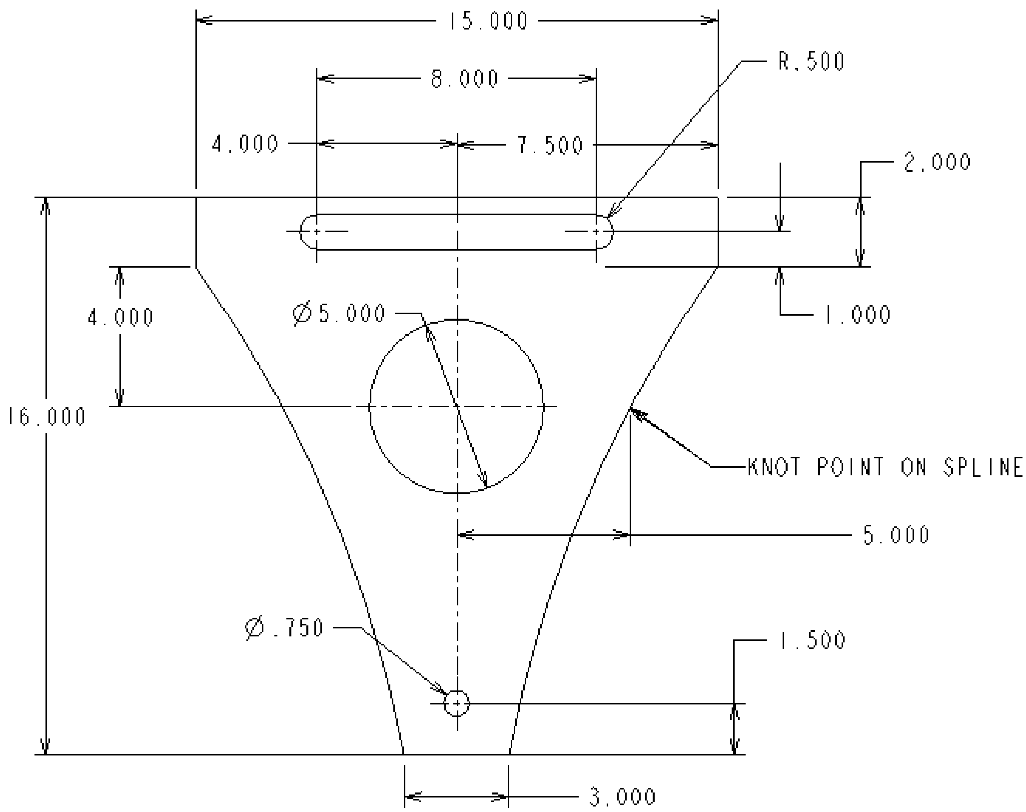
Applications with Behavior Modeler
Creo 2.0
Level 10

A customer has a need for 1,000 tangs for an architectural application. These tangs are subject to a vertical tension load. Of course architects being who they are, can never really make up their mind on what they want until absolutely the last minute. What the architect thinks he wants is shown below, of course maintain the left to right symmetry.



Your mission, if you choose to accept it, is to create an *optimized design where the goal is to minimize the **volume** (amount of material) of the tang.*

The basic design criteria requires the plate must meet a cross sectional requirement of having 1.5 square inches of material in all critical areas to meet the tension requirement being imposed.

A few things the architect does know:
1). The top of the tang can never exceed 20 inches wide, nor be less than 12 inches wide.
2). The bottom of the tang can never exceed 4 inches wide, nor be less than 2 inches wide.
3). The thickness of the tang can vary from .1 to .5 inches thick (don't be concerned about standard gauge thickness).
4). The "arc" on the side of the tang is actually sketched as a spline.
5). The knot point on the spline and the center of the large hole are always in line.
6) The slots and hole need to maintain their position in the vertical direction (no dimensional modifications to the values).

Part Modeling Hints:

Create lots of simple features rather than one complex feature. In other words, don't make the long slot and the base protrusion as one feature. Remember, when the computer is optimizing geometry, he won't stop just because the slot is going to overlap the part edges. He may attempt to do this causing feature failure due to poor sketching practices. You must think ahead!

You can dimension the knot point used to locate the mid point on the spline.

Optimization Modeling Hints:

You will need cross sectional information at the following locations:
Center of the slot near the top.
Center of the large hole in the center.
Center of the small hole at the bottom.

These have to be done as separate Analysis features. You will also need an Analysis feature defining the entire volume of the part.

Remember, you want to maintain a 1.50 square inches of area at **all** cross sectional locations and the plate thickness is allowed to vary.

Don't forget to tell the computer that the horizontal location of the middle knot point on the spline can vary. You might want to run a Sensitivity analysis to determine a range of reasonable values.

Print out the following:
Original design fully dimensioned similar to what was shown above. Make sure you locate the knot point (show dimensions for the cut feature). Indicate the plate thickness as a **note** in the lower left corner of the drawing.

Do an optimization and print the following:
Cut/Paste the filled in Optimization/Feasibility Dialog box into Word and print this. The instructor is looking to see that this was filled in appropriately.

Goal Convergence Graph (you name added to the title)

Do a Cross Section Mass Property Check at the three critical sections and print the m_p file for each case.

Updated full dimensioned detail drawing after the optimization was completed.

Add these to your documentation in the following order:
Original drawing
Screen capture of the Optimization/Feasibility Dialog box
Three m_p files (upper, middle, lower)
Updated detail drawing.

Note: If your graphs only have ONE point plotted (iterations = 0), then even though it appears that computations have been done, your input data is incomplete or in error. Remember that the width of the part at the location of the large hole can change and **this needs to be taken into account**. That is why you did a sensitivity study on this region. It is quite possible your graphs might have only two points shown.

Turn in the following documentation:

Cover Sheet
Level 7:
Detail Drawing of the T cross section, properly & fully dimensioned; only one view required.
Optimization Goal Convergence Graph
Mass Property File with added text as indicated above
Screen Capture of Optimization Dialog Box

Mathcad Prime calculation for I
Hand Calculation verification of MOI's

Level 8.5:
Detail drawing of the original design
Rough dimension sensitivity plot
Refined dimension sensitivity plot
Dimension Convergence plot
Detail drawing of the final design

Level 10:
Original drawing
Screen capture of the Optimization/Feasibility Dialog box
Goal Convergence Graph (you name added to the title)
Three m_p files (upper, middle, lower)
Updated detail drawing.