

ROPS DESIGN

TSV was commissioned to design a range of rollover frames for a series of Volvo excavators, ranging from 15 to 50 tons.

The TSV rollover design specialist reviewed with the Volvo agents a number of design options, including Plate versus RHS designs, frame configurations, standard versus bush rigged and possible attachment points for the frame.

Once the aesthetic and manufacturing options were clear, each machine was measured to enable an accurate assessment of the strength of the attachment points, ensure the design would fit without interference and closely follow the cab shape. These data, together with a extensive range of photos, were used to draw the machine.

Once an accurate AutoCAD representation of the relevant parts of the machine was complete, a preliminary frame was drawn, using informed estimates of sizes as a starting point for the frame. The customer then gave design approval prior to commencing the frame analysis.



Figure – Preliminary frame layout

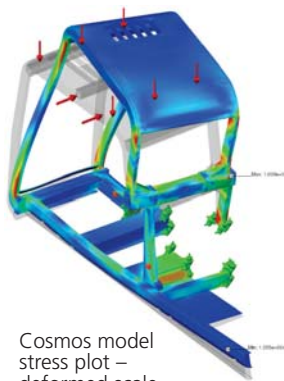
Computer aided design and engineering

TSV brings to bear the powerful combination of AutoCad, 3D solid modelling and Finite Element Analysis (FEA). FEA saves time and money, reduces risk, and optimises performance of parts and assemblies. Prototyping is minimised, materials and weight are optimised, performance is predicted. Rapid analysis and revision turns days of hand calculation into hours, hours into minutes - and all with vastly greater accuracy.

A 3-dimensional model was constructed using a parametric modeling package. The model included the rollover frame itself and the structural portion of the base that would have to support the loads imposed by the frame.



Solid Edge Model of Frame



Cosmos model stress plot – deformed scale 1:12

The 3D model was then imported into a Finite Element Analysis package to determine the strength of the frame and ability to absorb impact energy without failure. The model was restrained at appropriate points and loads applied according to the OSH Code of Practice. This included 3 static load scenarios, applied separately and 2 impact loads. Additions and modifications were made to the frame in order to comply as well with strengthening as necessary in the machine base to support the loads imposed by the frame.

Once Compliance with the Code of Practice was established, the necessary amendments were made to the drawings and a set of 6 manufacture drawings were developed for each machine.



Frame fabrication drawing

TSV are consulting mechanical engineers providing a wide range of engineering design and analytical services, ranging from specialised rollover protective structures to process engineering solutions.



The manufacture drawings were supplied to the client for final design approval. At this point any minor manufacturing alterations were done at the clients request. The modifications were then included in the drawings issued for construction.

AutoCAD files were sent to the profilers of the necessary parts. This enabled a kitset type manufacture that was significantly quicker than previous fabrication methods employed.

During the fabrication of the frames, progress photos were supplied to TSV to ensure correct interpretation of the drawings. Once the frame was complete, certification was issued in the form of a label and certificate stating compliance with the OSH Code of Practice.



Completed frame on machine

BUDGET

This project was completed for less than a quarter of the manufacturing cost.

KEY CUSTOMER BENEFITS

The new design gave the operator a better view from the cab.

The design is aesthetically more pleasing than that used previously.

The manufacture time to produce the frames was significantly less than the old design.

Using Finite Element Analysis ensured an optimum design solution.