

LEADING EDGE OF SUB-FRAME

The following document has been prepared by TCS to provide guidance to vehicle modifiers when fabricating a body sub-frame and focuses on the 'leading' or front edge of the sub-frame.

These guidelines are supplied without prejudice and free of charge to assist body builders. TCS will not be held liable for any problems that arise from misinterpretation of these guidelines or from the introduction of new rules after the issue date of these guidelines. The following documents should be read in conjunction with these guidelines:

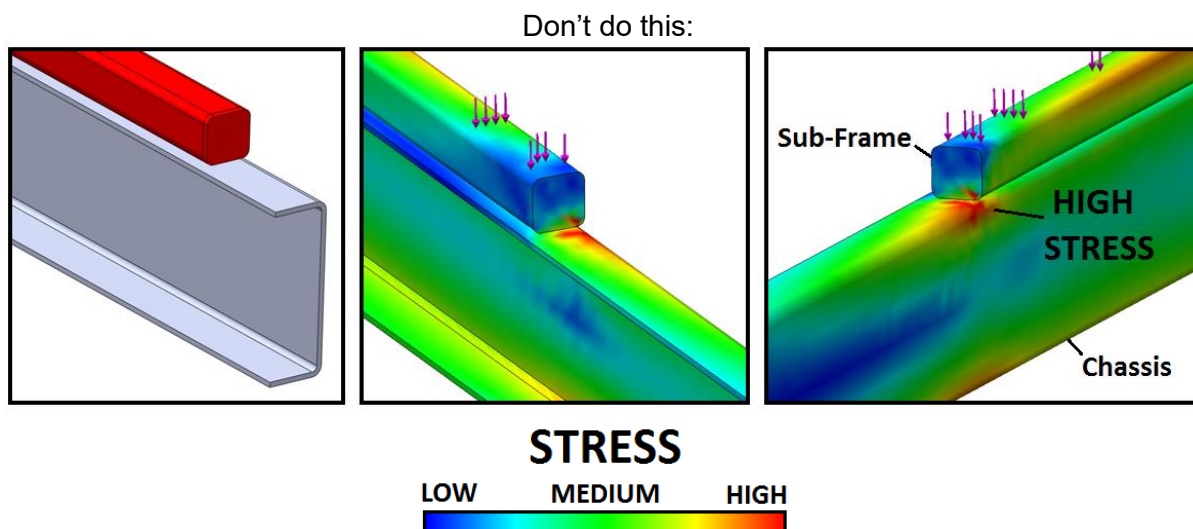
1. OEM Modification & Body Building Guidelines
(takes precedence over VSB-6 and TCS guidelines)
2. VSB-6 Section J: National Code of Practice for Body Installations on heavy vehicles
(this is largely paraphrased throughout this document but still takes precedence over TCS guidelines)
3. Disclaimer on the last page of this document.

All modifications must be carried out by a suitably qualified tradesperson in accordance with the relevant Australian Design Rules, Australian Standards and National Codes of Practice. Any uncertainties should be discussed with TCS prior to commencing the modification.

Appendix 1 contains extracts from various OEM Body Building Guidelines for modern vehicles. OEM guidelines must always be sought and reviewed by the modifier (TCS has a vast database and can often provide guidelines for older vehicles) but if OEM Guidelines cannot be found for the vehicle in question, refer to the instructions of VSB6 which are largely summarised below.

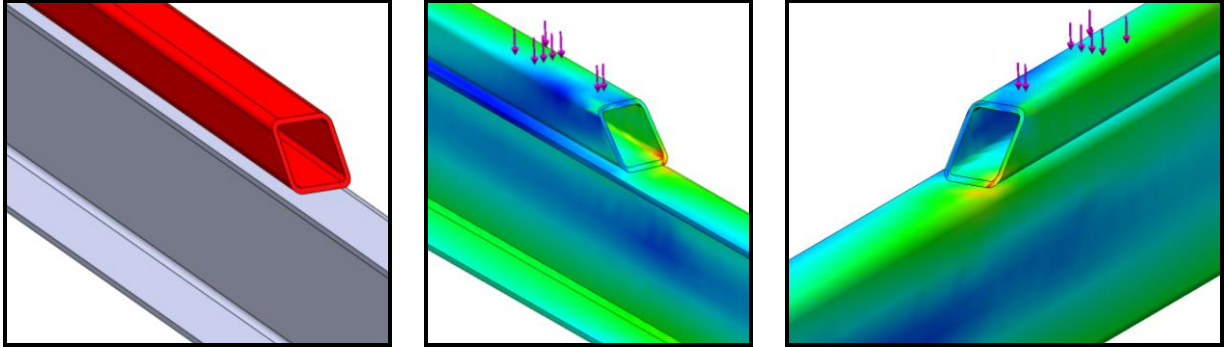
The leading edge of the sub-frame must be designed so that the stiffness of the sub-frame is gradually reduced.

This prevents the front of the sub-frame acting like a knife edge and point loading the vehicle chassis. If the sub-frame ends abruptly the chassis may fail and the body builder may be held responsible. The effect of this point loading is shown in the computer simulations below.

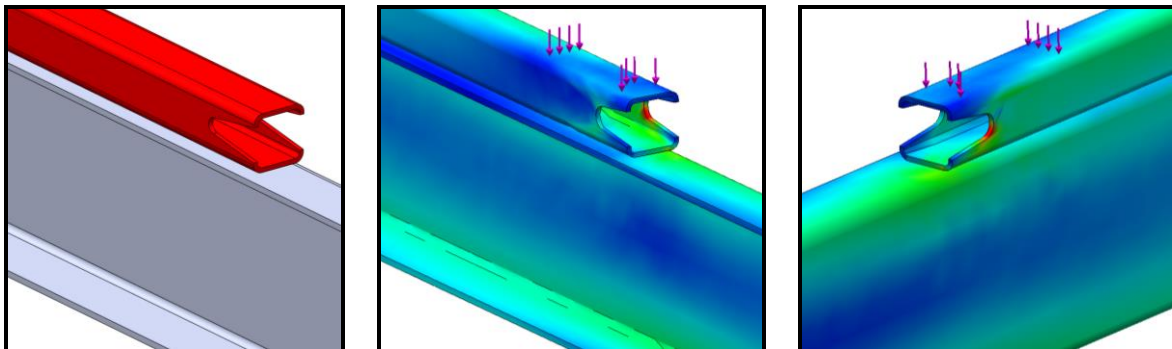


LEADING EDGE OF SUB-FRAME

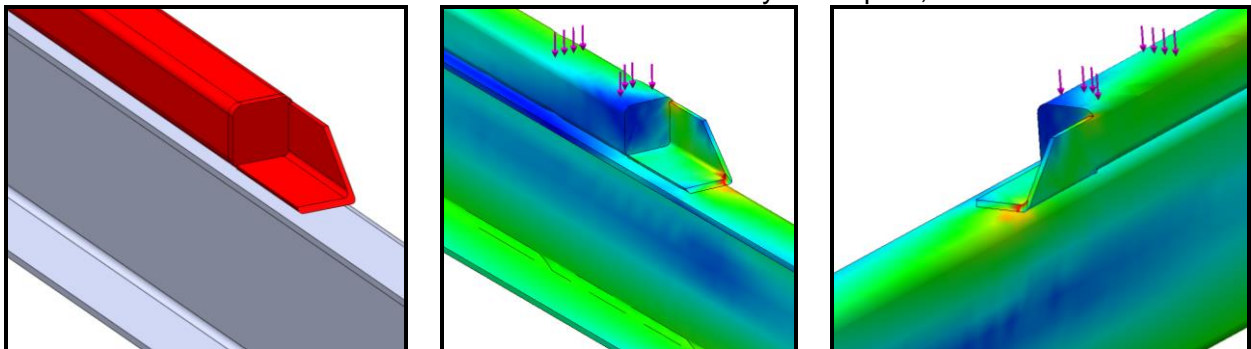
This profile provides a gradual reduction in stiffness and protects the chassis:



So does this one:

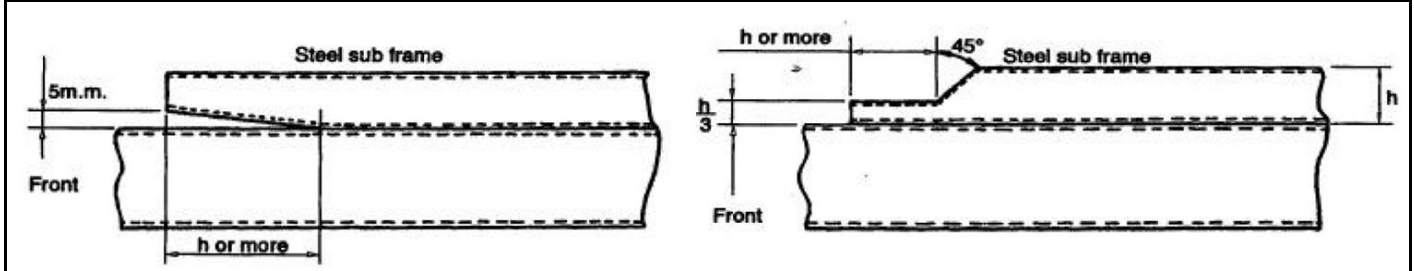


If the sub-frame is second hand and has been built incorrectly in the past, a section can be attached:

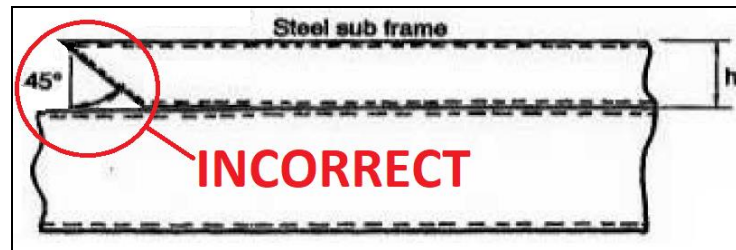


LEADING EDGE OF SUB-FRAME

VSB6 recommends using the leading edge profiles shown below:



It is important to note that some modifiers confuse the figures above and fabricate a leading edge that looks like this:

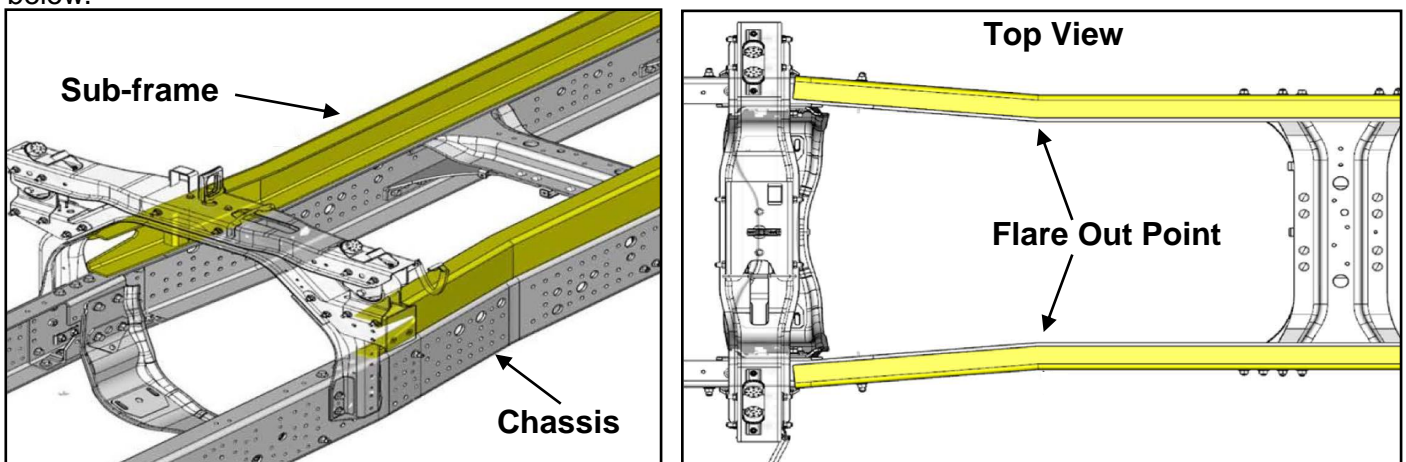


This leading edge does not provide the intended stress reduction and **should be avoided**.

To further reduce the stress on the chassis, the subframe members should be identical in structure on the left and right hand side (as much as practical) and **extend as far forward as possible, or as far forward as recommended in OEM Modification & Body Building Guidelines**; preferably forward of the rear spring hangers of the front-most steer axle.

Caution when lateral spacing between chassis rails changes (i.e when chassis flares out near cabin)

Some chassis will not have a uniform spacing between the chassis rails. When this is the case, it is generally recommended for the sub-frame to follow the profile of the chassis, as shown in the diagrams below.

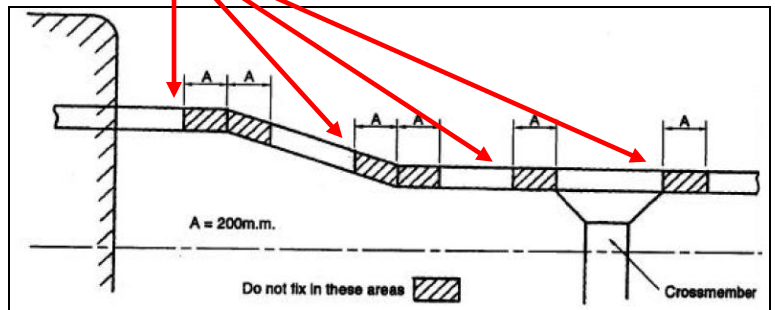
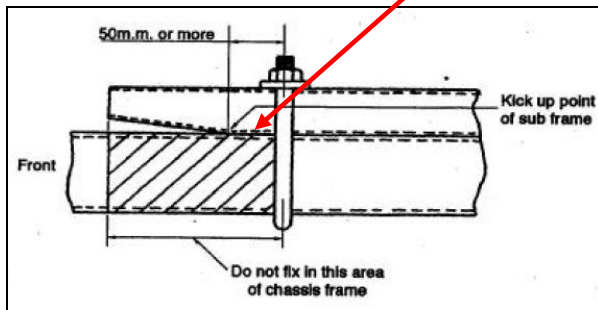


Sub-frame members should be attached to the chassis in similar locations on the left and right hand sides of the vehicle.

Original: 04 June 2014, Revised: 09 November 2018

LEADING EDGE OF SUB-FRAME

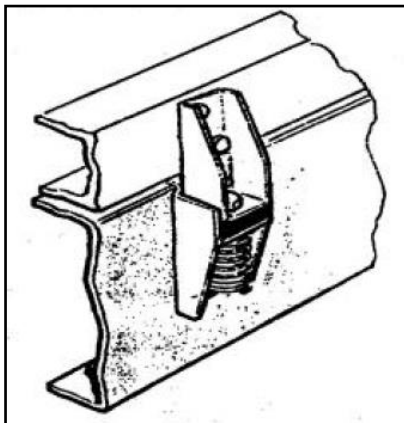
Chassis mount plates or brackets **must not** be located in the region of reduced stiffness at the leading edge of the sub-frame **or** at the edges of cross-members **or** in the regions where the lateral spacing of the chassis rails changes:



When mounting flexible bodies such as trays and tautliners, it is common to use parallel flange channels with wooden packers. It is strongly recommended that the wooden packing extends forward of the subframe to reduce the stress concentration on the chassis. It is also critical that the leading edge of the sub-frame channels are tapered, frog-mouthed or under-cut rather than vertical.

If there is not enough room to extend the wooden packer as described above, the under-side of the leading edge of the packer should be chamfered as shown in the Hino and Isuzu guidelines on pages 9 and 10 respectively.

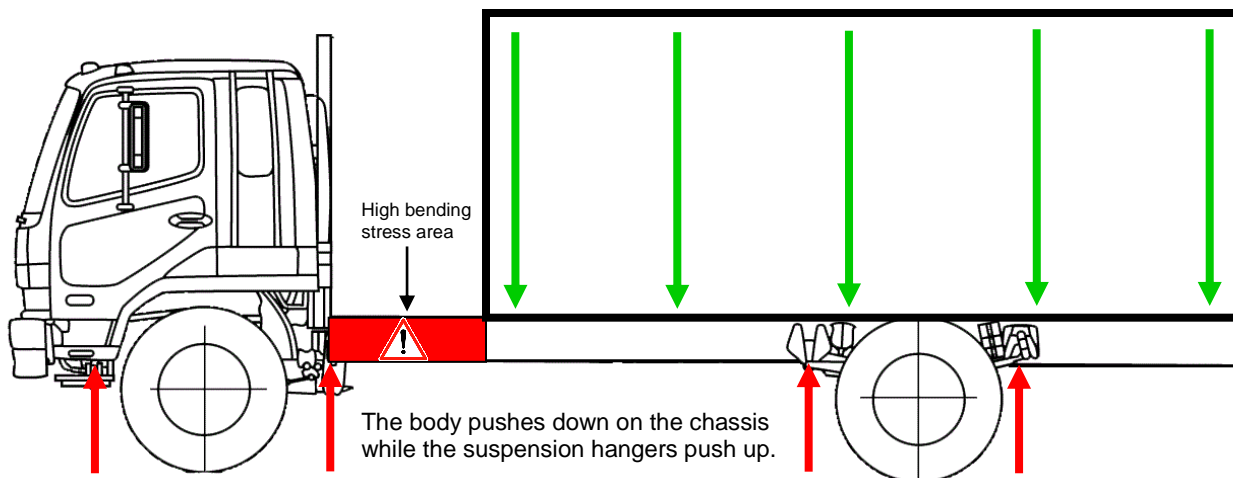
In certain applications, flexible mounts may also be utilised to reduce stress concentrations on chassis. Examples of spring mounts are provided below:



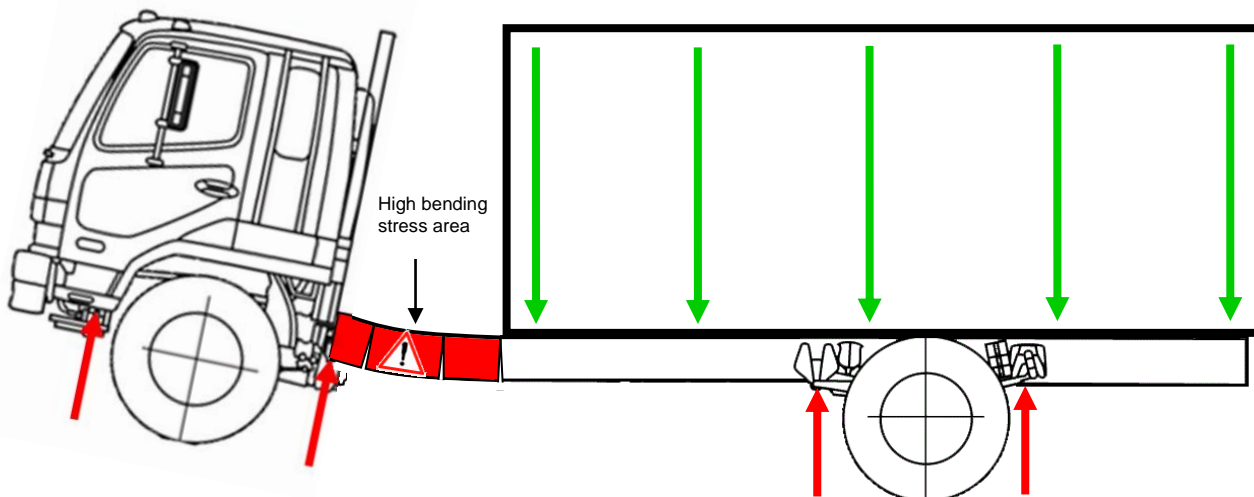
LEADING EDGE OF SUB-FRAME

Risks of chassis damage without a sub-frame or with a sub-frame that doesn't extend as far forward as possible, or as far forward as recommended in OEM Modification & Body Building Guidelines.

A lot of chassis aren't strong enough for certain applications without the extra reinforcement that a sub-frame provides. (In all instances, diagrams are generic and not related to a specific vehicle).

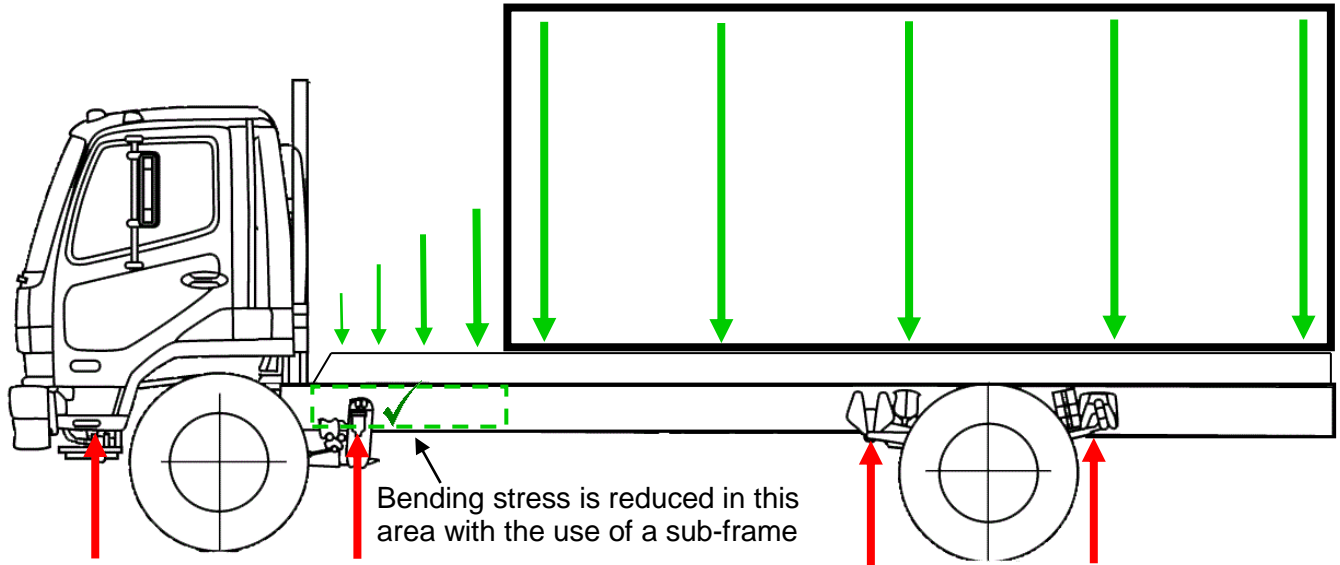


Without a sub-frame, these forces can bend and damage the chassis. This can happen either instantly or over time.

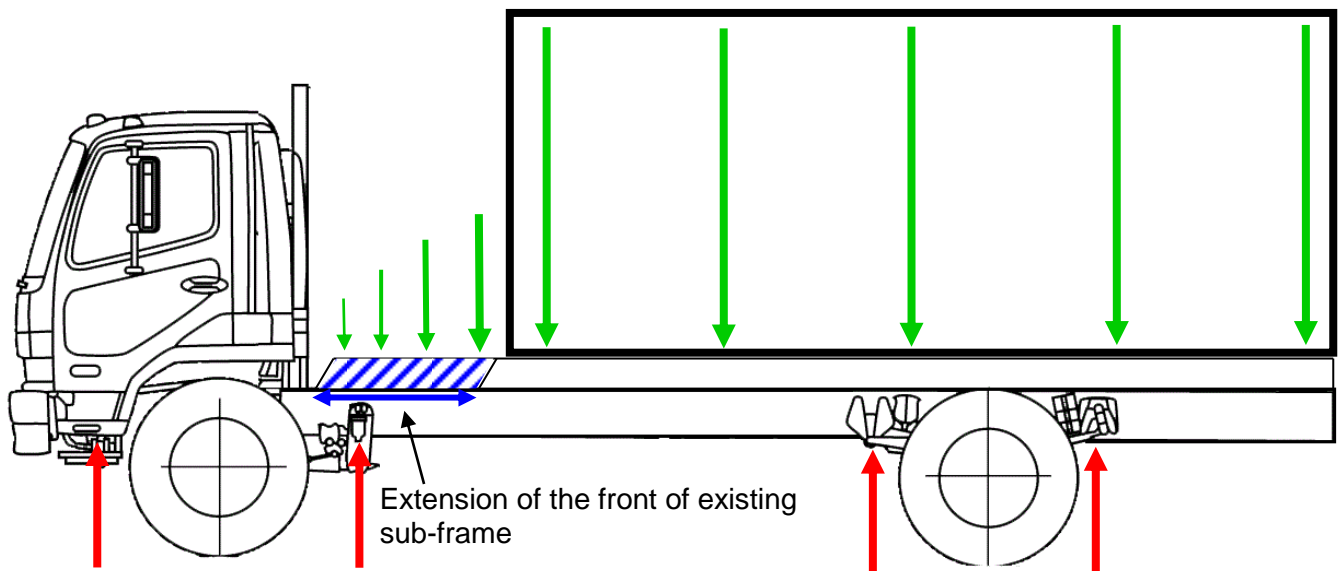


LEADING EDGE OF SUB-FRAME

If a sub-frame is extended as far forward as permissible (ideally if space and OEM guidelines permit, extend the sub-frame over the rear spring hanger of the steer axle), it provides extra reinforcement to the chassis to help prevent the bending shown above from occurring.



Sometimes, the body structure itself is strong enough to provide reinforcement for the chassis without an extra sub-frame (E.g waste compactor body or a rigid tanker) but as the body is not always custom built for the truck, it may be necessary to add/extend the front of the structure to provide the necessary support for the chassis.



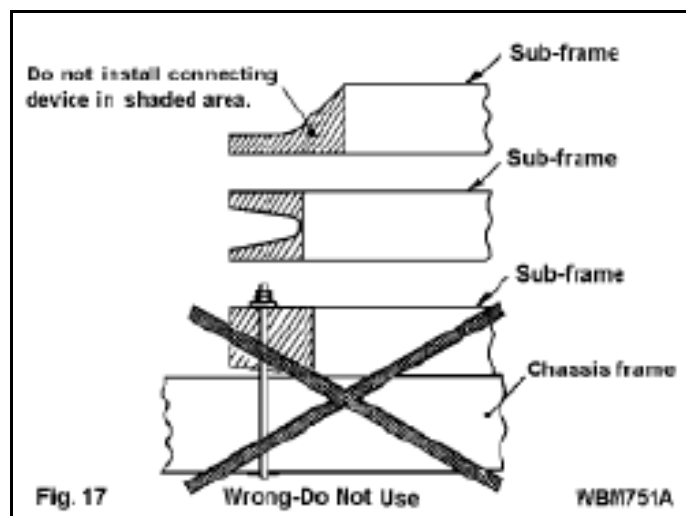
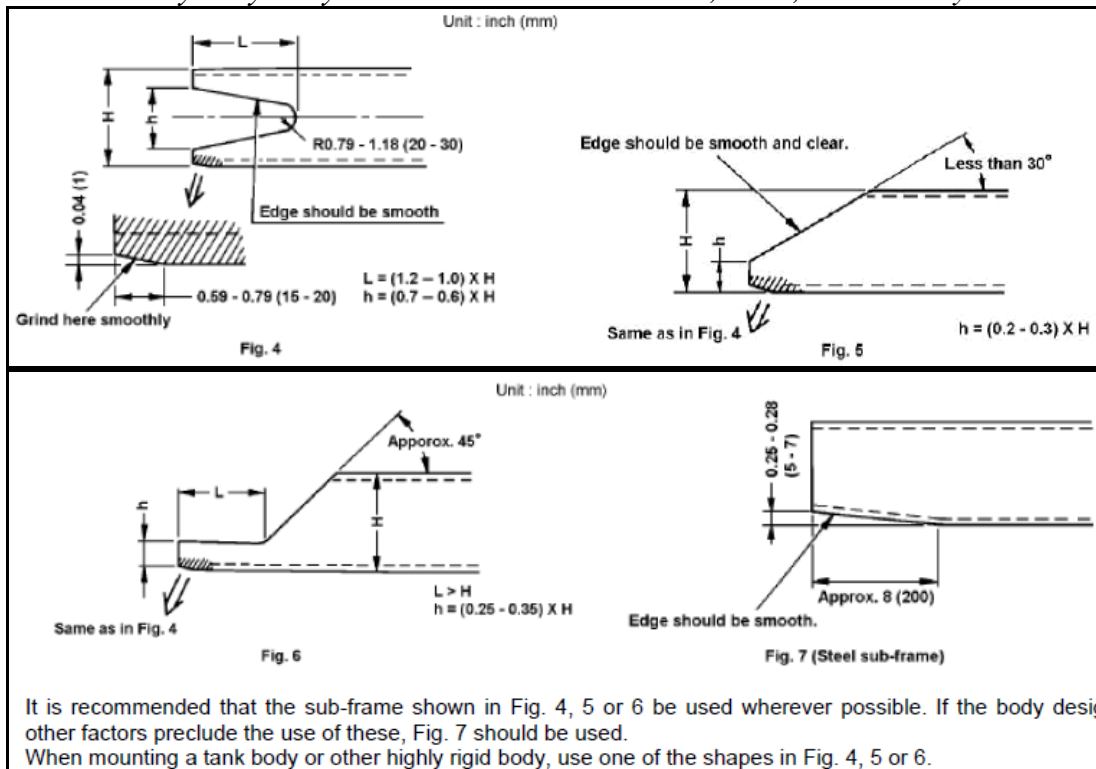
LEADING EDGE OF SUB-FRAME

Appendix 1 – Extracts of OEM Guidelines

The OEM guidelines relevant to the exact vehicle in question should always be sought and reviewed by the modifier; the following extracts are examples only which have been taken from various OEM guidelines for modern vehicles. Any annotations in red have been added by TCS.

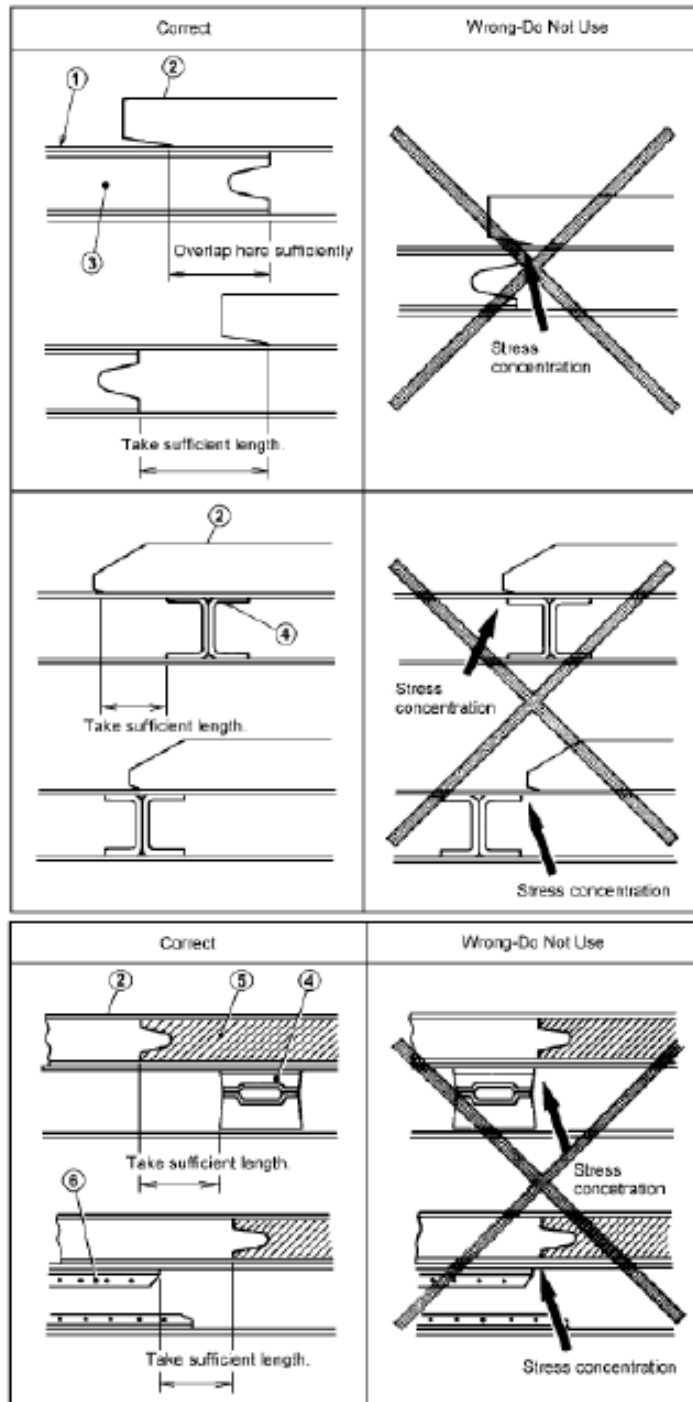
UD Trucks

Taken from “GH13 Heavy Duty Body Installation Manual” - GKB, CWB, GWB – May 2010



LEADING EDGE OF SUB-FRAME

3. POSITIONS OF FRONT-END REINFORCEMENT



- ① Chassis frame
- ② Sub-frame
- ③ Reinforcement (chassis frame)
- ④ Crossmember
- ⑤ Reinforcement (sub-frame)
- ⑥ Gusset L-shaped reinforcement

Fig. 11

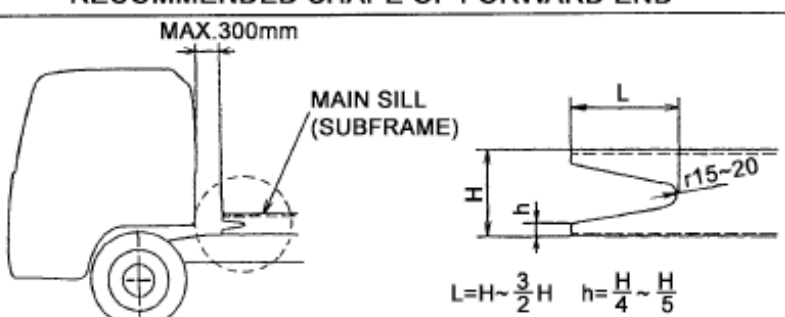
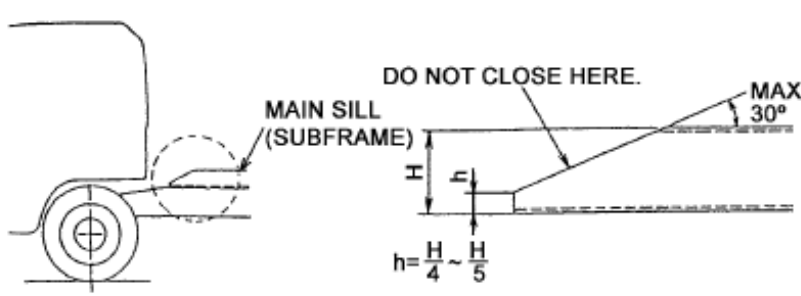
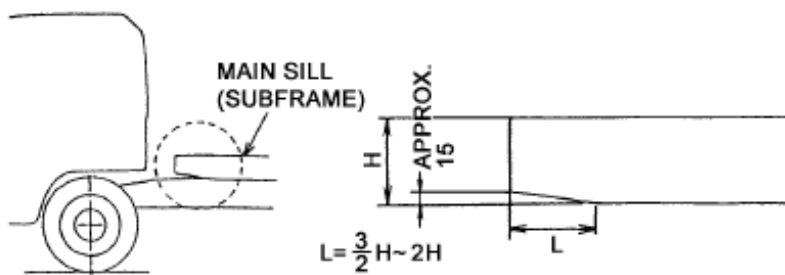
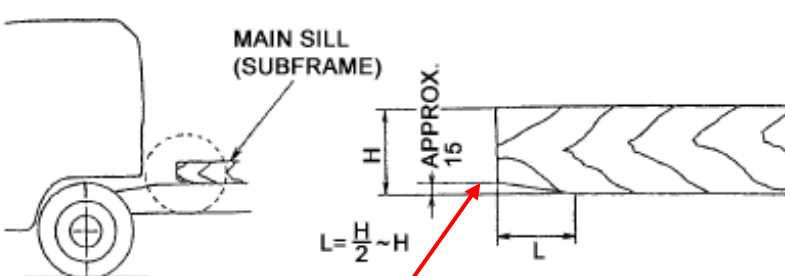
The points of the chassis frame where its rigidity changes (e.g., crossmember, gusset and reinforcement) must not be located with the front end (contact point) of the sub-frame or the head and tail of any reinforcement (Fig. 11).

LEADING EDGE OF SUB-FRAME

Hino

Taken from "KC-AA201FIG1" – general – 2008

UNIT : mm

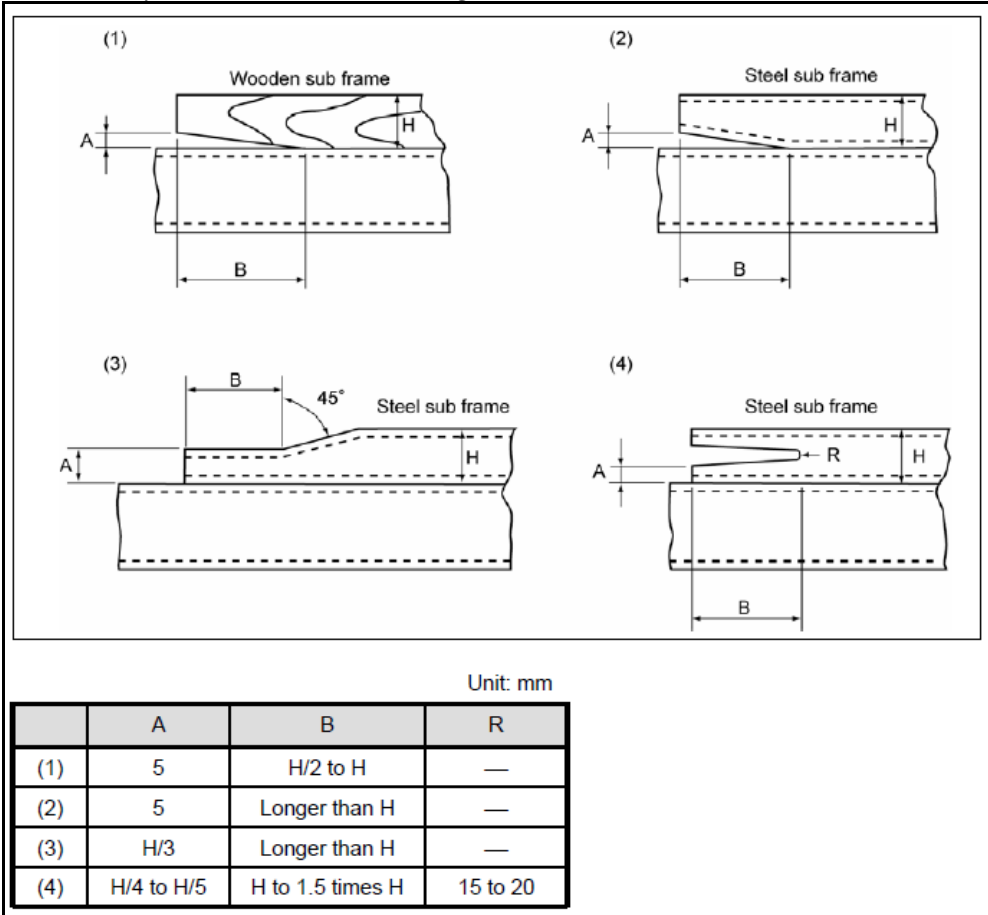
MAIN SILL (SUBFRAME)	
MATERIAL	RECOMMENDED SHAPE OF FORWARD END
A PRESSED STEEL	 <p>MAX. 300mm</p> <p>MAIN SILL (SUBFRAME)</p> <p>$L=H \sim \frac{3}{2} H$ $h=\frac{H}{4} \sim \frac{H}{5}$</p>
B SHAPED STEEL	 <p>DO NOT CLOSE HERE.</p> <p>MAIN SILL (SUBFRAME)</p> <p>MAX. 30°</p> <p>$h=\frac{H}{4} \sim \frac{H}{5}$</p>
C PRESSED & SHAPED STEEL	 <p>MAIN SILL (SUBFRAME)</p> <p>APPROX. 15</p> <p>$L=\frac{3}{2} H \sim 2H$</p>
D WOOD	 <p>MAIN SILL (SUBFRAME)</p> <p>APPROX. 15</p> <p>$L=\frac{H}{2} \sim H$</p>

Please Note: TCS will not certify a sub-frame made completely from wood on any vehicle

LEADING EDGE OF SUB-FRAME

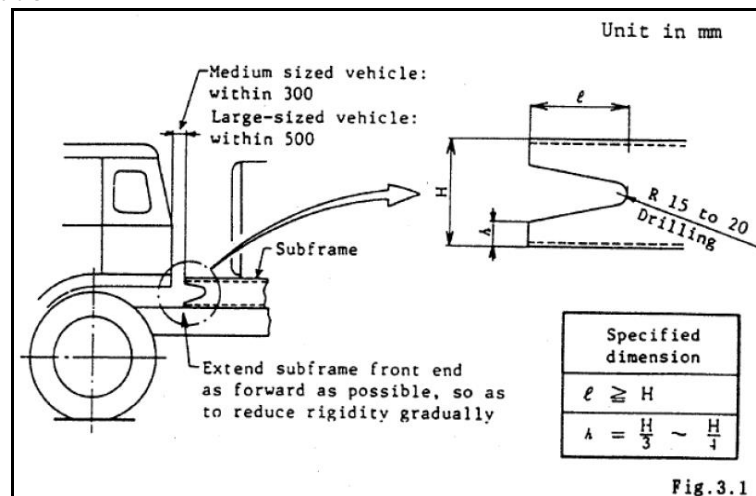
Isuzu

Taken from "F-series_Body_Builder_Guide-v2" – general – Nov 2009

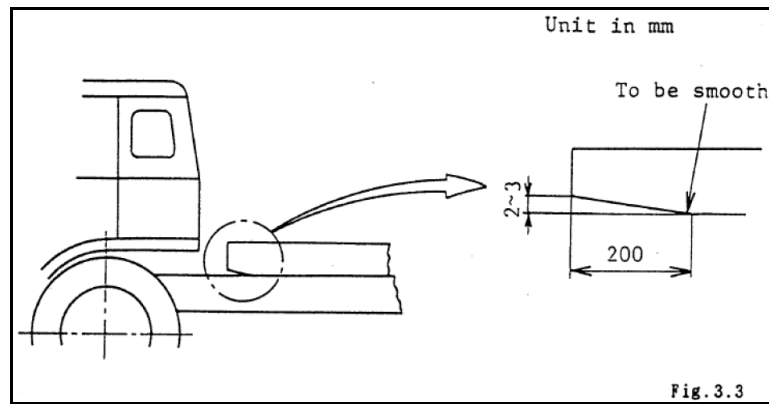
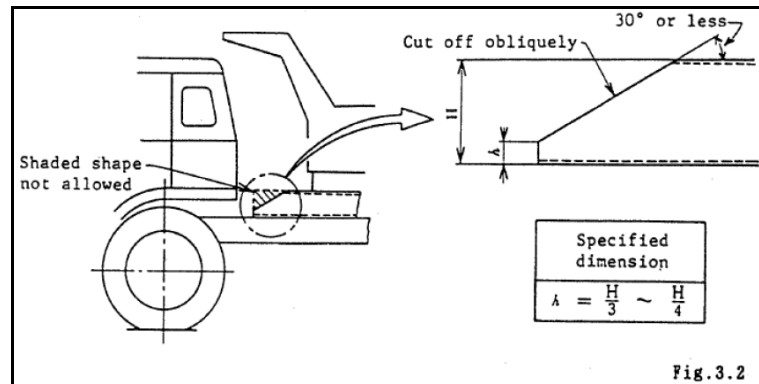


Fuso

Taken from "Mitsubishi FUSO Body Builders Information for HDT and MDT_20080605" – Medium and Heavy - general – Jun 2008

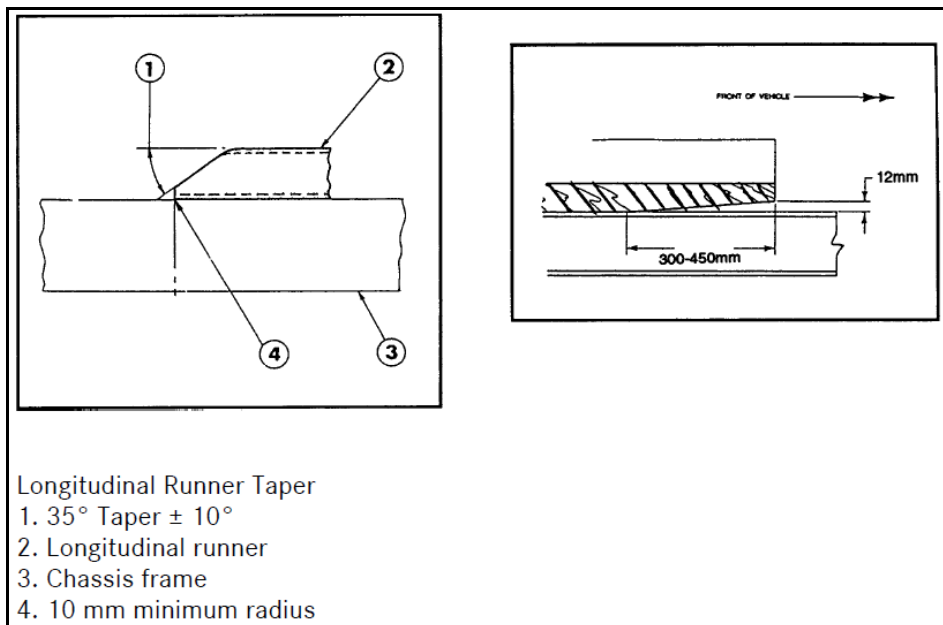


LEADING EDGE OF SUB-FRAME



Freightliner, Mercedes Benz and Sterling

Taken from "Daimler Trucks Body Builders Guide" – General Heavy – Dec 2007



LEADING EDGE OF SUB-FRAME

Kenworth

Taken from "KW Body Equip Mounting Guide 2009" – general – Feb 2009

The forward end should be tapered and radiused as shown in Figure 58. Forward Sub-Frame End Taper below, to give a smooth load transition and thus avoid stress concentrations. Taper angle of 30° is preferred, but not to exceed 45° or be less than 15° .

Where the sub-frame rear-end terminates before the end of frame it should also be tapered and radiused as shown in Figure 58. Forward Sub-Frame End Taper.

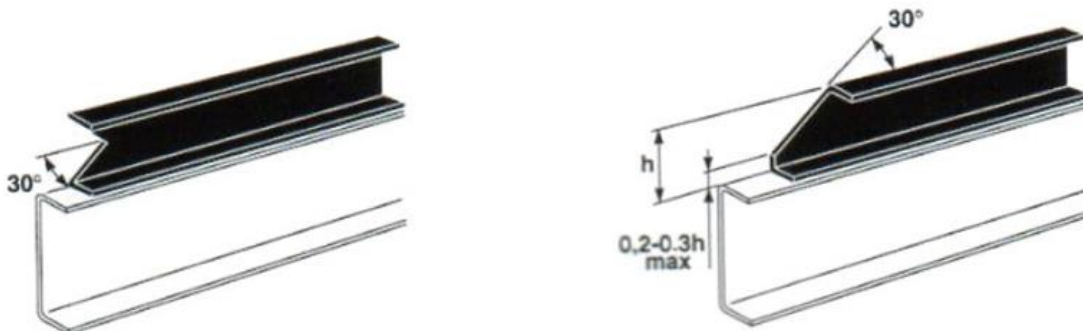
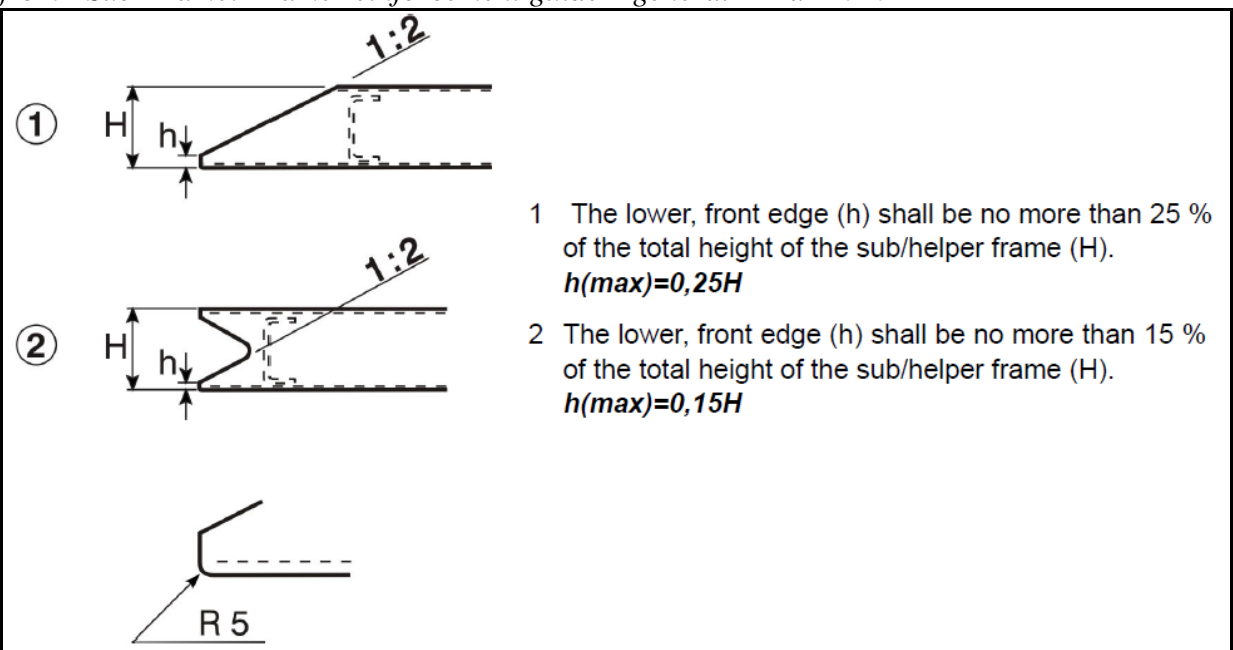


Figure 58. Forward Sub-Frame End Taper

Volvo

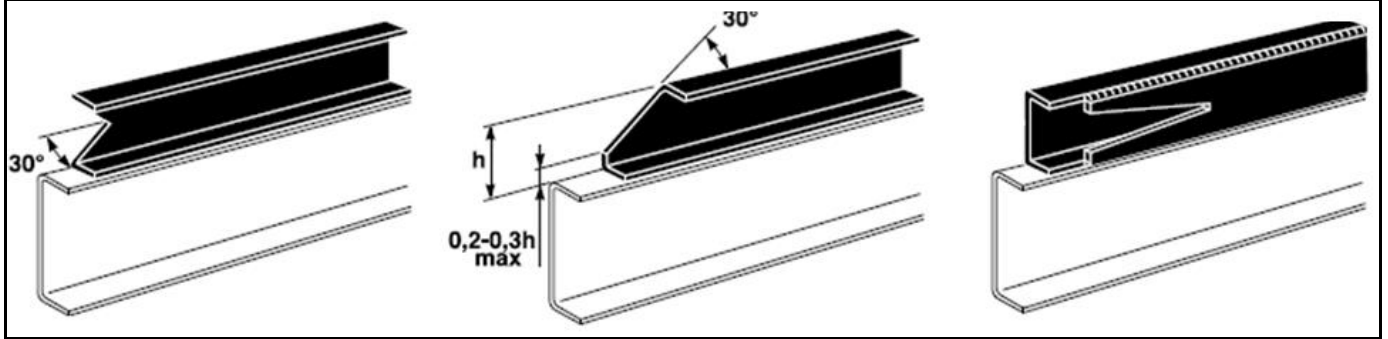
Taken from "Sub-Frame: Frame reinforcement guide – general – Mar 2010"



LEADING EDGE OF SUB-FRAME

DAF

Taken from "BBG201222EN" – LF, CF, XF105 – 2012



MAN

Taken from "tgl tgm e2014 v1 en" – TGL, TGM, TGS, TGX – 2014

To avoid variations in rigidity, the auxiliary frame must be tapered or recessed at the front (see Fig. 04-IV and Fig. 05-IV).

Fig. 04-IV: Auxiliary frame tapering at front

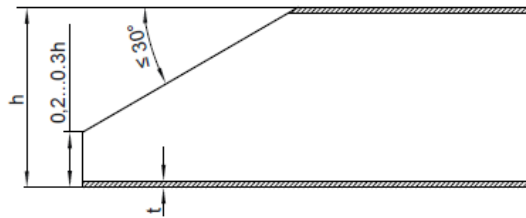
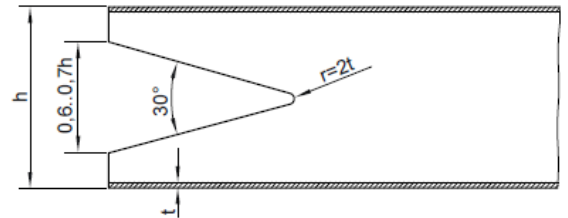


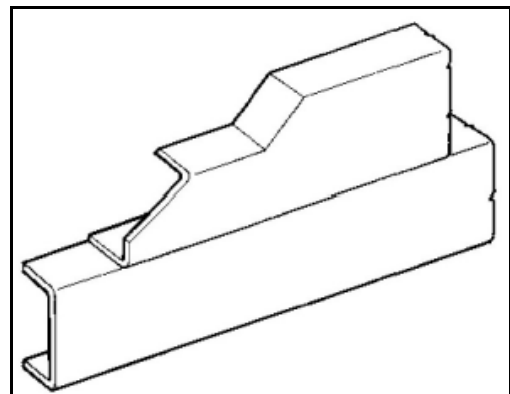
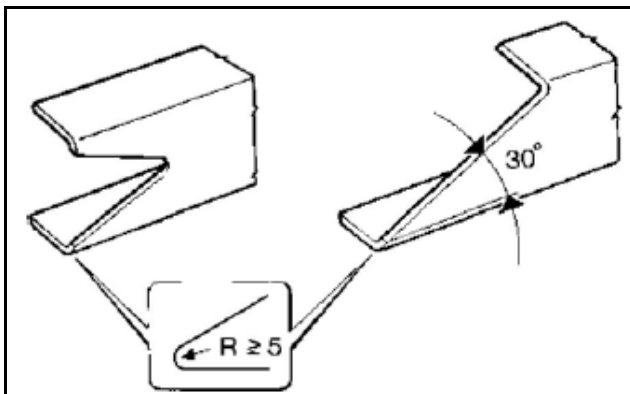
Fig. 05-IV: Auxiliary frame recess at front



Iveco

Taken from "ACCO Body Builders Guideline – 2012" – ACCO

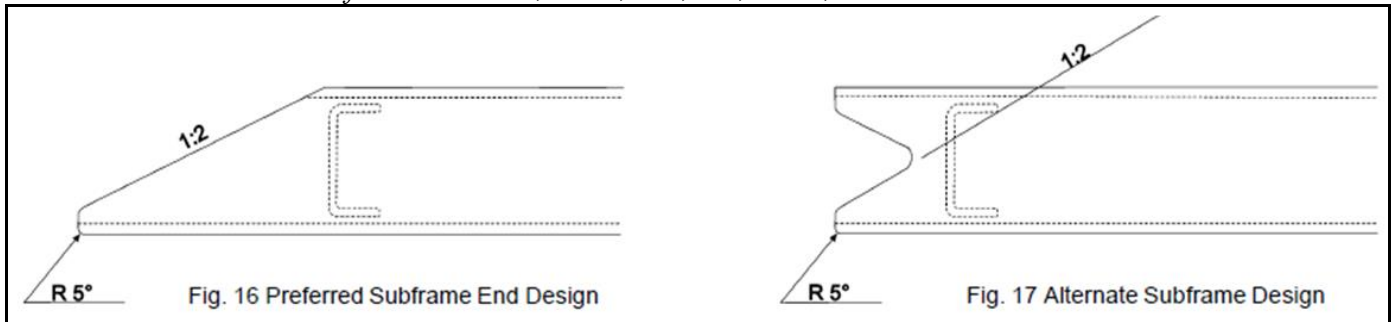
(The same diagram can also be found in the Astra, Eurocargo, Stralis and Trakker guidelines)



LEADING EDGE OF SUB-FRAME

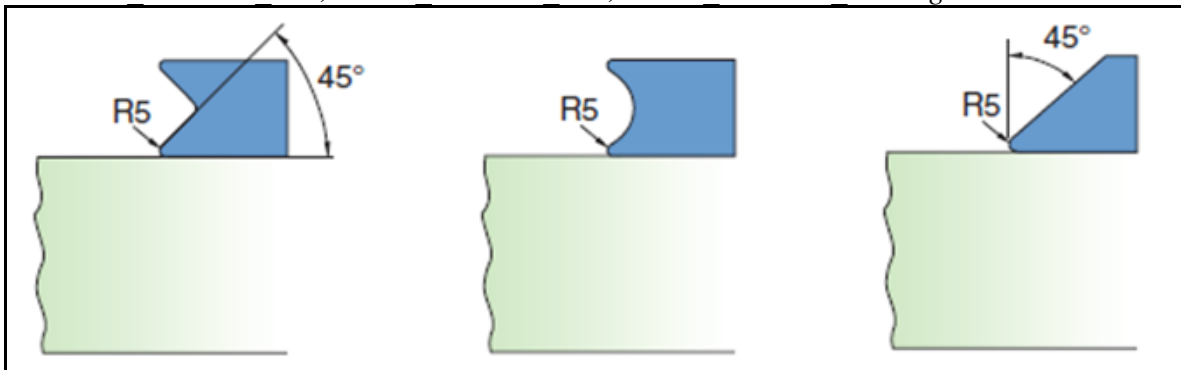
Mack

Taken from "PV776-89133506 body installation" – CMM, CMH, CLX, CSM, CXX – Nov 2013 and
"PV776-88958262 chassis frame" – CXU, CHU, GU, TD, MRU, LEU – Feb 2010



Scania

Taken from "bwm 0000380 01", "bwm 0000410 01", "bwm 0000448 01" – general – 2014



LEADING EDGE OF SUB-FRAME

ABOUT THESE GUIDELINES:

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Suggestions or comments about these guidelines are welcome. Please write to the Manager, Transport Certification Services, 14/69 Acacia Road, Ferntree Gully, VIC 3156.

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