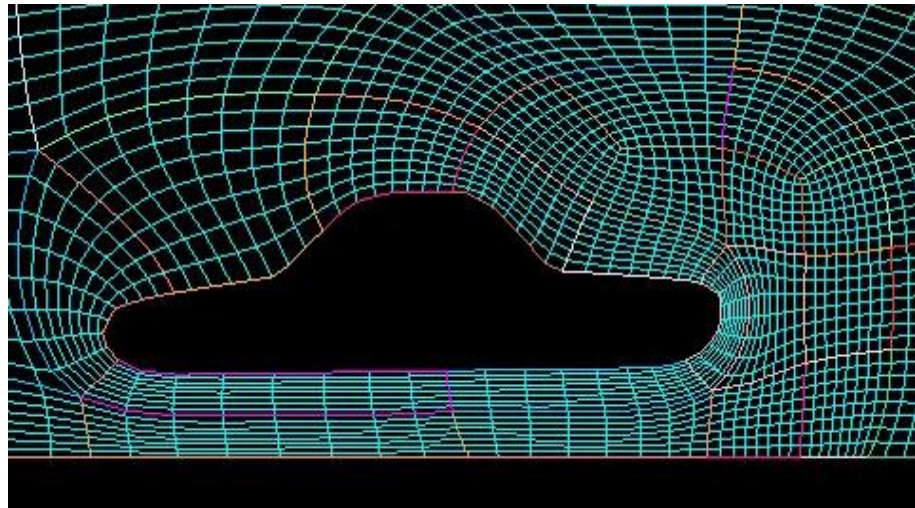# Tutorial 10.1: Compact Enrichment

Sometimes we want a certain area of a grid to be more detailed than others. In **GridPro**, we use a technique called compact enrichment to make areas of a grid more refined than others.

What You Will Create
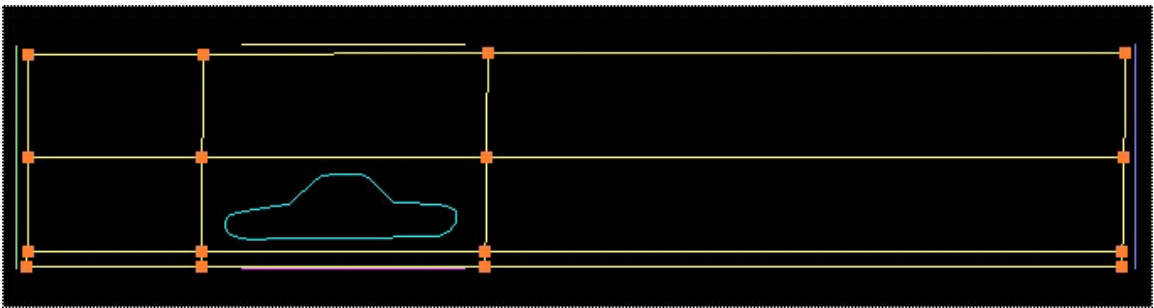

What You Will Learn

- The technique of compact enrichment

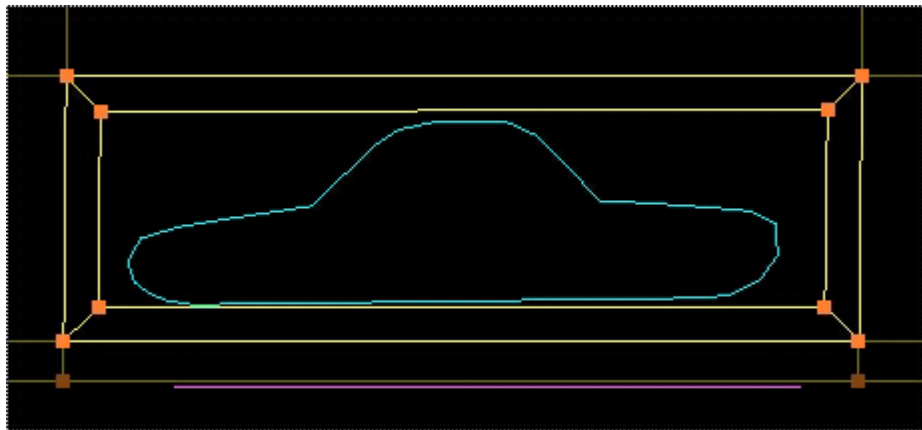- Using internal surfaces

Step 1   Creating an Initial Grid

Load the **Tutorial_10.1.fra** file. With the cut plane and axes turned off, you should see the picture below:
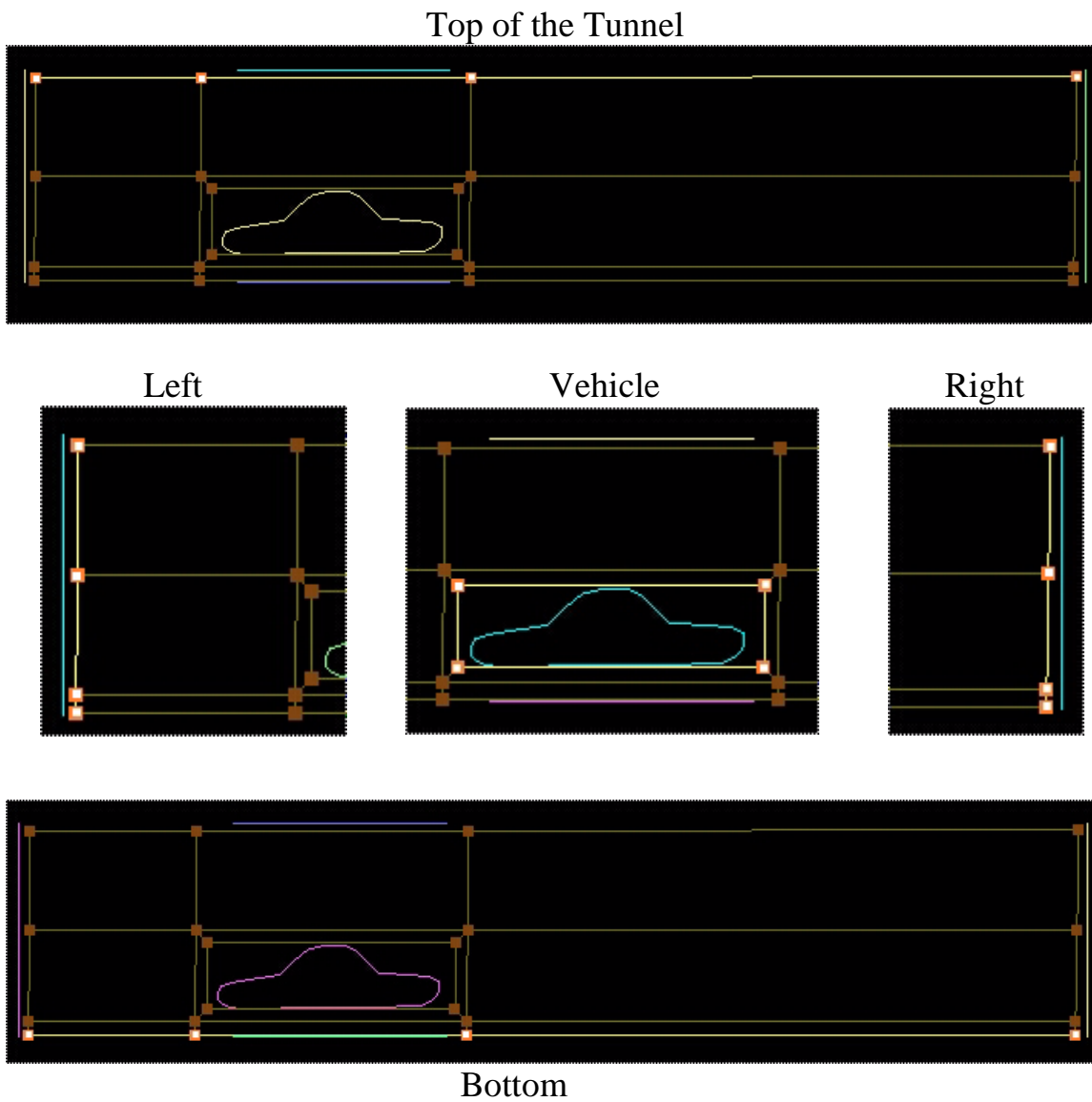

Create a new box-like Cartesian topology, to segment the space as shown below.
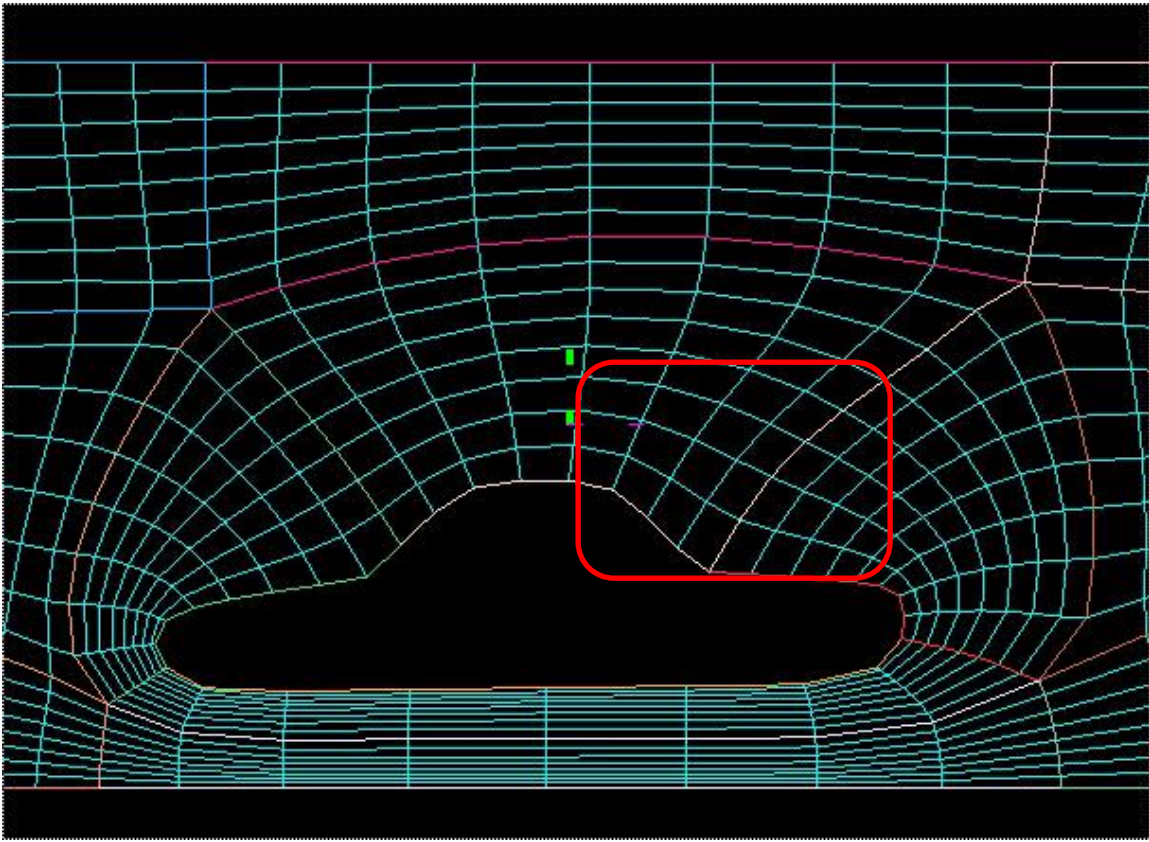

Next, wrap the inner box topology 10% less around the car. You should see the following.

Assign surfaces as shown below.

Top of the Tunnel

Left

Vehicle

Right

Bottom

Choose **Ggrid: start** from the **topo** menu and click **ok**. Load the **blk.tmp** file to see the grid. After a minute or two, the grid (with a shell surface) should look like the following.
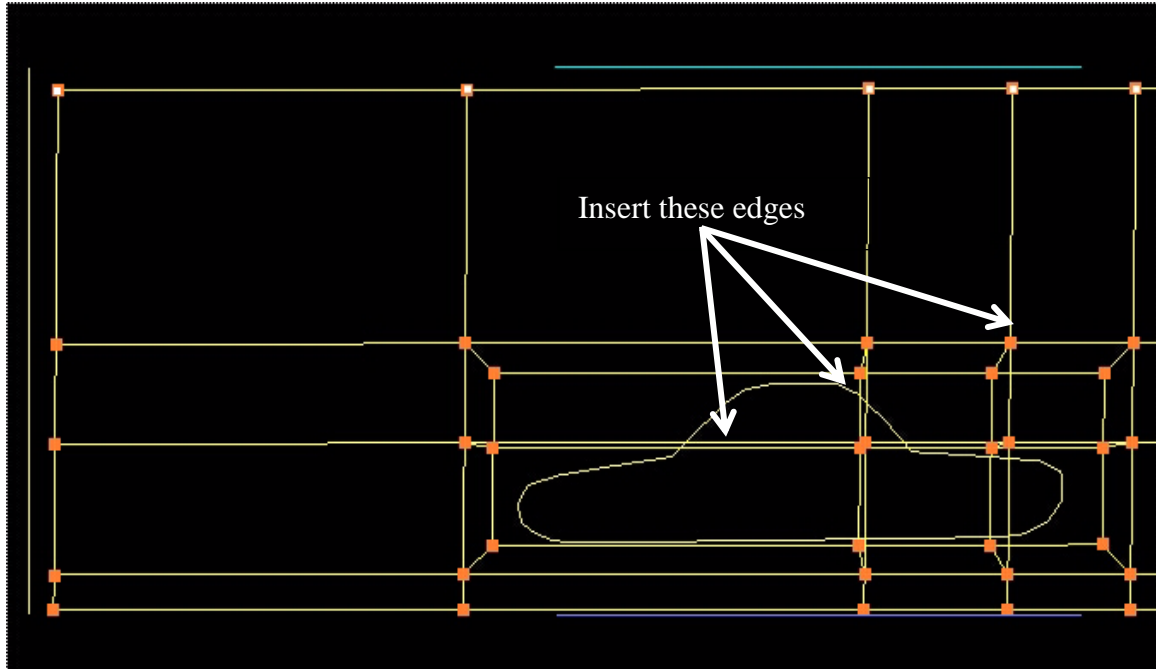
Notice how coarse and unrefined the grid is in the area within the red bock. We want to improve the grid resolution in this area by using a new technique called compact enrichment.
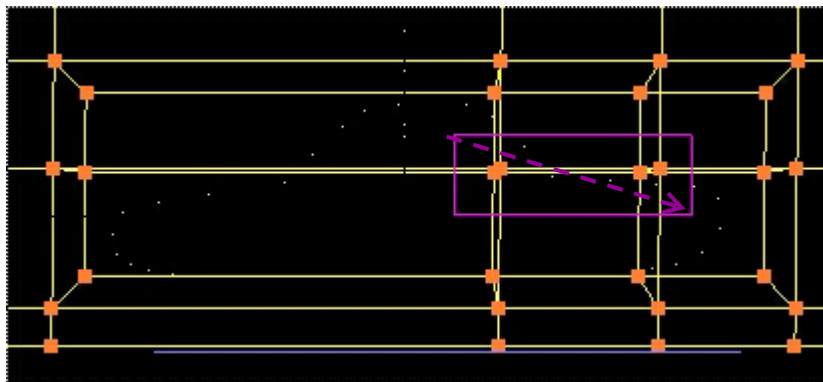
Step 2 Improving the Grid

The first thought that one might have as to how to improve this grid is to increase the grid density settings. This idea is not necessarily wrong, but we want to emphasize a specific part of the grid.

A possible solution might be to simply add more topology near that area.Let's try just that.

Add topology so that it looks more like the following. (Don't worry about surface assignments, as **GridPro** makes sure to preserve them).
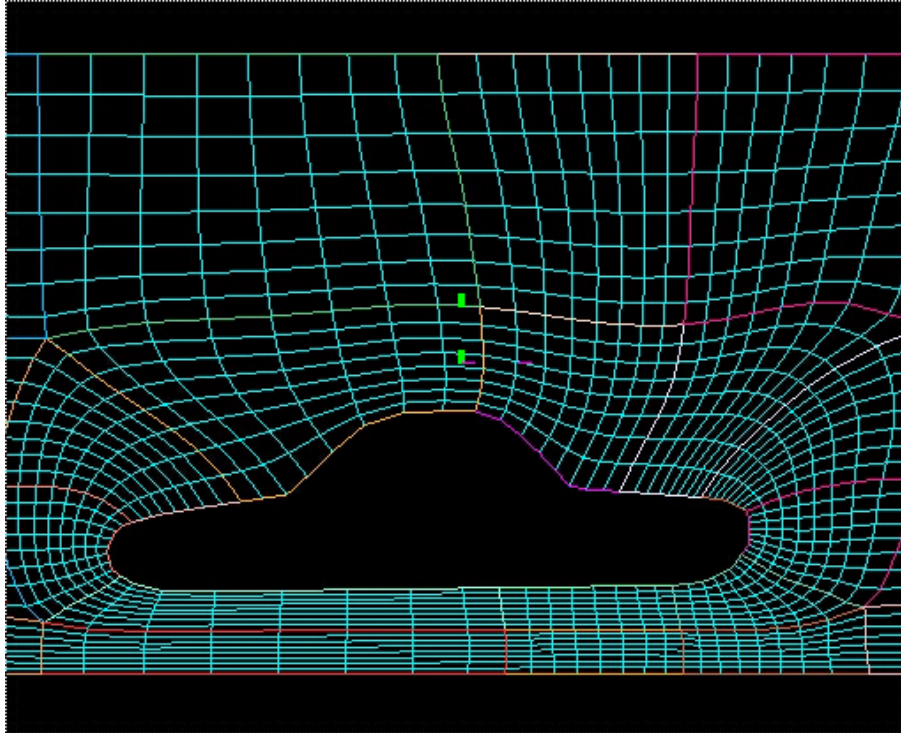
Before this topology will work, you must remove all sections that go through the car surface. The easiest way to do this is to hold down the key and the right clicking a box around the four unwanted corners.
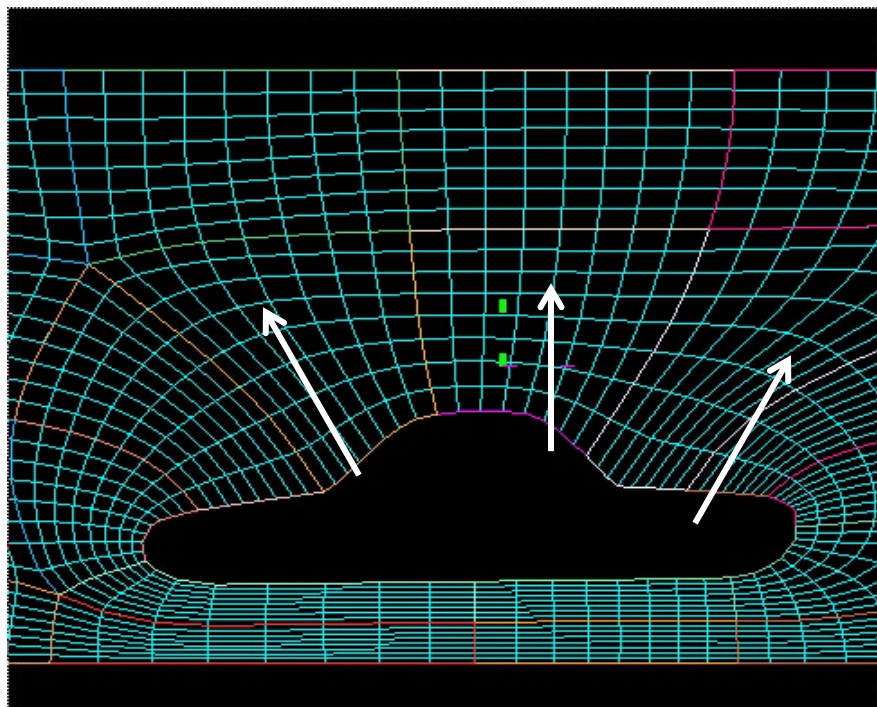

Now, start **Ggrid** and see what happens. Load the new grid from **blk.tmp** as soon as possible. It looks like we have improved upon this area a great deal.

After waiting for a few more minutes, reload the grid. You'll notice that it no longer looks like a denser version of the first one. The internal edges you have added did not change the character of the topology: it is still a polar like structure around the car that appears within an otherwise Cartesian like structure. Thus, we must change topology in a way that really changes the pattern of points.
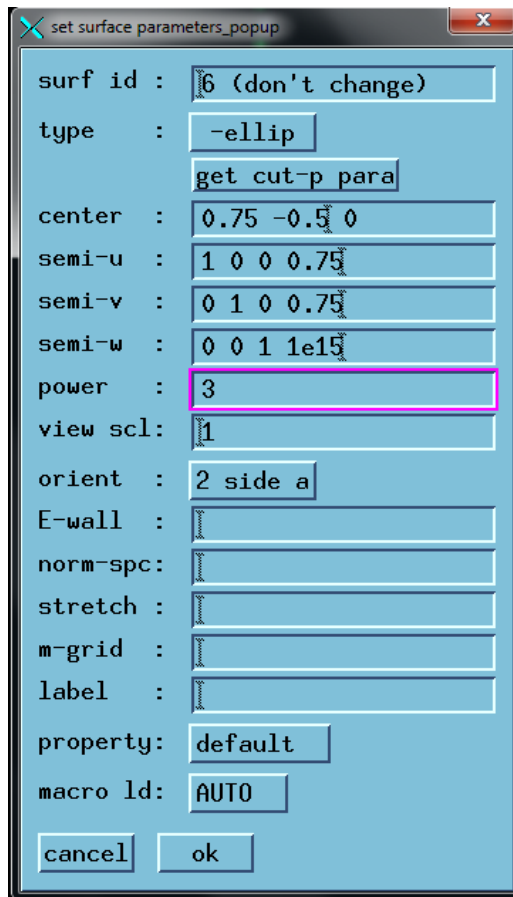
Step 3   Adding an Internal Surface

We know how to add edges to the grid by adding topology, which seems like a good starting point. However, we need to somehow really change the pattern of points and the bound these new edges in order to make the grid more compact within them. In order to do this, we will add an internal surface, along with the necessary topology. Such steps are crucial to compact enrichment.

First remove the topology that you added in the last step. The easiest way to do so is to use the [icon] button in the topo part of the **UNDO-REDO** panel.
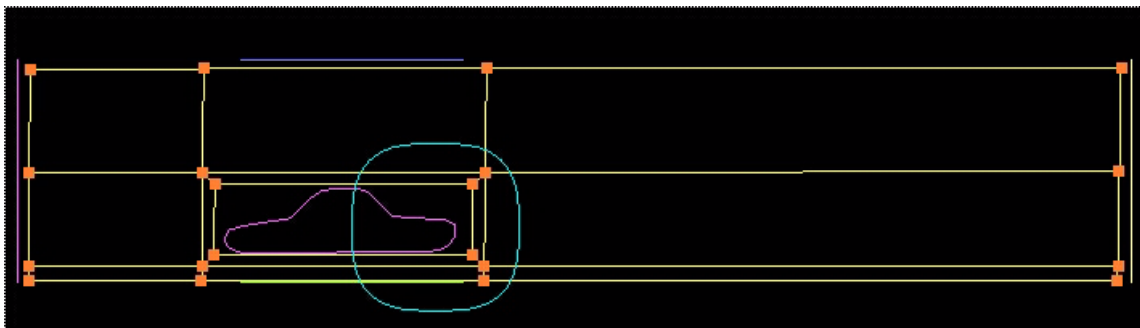
Now, create an internal ellipsoid by choosing **load:-ellip** from the **surf** menu. Give this surface the following properties.
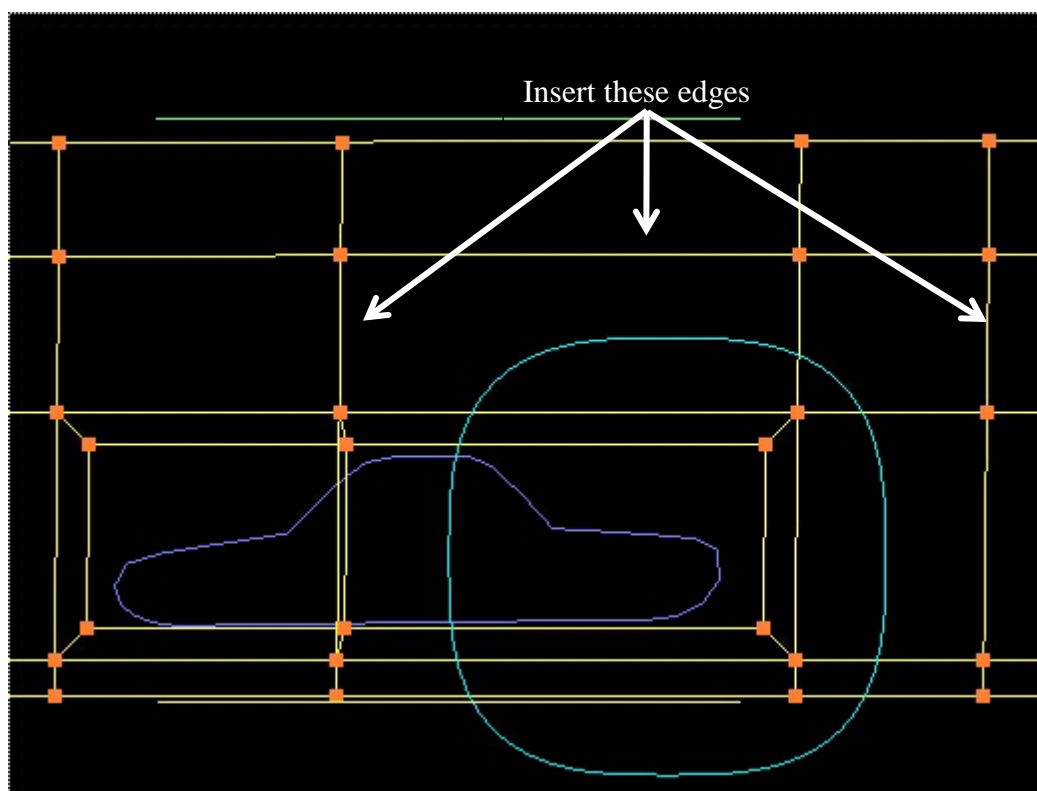
set surface parameters_popup	x
surf id :	6 (don't change)
type :	-ellip
	get cut-p para
center :	0.75 -0.5 0
semi-u :	1 0 0 0.75
semi-v :	0 1 0 0.75
semi-w :	0 0 1 1e15
power :	3
view scl:	1
orient :	2 side a
E-wall :	
norm-spc:	
stretch :	
m-grid :	
label :	
property:	default
macro ld:	AUTO
cancel	ok

Notice that the surface we're adding is two-sided. To generate parts of the grid on both sides of a surface, it must be specified as a two-sided surface.

The situation should now look like the following.

Now, you will add the topology associated with the new surface. Begin by inserting three edges by holding down the ⌨ key as shown.
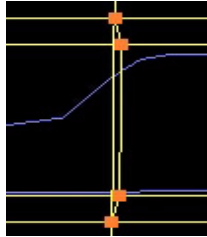

Insert these edges

Remove the two edges that cross through the car shape by holding down the ⌨ key and clicking on each of them. Now, the topology should look like the picture below.
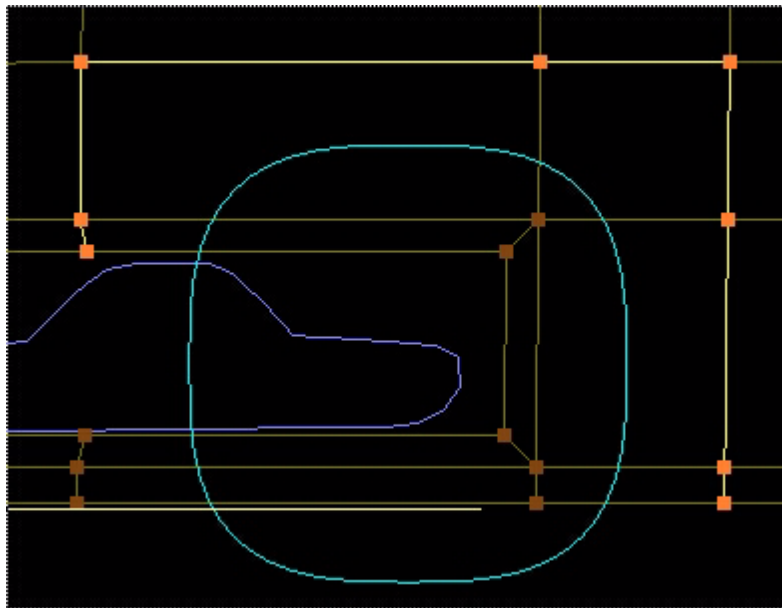
Pruning

Notice that you have to remove two edges inserted in the car box. Unusual topology such as that shown in the image below is often created when an insert is performed in an area that was created by a wrap in two-dimensions. The important aspect to n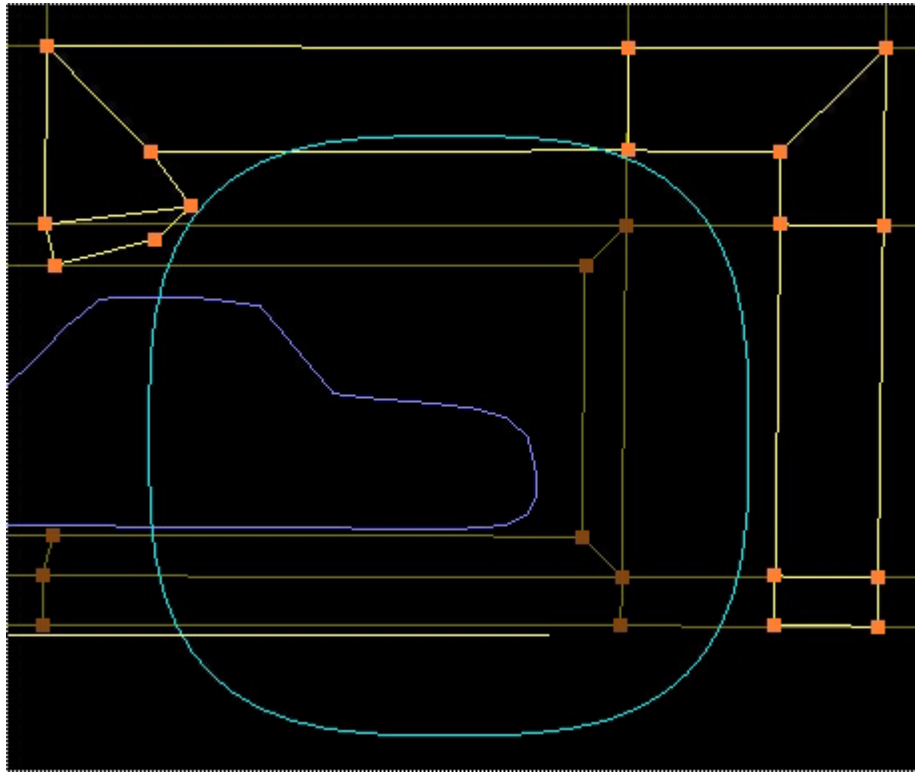ote is that two new edges are added, one of which causes an unwanted intersection between edges. This edge must be "pruned" or removed from the topology in order for it to work. Occasionally, this extra edge will appear to be invisible because it is overlapped with the other edge. Be aware of such possible problems when building two dimensional topology.
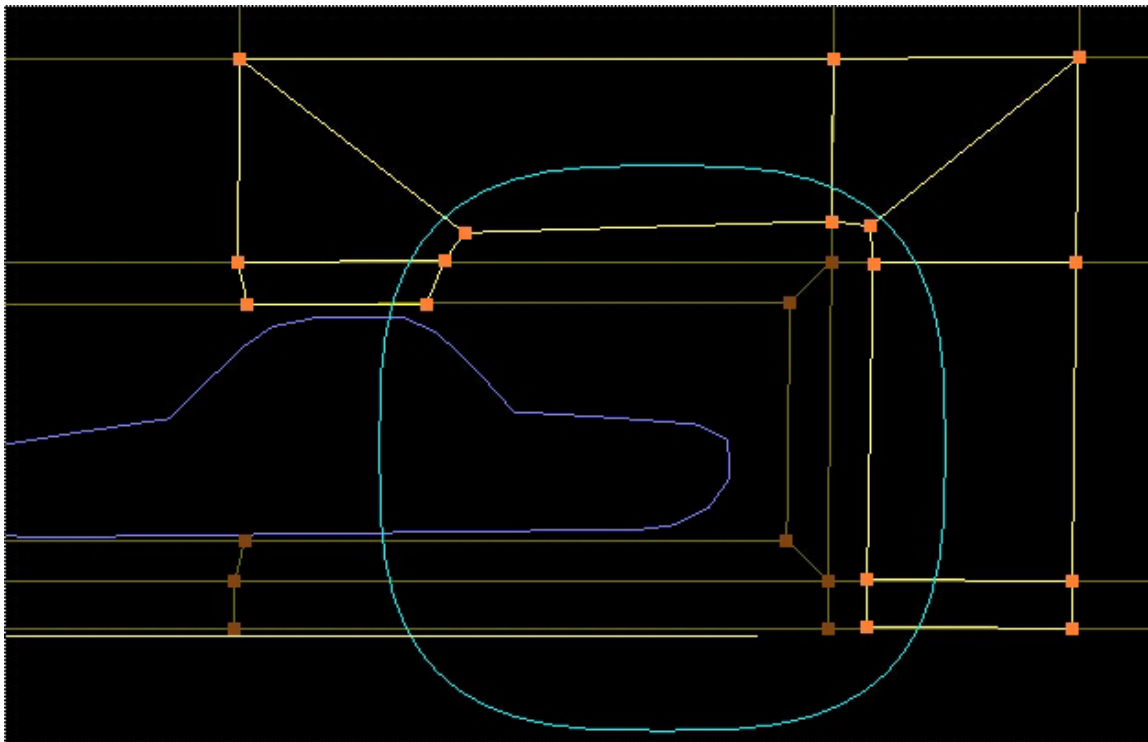
Now that we have topology for the outside of the new surface, we need topology for the inside, too. To do this we will use the wrap feature. First, add the surrounding topology to an empty group as shown below.
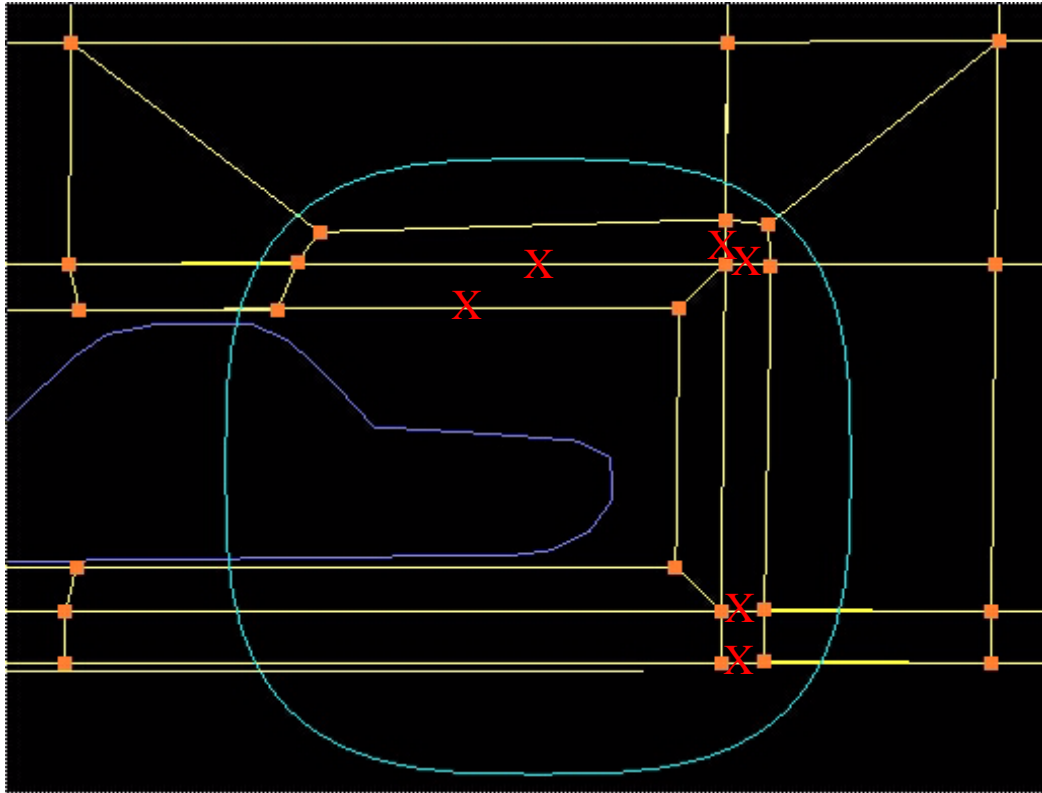
Choose **wrp - 25% smaller** from the **TOPO** command panel. You should see something like the following.
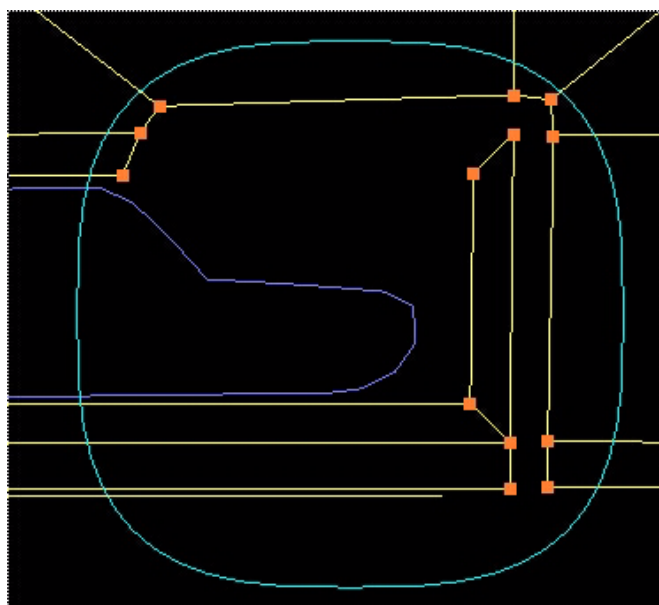
Adjust the new corners so that they are inside the surface, so the topology looks like the following image.
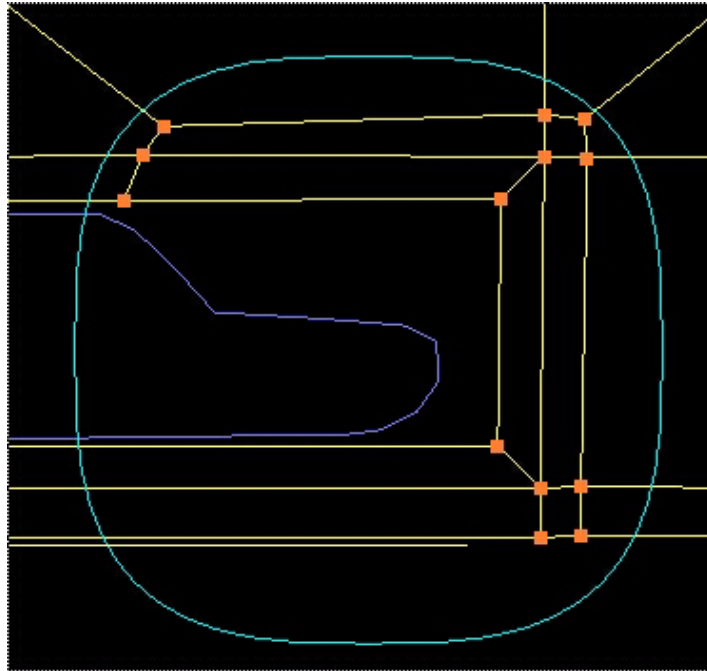
Notice that many of the new topology edges in the active group seem to overlap some of the inactive ones. This is helping move towards the topology we want. However, you first need to remove the original edges, and then add pieces connecting the old and new points.
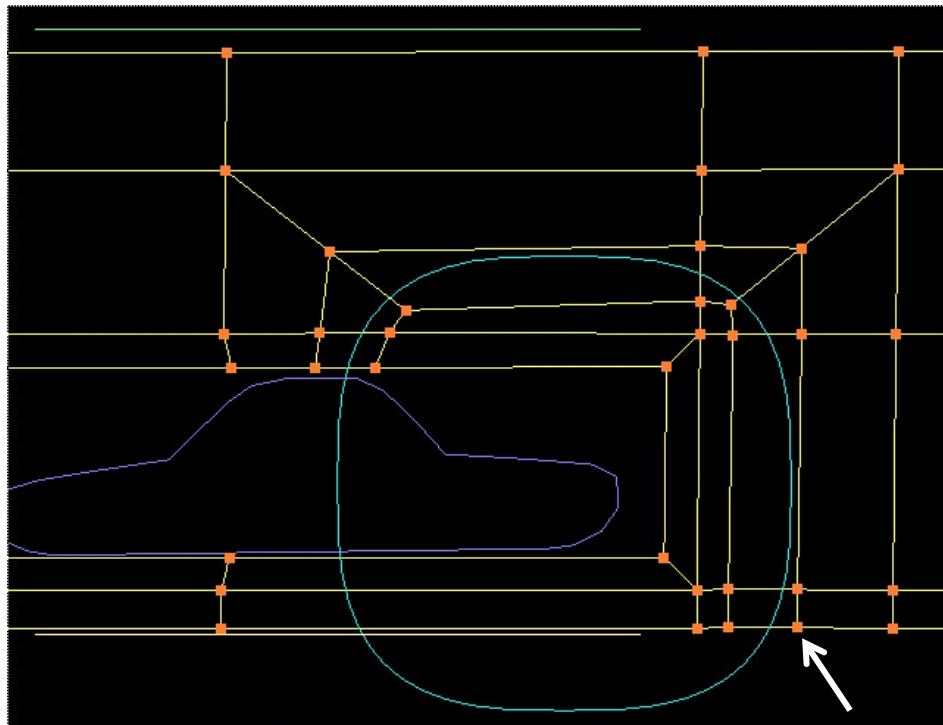

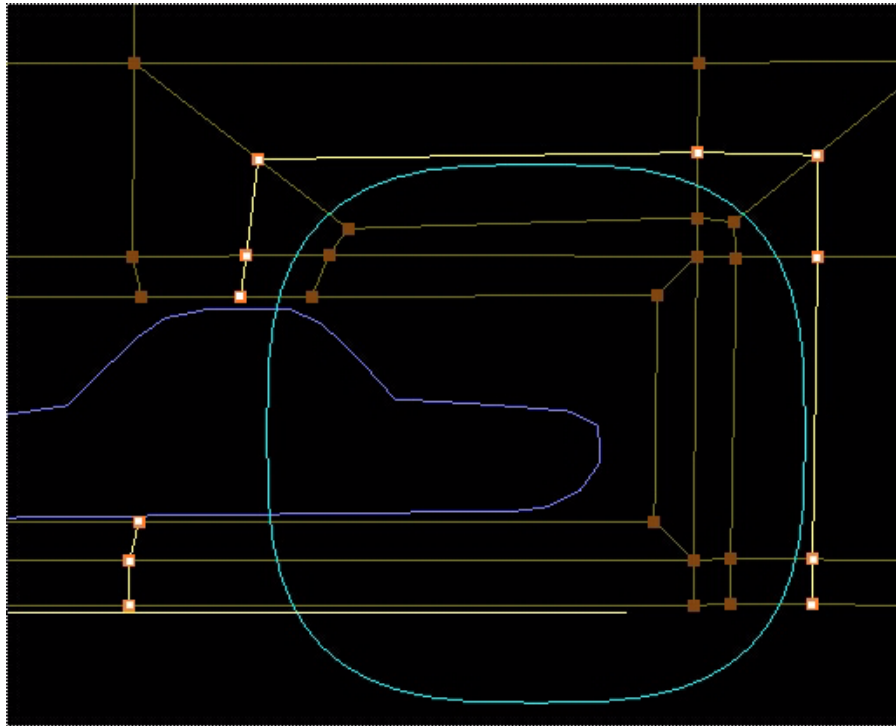Remove the six edges indicated, so that the situation looks as follows.

Add edges between nearby corners to further complete the topology. It should now look like the following.

Finally, insert a layer of topology almost tangent to the new surface, as shown below. Do this by holding down the key and left-clicking where indicated.

The only step left before gridding is to make the surface assignments for the new surface. Do so as shown below.

Choose **Ggrid: start** from the **topo** menu, click **OK**, and load the grid. Notice how much more enriched it is in the highlighted area.