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INCORPORATING LOAD CELLS INTO A SUB-FRAME

The following document has been prepared by TCS to provide basic guidance to vehicle modifiers when installing load cells between a vehicle chassis and body.

These guidelines are supplied without prejudice and free of charge to assist modifiers. TCS will not be held liable for any problems that arise from sole reliance on, or 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. Vehicle Manufacturer (OEM) Body Building Guidelines
   (takes precedence over VSB-6 and TCS guidelines)
2. VSB-6 Sections J (Body Mounting) and H (Chassis Frame)
   (VSB6 is the National Code of Practice for heavy vehicle modifications and takes precedence over TCS guidelines. At the time of printing, VSB6 could be accessed via the following link: http://www.infrastructure.gov.au/roads/vehicle_regulation/bulletin/vsb_06.aspx*)*

All modifications must be carried out by suitably qualified tradespeople 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. **These guidelines are not intended to be used as the sole instructional tool for vehicle modifiers; modifiers must be suitably qualified tradespeople who are experienced in modifying heavy vehicles. These guidelines do not provide all the necessary information to carry out a load cell installation and must only be used as a supplementary quick reference guide.**

Generally, all bodies need a suitably strong, continuous sub-frame. If load cells are to be installed, they should be mounted on brackets that are bolted to the web of the chassis rails and integrated into the sub-frame. Integrating the load cells into the sub-frame helps to spread the load through the chassis, which minimises concentrated chassis loading and reduces the likelihood of chassis failure. Diagrams in this document have been simplified to illustrate the topics being discussed and therefore may not show all components necessary for a complete sub-frame. Intermediate chassis cross members, suspension components, etc are also not shown. A simplified example of a sub-frame with integrated load cells is provided below:

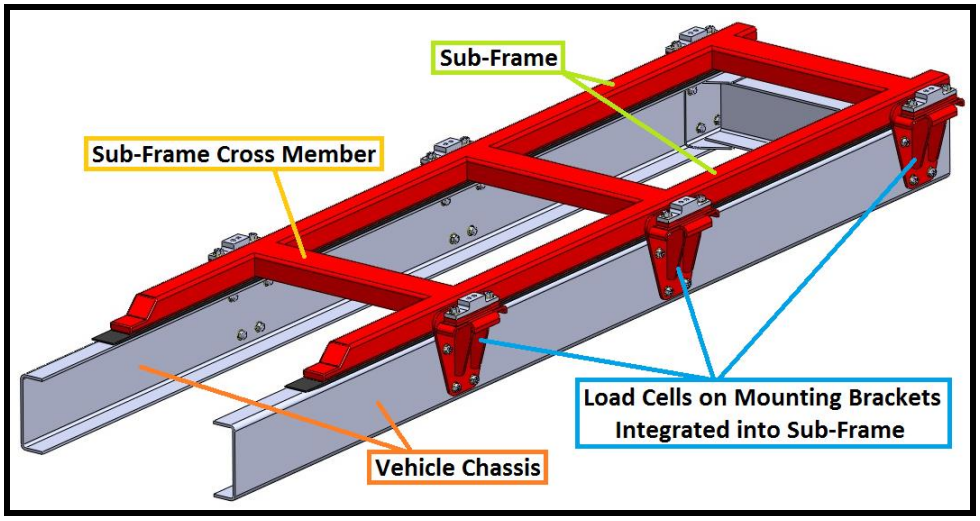

FIGURE 1: BASIC SUB-FRAME THAT INCORPORATES LOAD CELLS

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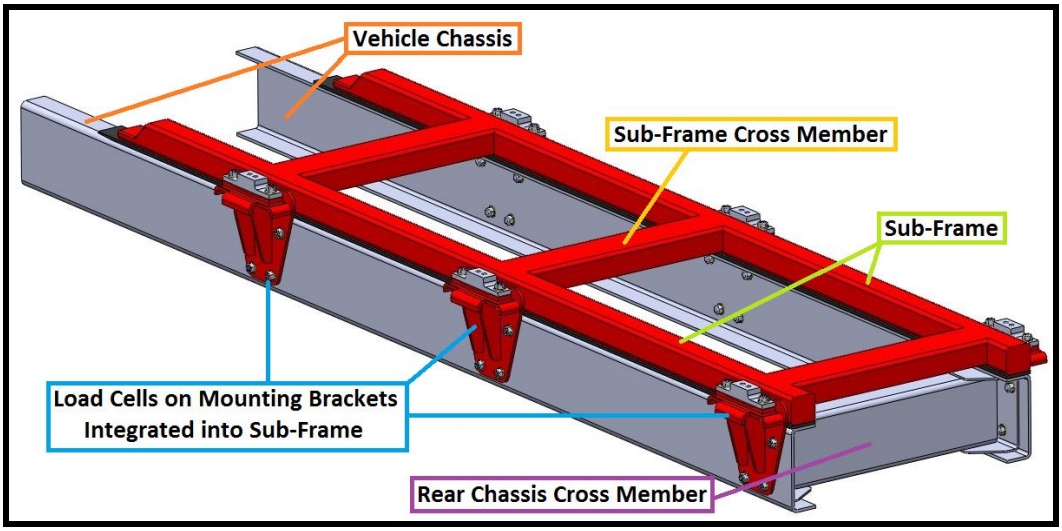

FIGURE 2: BASIC SUB-FRAME THAT INCORPORATES LOAD CELLS

The leading edge of the sub-frame should be provide a gradual reduction in stiffness to prevent chassis damage. Refer to TCS' '*Leading Edge of Sub-Frame'* guidelines for further information.

The mounting brackets must be positioned to ensure the body does not rest on the sub-frame, otherwise the load cells will not give an accurate indication of body weight.

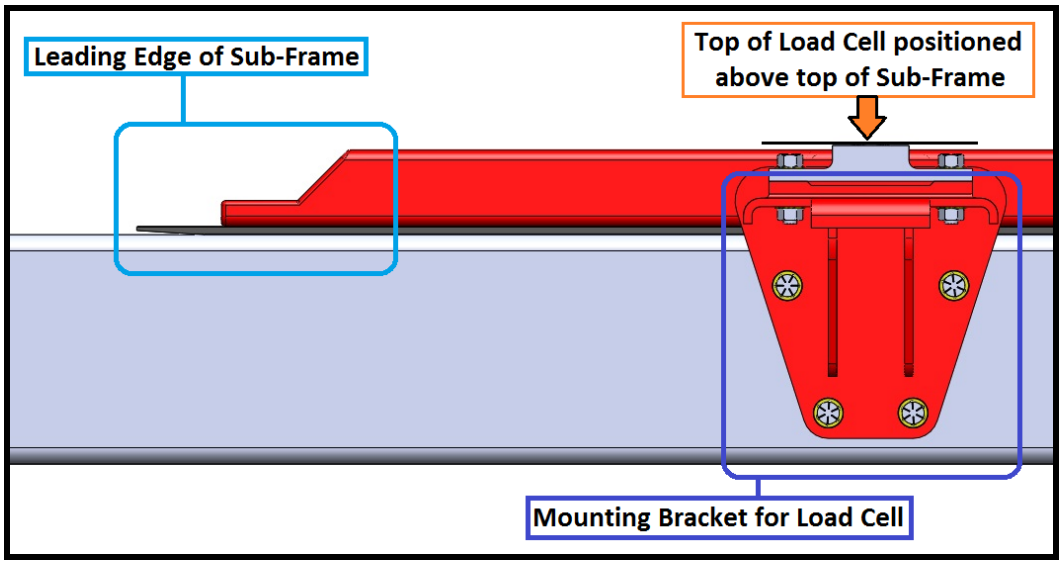

FIGURE 3: EXAMPLE OF SUITABLE SUB-FRAME LEADING EDGE AND LOAD CELL MOUNTING BRACKET

A conventional steel hollow-section sub-frame is sometimes impractical for the intended application of the vehicle as it causes the centre of gravity of the body to be too high. In instances such as this, where it is not possible to use a steel hollow section sub-frame due to height restrictions, please contact TCS to discuss alternative members that may be able to be used for the sub-frame, such as steel angle sections.

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It is recommended that the sub-frame cross members are installed in the vicinity of each set of load cells to minimise eccentric/offset loading experienced by the chassis rails. As a further recommendation, in applications where it is critical to maintain the torsional flexibility of the chassis between the front and rear axle groups, these sub-frame cross members should be constructed from open sections (e.g. channels) rather than closed sections (e.g. SHS or RHS) to reduce the torsional rigidity of the sub-frame.

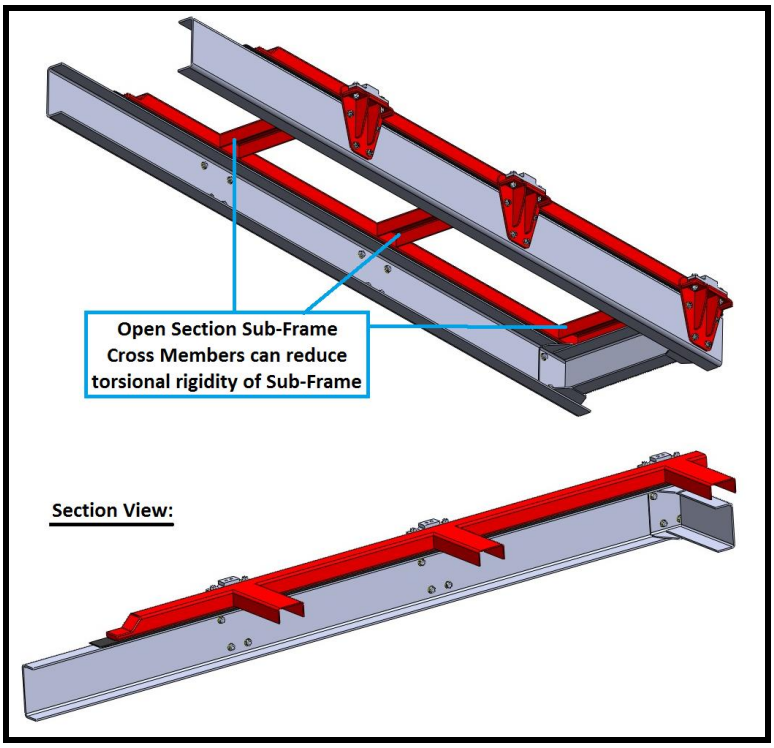

FIGURE 4: OPEN SECTION SUB-FRAME CROSS MEMBERS

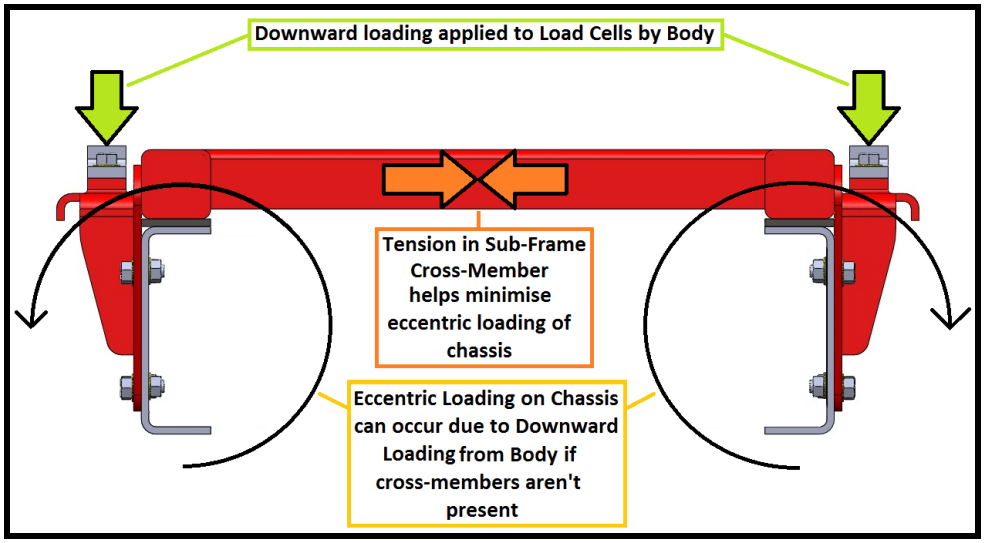

FIGURE 5: A SIMPLE EXPLANATION OF ECCENTRIC LOADING AND THE EFFECT CROSS-MEMBERS CAN PLAY IN REDUCING IT

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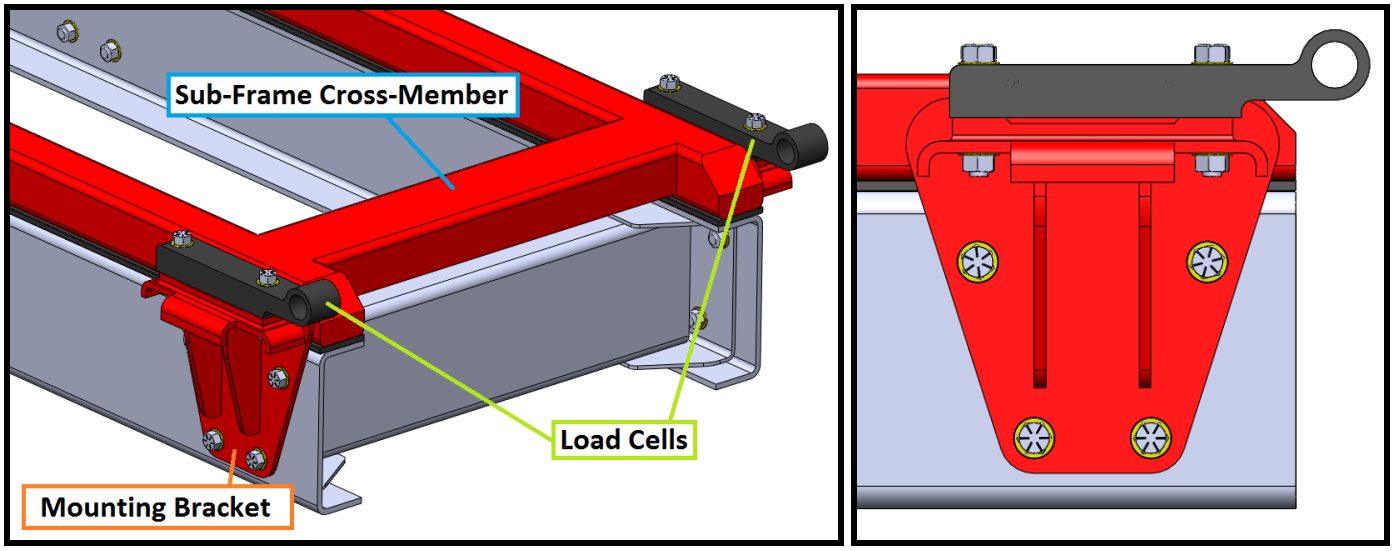
A cross-member is required at the rear end of the chassis. Wherever possible, the OEM cross-member should be retained and/or reinstalled if the rear of the chassis is shortened. A towbar mounted directly between the chassis rails is often a suitable substitute for a cross-member, but if the towbar is mounted to the outer webs of the chassis rails and the towbar cross-member is positioned below the chassis rails, a cross-member directly between the chassis rails should still be installed.

In tipping applications, load cells are often incorporated into the ram and tipping pivots of the vehicle. Please refer to TCS' '*General Tipper Body Guidelines'* for general tipper information. The front set of load cells are commonly mounted on top of the ram cross-member, underneath the ram itself, therefore the nature of loading experienced by the ram is generally un-changed whether load cells are fitted or not. However, care must be taken to integrate the rear load cells into the sub-frame to prevent point loading the rear of the chassis. Two suggestions for this are outlined below.

The load cells (which usually incorporate the tipping pivots) can be mounted onto suitably strong brackets and a sub-frame cross-member would be installed between the brackets as shown below:



FIGURES 6A & 6B: LOAD CELLS WITH INTEGRATED PIVOT MOUNTED ON BRACKETS AND INTEGRATED INTO SUB-FRAME

Alternatively, a portion of the rear sub-frame can be removed to accommodate the load cell. If this is done, drilling of the top chassis flange to mount the load cells must be avoided. A suggestion for this type of setup is outlined below. The load cells can be mounted to thick steel lower mounting plates using upside down counter-sunk high tensile fasteners. The lower mounting plates should be integrated into the sub-frame and the side mounting plates should be extended forward of the region where the portion of sub-frame was removed to provide some compensation for the loss in stiffness that would usually be provided by the sub-frame. The edges of the sub-frame, lower mounting plates and side mounting plates should overlap (i.e. not be located in the same vertical plane) and should be tapered to provide gradual changes in stiffness. As always, if anything is unclear or the suggestions in this document will not work on a certain vehicle, TCS should be consulted before proceeding with the modification.

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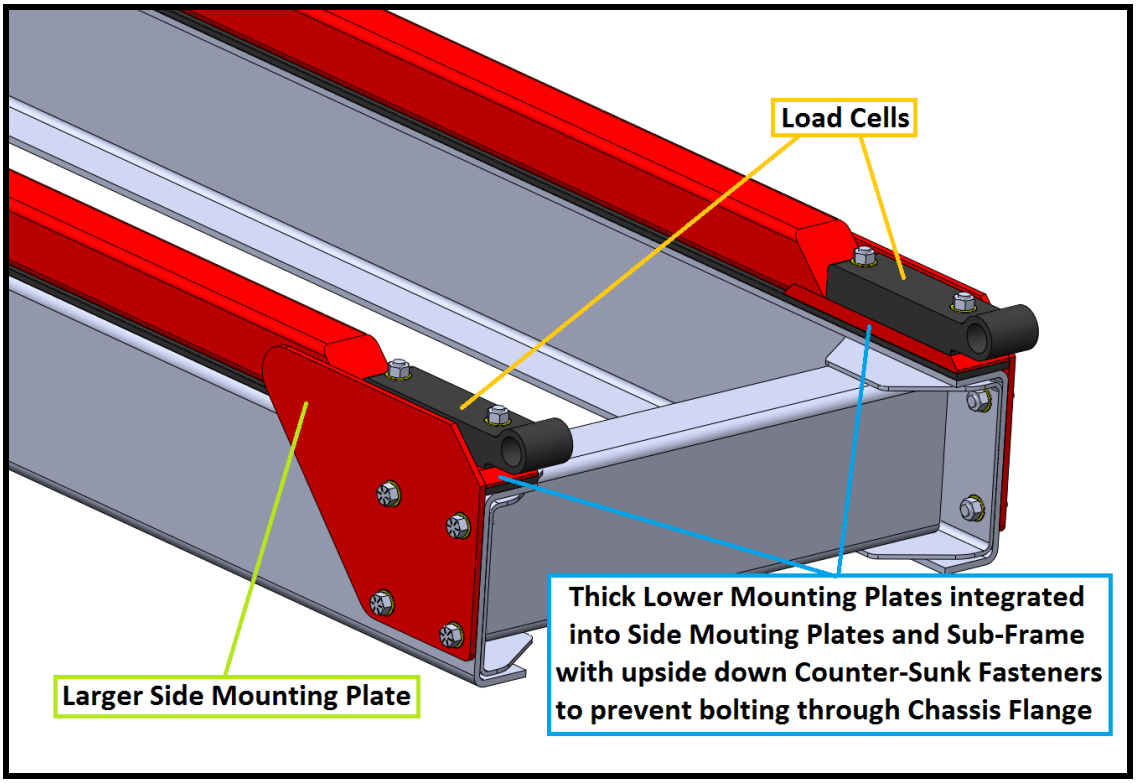

FIGURE 7: LOAD CELLS WITH MODIFIED SUB-FRAME, LOWER MOUNTING PLATES AND LARGER SIDE MOUNTING PLATES

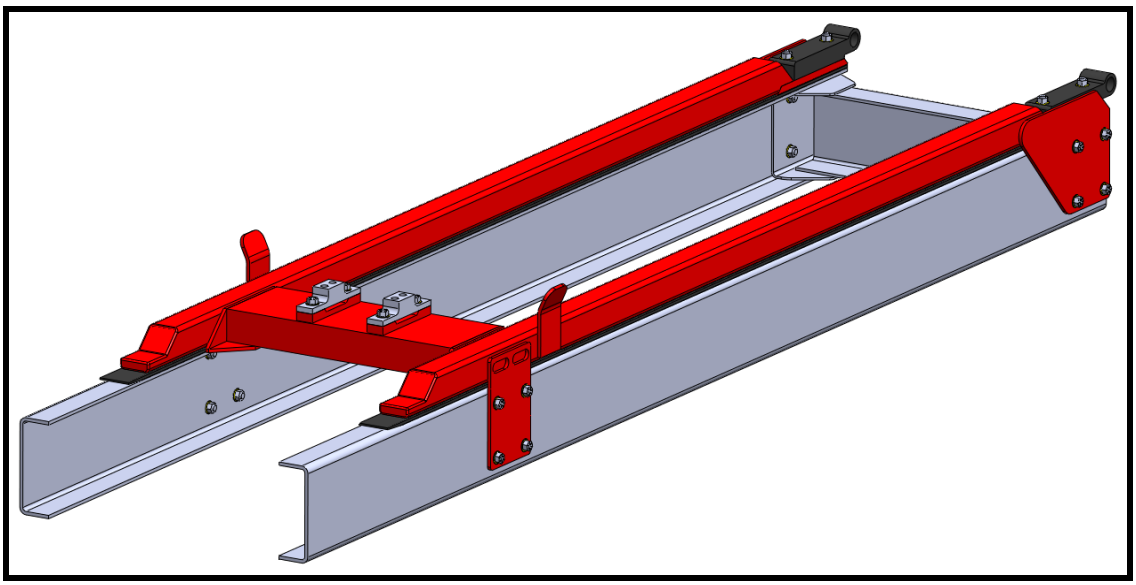

FIGURE 8: TIPPER SUB-FRAME WITH INTEGRATED LOAD CELLS

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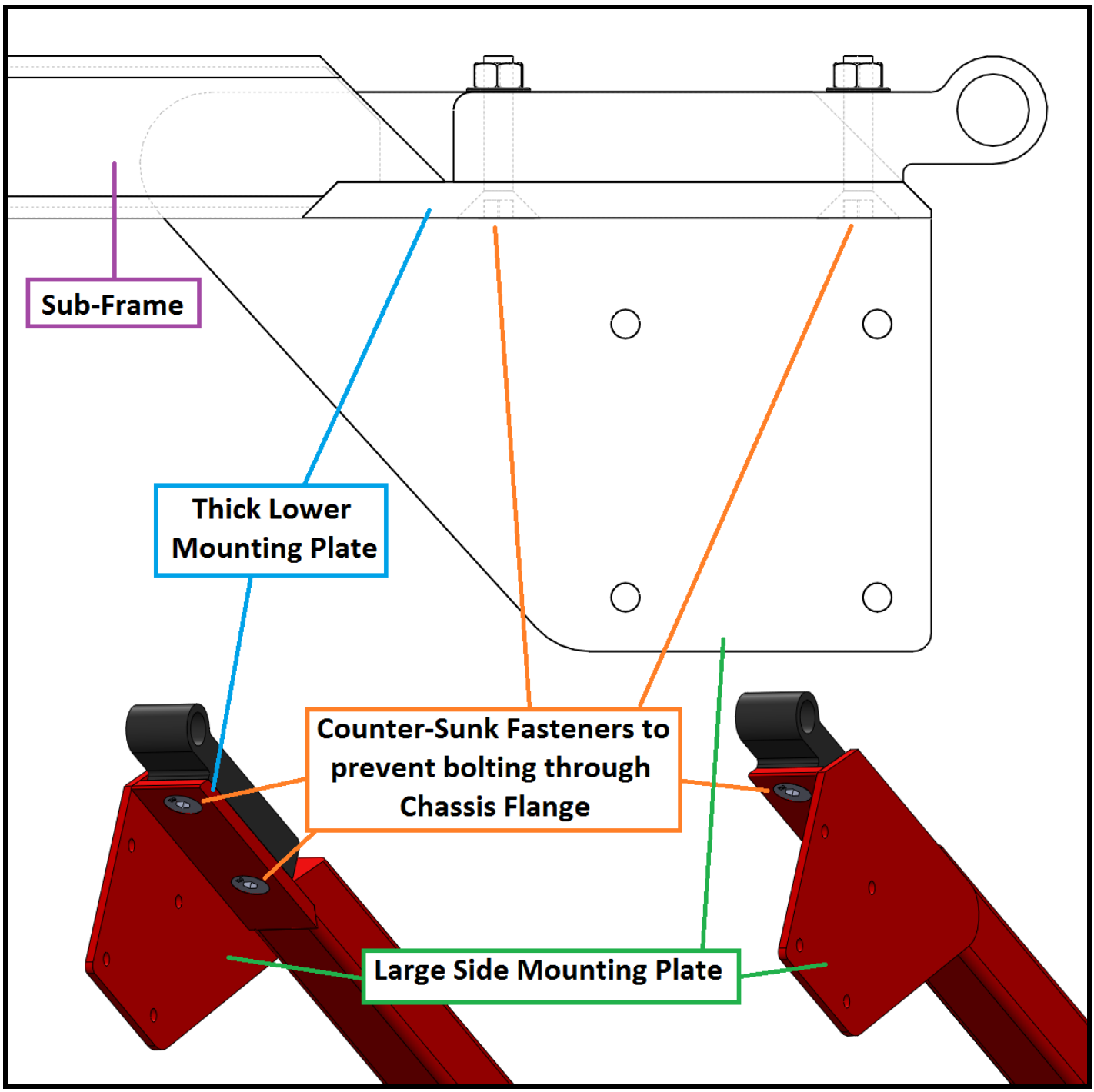

FIGURE 9: LOAD CELLS WITH MODIFIED SUB-FRAME, LOWER MOUNTING PLATES AND LARGER SIDE MOUNTING PLATES