



Product Line: Productivity analysis and improvement in Design using ANSYS Workbench environment.

Objectives:

Analysis and Design Optimization of design for Gusset shape side stakes for freight cars

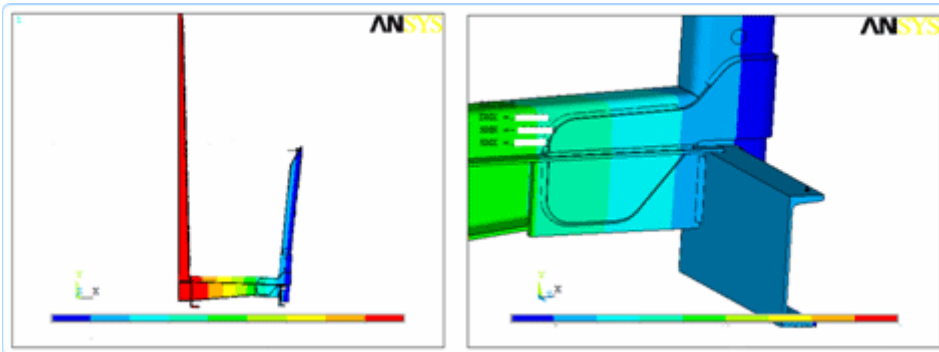
- Improper Design
- Failure and breakage due to increased stress and heat during operation.
- Wastage of material

Product Methodology:

Designing of 3D CAD model from scanned image

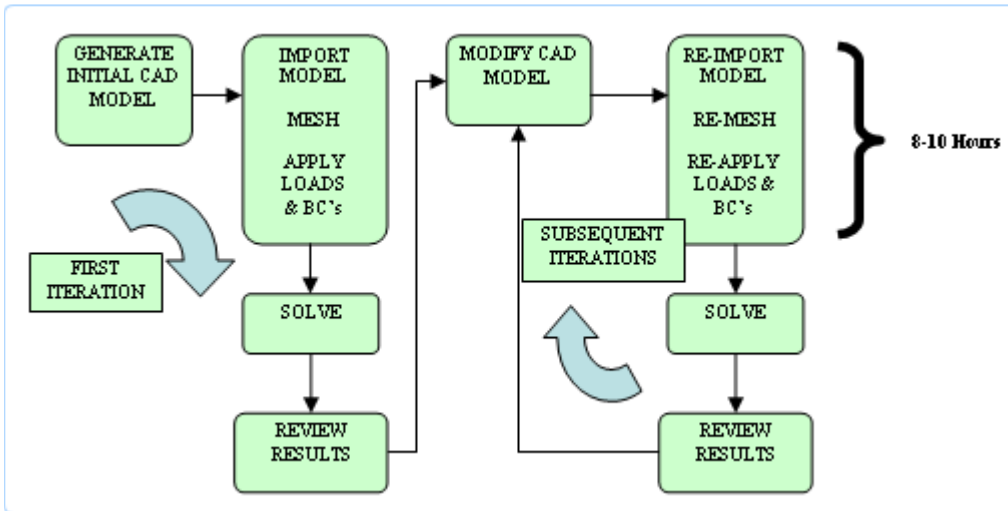


Static load Analysis for gusset shape optimization



Traditional Approach:

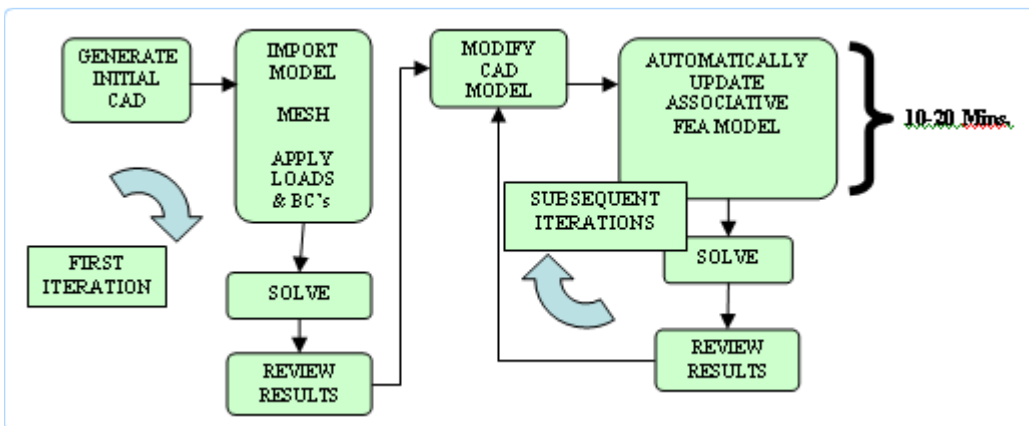
In a 'traditional' FEA approach, a CAD model will be imported into the analysis software, meshed and loads & other boundary conditions will be applied to it.



The model would be solved and the results will be reviewed. Upon every subsequent design iteration, the same process is repeated time and again in 'traditional' approach usually used. Preprocessing of the model, using the traditional approach, takes 8 to 10 hours per iteration.

New Approach:

Using the new approach, the same pre-processing task is reduced to around 10 to 20 minutes. This represents a 50-fold productivity improvement. Little to no time is spent on pre-processing, which could be considered as a mundane and unproductive activity.

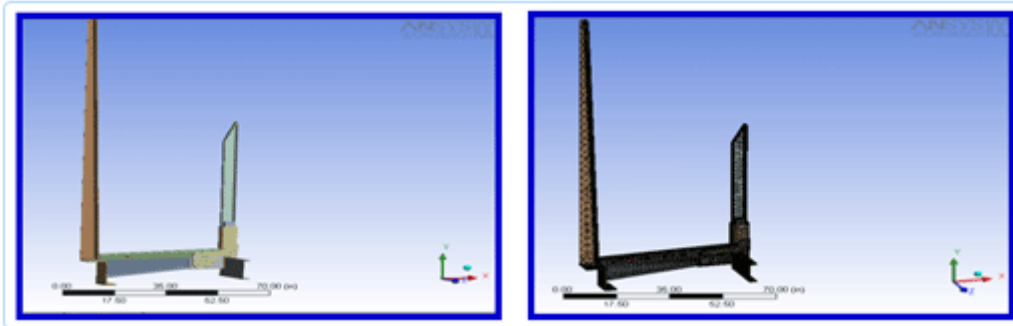


The user interface is very easy to use and efficient at getting the job done quickly. The automatic mesh is robust and although the user can have control over the mesh parameters, the defaults can be accepted and hence meshing is not one of the required steps.

The process flow diagrams shown above captures the differences in the iterative design process between the traditional and the new approach.

CAD Integration

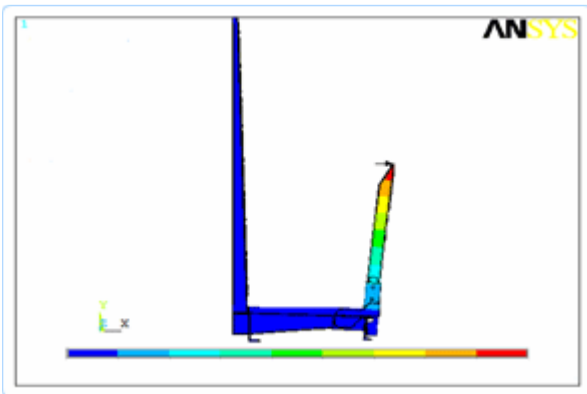
The complexity of the geometry of the cast products dictates that the model must be generated with a high end CAD package rather than modeled separately within an analysis package.



The robust and tight CAD / FEA interoperability plays an essential role in gaining productivity improvements.

X-displacement plot

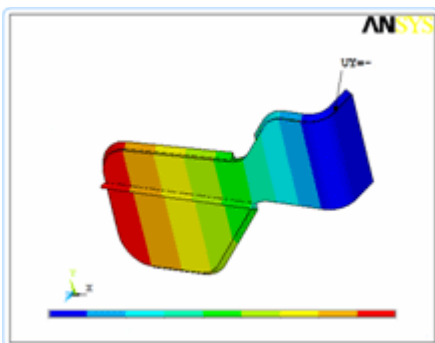
Top of stake beam has much more movement away from the center than vertically downwards.



Y-displacement plot

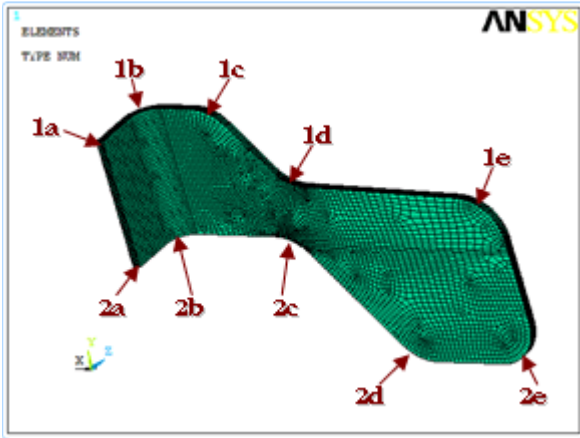
Displacement plot for gusset and attached weld beads:

Maximum vertical displacement is at point farthest from the center of symmetry.



Nomenclature of gusset locations for subsequent plots

Gusset can be visualized as consisting of two different portions. First, portion 1d-1e-2e-2d-2c-1d, the portion rigidly fixed and sufficiently welded with other components, and second, 1a-1b-1c-1d-2c-2b-2a-1a, which is more 'hanging', and experiences much more movement as its pushed away by the stake pocket. Location 1d and 2c lie at the root of this second portion and are thus prone to develop high stresses.



Benefits:

- Proper 3D model and perfect Design achieved.
- Reduced cost and Production time.