design that is compatible with the design of the chassis to ensure that the modified trailer's torsional rigidity is similar to that of the original chassis design. The simplest method to ensure this is to use original manufacturer's cross members, where possible, installed in accordance with the manufacturer's recommendations.

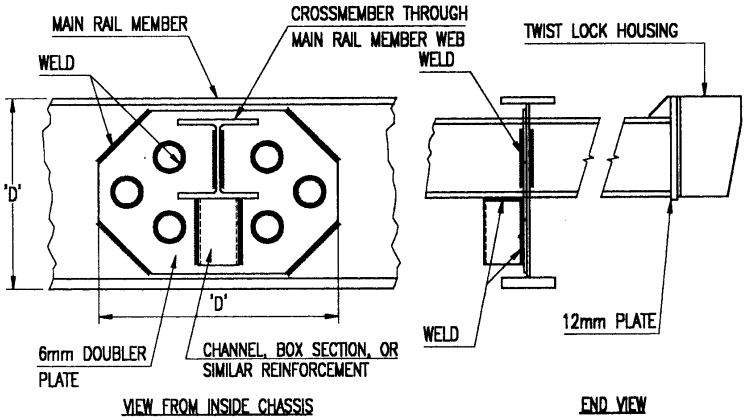
Where this is not possible, any alternative cross member design and method of attachment should provide similar bending, tensile, and torsional strength and rigidity to that of the original manufacturer. For example, closed-section cross members fabricated from RHS and pipe have high torsional rigidity compared with open sections such as RSJ's and channels, and should not be used as replacements for open section members.

Cross members should be welded or bolted to the main rails by the webs only. Welding or bolting through the rail flanges is not permitted. RSJ cross members must be welded by the web only. Reinforcement of the cross member to main rail connection is generally required. An example of a suitable arrangement is shown below.



Cross members must have sufficient strength to accommodate the forces imposed by the load under all conditions with an adequate factor of safety. For example, trailers designed to carry heavy wheel-type loads, such as earth-moving equipment, would have cross members relatively closely spaced and/or larger than a standard trailer.

Typically, cross members carrying container locks would continue full width through the frame rails, and have a doubler plate on the frame rail web and suitable stiffener under the cross member. An example of a suitable arrangement is shown below.



TYPICAL CONTAINER LOCK CROSSMEMBER ARRANGEMENT

Suspension cross members must adequately support the suspension assembly to accommodate the high bending forces in these regions. To achieve this, the suspension hanger brackets must be fastened to the cross member(s) directly and/or through the chassis rails.

The end of frame cross member is often used for mounting a tow coupling, and if so, must be designed and manufactured to satisfy the requirements of ADR 62 "Mechanical Connections Between Vehicles". It should be noted that tow members with a high D-value require substantialreinforcing and bracing.

All chassis components should be straight prior to assembly (with the exception of any camber designed into the main rails). Bowed components must not be straightened by the assembly of the chassis.

All fabricated sections and components of the chassis must have suitable radii on any bends, and be free of cracks, notches and imperfections.

Holes are to be drilled or punched. Flame cut holes are not permitted, unless ground or reinforced.

The distance between hole centres is to be not less than 3 times the diameter of the largest hole.

Fastener hole diameters must not exceed the fastener diameter by more than 1.5mm and should not be elongated.

All bolts for structural purposes must be ISO Metric Grade 8.8 or SAE Grade 5. Countersunk bolts should be avoided where possible, and allowance made for their lower tensile capabilities.

All structural bolts should be fitted with hardened washers and self-locking nuts. Spring-type lock washers are **not** permitted on structural members.

All fasteners that are removed should be replaced with new fasteners to avoid the possibility of re-using fasteners whose mechanical properties have been compromised in prior use.

All bolts must be tightened in an acceptable manner to the correct torque.

Alteration to air or hydraulic lines should use piping of the same bore as the original manufacturer's, and should not introduce additional restrictions at fittings.

Any alteration to the electrical system should be waterproof and electrically sound.

5.2 Cutting of Frame Rails

When the modification of a chassis involves cutting a frame, primary consideration must be given to the maintaining of the structural integrity of the chassis.

Two situations that can occur in the modification of a trailer chassis are:

1. The load distribution on the frame is improved and bending stress in the frame is reduced over the unmodified chassis, as in the case of a kingpin to suspension centre dimension reduction

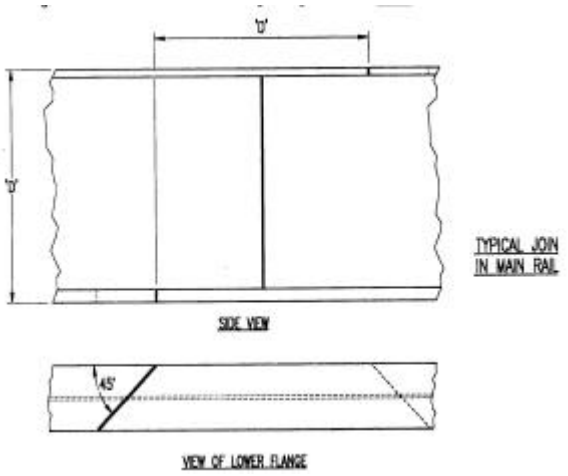
2. The load distribution on the frame is degraded, for example, by the increasing of the kingpin to suspension centre dimension or the addition of another axle behind the rearmost axle. The load distribution may increase the bending stress on the frame to values beyond which the unmodified frame is considered adequate. Note that moving the kingpin forward by even a small amount (for example, 300mm), may have a profound affect on the bending stress in the chassis, and the stress **must** be re-calculated.

Where the load distribution is improved and the bending moment in the frame is reduced, the modification should be adequate provided that any joint in the chassis rails is not located in a region of high stress, and that the method of joining and any joint reinforcement are satisfactory.

Where the load distribution results in a greater bending moment than the standard options offered by the original manufacturer, the strength of the modified chassis must be demonstrated to be adequate by an Engineer's calculations.

Any join in the chassis must **not** be placed at a point of high stress, for example, at the neck or in the vicinity of suspension hanger brackets. The region where a cross member meets the frame rails and the immediate vicinity should be avoided where possible. Joins are generally best positioned in the deeper section of the frame rails.

The configuration of the join in the frame rail should be in accordance with the original manufacturer's recommendations or, if unavailable, the joins in the top flange, web, and lower flange(s) must be staggered in a manner similar to that shown below. Where possible, joins in the lower flange should be made at 45 degrees. Straight joins in the lower flange should be reinforced (refer to Section 5.4).



5.3 Welding of Frame Rails

Before any welding is performed on the trailer chassis, the material specification of the frame rail must be determined to ensure the correct welding procedure is used. All welding must be carried out in accordance with the original manufacturer's recommendations, and AS 1554 SAA Structural Steel Welding Code or similar accepted standard and carried out by a competent tradesperson.

Always attach the earth welding cable terminal as close as possible to the region in which welding is being carried out. Never attach the welding earth cable terminal to components such as axles, springs or other suspension components. Arcing on these components may cause serious damage to bearing surfaces, springs, or other stressed components. Special attention must be paid to suspension parabolic leaf springs and air suspension springs. Every care must be taken to protect these components against welding sparks and spatter.

Hoses and conduits, for example for brake and electrical systems, should be protected from cutting and welding sparks and spatter. Plastic and rubber materials should not be exposed to temperatures above 80°C.

Auxiliary air, oil, and fuel tanks in the vicinity of welding should be removed.

As a precaution, electronic components for the anti-lock braking system, if fitted, should be disconnected before the commencement of welding.

Welds should not be placed within 25mm of the edge of the flanges, except for joints in the rail flange or attachment of longitudinal strapping. Welds must not be undercut.

Welds transverse to the rail flanges should be avoided wherever possible, and are **not** permitted in regions of high stress.

Special attention should be given to joint preparation, pre- and post-heat, and welding consumables. Low hydrogen consumables should be used for welding of suspension brackets.

Joins in the frame rails must undergo full edge preparation on the top and bottom flanges and be continuously welded all around.

All paint, dirt, and grease should be removed in the region of the weld prior to welding. In low ambient temperatures or if there is dew or other moisture present, the region to be welded should be warmed slightly with an oxy-fuel torch. Welds must not be cooled with water.

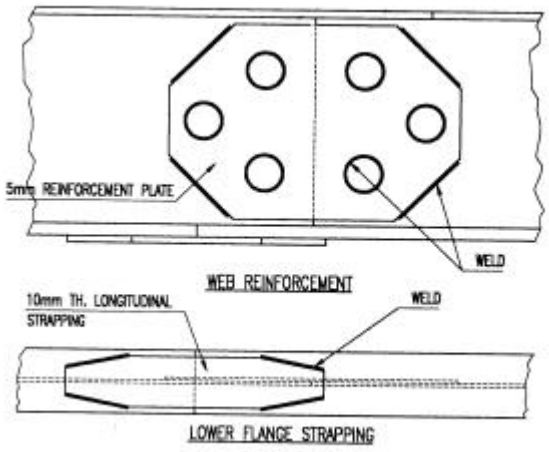
The minimum length of any weld should be 30mm and care should be taken that welds are not undercut.

Welds may be ground flush with the chassis rail, but care should be taken not to grind back the weld and chassis rail material excessively, so reducing the section thickness. Grinding should be carried out so that the grinding marks are **along** the frame rail.

5.4 Frame Rail Reinforcement

Joins should be positioned in regions of low stress, but if this is not possible, frame rail reinforcement may be required to ensure adequate chassis strength.

The reinforcement would typically consist of a web stiffening plate weld, and flange strapping plates. Reinforcing sections should be attached to the chassis rail securely by welding.



The ends of any reinforcing section should be tapered to reduce the abrupt change in chassis stiffness as a result of the installation of the reinforcement.

The thickness of any reinforcement section should not exceed the thickness of the chassis rail material at the point of reinforcement.

6. RECORDING

The Appendix to this document is Appendix H5 that:

- Outlines specific requirements pertaining to trailer chassis modifications with should be addressed by the Modifier.
- Includes a checklist appropriate to Modification Code H5 that must be completed.

Analysis notes, sketches and other trailer data, any calculation sheets, and the completed checklist should be retained by the Certifying Officer for at least the period specified in Part A of this National Code of Practice.

HEAVY VEHICLE MODIFICATIONS

Appendix H5

Modification Code H5

TRAILER CHASSIS FRAME MODIFICATION

Modifications that are covered under this Code are:

1. Chassis modifications where the registration category of configuration of the trailer to be modified is not changed.

Modifications that are **not** covered under this Modification Code are :

1. Modifications that change the registration category of the trailer
2. Changes in the mass rating of trailers
3. The fitting of alternative suspension systems
4. The fitting of king pins or other tow couplings
5. The mounting of bodies on trailers

NOTE: The modified vehicle/modifications must continue to comply with all applicable ADR's, Australian Standards or Regulations/Acts.

Outlined below are some areas of the trailer that may have been affected by the modifications and that may require recertification, testing, and/or data to show compliance for the modified trailer.

DETAIL	REQUIREMENTS
ATM rerating	Section S
Fitting of alternative suspension	Modification Code F2
Trailer Brake System Upgrading - Non standard	Modification Code G3
Trailer Brake System Upgrading - Standard	Modification Code G8
King pin or tow coupling installation	Section P
Body mounting	Section J

HEAVY VEHICLE MODIFICATIONS

Appendix H5

Modification Code H5

TRAILER CHASSIS FRAME MODIFICATION

SPECIFIC REQUIREMENTS

1. Wheelbase or frame extension or reduction

To achieve a desired wheelbase, it is preferable to shorten a longer wheelbase chassis than to extend a shorter wheelbase chassis. This has the advantage of possibly eliminating joins in the chassis rails.

1.1 Kingpin to suspension centre dimension increase or frame lengthening

Where possible, the increase in kingpin to suspension centre dimension should be achieved by moving the entire suspension/axle assembly(s) and/or kingpin/attachment assembly to the appropriate position or by extending the front or rear overhang. Cutting and joining of the chassis should only be performed when there is insufficient chassis length to achieve the above. When the suspension/axle assembly(s) or king-pin/attachment assembly is relocated, all associated cross members and chassis reinforcements must also be relocated.

The extended chassis, if outside the original manufacturer's options, must have stress calculations performed by an Engineer to ensure the allowable limits are not exceeded. These calculations are required to be kept on file by the Certifying Officer for at least the period specified in Part A of the National Code of Practice.

If the modified kingpin to suspension centre dimension exceeds that offered by the original manufacturer, it is likely that the frame will require additional reinforcement. All frame reinforcements must be in accordance with this Code.

Note that an extension of the trailer kingpin to suspension centre dimension may require additional testing of the braking system to show compliance with the requirements of G3 or G8 of this Code of Practice.

1.2 Kingpin to suspension centre dimension reduction or frame shortening

Where possible, the reduction in kingpin to suspension centre dimension should be achieved by moving the entire suspension/axle assembly(s) and/or kingpin/attachment assembly to the appropriate position. When the suspension/axle assembly(s) or kingpin/attachment assembly is relocated, all associated cross members and chassis reinforcements must also be relocated.

It may also be necessary to reduce the trailer rear overhang to maintain compliance with the relevant State jurisdiction's regulations.

The shortened kingpin to suspension centre dimension should be not less than the shortest optional kingpin to suspension centre dimension offered by the original manufacturer. If the kingpin to suspension centre dimension is shorter than the shortest optional kingpin to suspension centre dimension offered by the manufacturer, the trailer may require additional testing of the braking system to show compliance with the requirements of G3 or G8 of this Code of Practice.

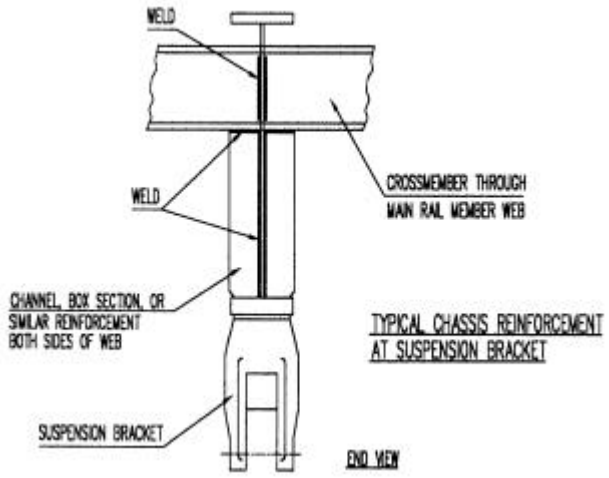
Note than a reduction in kingpin to suspension centre dimension may also result in a reduction in axle ratings due to restrictions from applying the bridge loading formula.

2. Suspension modifications

This Section of the Code is only applicable to the relocating of existing suspensions or chassis modifications arising from the fitting of an alternative suspension. This Section must be read in conjunction with Section F "Suspension" of this National Code of Practice.

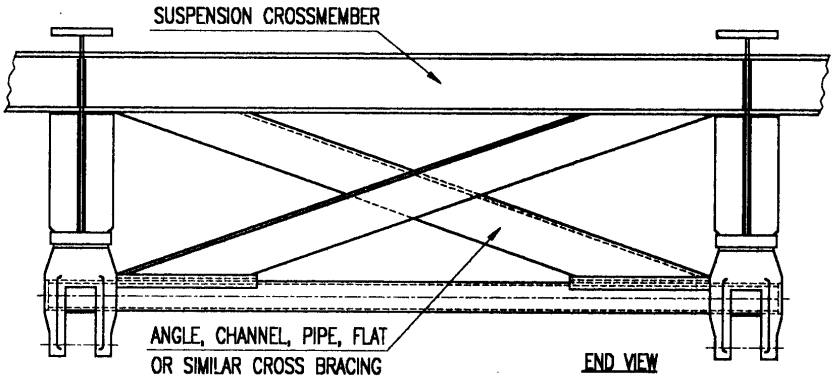
The design of cross members must be suitable for the type of suspension to be fitted and the design of the frame rails and cross members should allow the bad from the suspension spring hangers to be evenly distributed into the chassis.

The frame rail web should be suitably reinforced at the connection of the suspension hanger bracket, such as in the method shown below.



TYPICAL CHASSIS REINFORCEMENT AT SUSPENSION BRACKET

The frame will require adequate cross bracing at the suspension mounting positions. The material used for the cross bracing is often dictated by the design of the suspension brackets. Cross bracing at least equivalent to the original manufacturer's must be incorporated into the chassis at the suspension mounting positions.



TYPICAL CHASSIS CROSS BRACING AT SUSPENSION BRACKETS

The new suspension must be the correct width for the chassis.

If the suspension mass rating is less than the original, re-rating of the trailer may be required in accordance with Section S of this National Code of Practice.

If a non-optional suspension is to be fitted to the trailer, the suspension manufacturer's installation instructions should be followed. In addition, a full analysis of the chassis/suspension package must be undertaken.

A change to a non-standard suspension configuration requires re-calculation of the braking system and re-certification to ADR 38/... Refer to Section G of this National Code of Practice.

3. Fitting or removal of axles

Any change in the number of axles will likely result in a change in the mass rating of the trailer. Refer to section 4 'Change in Trailer Mass Rating' below.

The addition or removal of axles requires a different suspension to be fitted. Refer to Section 3 of this National Code of Practice.

4. Change in trailer mass rating

Any mass re-rating of a trailer must be performed in accordance with the requirements specified in Section S of this National Code of Practice.

The usual modification is to install an additional axle to allow an increase in the mass rating of the trailer, for example, tandem axle semi-trailer to a tri-axle semi-trailer. If an increase in mass rating is sought, the trailer frame must be demonstrated to have sufficient strength to accommodate this increase by the duplication of an existing option offered by the original manufacturer, or by chassis strength calculations performed by an Engineer.

The modified chassis, if outside the original manufacturer's options, must have stress calculations performed by an Engineer to ensure the allowable limits are not exceeded.

For normal highway applications, the maximum stress at maximum static load for the modified chassis should give a factor of safety on the yield strength of the rail material of not less than three (3). For off-highway or other special applications, an engineering evaluation should be performed to determine a suitably increased factor of safety.

If the bending stresses exceed those found in the original designed chassis, it is likely that the frame will require additional reinforcement.

All frame reinforcements must be in accordance with this Code.

The modified trailer's braking system must also be shown to be adequate at the increased mass rating. Refer to Section G of this National Code of Practice.

5. Fitting fifth wheels (B-double trailers), king pins, or other tow couplings

The fitting of any fifth wheel, king pin, or other tow coupling must satisfy the requirements of Section P of this National Code of Practice and ADR 62/.. "Mechanical Connections Between Vehicles".

The modified chassis must have adequate strength to accommodate the forces delivered via the fifth wheel, king pin, or other tow coupling fitted.

HEAVY VEHICLE MODIFICATIONS

Checklist H5

TRAILER CHASSIS FRAME MODIFICATION

(Y=Yes N=No)
Delete if not applicable

1.	Is the modified chassis configuration the same configuration as the original chassis (i.e. is the category of registration unchanged)?	Y	N
2.	Is the slope, camber, and skid plate height suitable for the intended application of the trailer?	Y	N
3.	Has the chassis been shown to be of sufficient strength with a suitable factor of safety for the proposed mass rating of the trailer?	Y	N
4.	Does the chassis have suitable torsional characteristics for the intended application of the trailer?	Y	N
5.	Have materials of the correct dimension and specification been used in the modification of the chassis?	Y	N
6.	Do all changes in section have a smooth transition?	Y	N
7.	Is the cross member design and spacing adequate for the intended application of the trailer and nature of the load?	Y	N
8.	Are the cross members fastened only to the webs of the main rails?	Y	N
9.	Are the cross member to main rail connections suitably reinforced?	Y	N
10.	Are all container twist locks adequately connected to the chassis and all cross members that support container twist locks of sufficient strength?	Y	N
11.	Are all suspension brackets suitably and adequately attached to the chassis?	Y	N
12.	Has the chassis been suitably reinforced at the attachment positions of the suspension hanger brackets?	Y	N
13.	Has the suspension assembly(s) suitable cross bracing?	Y	N
14.	Do all suspension, axle, wheel, and chassis components have sufficient clearance to accommodate the entire range of travel of the suspension, including the complete deflation of an air bag in an air suspension?	Y	N
15.	Are all joins in the chassis in regions of low stress, or if not, have the joins been adequately reinforced?	Y	N
16.	Have good welding practices been followed?	Y	N

HEAVY VEHICLE MODIFICATIONS

17. Does the trailer meet the requirements of Section G of this National Code of Practice? Y N

18. Do all towing devices on the trailer meet the requirements of Section P of this National Code of Practice? Y N

19. Have the general requirements of Section 5 of this National Code of Practice been met? Y N

20. Is the quality of workmanship to a satisfactory standard? Y N

NOTE: If the answer to any relevant question is "NO", the modification is not acceptable.

Certification

Trailer Make:..... Model .....

Vehicle Chassis No/VIN:…….. .

Vehicle Modifier: .

Examined by:…….

Company (if applicable):……..…….

Certifying Officer No:……Modification Certificate No:……

Modification Plate No:……

Signed:……..……Date:……