AUTODESK UNIVERSITY 2014

With Infrastructure Design Suite You Will Make the Best Rail Project Ever

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CV5454-L-P In every rail Building Information Modeling (BIM) design that you do, you need the most effective options to help you make the right decision. InfraWorks software can help you do this. With the software's capacity to analyze many scenarios, you can make several proposals and choose the most effective one to fulfill the basic premises of the project, and you can show these proposals in an easy way to all stakeholders. Then, you can use the Rail Layout Module in AutoCAD Civil 3D software to design the whole railway, its details, and analyze it. With all the analysis done, you can generate reports and the final documentation thus, delivering the most effective rail project you have ever created.

Learning Objectives

At the end of this class, you will be able to:

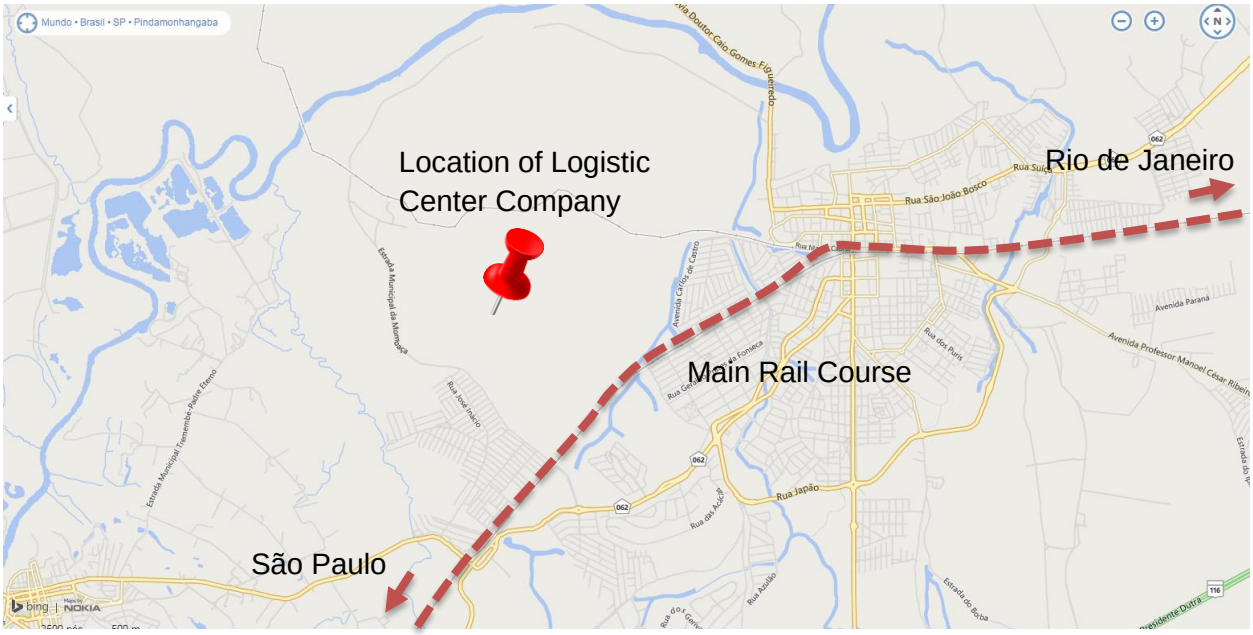
- Know how to develop rail design using Infrastructure Design Suite software
- Know about integration with many software systems to make a great rail project
- Know how to make a presentation to show your rail project in a simple way
- Know how to generate the documentation to deliver your rail project.

About the Speaker

Pedro Luis Soethe Cursino is a civil engineer and technical specialist with Infrastructure Brazil. He has worked in the infrastructure industry for the past 18 years, and he specializes in highway projects. Pedro has been using AutoCAD Civil 3D software for 7 years and the industry-specific AutoCAD software products for over 15 years. Pedro is an AutoCAD Civil 3D Certified Professional. He has presented at Autodesk University 2012, 2013 and 2014 in Brazil and at Autodesk Infrastructure Symposium in 2013 in Vegas. His vast experience includes real-world application of InfraWorks and AutoCAD Civil 3D software in the engineering, natural resources, and infrastructure (ENI) industry, as well as in mapping and infrastructure. He enjoys teaching and specializes in relating to class participants and helping them to get the most out of training courses.

The structure of the class.

The class is about a connection between a Logistic Center Company and a Main Rail Course in Brazil.



The map above shows the location of the new Logistic Center Company and the Main Rail Course. We need to connect the LCC to the MRC.

We divided the design in two parts. One of them is the preliminary design, which we will do in InfraWorks 360. The other is the design detailing which we will do in AutoCAD Civil 3D.

We recorded the whole process and posted it at https://screencast.autodesk.com under the class code ***CV5454-L-P.***

We will be referencing the videos in class and throughout this handout.

We separated the data sets for each part into different folders. For example, if you want to start from the AutoCAD Civil 3D part it's ok - just start from folder "*04 – AutoCAD Civil 3D Step 01".* This data set and the others are in the DataSet folder, in our class folder at the AU Las Vegas site.

Let's say we were starting from InfraWorks 360.

Using InfraWorks 360 to create a good preliminary design.

We will be using the InfraWorks 360 to create a preliminary idea of what we want. This software will help you deliver a great presentation and generate a clear display of all the all variables involved in the design.

In our class, we will be designing a connection between a new logistic center company, further on referred to as LCC, to the main rail course, further on referred to as MRC, which connects the main cities in Brazil.

The owner of the LCC and the company that manages the MRC need to approve the preliminary design before releasing the final stage of the design. The best way to do this is through InfraWorks 360.

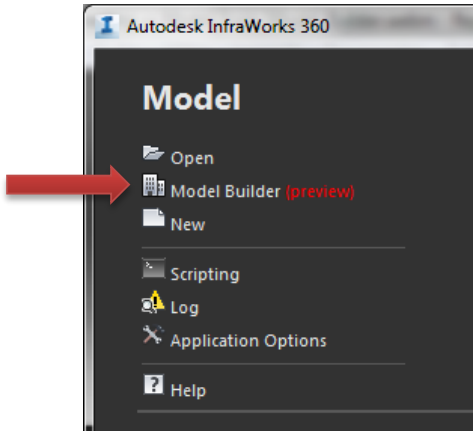
Starting the Project by creating the Model.

The first thing we need to do is obtain the bases for our project. The bases are survey data such as terrain elevation and the all information we need to make the project.

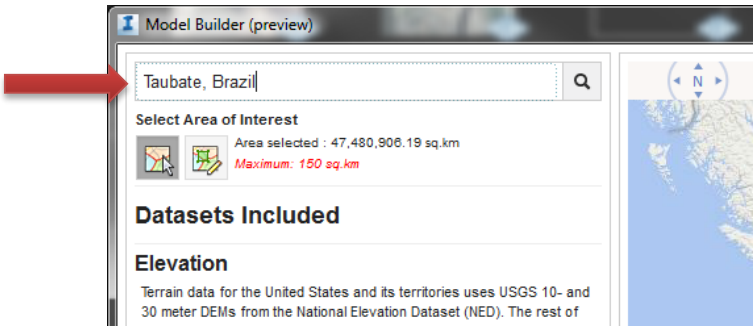
To do this we need to contract a surveyor to collect all the land data. In our particular case, the area, which we would need to survey, is too large, since we do not yet know exactly where the new railway will pass between the LCC and the MRC. Collecting data from an area that large is too expensive.

Fortunately, we have a way to do this free, the only thing you need is InfraWorks 360. InfraWorks 360 has an excellent tool that can obtain all the data you need in simple way. This tool is a *Preview* tool. Obtaining the model from this tool is very simple. Just follow these few steps.

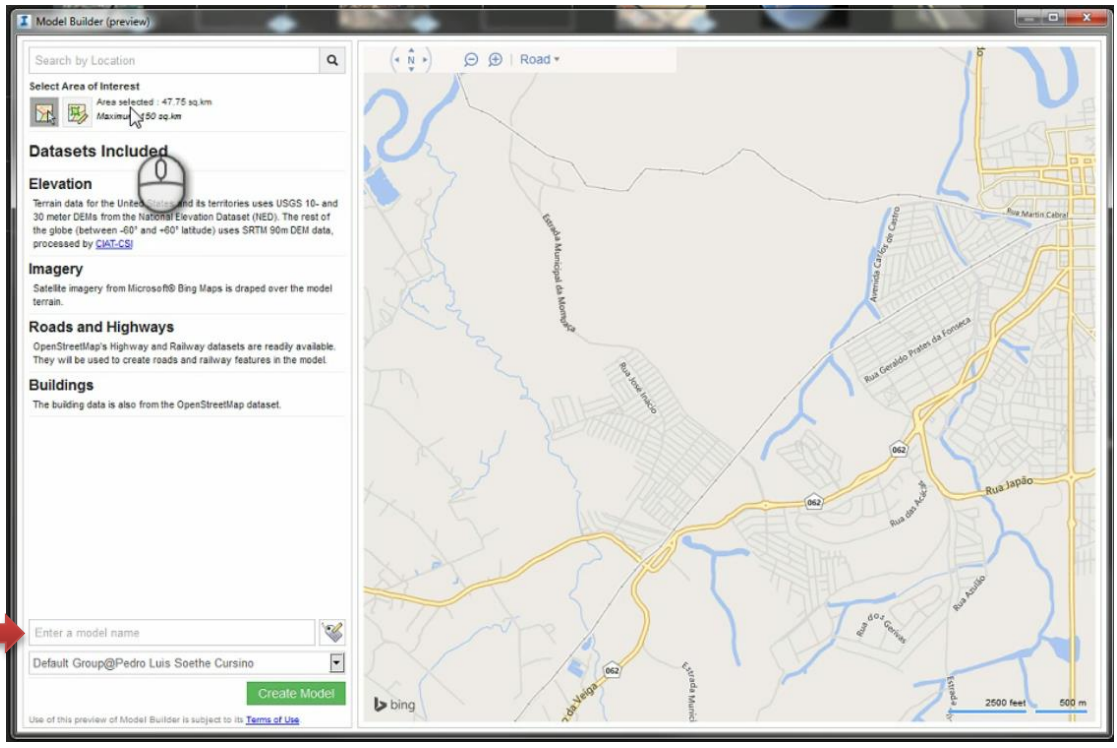
1. The first thing you have to do is launch InfraWorks 360. Click on "*Model Builder"* as shown in the figure below.



2. The *Model Builder (Preview)* will appear. In the top, we have a search box. There, enter the name of the project location. In this case, it is "*Taubate, Brazil"* as show in the figure below.

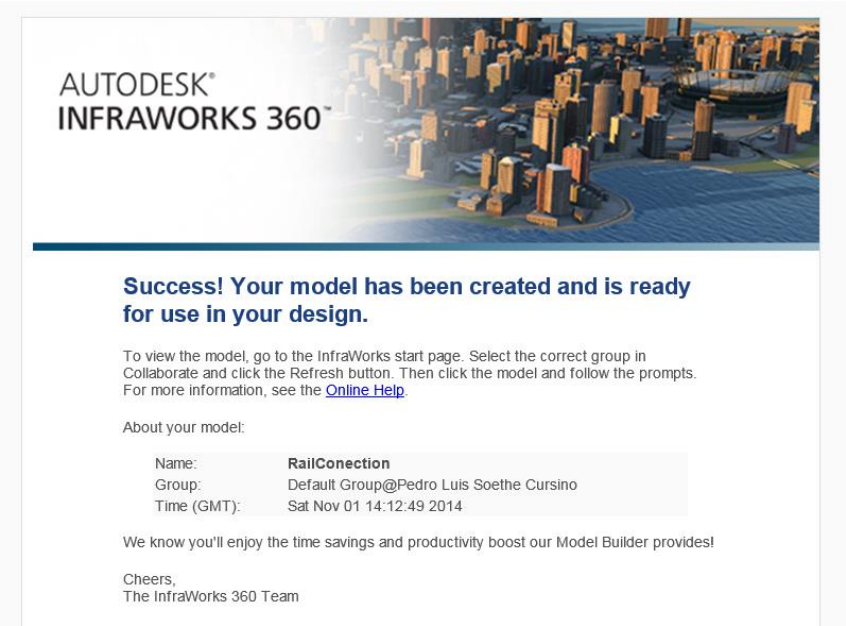


3. After some time, the location will appear on the right side where the map is located. Try to find the area showed in the figure below.

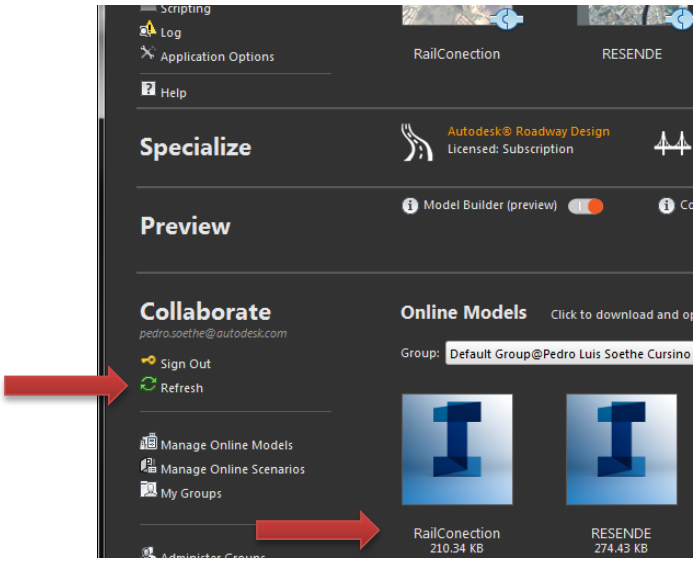


4. After you find the location, enter the name of the model in the box marked in the figure above. In our case, I entered the name "Rail Connection". After you enter the name click on button *Create Model* 

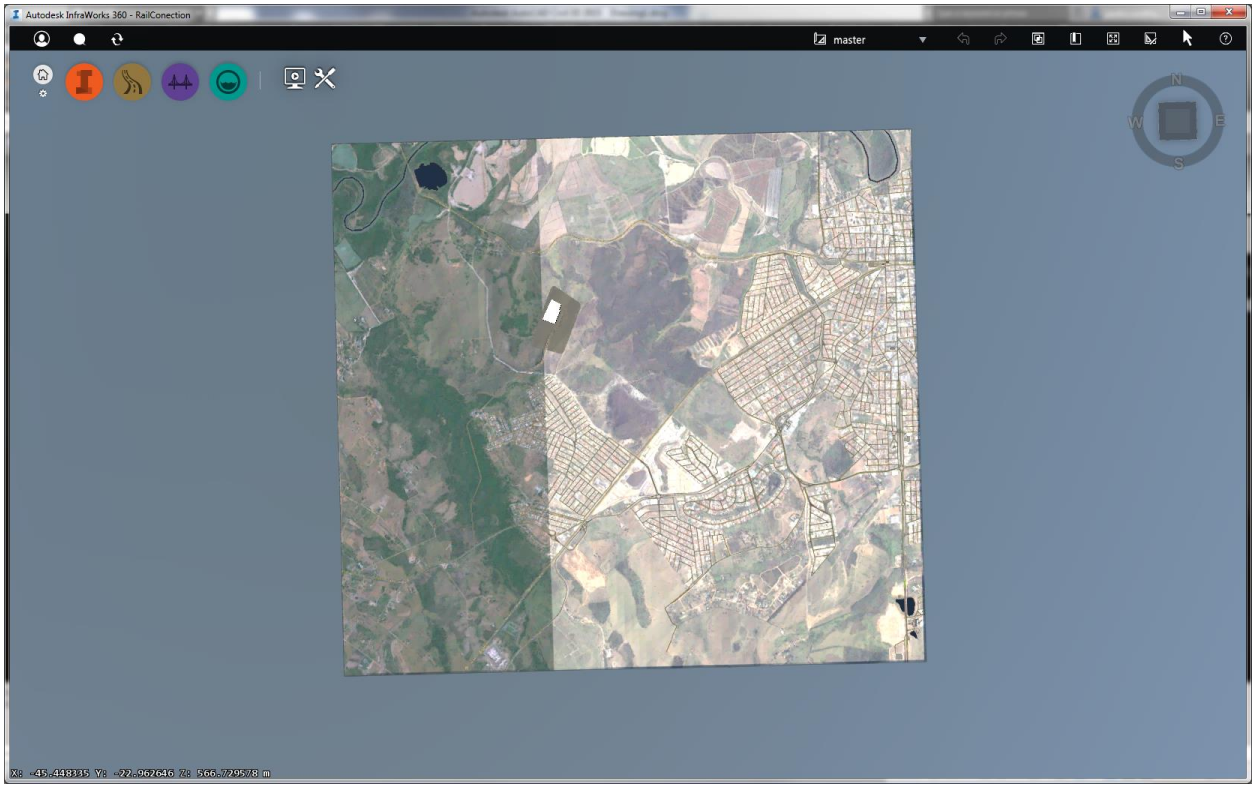
5. A message will appear informing that the model will be finished in 10 to 15 minutes, and as soon as finished you will receive an e-mail.
6. Wait for the e-mail such as the figure below informing you the model has been created and is ready for use.



7. Go back to InfraWorks 360. Click on the *Refresh* button and the model will appear under the *Online Models* section. Select the model and download it.



8. The model will open and appear on your screen.



9. If you feel that you have missed anything, I recommend that you open these two videos. They explain the process up until now.

   01 - InfraWorks 360 - Creating a Model from Model Builder - CV5454-L-P
   https://screencast.autodesk.com/Main/Details/2ec43346-2cd8-477d-9a28-d4ac2ed6783f

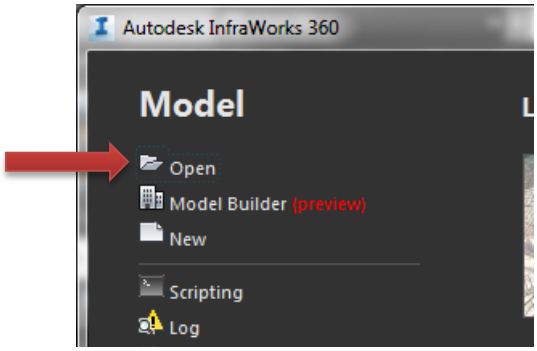
   02 - InfraWorks360 - Importing and Opening the Model - CV5454-L-P
   https://screencast.autodesk.com/Main/Details/ff3ca72c-9cdb-4093-8612-c027ddd59e82

Starting in InfraWorks 360

Opening the Model

If you have decided to start from here, we will be opening the finished model. It is located in the DataSet folder called "*1-InfraWorksModel"* under the name *RailConnection.sqlite*. Follow these few steps to open the model in InfraWorks.

1. Select *Open*.

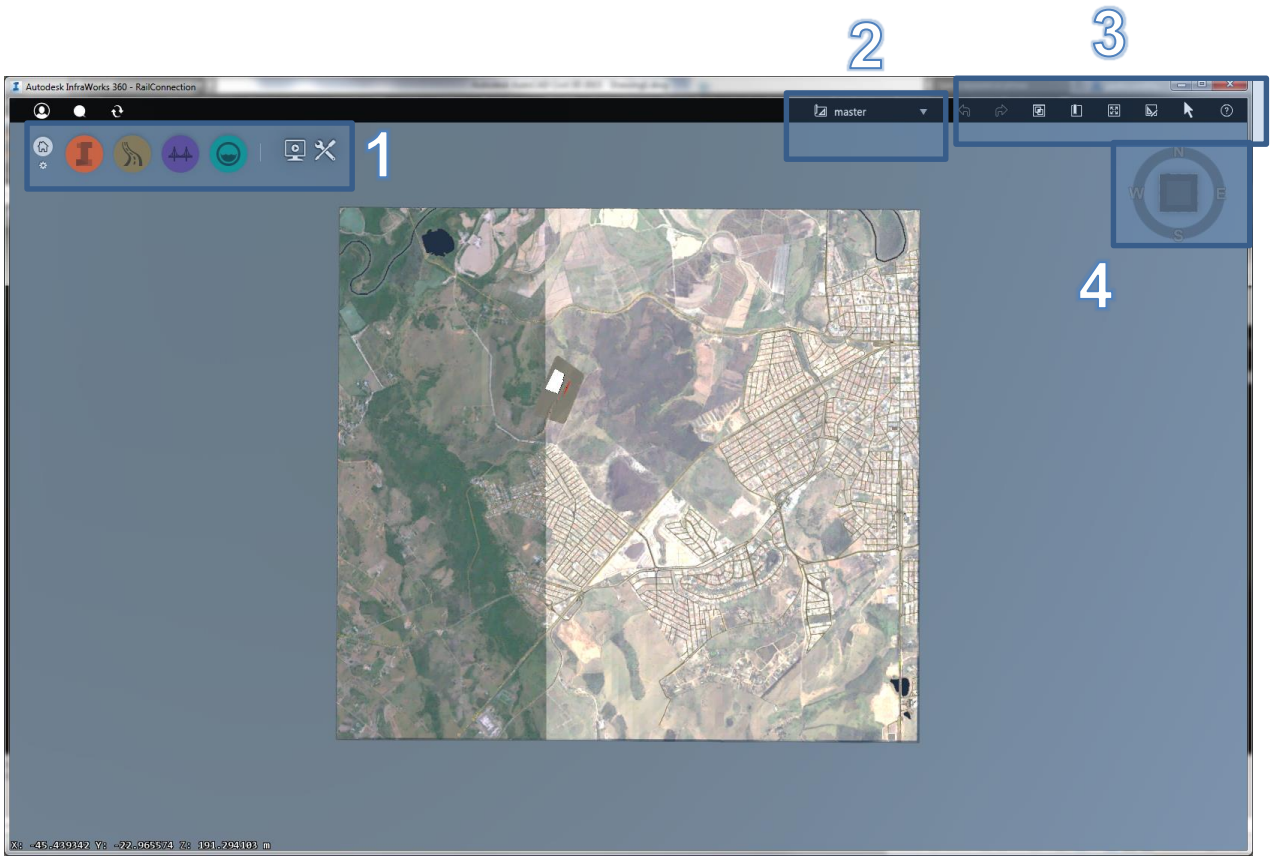


2. After that, the *Open* dialog box will appear. Find the *RailConnection.sqlite* file and select the *Open* button.
3. The model will appear in the InfraWorks.

Some useful information about the InfraWorks 360.

Now, we will discuss a bit more about the InfraWorks 360. This product is relatively new. This particular release of InfraWorks launched this year (2014).

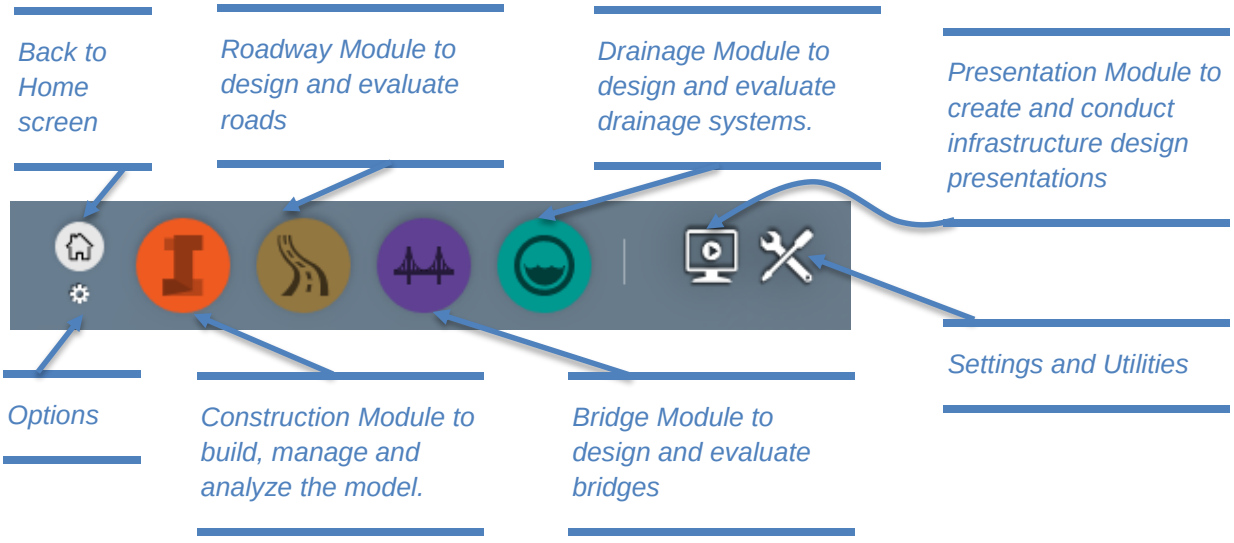
The first thing to know is about its workspace. InfraWorks 360 has a unique workspace different from any Autodesk product.



The figure above show us the workspace of InfraWorks 360

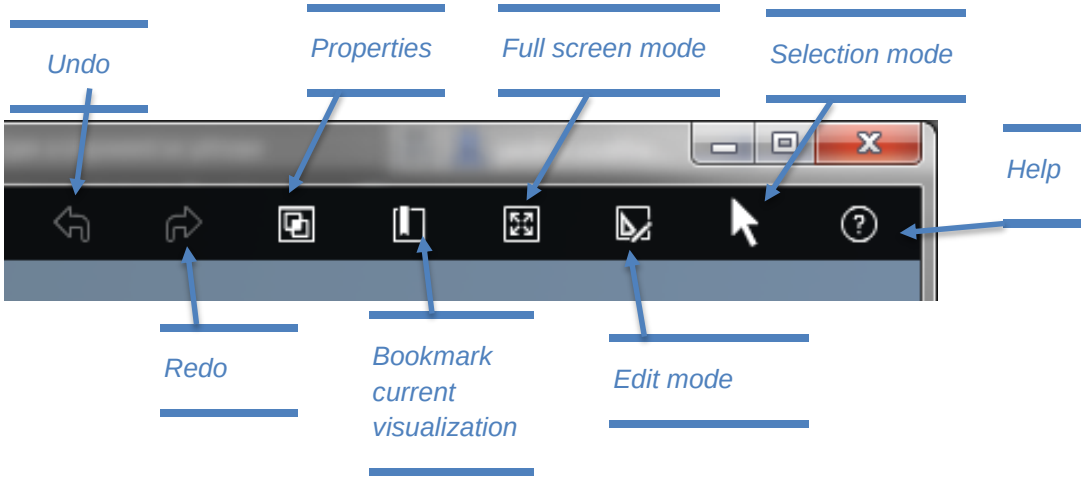
1 - In box number one, we have the modules of InfraWorks. These modules enable us to design roads, buildings, city furniture, covered areas, bridges, drainage systems and so forth.

With these modules, we can design, evaluate, and perform analysis, quantifications and especial visualizations, renders and animations.



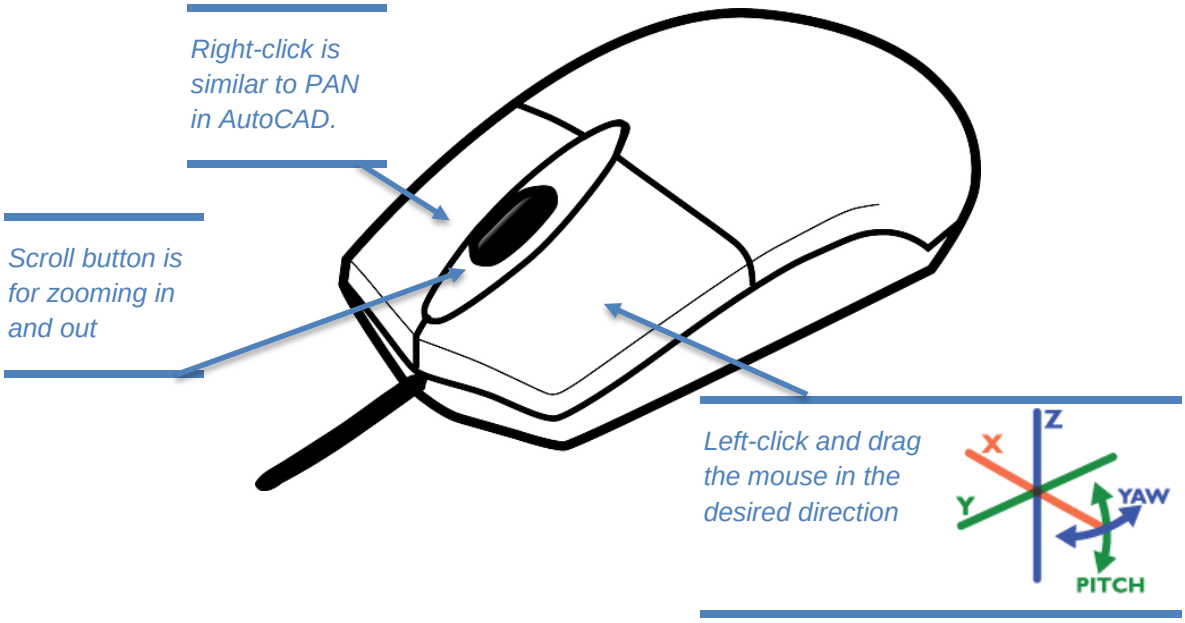
2 – Box number two is where the different proposals for your design are stored.

3 – In box number three, we have some commands to manipulate the model.



4 - Box number four contains the gizmo to set visualizations modes.

The final thing is how the mouse controllers behave. It is very similar to Google Earth controllers.



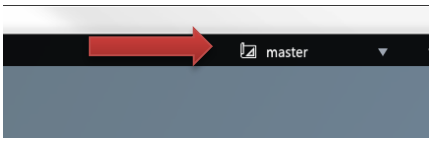
Working with proposals

One of the greatest features of InfraWorks is the chance to work with multiple proposals.

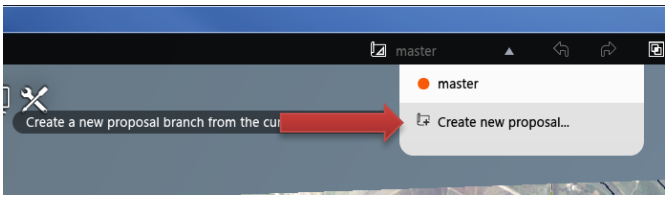
How did I make these proposals?

It is very simple to create new proposals. Follow these steps to setup more than one proposal.

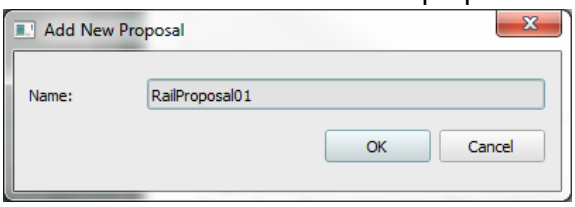
1. For starters, you are in the Master proposal. Select the arrow beside “master”.



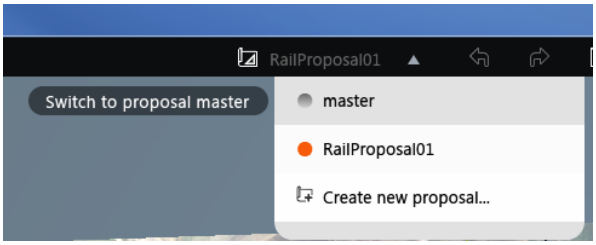
2. Select *Create new proposal*



3. Give a name to this new proposal.



4. Click *OK*, and you are all set. You have successfully created a proposal based on the previously selected proposal.
5. To alternate between proposals, reopen the proposal menu and choose another proposal.



Cool Tip: When you create a new proposal, all of the elements in the currently selected proposal go to the new proposal. The MASTER proposal is the original model; we strongly recommend that you do not use this MASTER proposal for anything! Before you start creating a different situation, save a new proposal from the MASTER proposal.

6. If you feel that you have missed anything, I recommend that you open this video. It explains this process.
   03 - InfraWorks 360 - Creating Proposals - AU CLASS - CV5454-L-P
   https://screencast.autodesk.com/Main/Details/2ec43346-2cd8-477d-9a28-d4ac2ed6783f

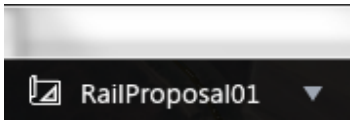
Starting to create ideas

After creating the new proposal, we will start by creating two separate options.

To create these options we have two different ways. One of them is using the Railways command, but in doing so, we are not able to export the Alignment to *AutoCAD Civil 3D.* However, we do have some great workarounds.

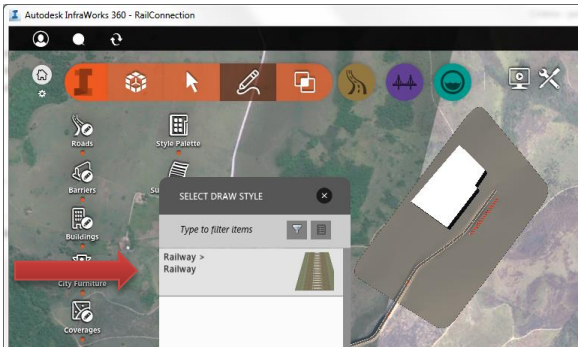
Using the Railway command

Let's get started. All we need to do is follow the next steps.

1. Make sure you are in the Proposal Number 01 

2. The first thing we have to do is access the construction menu and then select the icon Railway, or Add Railways to your conceptual design, as shown below.

3. Now choose the Railway Style.



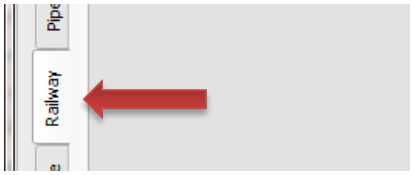
4. After that, the only thing you need to do is to click on the model and try to find the best design.
5. If you feel that you have missed anything, I recommend that you open this video. It explains this process.
   04 - InfraWorks 360 - Creating The First Idea - AU CLASS - CV5454-L-P
   https://screencast.autodesk.com/Main/Details/2ec43346-2cd8-477d-9a28-d4ac2ed6783f

Change the Railway style.

After creating the railway, we can make changes in the Railway style. To do this follow the next steps.

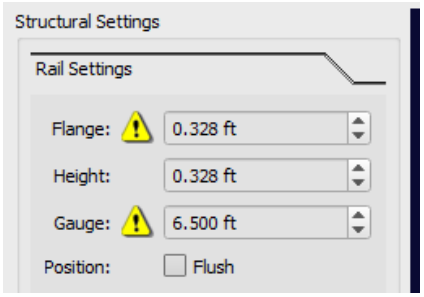
1. In the construction menu, look for the *Style Palette.*

2. After that, find the Railway tab.



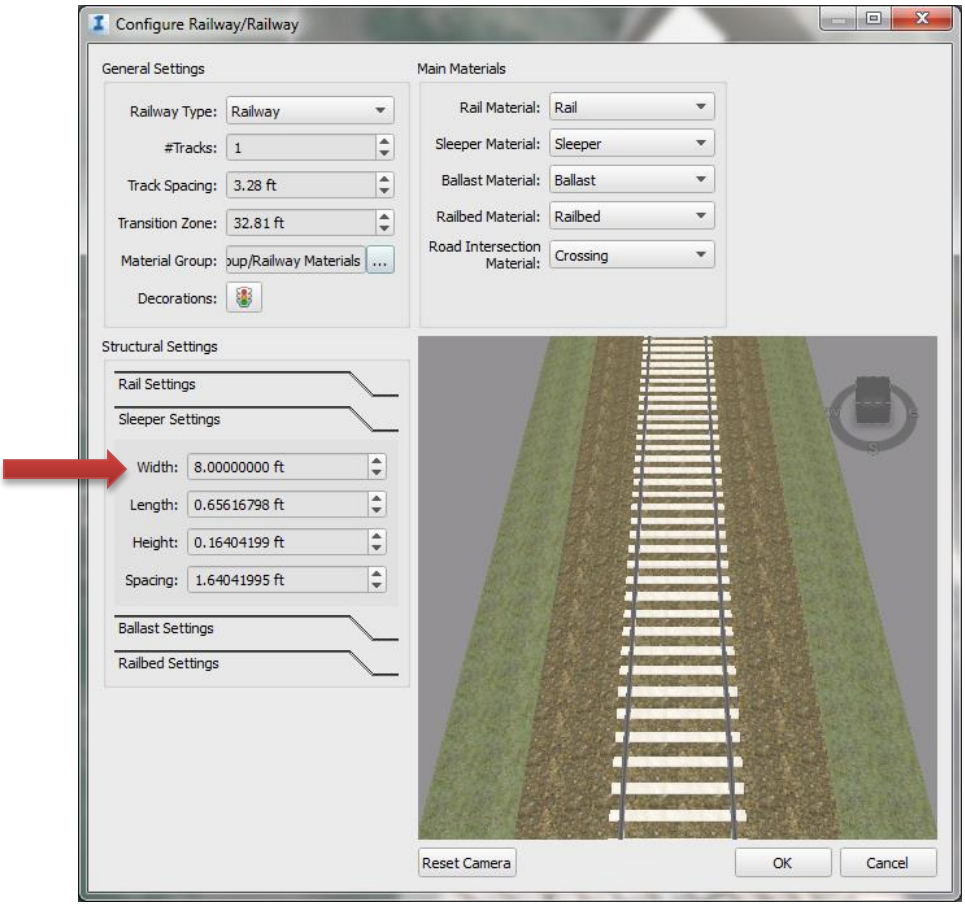
3. Double click on the style.

4. The *Configure Railway* dialog box appears. There we can make several changes like structural options and materials. Let's try to change the *Gauge* to 6.50ft.



5. After doing so, this icon will automatically appear  in front of Flange and Gauge. This icon means that now the sleeper is smaller than Gauge+Flange. Therefore, we need to change the *Sleeper.*

6. Click on *Sleeper Settings* and then in *Width* change to 8.000ft. You will see that after that, the *preview* image will appear again.



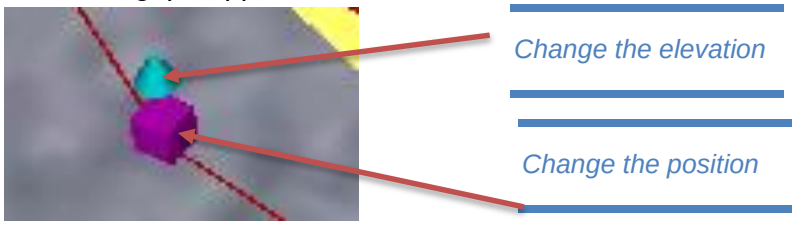
7. Click on *OK*, and the model will be updated automatically.
8. If you feel that you have missed anything, I recommend that you open this video. It explains this process.
   05 - InfraWorks 360 - Changing Styles - AU CLASS - CV5454-L-P
   https://screencast.autodesk.com/main/details/2ca7fa42-6db0-4181-a94e-d19681269cc5

Modifying the Railway geometry.

You can modify the geometry already made. To do so, follow the next steps.

1. Select the *Edit Mode.*

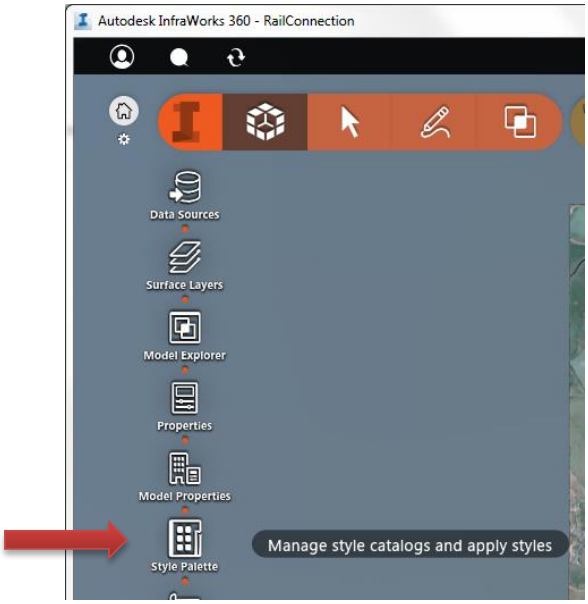
2. After that, select the *Rail* that was created.
3. Notice the *grips* appear



Importing the new Railway style as a Roadway.

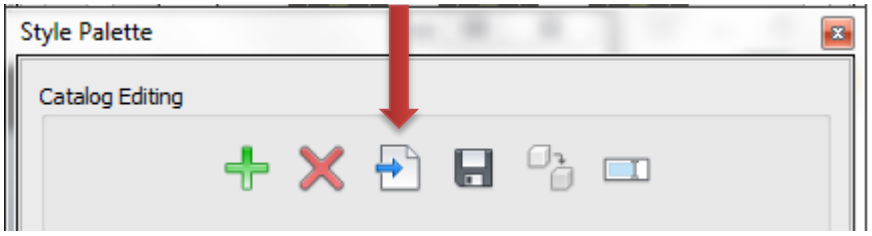
Now we will start doing the same thing but using a Railway as a Roadway, and with that exploring new possibilities, like defining curve radii, profile, and more. To do this we need to import a style from the Data Set files. To do this follow the next steps.

1. Open the *Style Palette.*

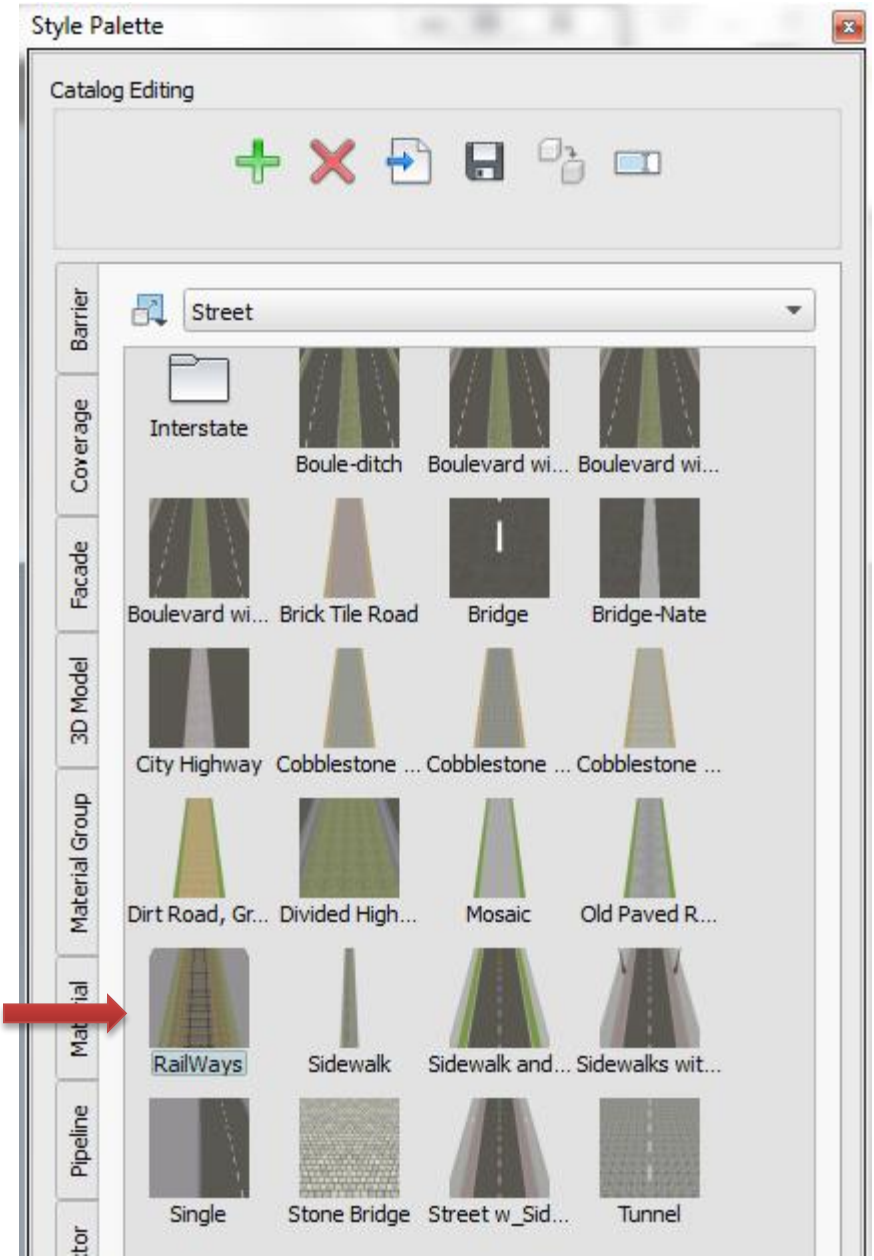


2. In the Style Palette go to the *Road* tab. 

3. Now we are going to import the Style clicking on the button as show bellow.



4. In the DataSet folder called *2-RailStyle* select the *RailRoadPedro.styles.json*.
5. The new *Style* will appear named *RailWays*

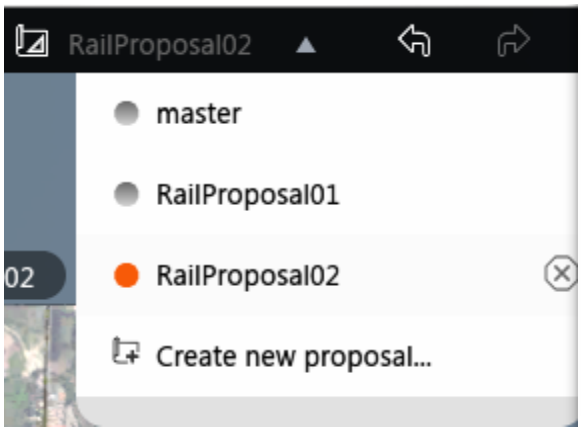


6. After that, we can use this new style in our project.

Creating the second idea.

Much like the first idea, we will create a new option, but now using the *Style* we imported.

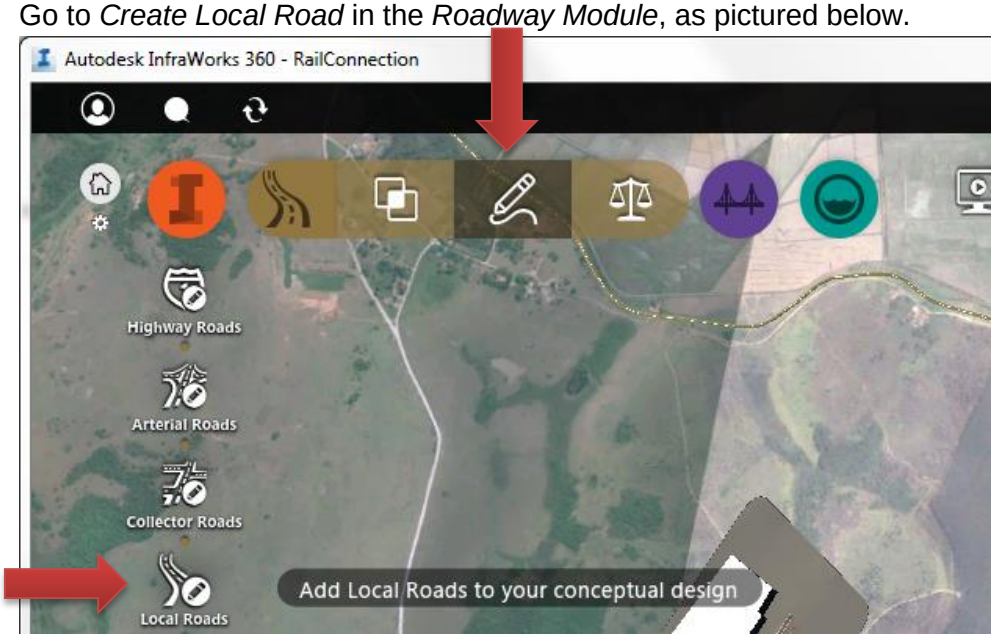
The first thing we have to do is change the *Proposal* to *RailProposal02*



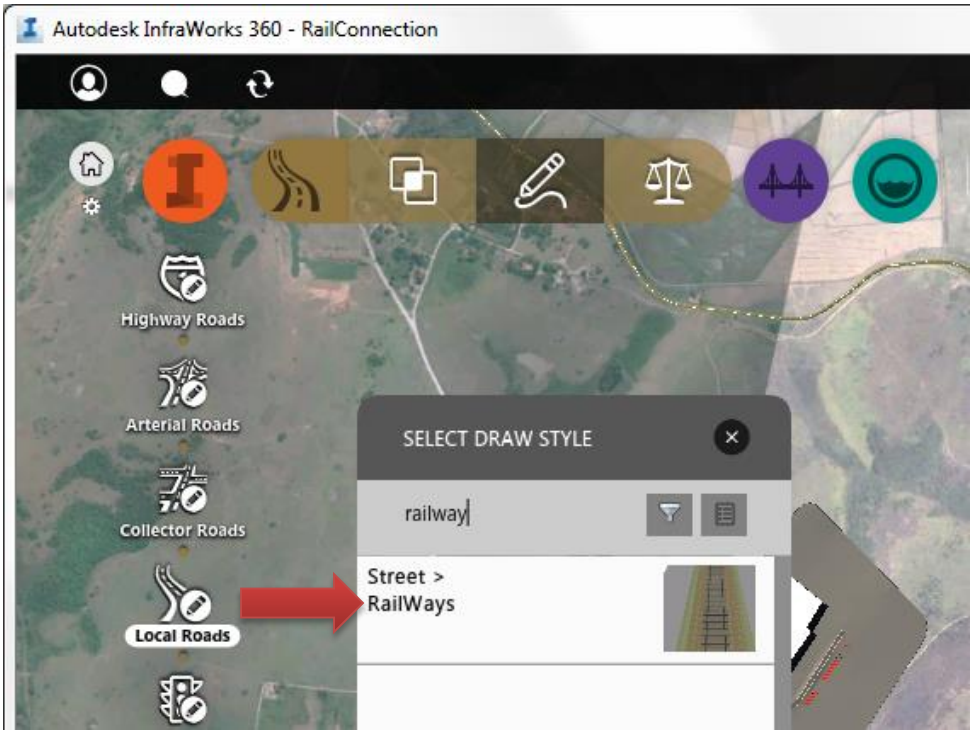
Cool Tip: If you have not created the new *proposal* yet, change first to *Master* and then create the new *proposal*, if you will create the new *proposal* under another *proposal* everything from this proposal goes to the new one.

Now follow the next steps.

1. Go to *Create Local Road* in the *Roadway Module*, as pictured below.



2. The dialog box named *Select Draw Style* will appear, and then we must choose the *Railway Style.* To find it more quickly, type *railway* at the top of the *dialog box,* as shown below.



3. Select the *RailWays* style.
4. After that you can create the new proposal.
5. Notice that we now have a chance to choose the speed.

The speed changes the minimum radius based on the AASHTO.

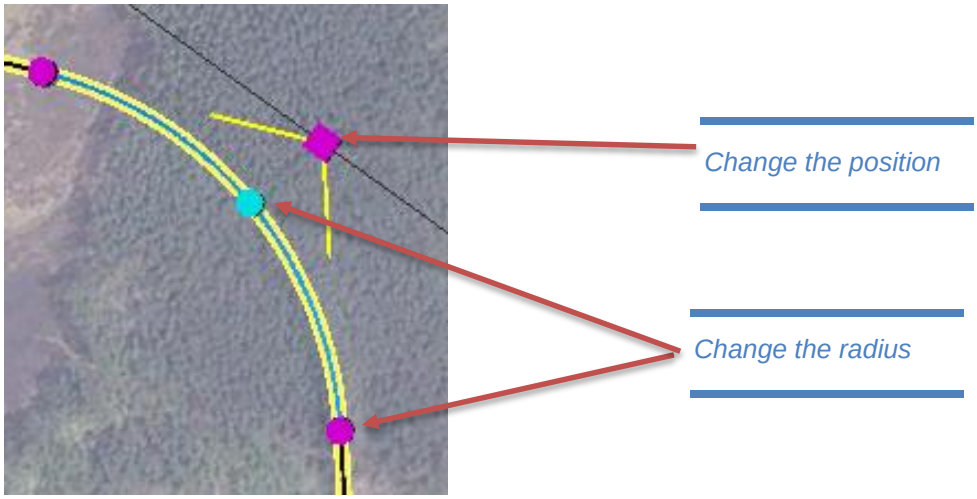
6. Design the proposal.

Modifying the Railway geometry.

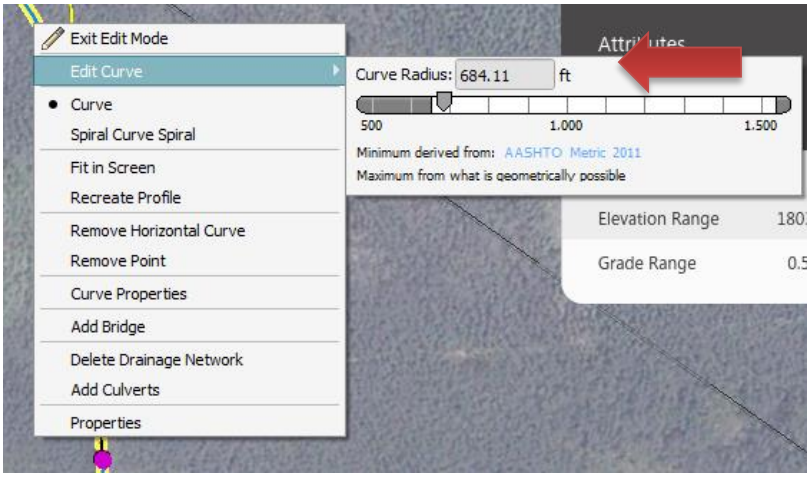
You can modify the geometry already made. To do so, follow the next steps.

1. Select the *Edit Mode*

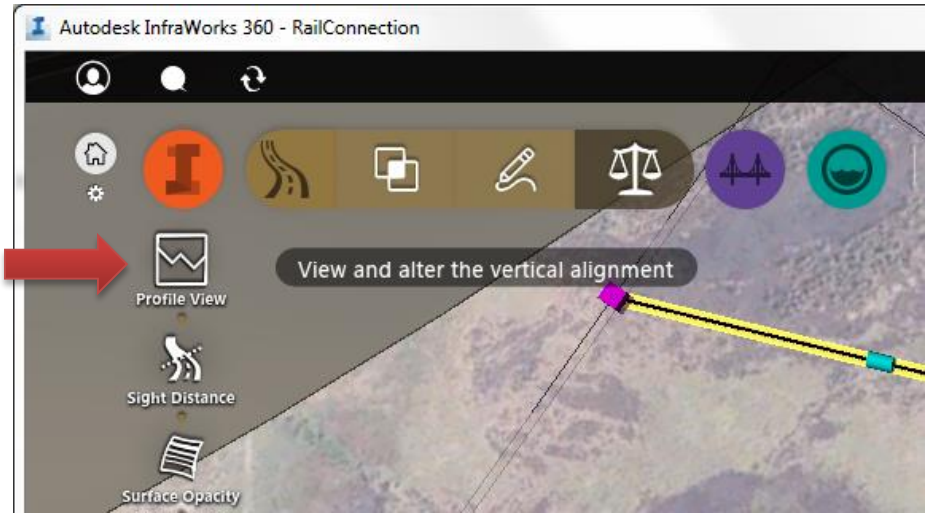
2. After that select the *Rail* that was created.
3. Notice the *grips* appear



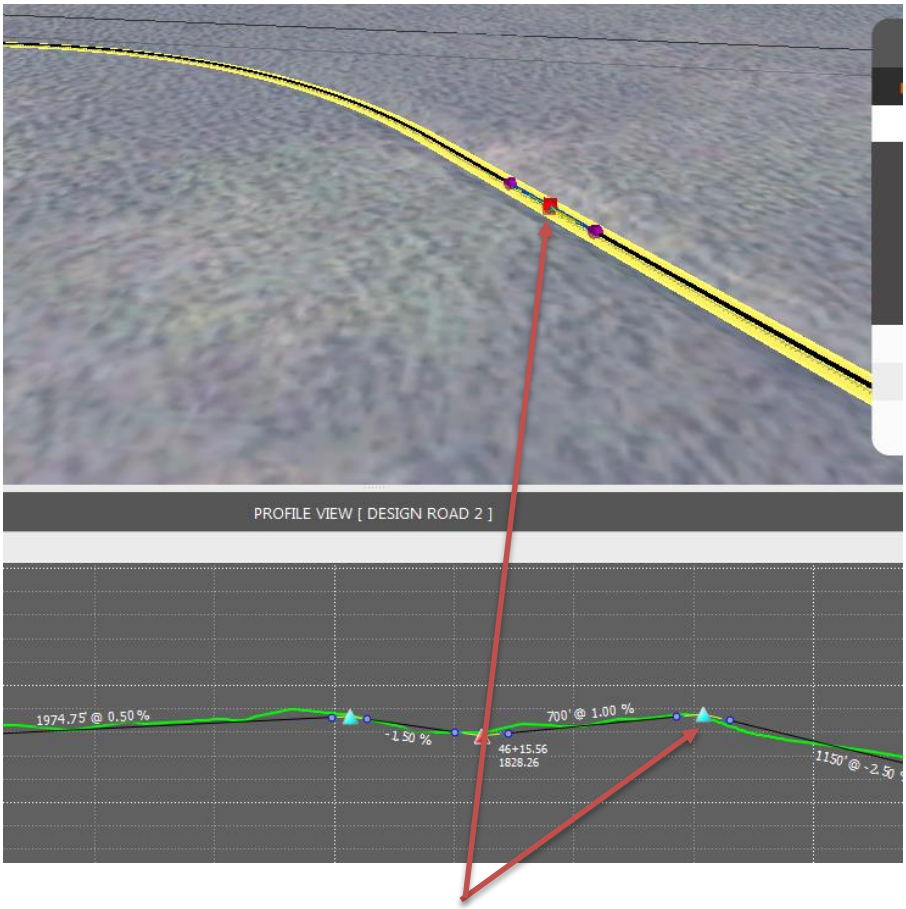
4. We can modify the radius of the curve just by clicking on the curve with the right button of the mouse. In addition to that, you can change its size typing the new radius.



5. If you want to change the *Elevation* you can do so by altering the *Profile*. Click on *Profile View*, as shown below.



6. The profile will appear at the bottom. After that, you can modify the PVIs and those changes will automatically appear in our model. If you change the view, you can make changes directly to the model, and those will appear in the profile view.



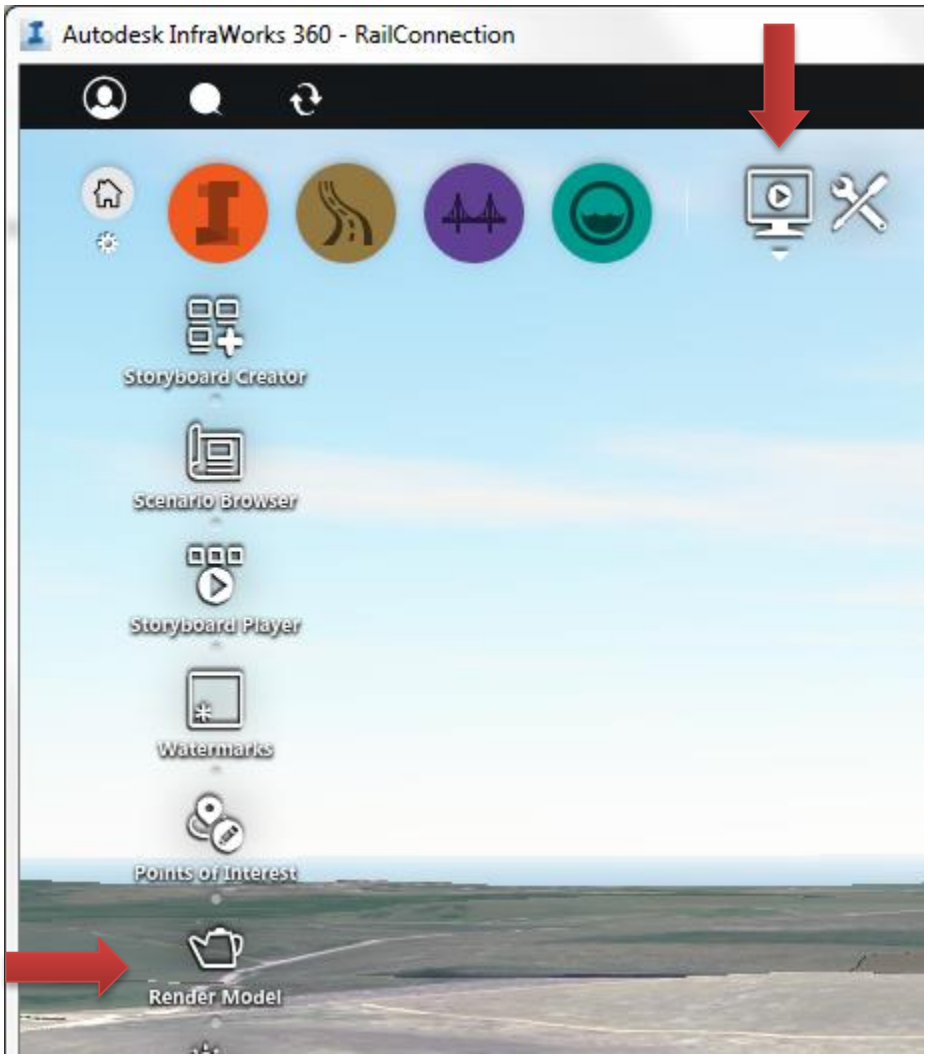
Change the position

7. We can make many other types of changes, and we show you how to do so in the following video, along with all that we have done up until now.
   06 - InfraWorks 360 - Creating a new Proposal with Roadway Module - AU CLASS - CV5454-L-P
   https://screencast.autodesk.com/Main/Details/81c021eb-ba64-410b-88cd-fa8d46c2180d

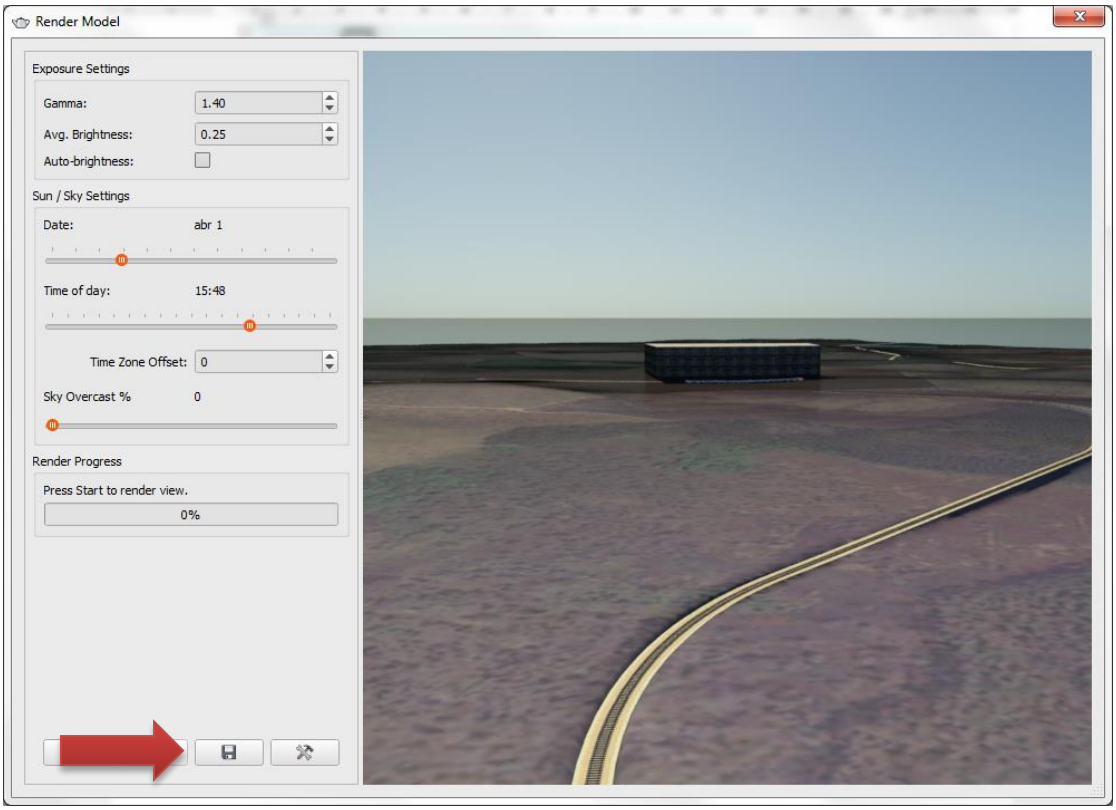
Creating a Visualization

To create a proper visualization in InfraWorks, there are some awesome possibilities. Let's take a look at some of them.

1. Set your model to show the portion you want InfraWorks to render.
2. Access the *Visualization Menu* and then select *Render Model*, as pictured below.

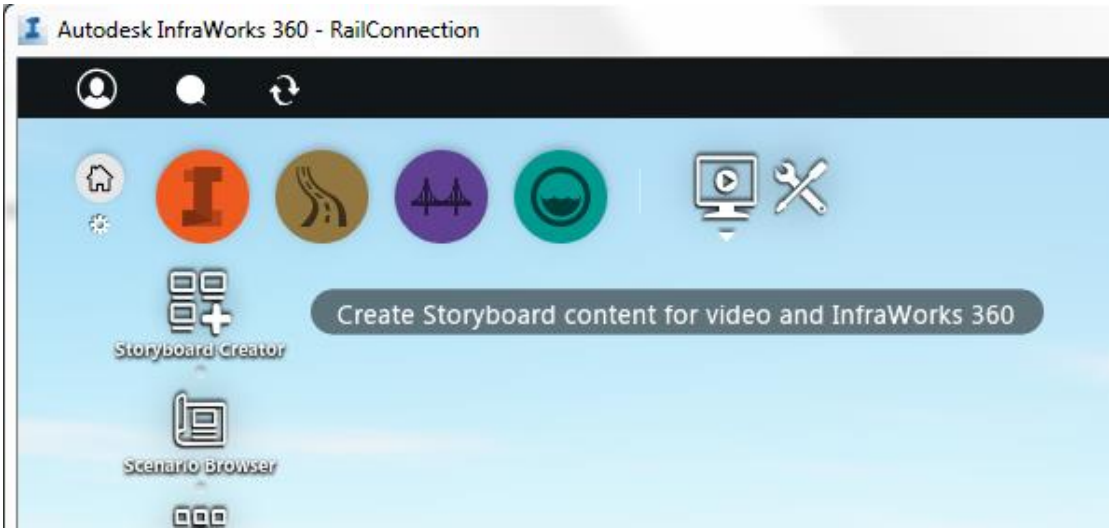


3. After you click on the *Render Model* button, the render automatically begins, so when you think the visualization is ok, select the *Stop button*  .
4. After doing so, select *Save.*

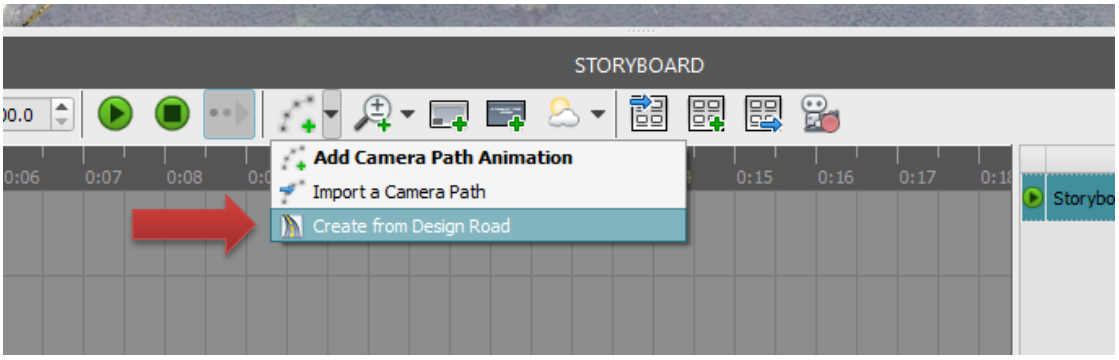


Another way to show your project idea to others is by creating an animation.

1. Access the *Visualization Menu* and then select the *Storyboard Creator* button.

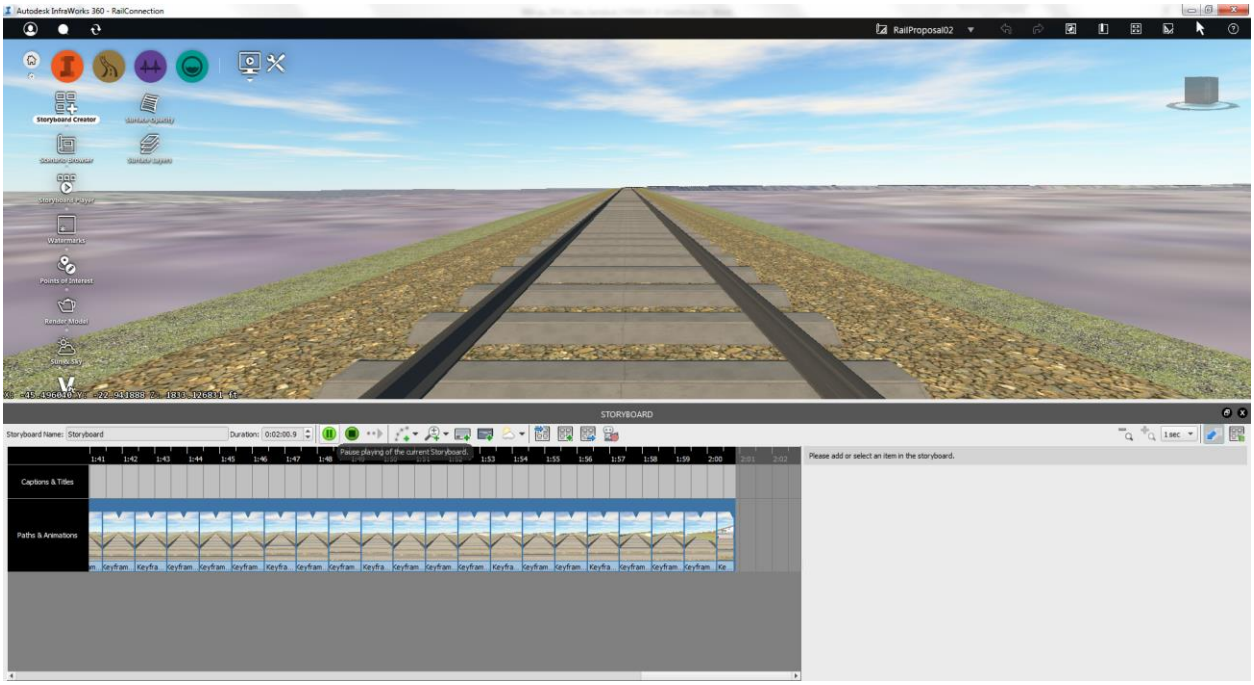


2. A dialog box named *Storyboard* will appear at the bottom of your model. Click on the *Add Camera Path Animations* button and then select the option *Create from Design Road*.



3. Click on the *Railway* and press *Enter.*
4. After that, the resulting animation will appear, frame by frame, in the storyboard.

5. If you want to see the results, click on the play button  .

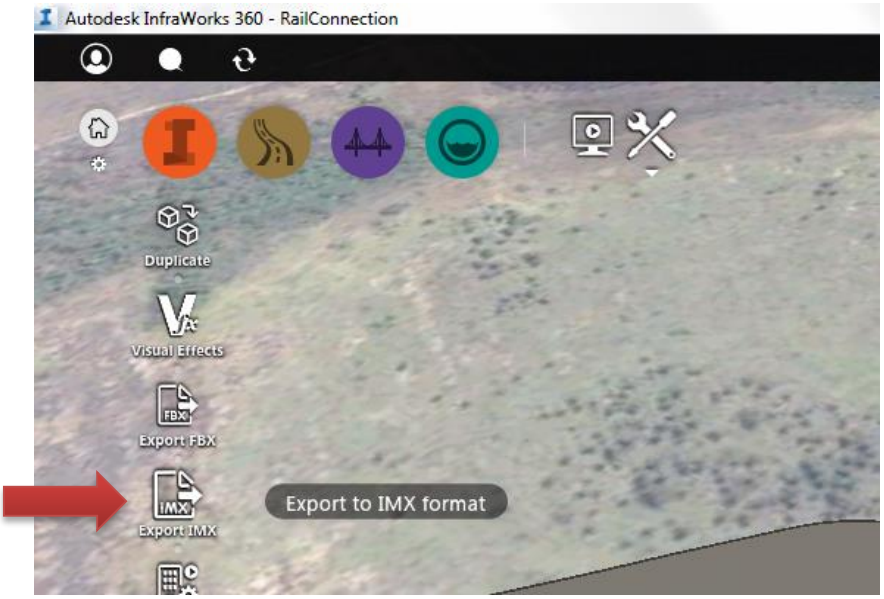


6. You can Export the animation by clicking on the recorder  .

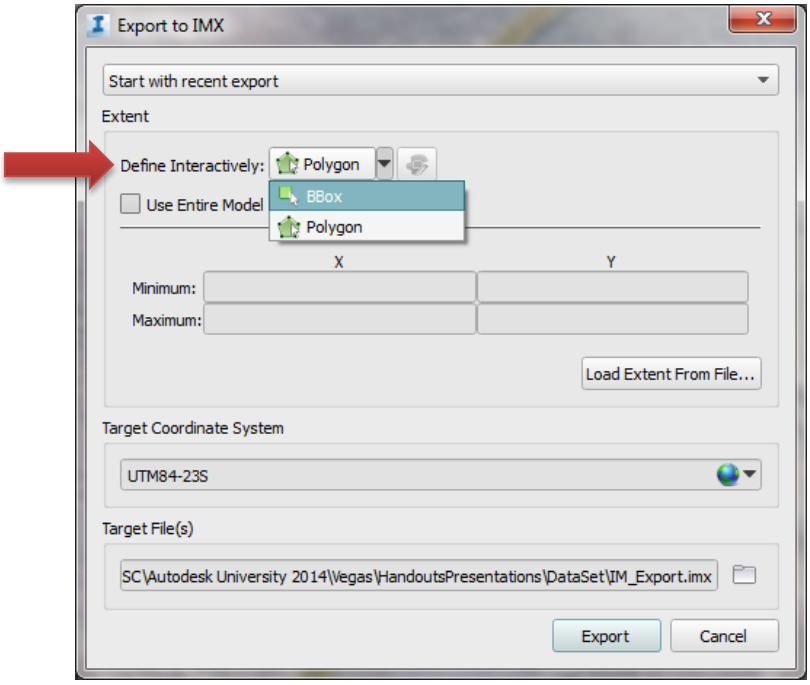
Exporting to AutoCAD Civil 3D

After you have decided on your project alternative in *InfraWorks*, it's time to advance in our Design, and we can do so with *AutoCAD Civil 3D.* We can export what we have done up until now in InfraWorks to *AutoCAD Civil 3D,* by following the next steps.

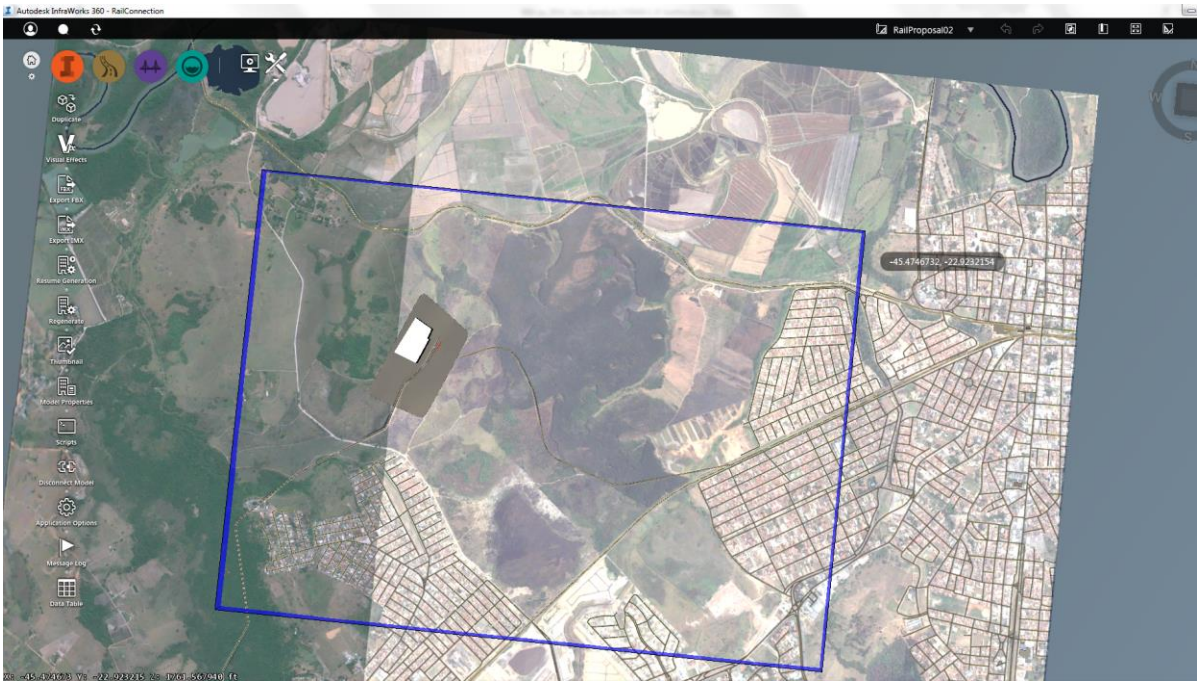
1. In the *Settings* menu select the *Export IMX* button.



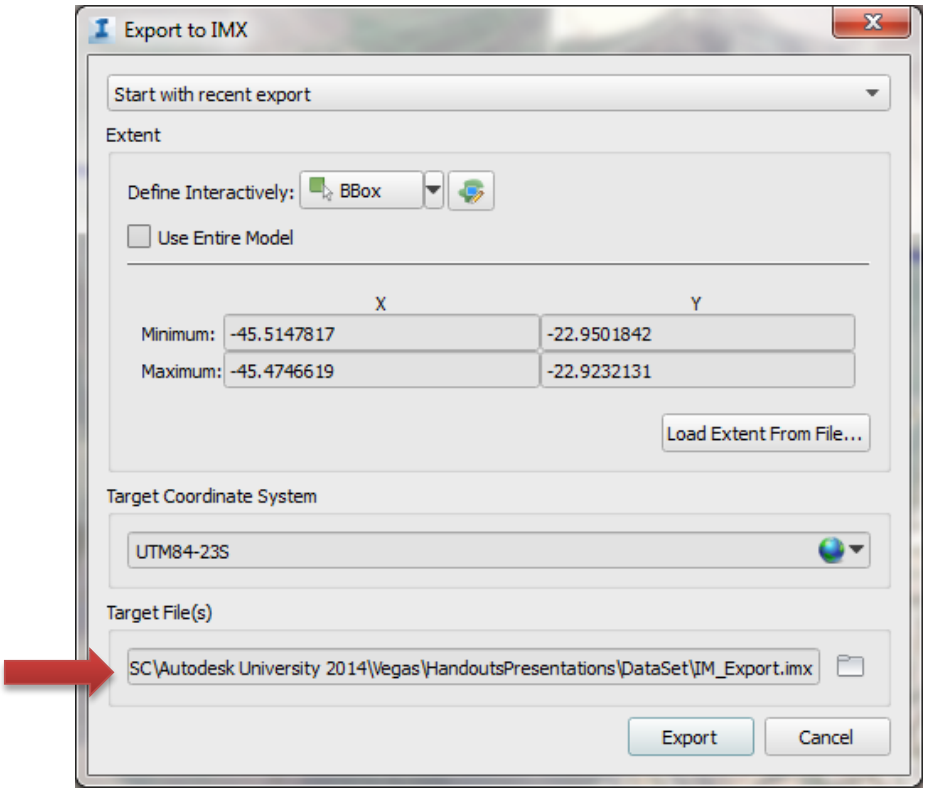
2. In the *Export IMX* dialog box, beside *Define Interactively,* select the downwards arrow and choose the option *BBox*.



3. Select the area which we want to export, as shown below



4. Select the folder where you want to save the IMX.



5. Click on *Export*.
6. To see the visualization part, as well as the part in which we export to AutoCAD Civil 3D, access the video bellow.
   07 - InfraWorks 360 - Creating a new Proposal with Roadway Module - AU CLASS - CV5454-L-P
   https://screencast.autodesk.com/Main/Details/81c021eb-ba64-410b-88cd-fa8d46c2180d

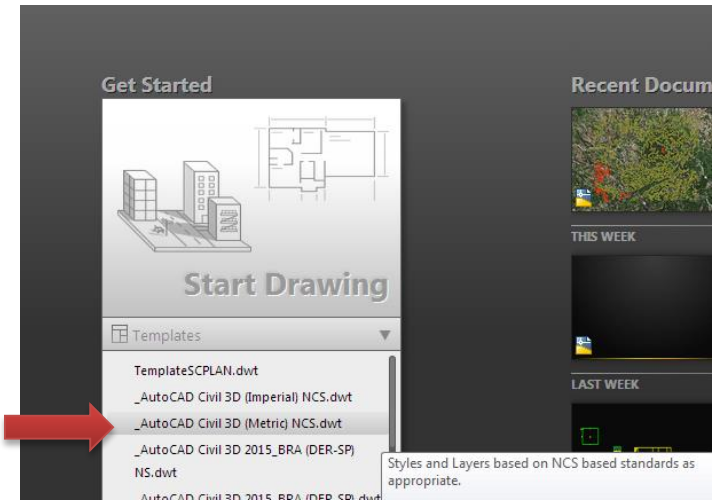
Developing the project with AutoCAD Civil 3D

Now we are developing the project inside the *AutoCAD Civil 3D*.

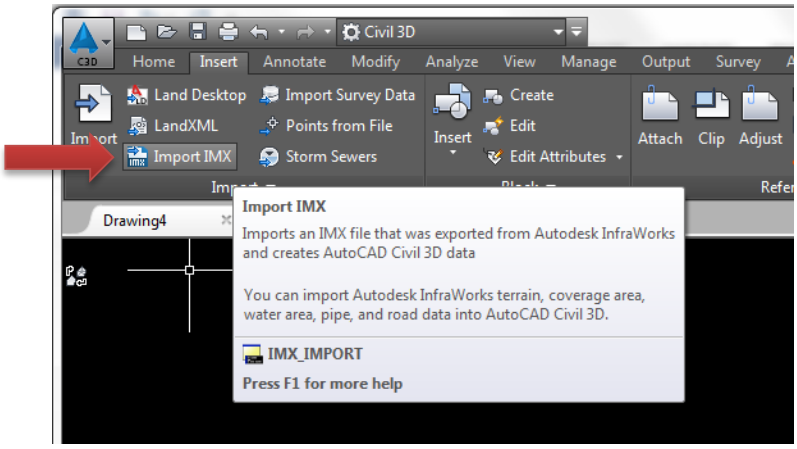
Importing to AutoCAD Civil 3D

The first thing we must do is open the *AutoCAD Civil 3D.* After that, just follow the next few steps.

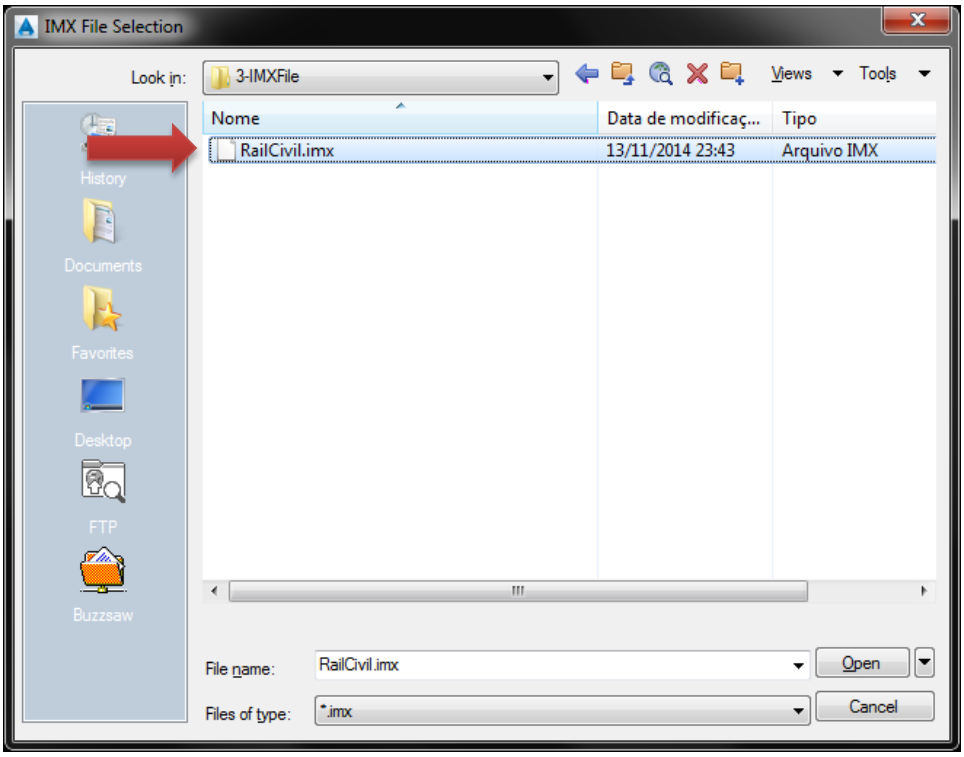
1. In the start screen click to *Start Drawing* with *_AutoCAD Civil3D (Metric) NCS.dwt*



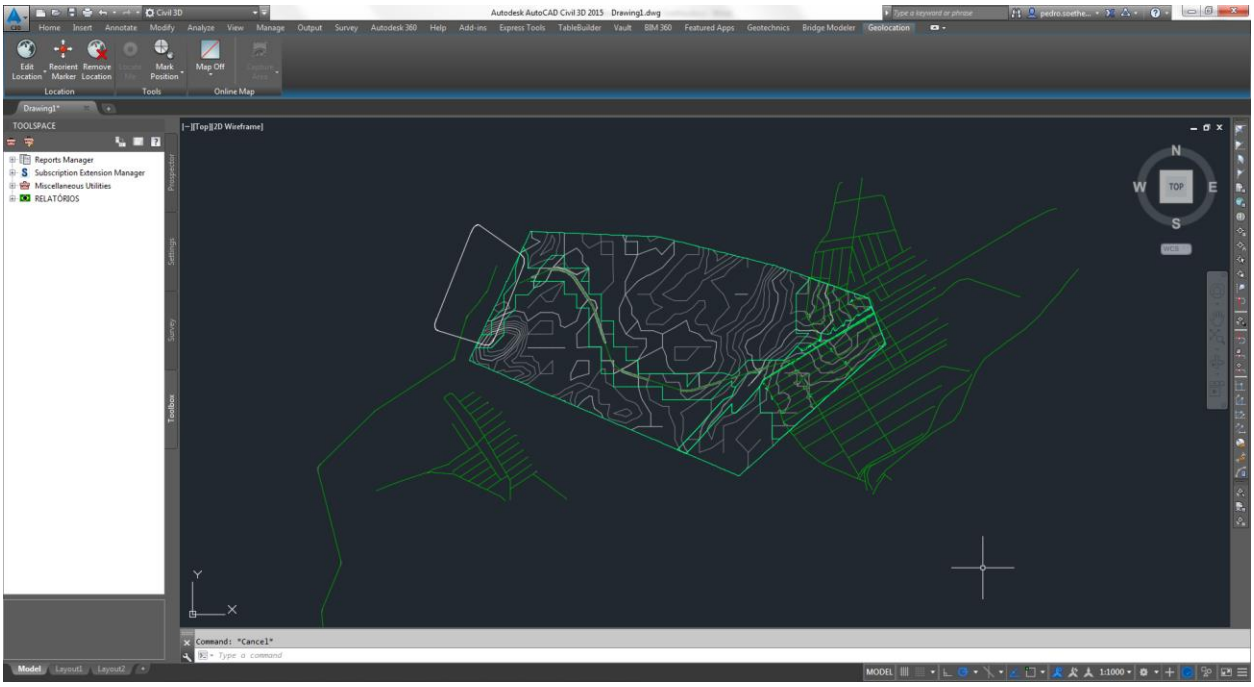
2. Now, go to the *Insert* tab on the Ribbon, and select *Import IMX*



3. In our *DataSet* folder named *3-IMXFile,* search for a file called *RailCivil.imx* and select *Open.*



4. After doing so, all the information created with Autodesk InfraWorks is imported to *Autodesk Civil 3D.*



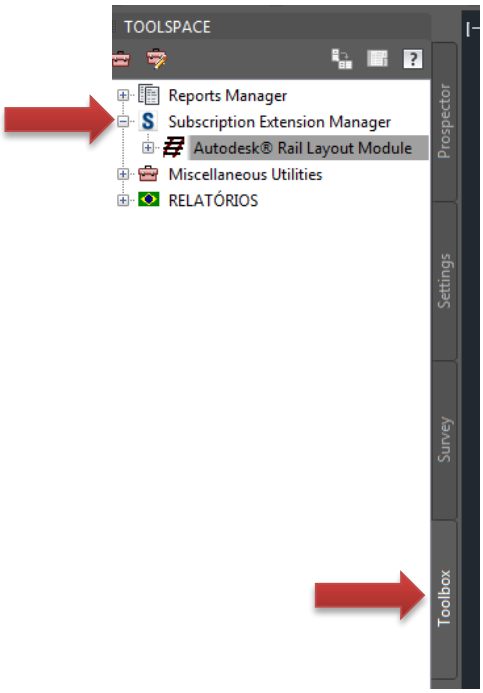
Creating the connection with Rail Layout Module

Now let's create a turnout to connect the Main Course to the new course. For this we will be using the Rail Layout Module. This application is available through *Autodesk Subscription*.

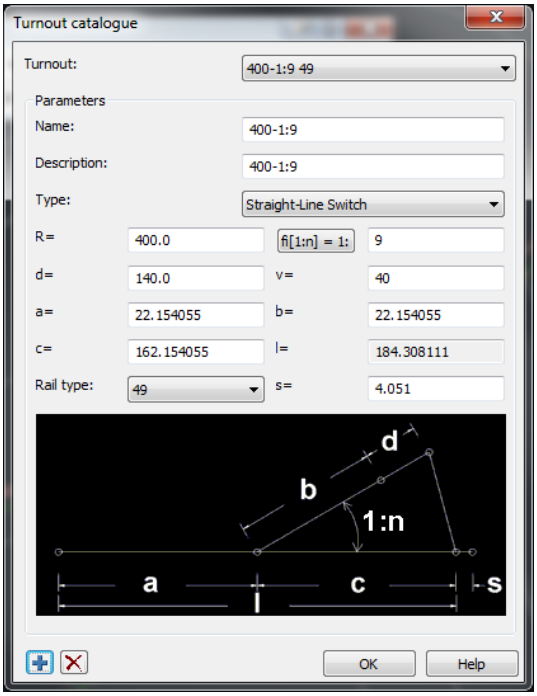
In this part, we will use the file named *RailDesign.dwg*, which is located in the *DataSet* folder called *4-AutoCAD Civil 3D File*.

To create the turnout, just follow the next few steps.

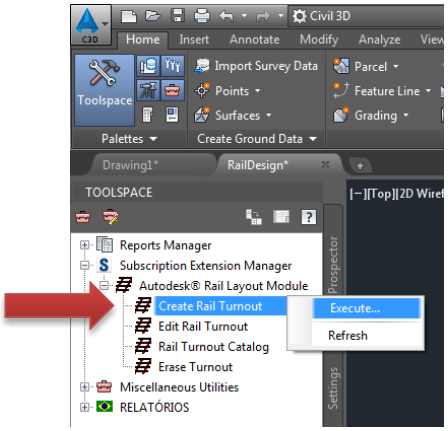
1. In the *Toolspace,* click on the *Toolbox tab*. Then click to expand the *Subscription Extension Manager*. The Autodesk Rail Layout Module will appear, as shown below.



2. Expand the *Autodesk Rail Layout Module* and right click the item *Rail Turnout Catalog.* Select *Execute*. The *Turnout catalogue* dialog box will appear. In this dialog box, complete the following tasks, as pictured below:
   a. Change the "R" to 400.00m (*minimum radius)*
   b. Change the "*d"* variable to 40.00m
   c. Change the *Name* to 400-1:9
   d. Click on the *Add*  button
   e. Click *OK* to close the *Turnout catalogue* dialog box.



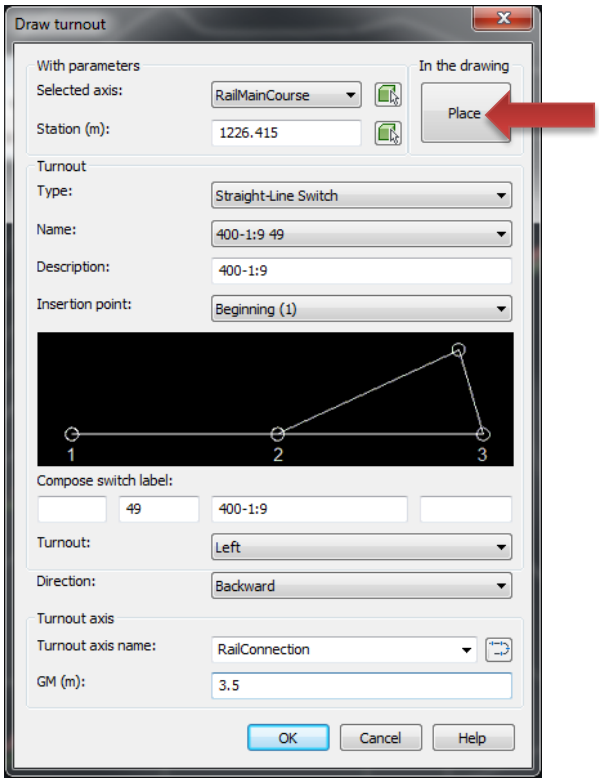
3. Again, in the *Toolspace*, below *Autodesk Rail Layout Module*, right click *Create Rail Turnout* and then select *Execute*.



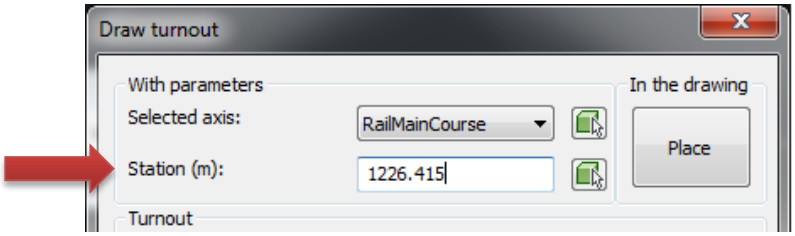
4. The dialog box *Draw Turnout* will appear. In this dialog box, set the following fields, as pictured below:

   a. Select axis – *RailMainCourse*
   b. Type – *Straight-Line Switch*
   c. Name – 400-1:9 49
   d. Insertion point – *Beginning (1)*
   e. Turnout – *Left*
   f. Direction – *Backward*

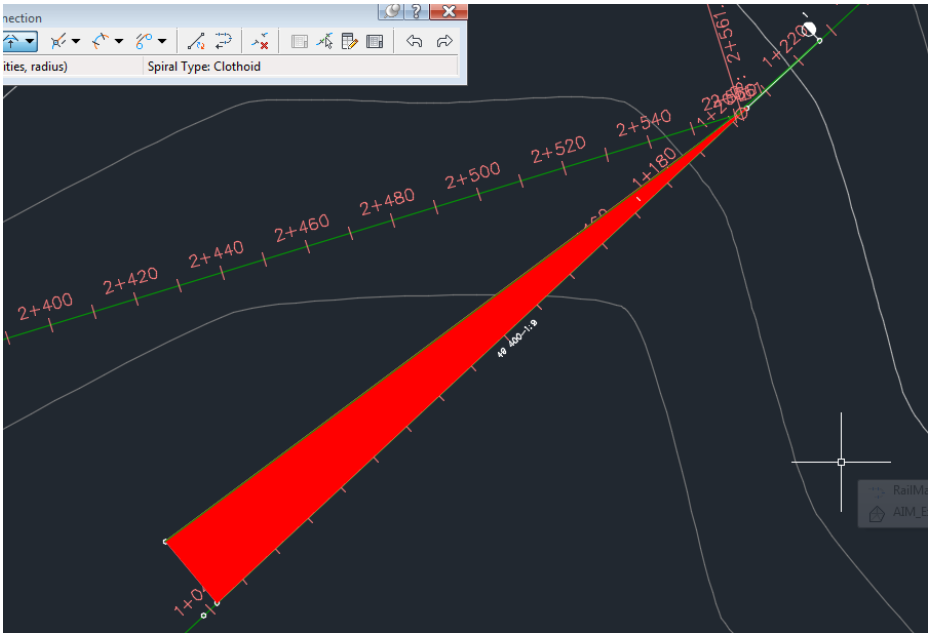
g. Turnout axis name: *RailConnection*
h. GM(m): 3.50



5. After that, we need to place the turnout in the drawing. To do this select the *Place* button, and insert the turnout in the drawing.
6. If you already know the station where the turnout should be allocated, you can just type in the station in the *Station (m)* field.



7. Now, select *OK* and the *Turnout* will be added to the design, as shown below.

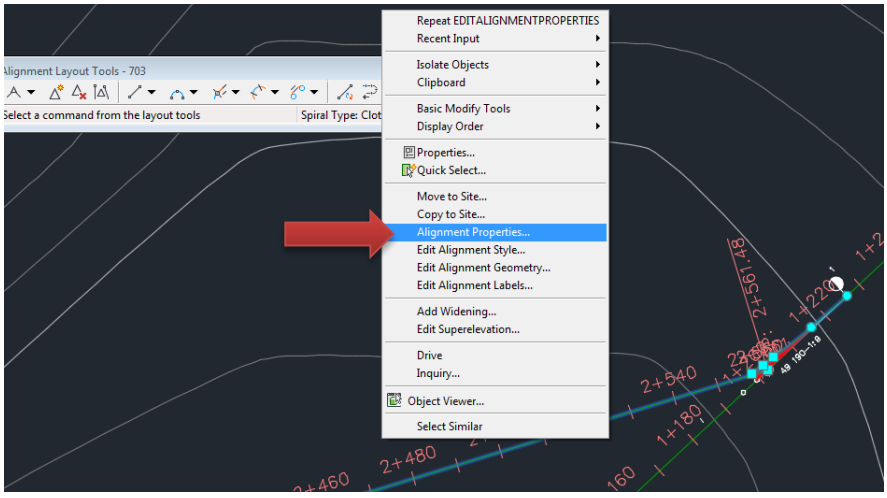


Change the type of Alignment and add Design Criteria

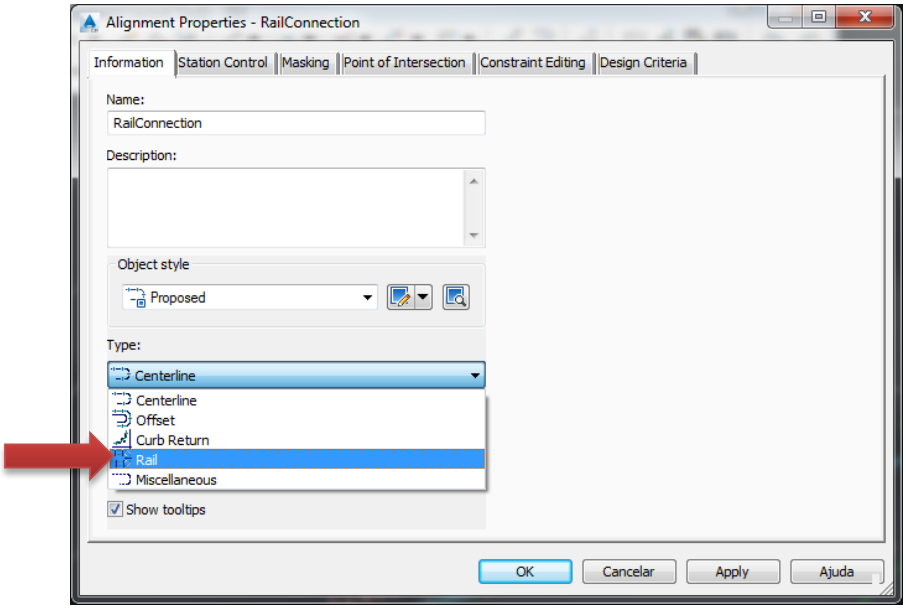
Now, we need to adjust the *RailConnection* alignment with the *Turnout* and check if the radii of the design are OK by setting *Design Criteria*.

The first thing we need to do is transform the *Alignment* into a *Rail Alignment,* to enable several things such as special *Criteria Design* and *Cant* calculations. To do so, follow the next steps.

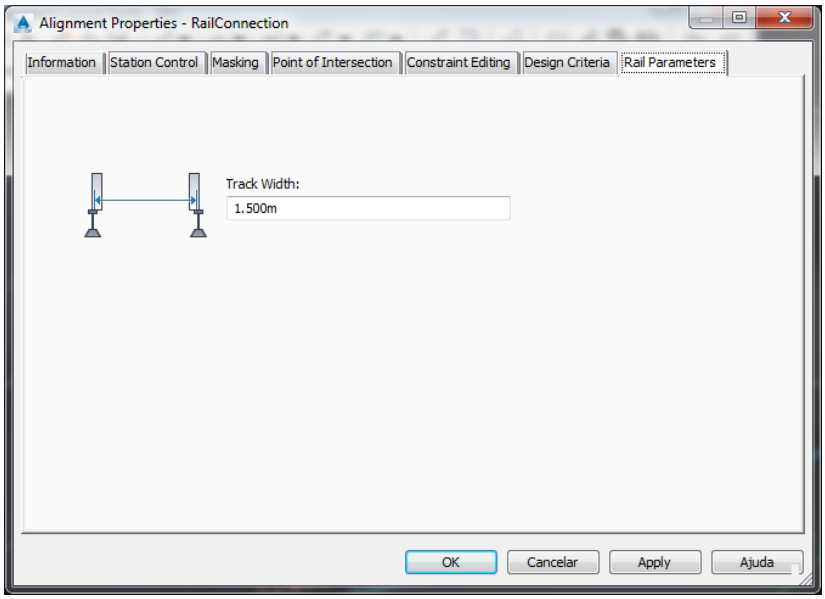
1. Select the *Alignment.* Right click the Alignment and select *Alignment Properties.*



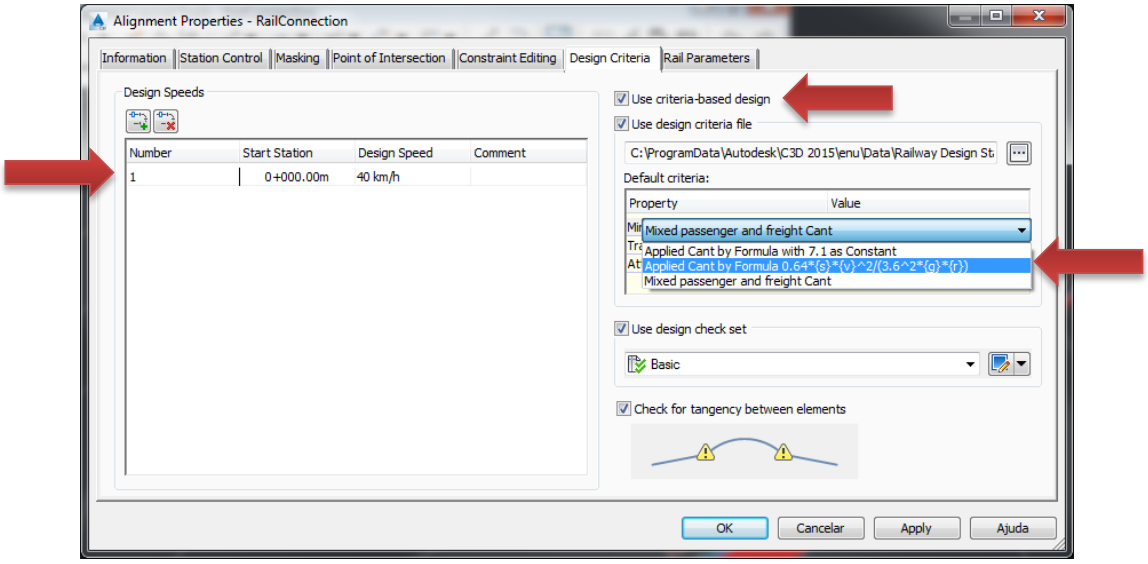
2. In the *Alignment Properties* dialog box, change the *Type* from *Centerline* to *Rail.*



3. After that, a new tab will appear, after *Design Criteria*. The new tab is called *Rail Parameters.* Select that tab, and change *Track Width* to 1.500m.



4. Now, select the *Design Criteria* tab. Click on the *Add Design Speeds* button and change the *Design Speed* to 40km/h.
5. Check the selection box *Use criteria-based design.* Click on the *Select File* button and select the file *_Autodesk Civil 3D Metric Rail Cant Design Standards.xml.*

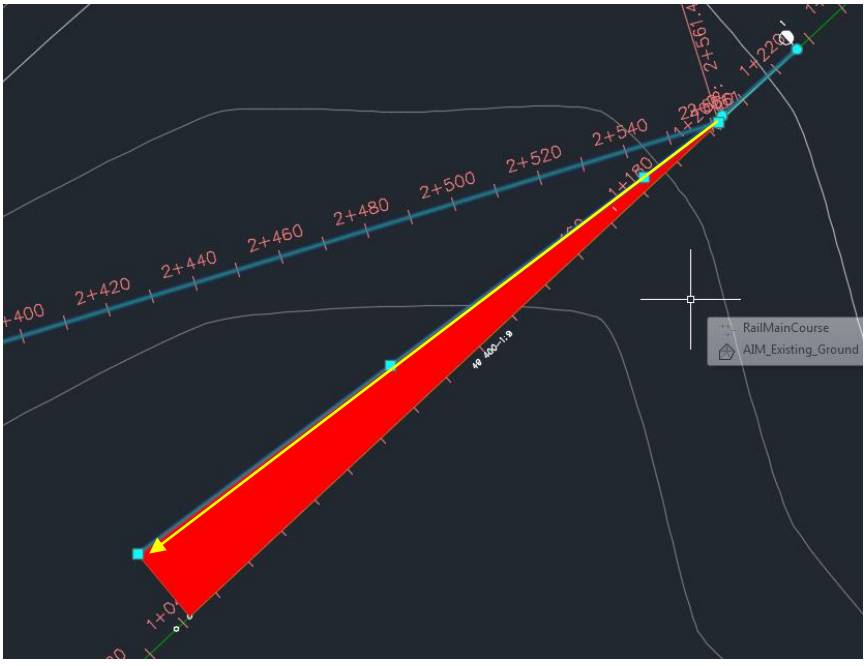


5. Change the *Minimum Radius* to *Applied Cant by Formula 0.64*

Adjusting the Alignment to the Turnout

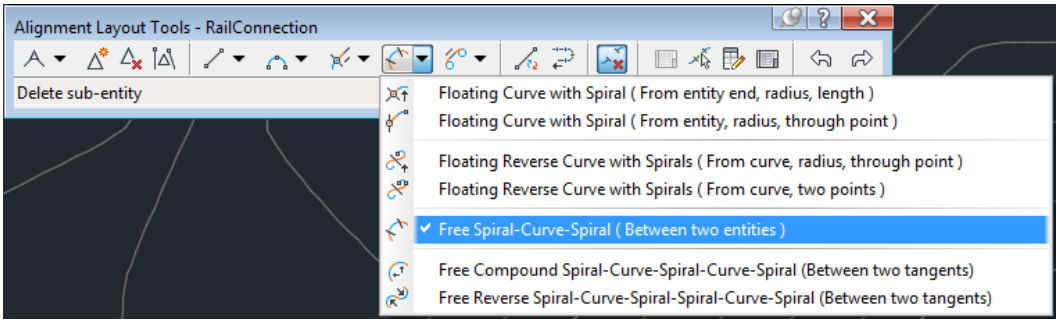
We will now adjust the alignment using *Design Criteria* and connect the *Turnout*. To do this, follow the next steps.

1. The first thing to do is connect the *Alignment* with the *Turnout*.

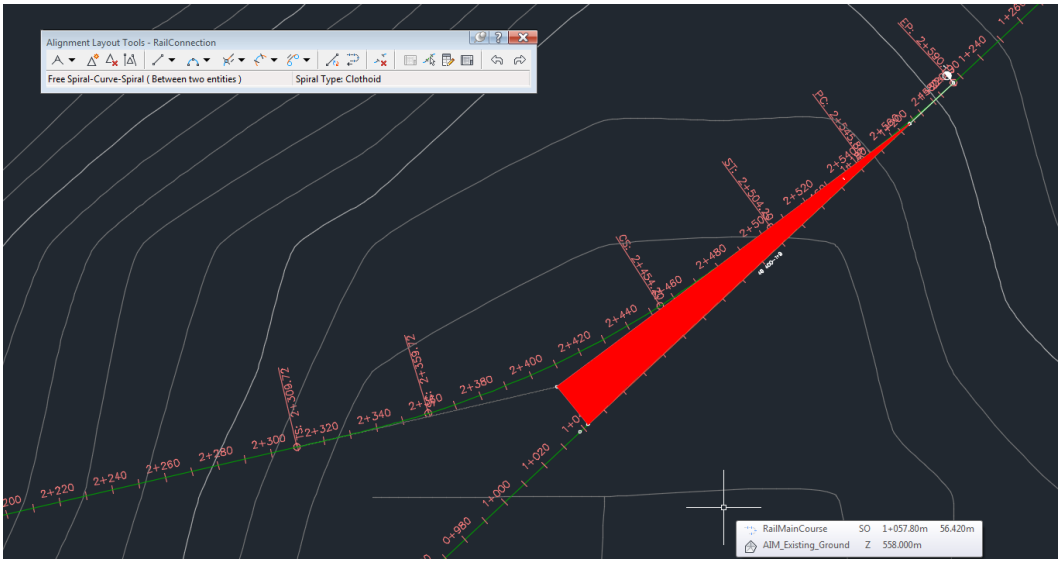


2. Then, we have to adjust the *Turnout curve* by adding a radius to this new PI so that it fits in with the rest. Click on the alignment *RailConnection* and then select the *Geometry Editor* button.

3. After that, click to add a *Curve-Spiral* and select *Free Spiral-Curve-Spiral (Between two entities),* as shown below.



4. Now, add the curve to the PI.
    a. Choose the option *LessThan180*
    b. Use the minimum *Radius* 350.00m
    c. Input 50.00m to the *Spiral* on both sides.



5. Do this to all of the curves to adjust the Radius and the Spiral. In doing so, all of the entities will be compatible to the *Design Criteria.*
6. To see the importing to AutoCAD Civil 3D part, as well as the part in which we add the Turnout and adjust the alignment with Design Criteria, access the video below.

08 – AutoCAD Civil 3D – Importing and Adjusting Alignment with Turnout - AU CLASS - CV5454-L-P
https://screencast.autodesk.com/Main/Details/c2d95b1d-265d-47f6-a3e6-44f960a0ae03

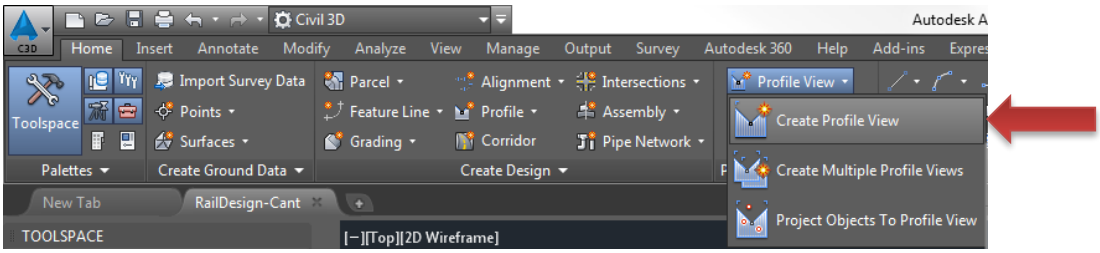
Creating the Profile

Now, we will create the *Profile* of the new *RailConnection.*

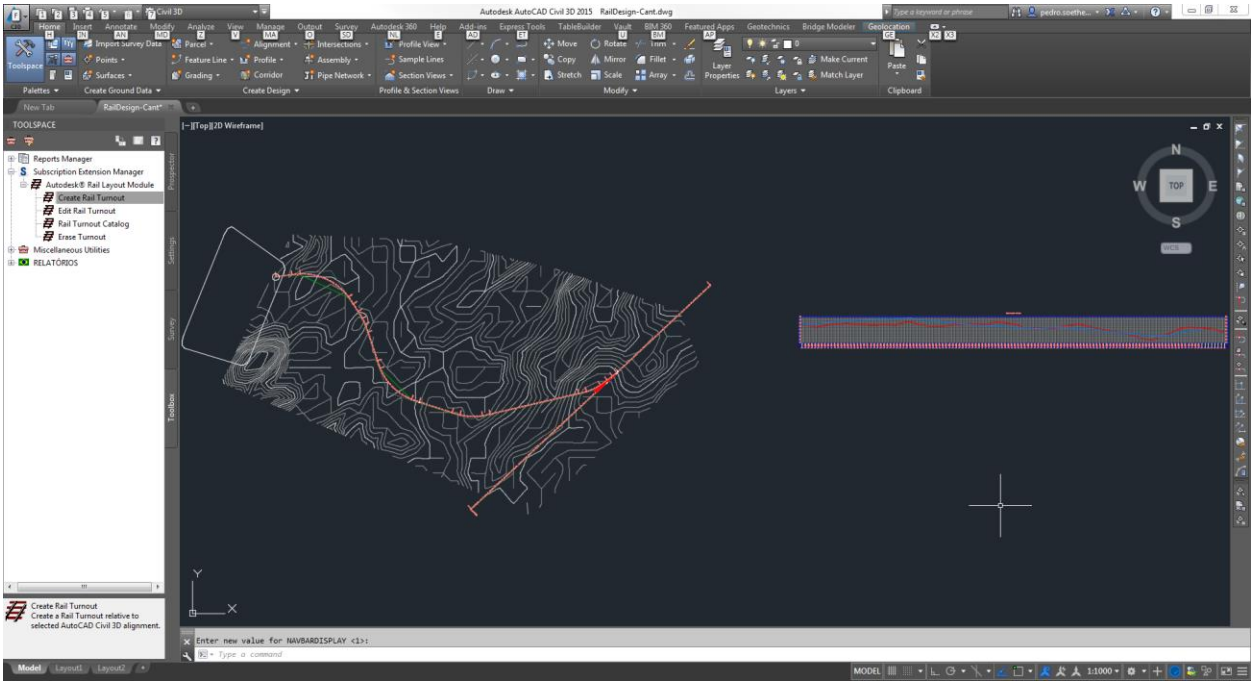
In this part we are using the file *RailDesign-Turnout.dwg* in *DataSet* folder *5-AutoCAD Civil 3D File - AfterTurnout.*

The profile already came from *InfraWorks* but we need to make some adjustments. To do so, just follow the next few steps.

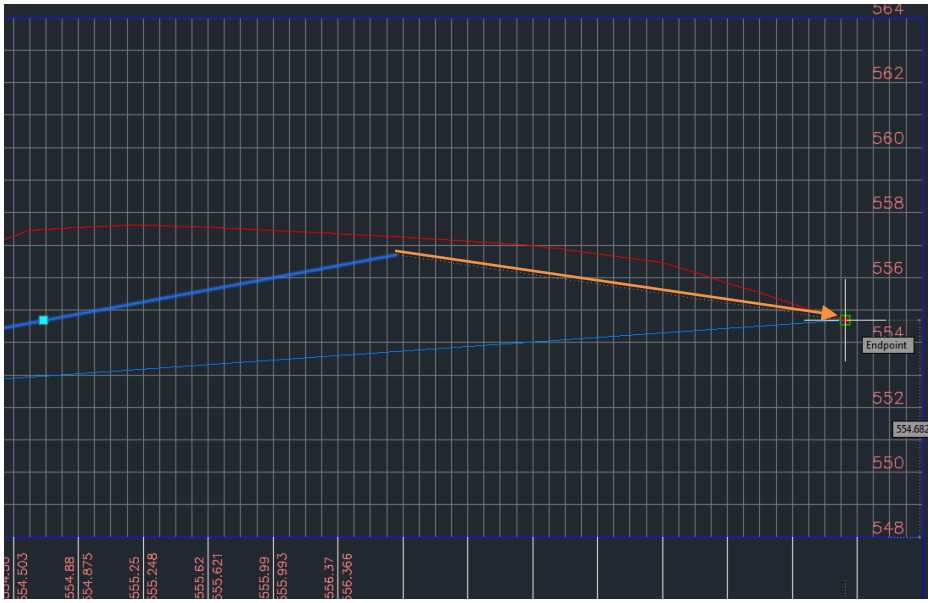
1. Click on the *Home* tab in the Ribbon. Select *Profile View* and then choose the option *Create Profile View.*



2. The *Create Profile View* toolbox will appear. Just select *Create Profile View.*
3. Select a place in the drawing to add the profile view.

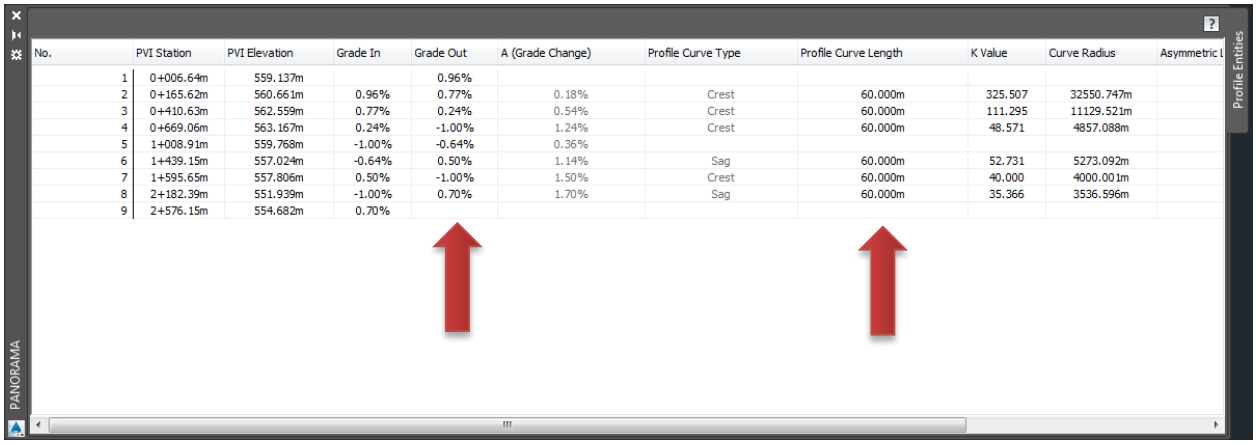


4. In this case we are using the Grade maximum of 1.00% and the Curve Length minimum of 60.00m.
5. The first thing we need to do is move the end of the project grade to end of the existing ground.



6. With the final ground profile selected, select the *Geometry Editor* button 

7. Then, click on the *Profile Grid View* button 
8. Now, adjust all of the *Grade Out* to a minimum of 1.00%
9. Adjust the *Profile Curve Length* to a minimum of 60.00m.



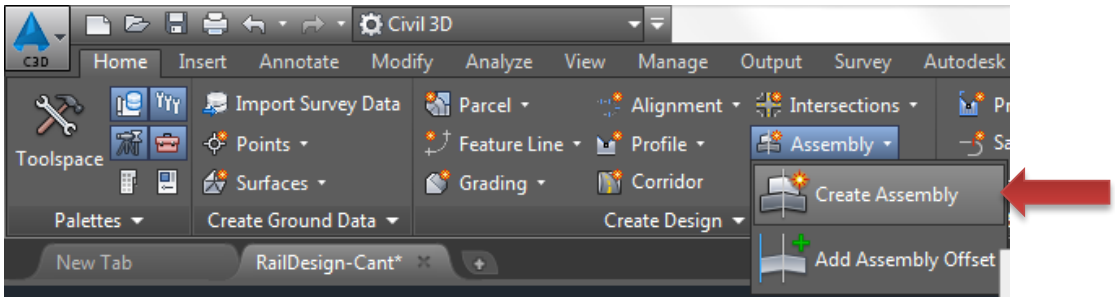
No.	PVI Station	PVI Elevation	Grade In	Grade Out	A (Grade Change)	Profile Curve Type	Profile Curve Length	K Value	Curve Radius	Asymmetric
1	0+006.64m	559.137m		0.96%						
2	0+165.62m	560.661m	0.96%	0.77%	0.18%	Crest	60.000m	325.507	32550.747m	
3	0+410.63m	562.559m	0.77%	0.24%	0.54%	Crest	60.000m	111.295	11129.521m	
4	0+669.06m	563.167m	0.24%	-1.00%	1.24%	Crest	60.000m	48.571	4857.088m	
5	1+008.91m	559.768m	-1.00%	-0.64%	0.36%					
6	1+439.15m	557.024m	-0.64%	0.50%	1.14%	Sag	60.000m	52.731	5273.092m	
7	1+595.65m	557.806m	0.50%	-1.00%	1.50%	Crest	60.000m	40.000	4000.001m	
8	2+182.39m	551.939m	-1.00%	0.70%	1.70%	Sag	60.000m	35.366	3536.596m	
9	2+576.15m	554.682m	0.70%							

10. Feel free to adjust other grade values.

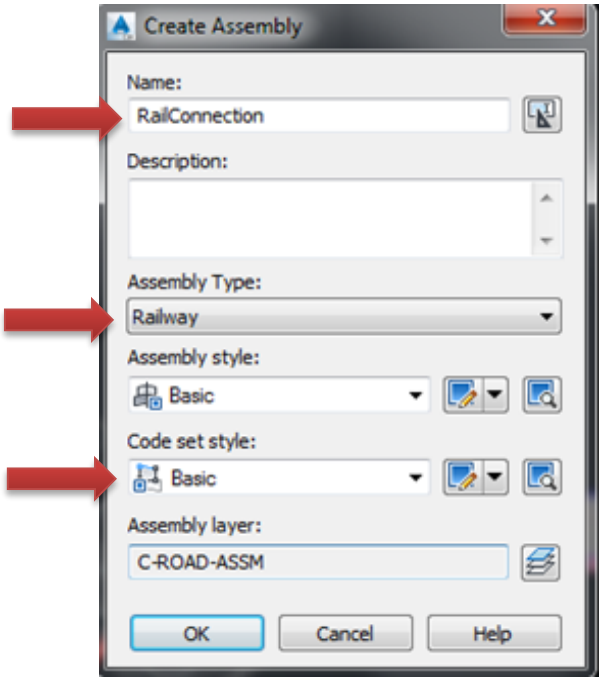
Creating the Assembly

Now, we will create the Assembly of this new Rail Connection. To do this, just follow the next few steps.

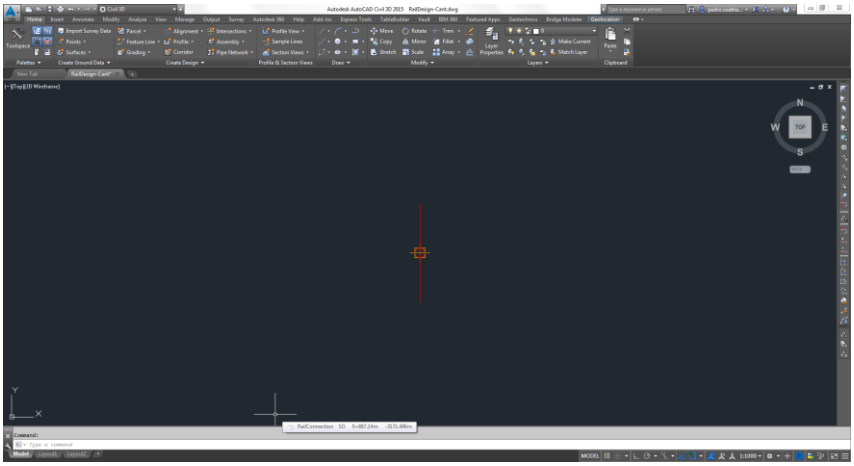
1. Select the *Home* tab in the Ribbon. Click on *Assembly* and the choose *Create Assembly,* as shown below.



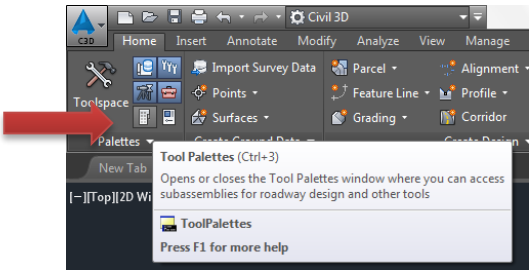
2. The *Create Assembly* dialog box will appear. In this dialog box change:
   a. The name to *RailConnection*
   b. The assembly type to *Railway*
   c. Code set style to *Basic*



   d. Click *OK*.
3. Select a clear spot in the drawing area.

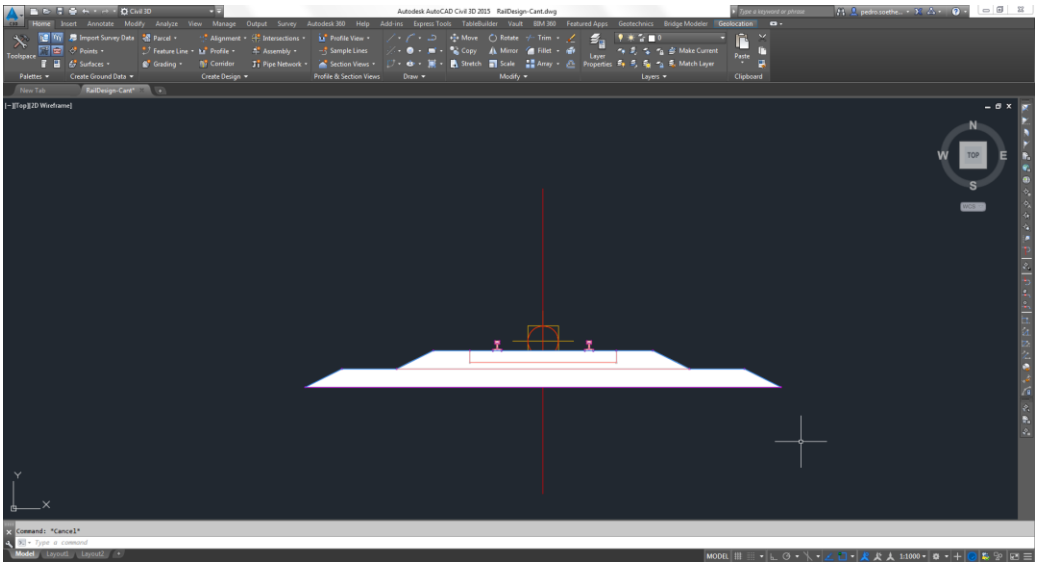


4. Now, in the *Home* tab of the Ribbon, select the *Tool Palettes* button.

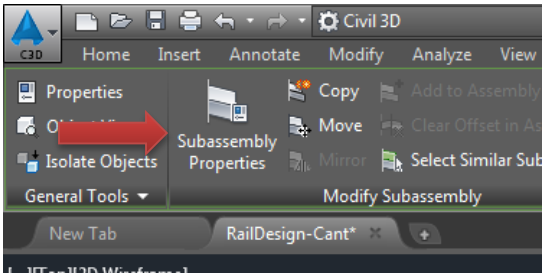


5. Select the *Bridge and Rail* tab.

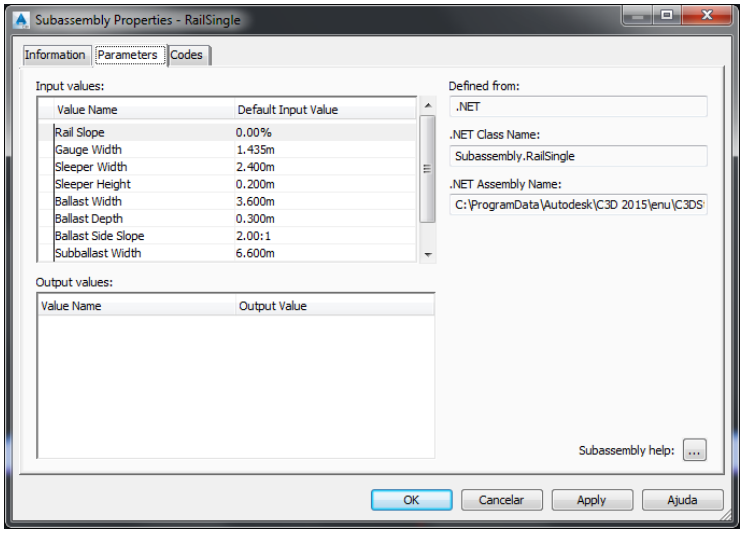
6. Then, select the subassembly named *RailSingle* and insert it in the center of the *Assembly.*



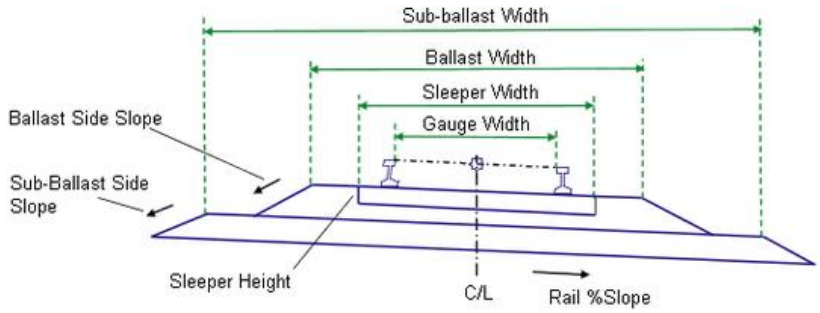
7. Select the *RailSingle* subassembly and in the Ribbon select the *Subassembly Properties* button, as shown below.



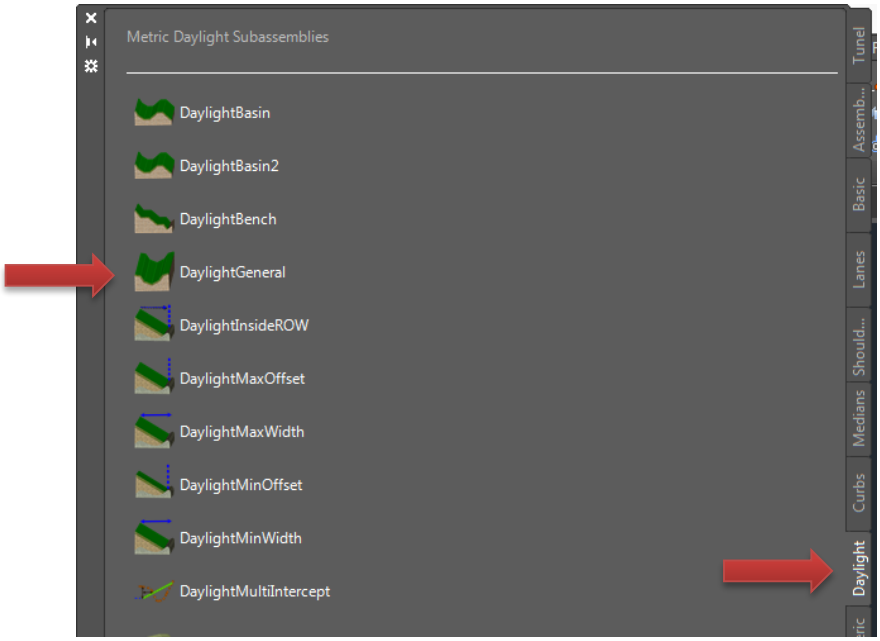
8. The *Subassembly Properties* dialog box will appear. Select the *Parameters* tab.

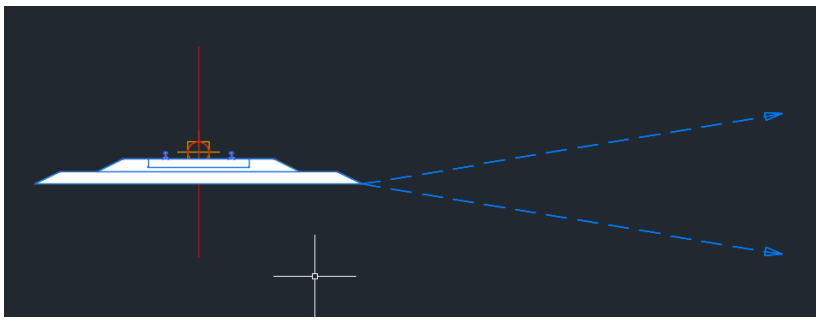


9. Here we can change many parameters within the subassembly geometry properties.

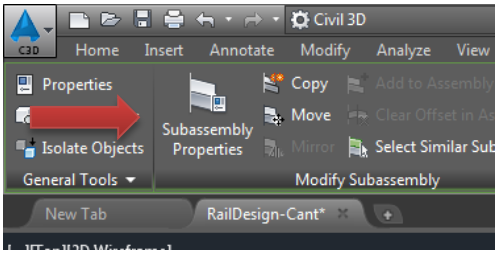


10. Change the *Gauge Width* to 1.50m and click *OK*.
11. Now, we must add a *Daylight* subassembly to both sides of the rail. Return to the *Tool Palettes* and select the *Daylight* tab. Click on the subassembly named *Daylight General* and insert it on the right side of the RailSingle subassembly.

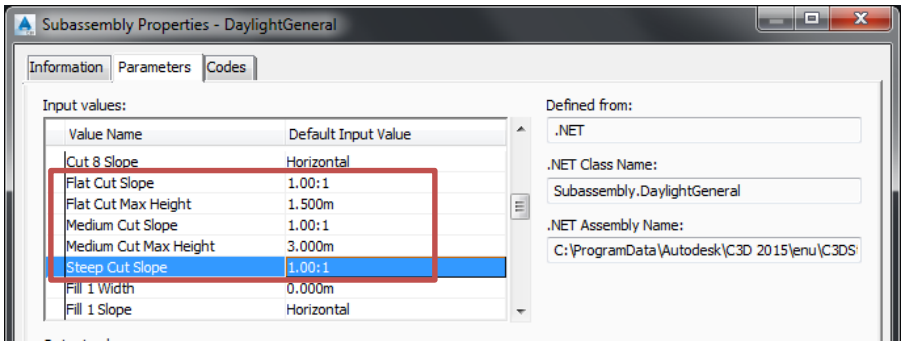




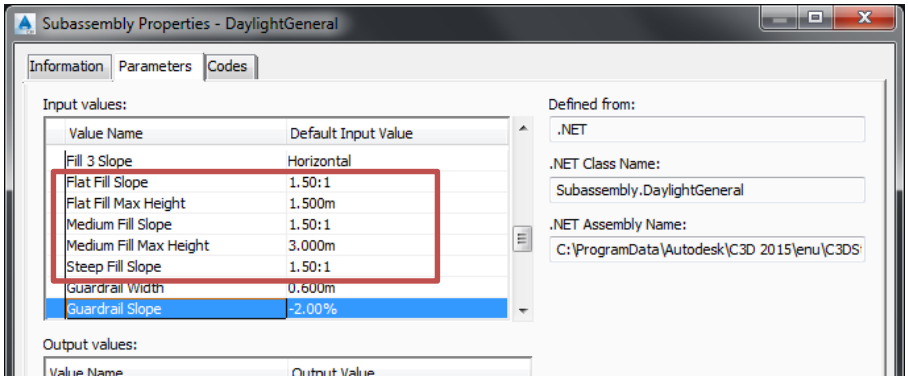
12. Select the *DaylightGeneral* subassembly and click on the *Subassembly Properties* button.



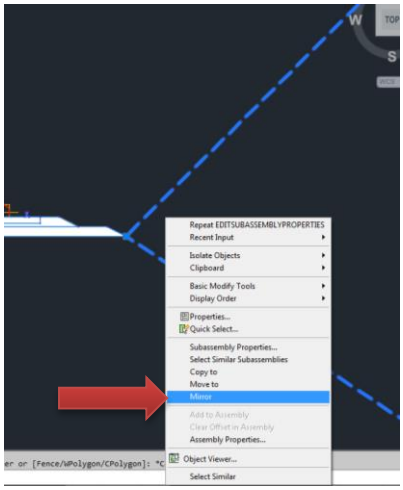
13. The *Subassembly Properties* dialog box will appear. Select the *Parameters* tab. Configure the parameters' input values as follows:
    a. *Flat Cut Slope* – 1.00:1
    b. *Medium Cut Slope* – 1.00:1
    c. *Steep Cut Slope* – 1.00:1



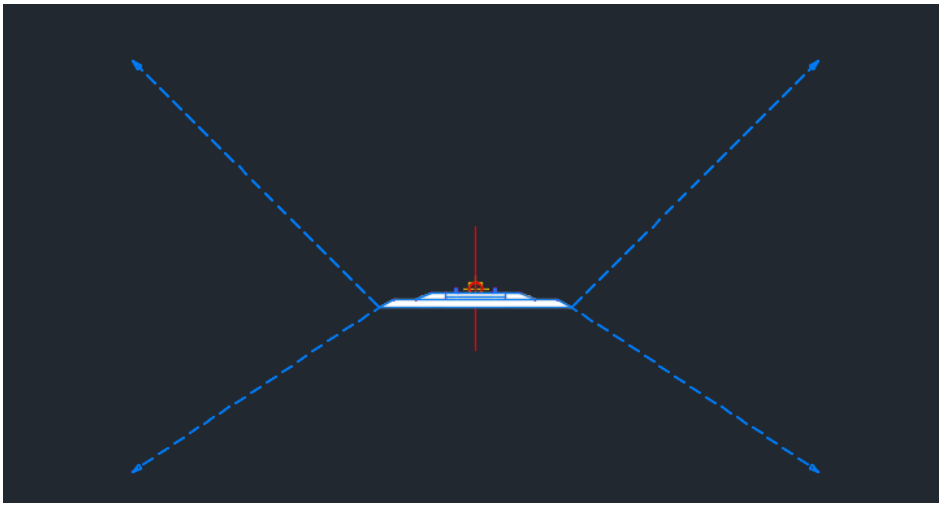
    d. *Flat Fill Slope* – 1.50:1
    e. *Medium Fill Slope* – 1.50:1
    f. *Steep Fill Slope* – 1.50:1
    g. Click *OK*



14. After that, right click the *DaylightGeneral* subassembly select the option *Mirror.*



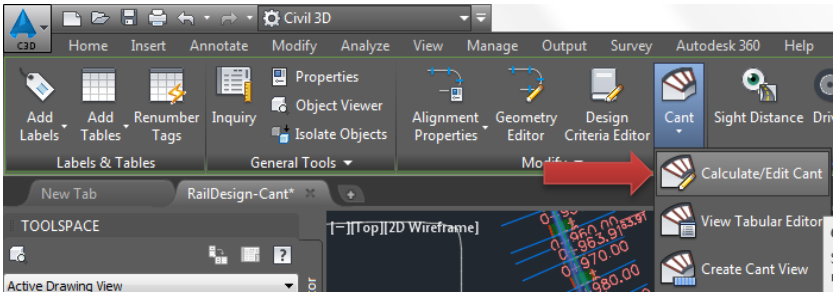
15. Now, click on the end of the left side of the *RailSingle* subassembly.



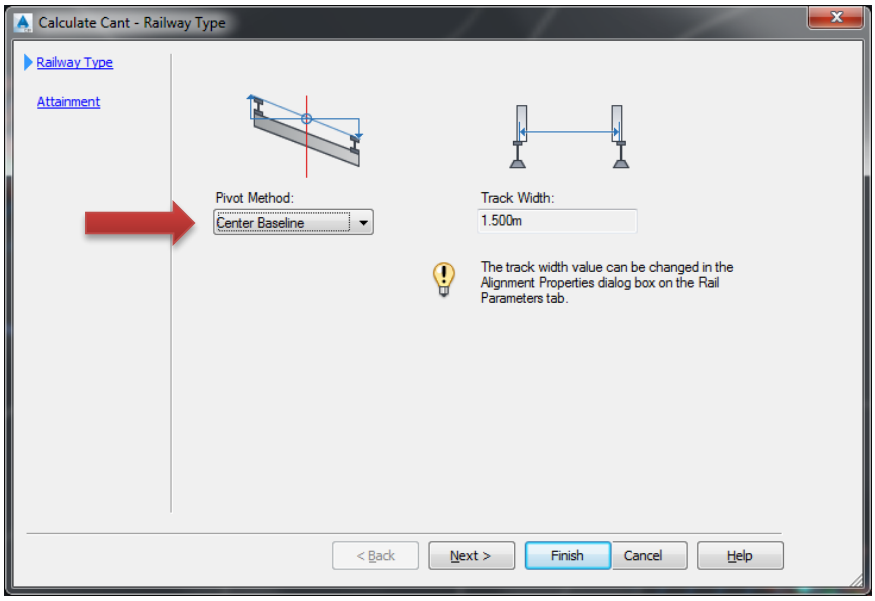
Calculation of Cant

Now, we will calculate the superelevation of the Railway, known as *Cant.*

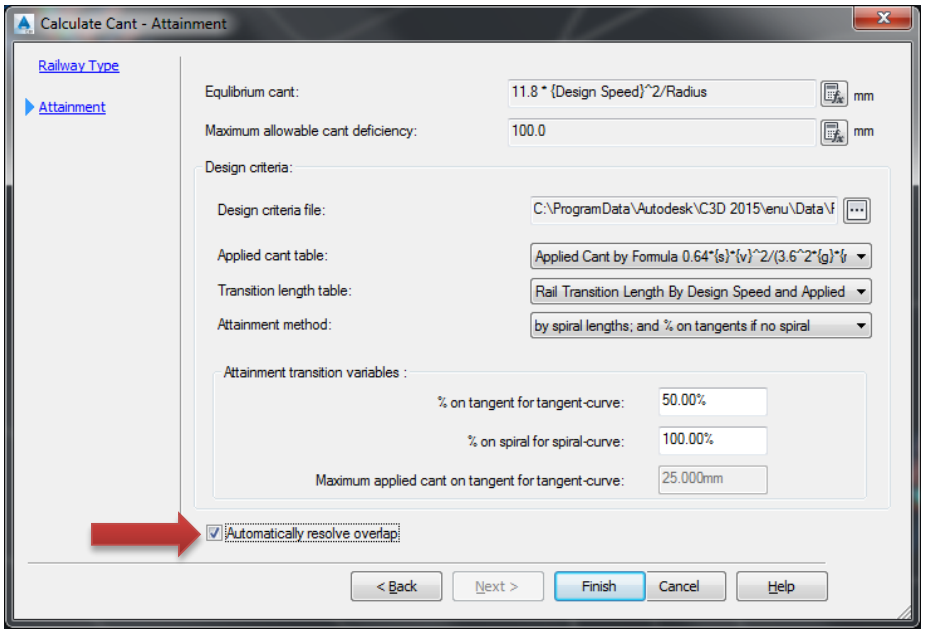
1. Select the *RailConnection* alignment. Then, in the Ribbon, click on the *Cant* button, and select *Calculate/Edit Cant*.



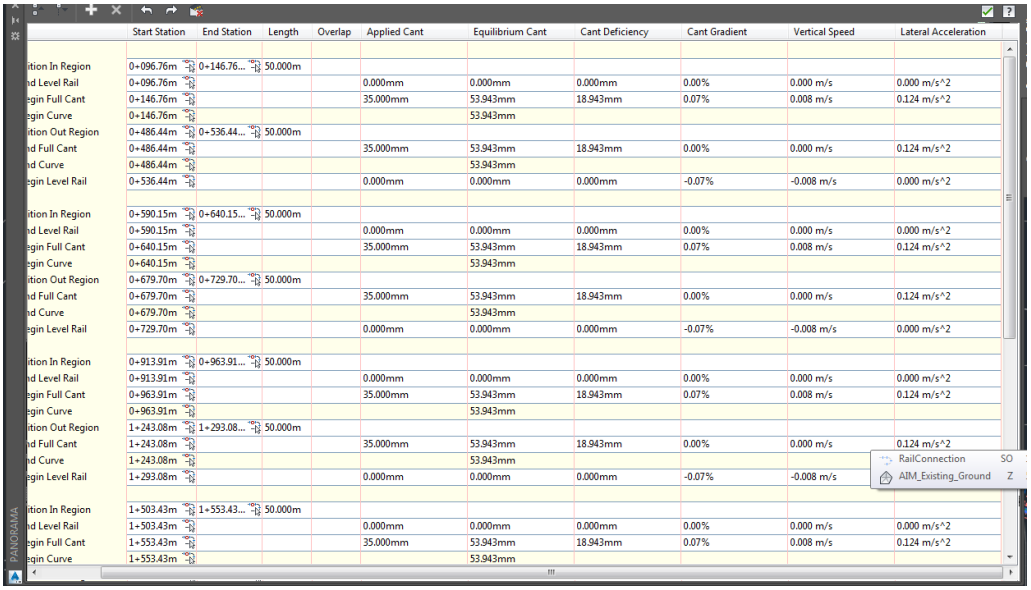
2. Click on the *Calculate Cant Now* button.
3. In the *Calculate Cant - Railway Type* dialog box change the *Pivot Method* to *Center Baseline*.



4. Click on the *Next* button
5. The only default we must change here is to mark the selection box *Automatically Resolve Overlap*, as shown below.



6. Click on the *Finish* button.
7. Check the *Cant Tabular Editor* to see the results of the Cant calculation.

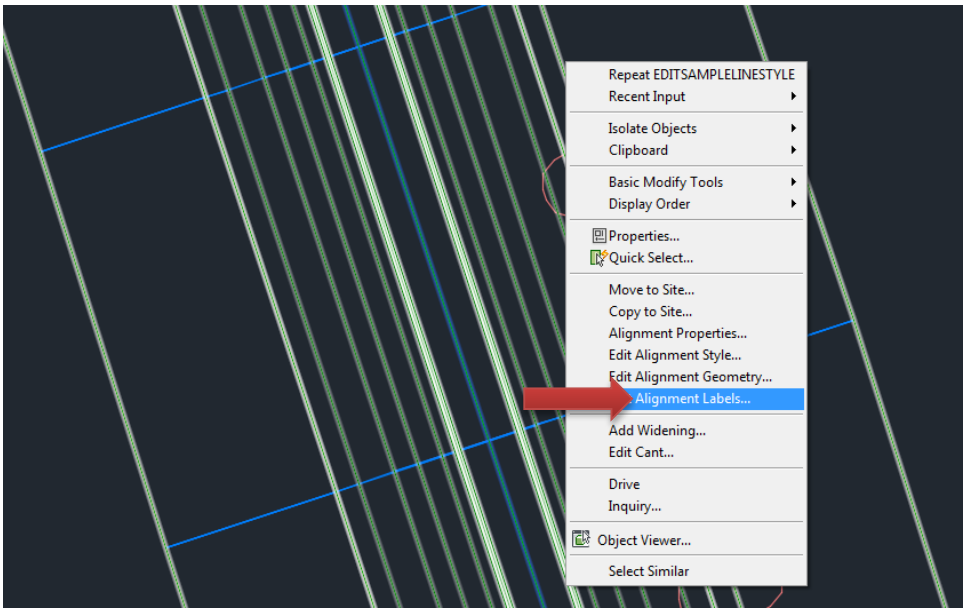


	Start Station	End Station	Length	Overlap	Applied Cant	Equilibrium Cant	Cant Deficiency	Cant Gradient	Vertical Speed	Lateral Acceleration
ition In Region	0+096.76m	0+146.76...	50.000m							
d Level Rail	0+096.76m				0.000mm	0.000mm	0.000mm	0.00%	0.000 m/s	0.000 m/s^2
gin Full Cant	0+146.76m				35.000mm	53.943mm	18.943mm	0.07%	0.008 m/s	0.124 m/s^2
gin Curve	0+146.76m					53.943mm				
ition Out Region	0+486.44m	0+536.44...	50.000m							
d Full Cant	0+486.44m				35.000mm	53.943mm	18.943mm	0.00%	0.000 m/s	0.124 m/s^2
d Curve	0+486.44m					53.943mm				
gin Level Rail	0+536.44m				0.000mm	0.000mm	0.000mm	-0.07%	-0.008 m/s	0.000 m/s^2
ition In Region	0+590.15m	0+640.15...	50.000m							
d Level Rail	0+590.15m				0.000mm	0.000mm	0.000mm	0.00%	0.000 m/s	0.000 m/s^2
gin Full Cant	0+640.15m				35.000mm	53.943mm	18.943mm	0.07%	0.008 m/s	0.124 m/s^2
gin Curve	0+640.15m					53.943mm				
ition Out Region	0+679.70m	0+729.70...	50.000m							
d Full Cant	0+679.70m				35.000mm	53.943mm	18.943mm	0.00%	0.000 m/s	0.124 m/s^2
d Curve	0+679.70m					53.943mm				
gin Level Rail	0+729.70m				0.000mm	0.000mm	0.000mm	-0.07%	-0.008 m/s	0.000 m/s^2
ition In Region	0+913.91m	0+963.91...	50.000m							
d Level Rail	0+913.91m				0.000mm	0.000mm	0.000mm	0.00%	0.000 m/s	0.000 m/s^2
gin Full Cant	0+963.91m				35.000mm	53.943mm	18.943mm	0.07%	0.008 m/s	0.124 m/s^2
gin Curve	0+963.91m					53.943mm				
ition Out Region	1+243.08m	1+293.08...	50.000m							
d Full Cant	1+243.08m				35.000mm	53.943mm	18.943mm	0.00%	0.000 m/s	0.124 m/s^2
d Curve	1+243.08m					53.943mm				
gin Level Rail	1+293.08m				0.000mm	0.000mm	0.000mm	-0.07%	-0.008 m/s	0.000 m/s^2
ition In Region	1+503.43m	1+553.43...	50.000m							
d Level Rail	1+503.43m				0.000mm	0.000mm	0.000mm	0.00%	0.000 m/s	0.000 m/s^2
gin Full Cant	1+553.43m				35.000mm	53.943mm	18.943mm	0.07%	0.008 m/s	0.124 m/s^2
gin Curve	1+553.43m					53.943mm				

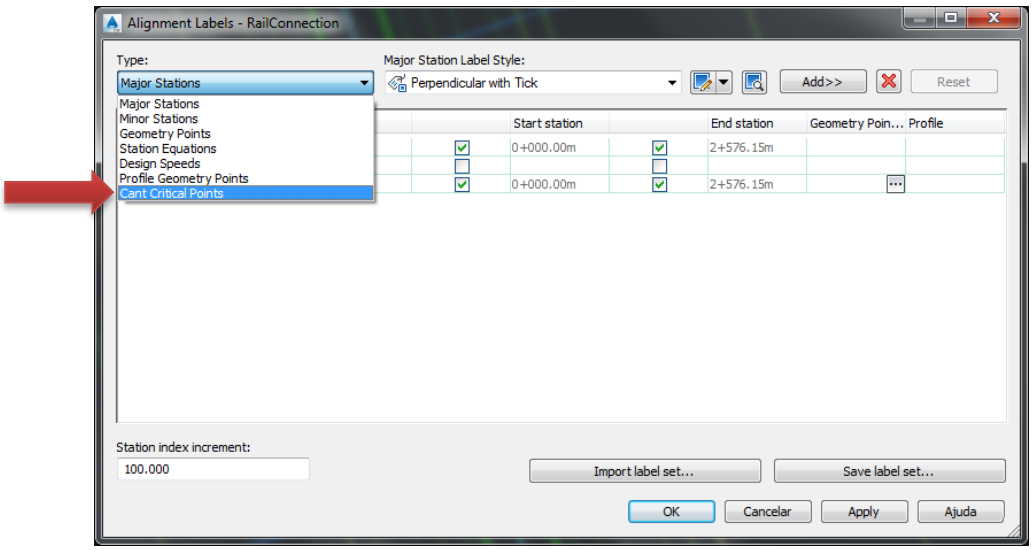
RailConnection SO
AIM_Existing_Ground Z

Adding Labels to the Alignment

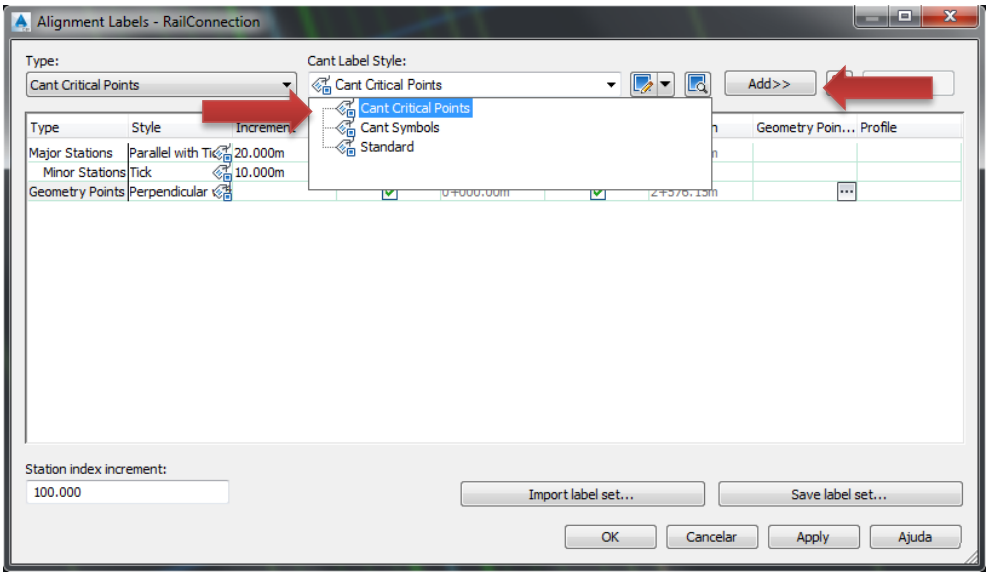
1. Right click the RailConnection alignment and select *Edit Alignment Labels.*



2. In the *Alignment Labels* dialog box, in *Type*, choose the *Cant Critical Points*.



3. Then, click *Add* >>.

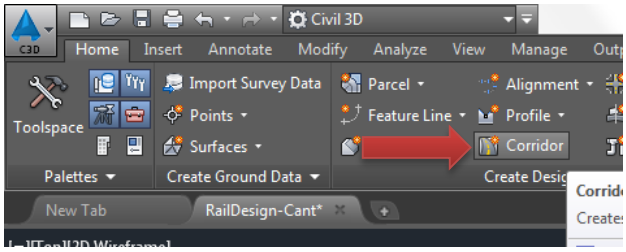


4. Click *OK*.
5. Click *OK* again.

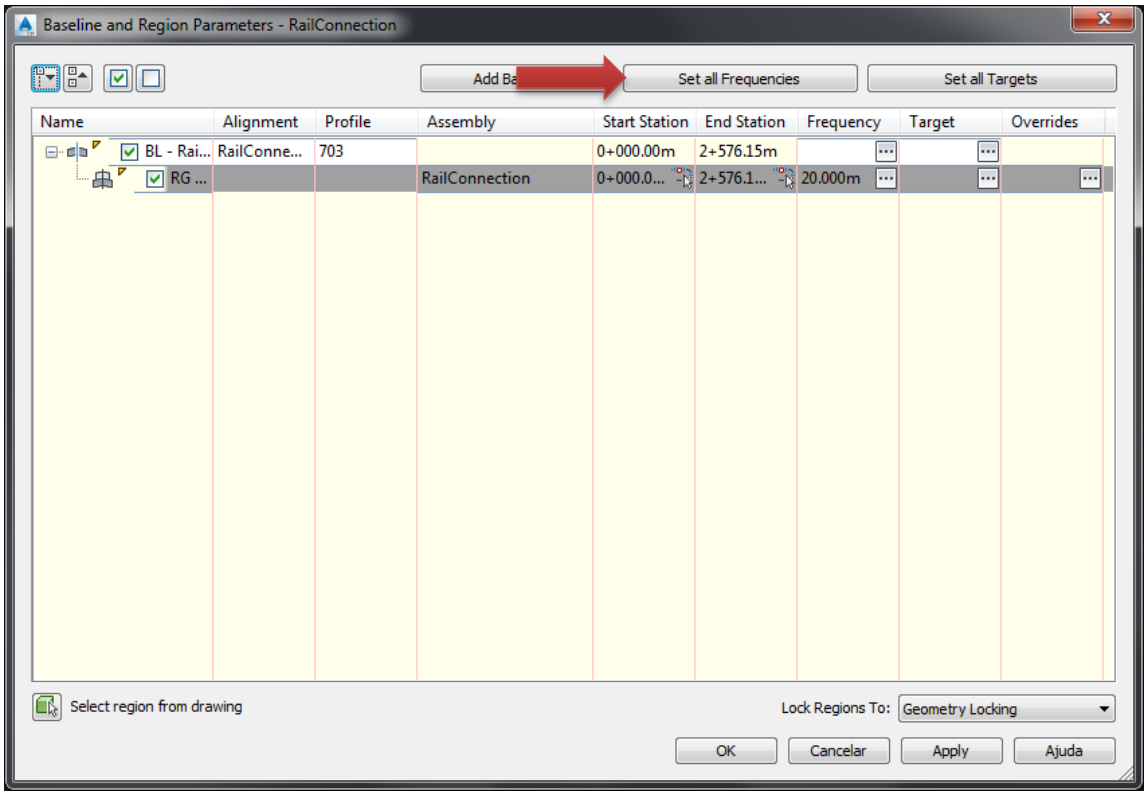
Creating the Corridor

Now we will combine the Alignment with the Profile and the Assembly in one single element called *Corridor*. To do this, just follow the next few steps.

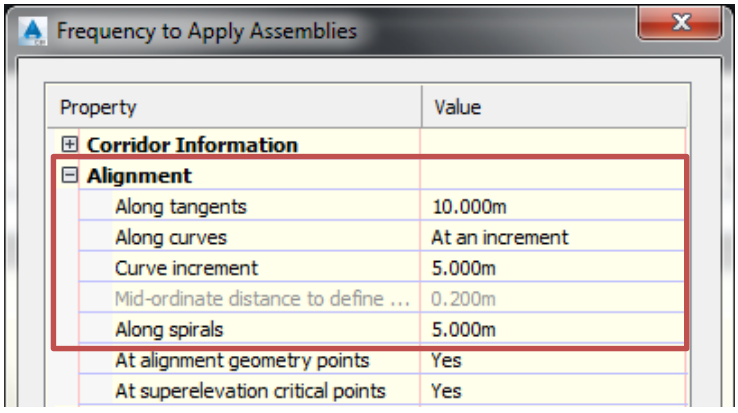
1. Select the *Home* tab in the Ribbon, and click on the *Corridor* button.



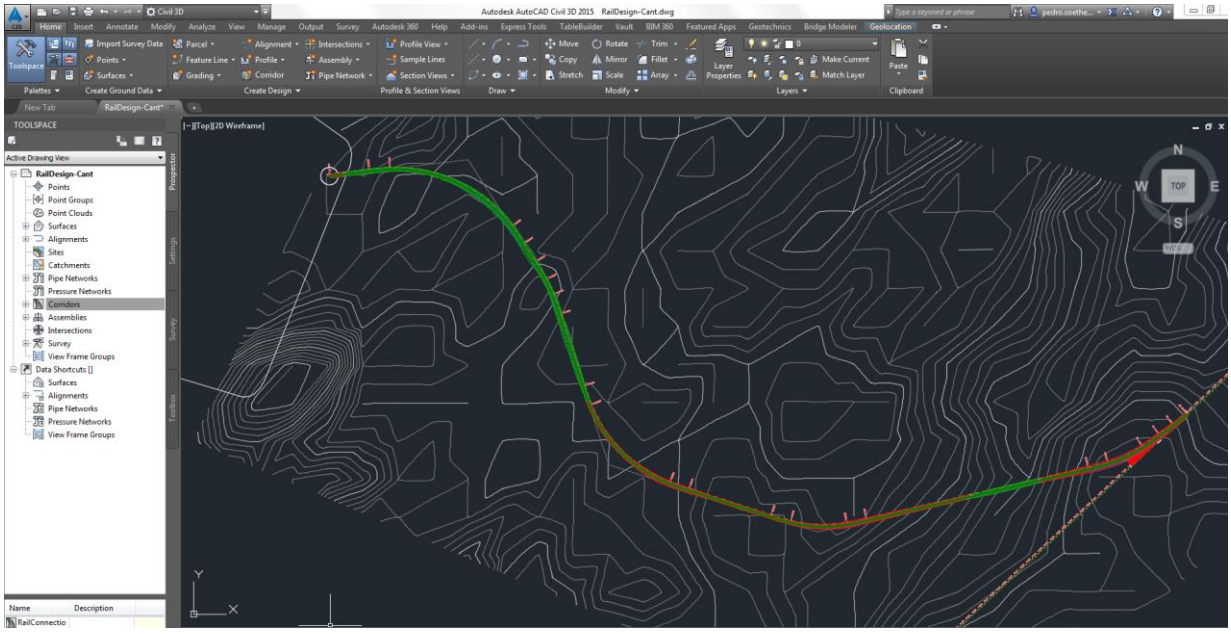
2. After that, the *Create Corridor* dialog box will appear. Set the following fields:
   a. *Name* – RailConnection
   b. *Assembly* – RailConnection
   c. *Target Surface* – AIM_Surface_Ground
   d. Click *OK*.
3. The *Baseline and Region Parameters* dialog box will appear. The only default we must change is the *Frequency.* To do so, click on the *Set all Frequencies* button.



4. In the dialog box, set the following values:
    a. *Alignment Tangents* – 10.00m
    b. *Curve Increment* – 5.00m
    c. *Along Spirals* – 5.00m
    d. Click *OK*.



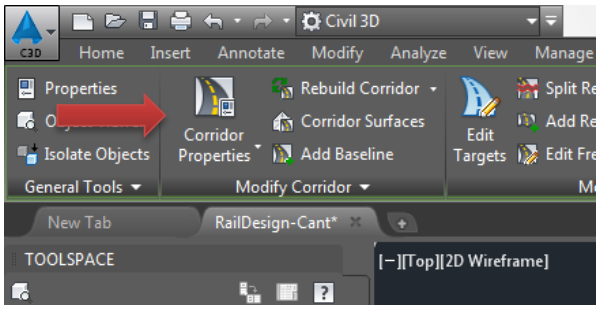
5. Click *OK* again to process the *Corridor*.
6. Select *Rebuild the Corridor*.
7. We now have successfully established the *Corridor* in the Drawing.



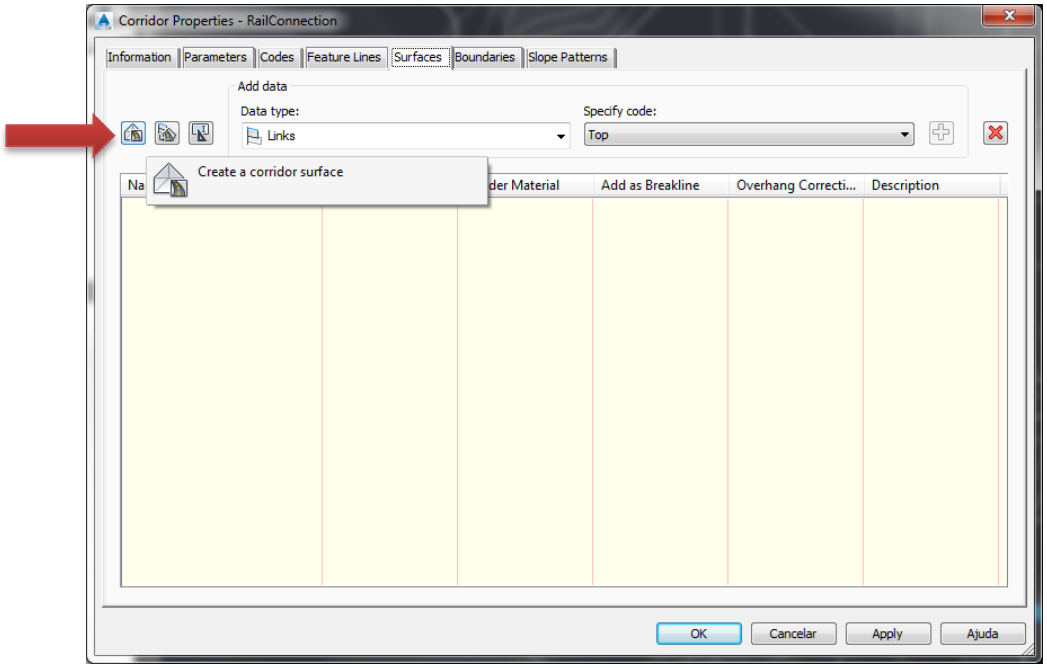
Creating the Corridor Surface

We must now create the *Surface* of the *Corridor*.

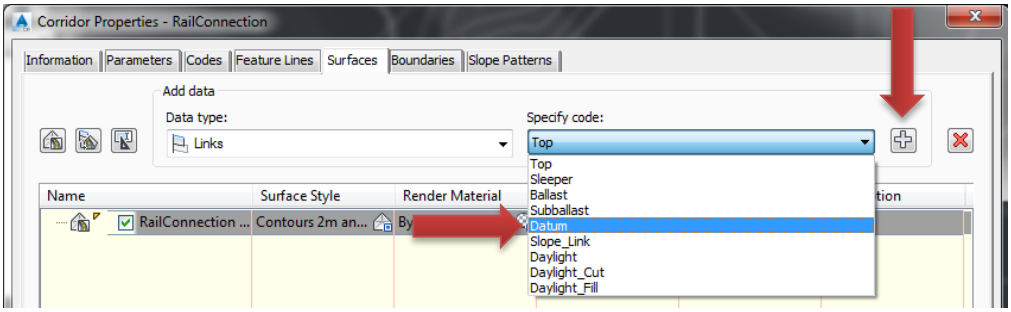
1. Select *Corridor* and in *Corridor Properties* button.



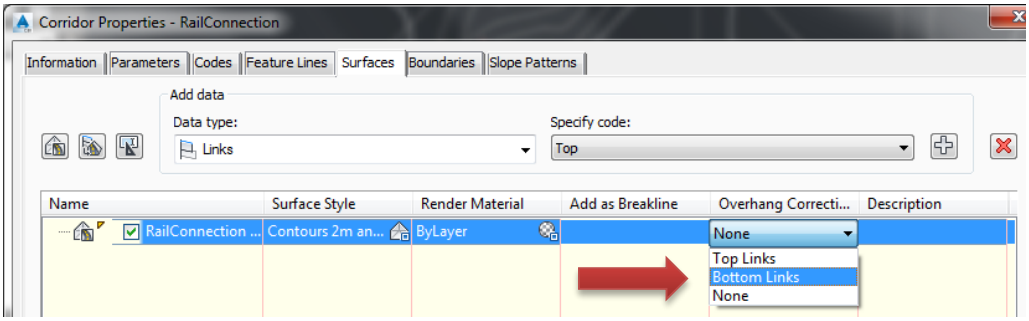
2. The *Corridor Properties* dialog box will appear. Select the *Surfaces* tab.
3. Click on the *Create a corridor surface* button, as shown below.



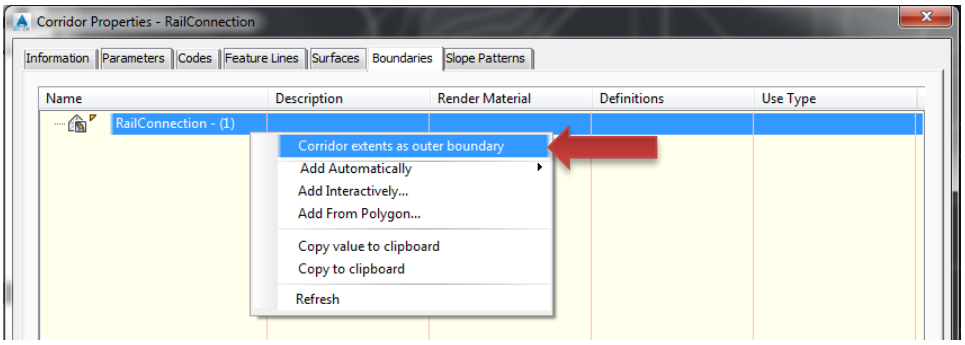
4. Under *Specify code,* select *Datum*. Then, click on the *Add* button.



5. Change the *Overhang Correction* from *None* to *Bottom Links.*



6. Select the *Boundaries* tab.
7. Right click the *RailConnection* and choose the option *Corridor extents as outer boundary*, as shown below.

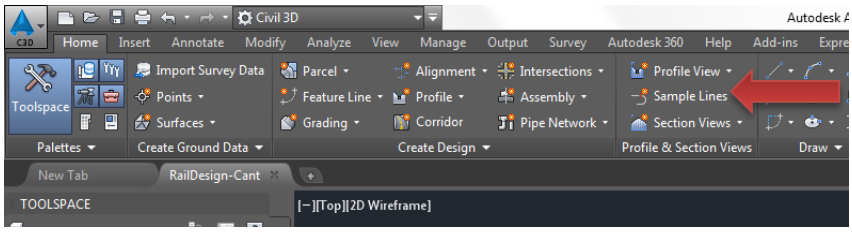


8. Click *OK* and then select *Rebuild the Corridor.*

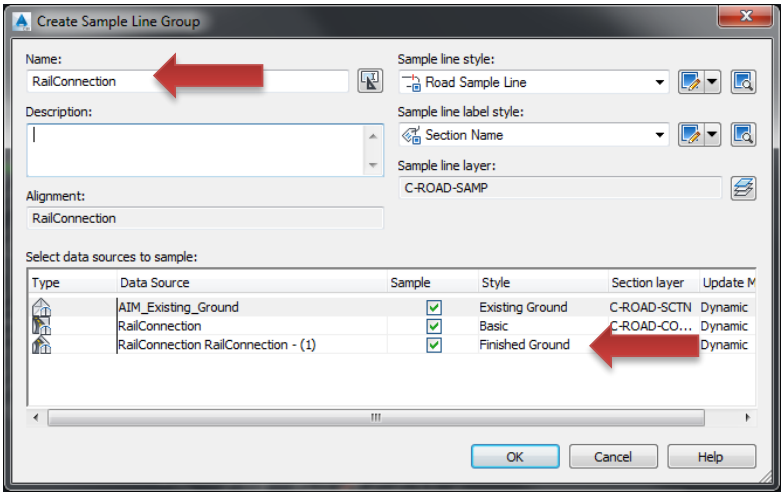
Creating Sections

We must now create the *Sections*, to check if everything turned out as expected.

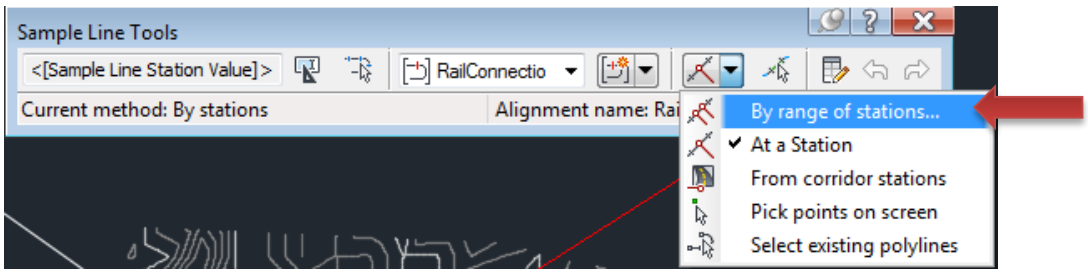
1. Select the *Home* tab, in the Ribbon. Click on the *Sample Line* button.



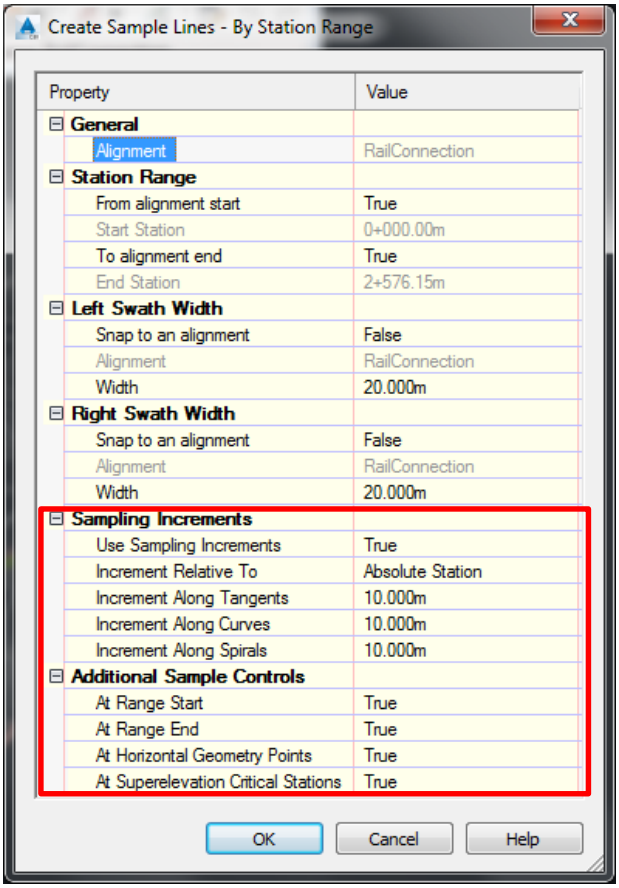
2. Hit *Enter* and then choose the *RailConnection* alignment in the *Select Alignment* dialog box.
3. Set the dialog box fields as follows:
    a. *Name* – RailConnection
    b. *Style of Corridor Surface* – *Finished Ground* (as pictured below)



4. Click *OK*.
5. The *Sample Line Tools* dialog box will appear. Expand the *Sample Line Creation Methods*, and select the option *By Range of Stations…,* as shown below.



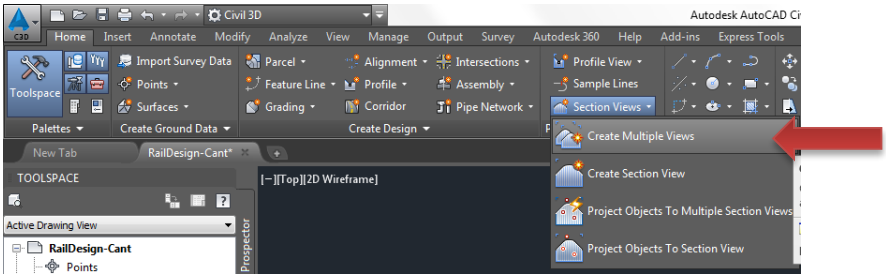
6. Change the following aspects to match the image below.
    a. *Increment Along Tangents* – 10.000m
    b. *Increment Along Curves* – 10.000m
    c. *Increment Along Spirals* – 10.000m
    d. *True* for all the options in *Additional Sample Controls.*



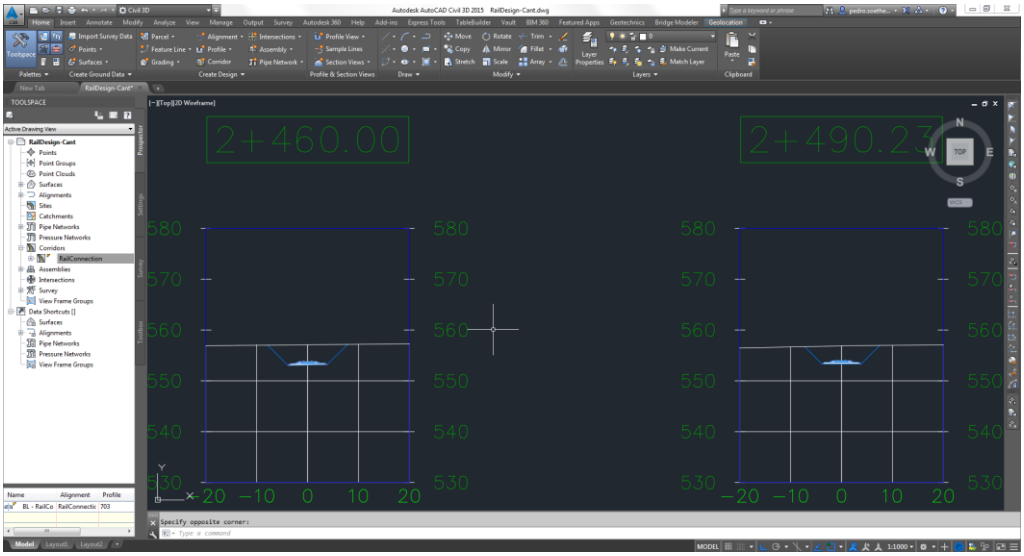
7. Click *OK*.
8. Hit *Enter.*

Showing the Sections.

1. Select the *Home* tab in the Ribbon. Click on the *Section Views* button and then select *Create Multiple Views*.

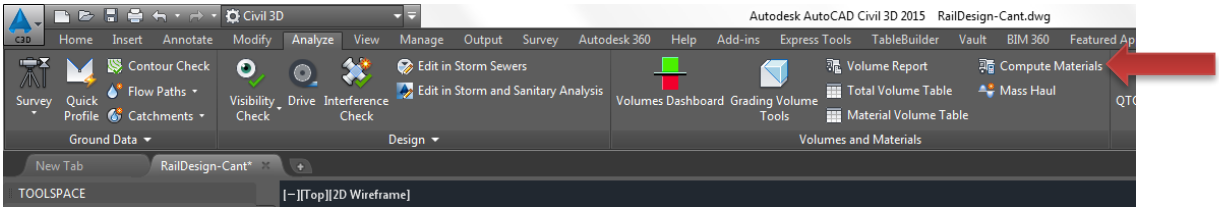


2. In the *Create Multiple Section Views* dialog box, select *Create Section Views*, and select a clear spot in the drawing area.

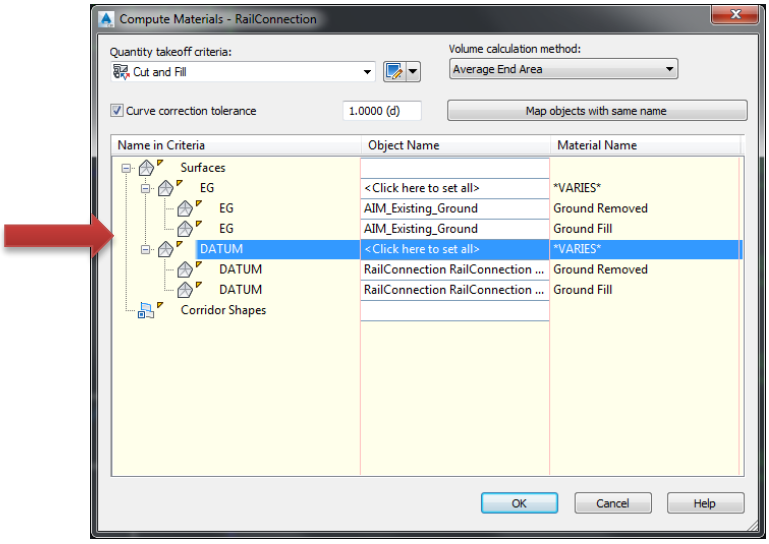


Volume Calculation

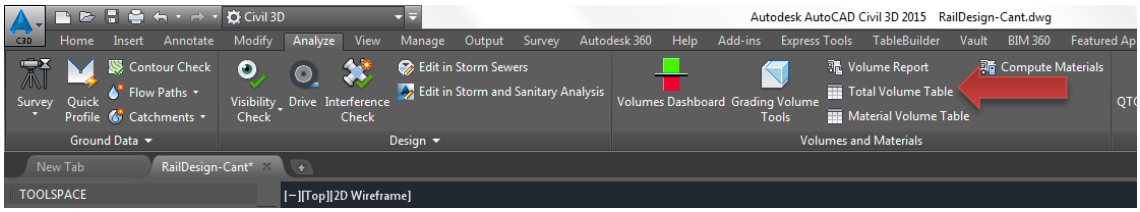
1. To calculate the Volume select the *Analysis* tab of the Ribbon. Then, click on the *Compute Materials* button, as shown below.



2. Click *OK* to confirm. The Compute Materials dialog box will appear.
3. Under Surfaces, in EG, *Click here to set all*, select the *AIM_Existing_Ground.*
4. In DATUM, in *Click Here to set all,* select the *RailConnection*.



5. Click *OK*.
6. Now, select *Total Volume Table*, as shown below.



7. Confirm the options and click *OK*.
8. Select a clear spot in the drawing area.
9. To see the profile part, as well as the part in which we create the sections, calculation of cant and volumes, access the video bellow.
   09 – AutoCAD Civil 3D – Create a Final Design - AU CLASS - CV5454-L-P
   https://screencast.autodesk.com/Main/Details/2df3b8ee-47dd-4628-b213-1409776300ef