AutoTURN 3D Conflict Analysis using OpenRoads Designer

CADD process by Matthew Ashford, documentation by Eric Vought

AutoTURN 3D Conflict Analysis can predict whether the bottom of a vehicle has enough clearance above a finish grade roadway. In this scenario, a tangent local road crosses four railroad tracks at a 70° skew to the roadway. The project replaces an uneven asphalt original grade track crossing with precast concrete track panels. One of the tracks is superelevated (diagram below). The AutoTURN vehicle for this design check is a 40’ lowboy trailer with a 5-inch bottom clearance.

AASHTO Greenbook, 2018

Rails that are superelevated, or a roadway approach section that is not level, need a site-specific analysis for rail clearances.

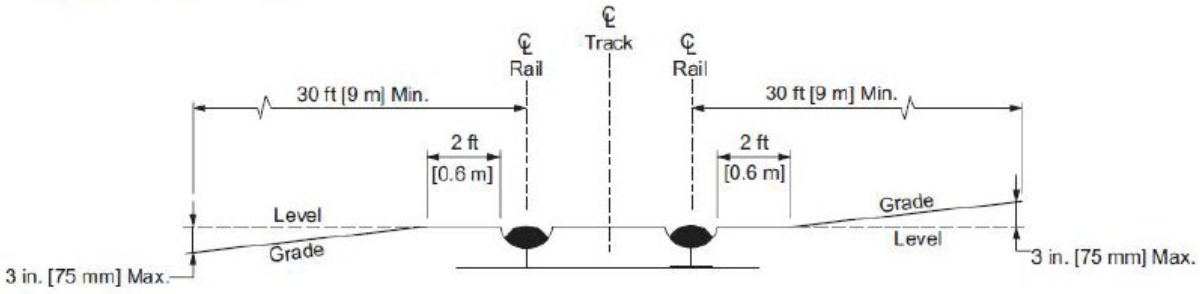
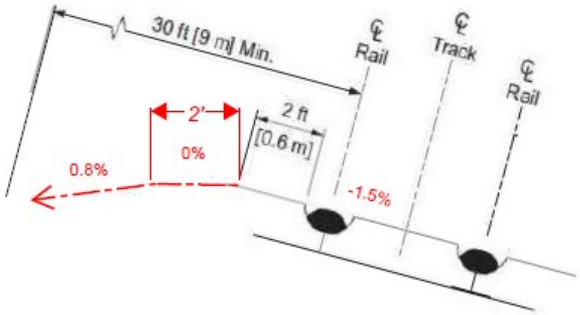


Figure 9-66. Railroad–Highway Grade Crossing



Key 21185: west track crossing Queen Ave

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Reply for advice about railroad crossing geometry from Clayton Wellman, US DOT, by email on 9/28/2026: *NCHRP Report 1061 Section 6.8 (Vehicles with Low Ground Clearance) clarifies that a 2D profile view is only valid when vehicles approach a level crossing at 90 degrees. When track superelevation puts the vehicle's wheels at different elevations (or when the crossing is skewed), you must perform a three-dimensional (3D) clearance analysis in a computer-aided design and drafting (CADD) system to accurately model the spatial orientation of the vehicle over the tracks. The clearance analysis should evaluate potential contact points across the front overhang, primary wheelbase, and rear overhang using a conservative 5-inch undercarriage ground clearance model.*

This is an example of a 3D clearance analysis being performed (I am not promoting this specific tool; it is provided for informational purposes). Based on the software package your agency uses, you will need to determine what tool you have available to perform this analysis for your rail crossing."

https://youtu.be/sSX5tzToEK8 (video duration is 9:56)

"The video below shows how easily a truck can get hung up on tracks and your situation is more complex than this one."

https://youtu.be/VXLD4BVK7Dw (video duration is 2:23)

CADD Workflow

The following workflow uses OpenRoads Designer (ORD) (v24.00.02.025) to produce a mesh for the purpose of running 3D Conflict Analysis with AutoTurn Pro (2024.12.01.53). This workflow has proven to be successful, but ORD likely has other methods which also produce a useful mesh.

Creating an ORD mesh the key to performing AutoTURN 3D conflict analysis.

The terms AutoTURN uses may be confusing to ORD users because AutoTURN indicates a terrain is needed to work in 3D. In actual practice, AutoTURN may only run on an ORD mesh. An ORD mesh differs from an ORD terrain.

Using an ORD terrain results in various AutoTURN error messages as shown below:

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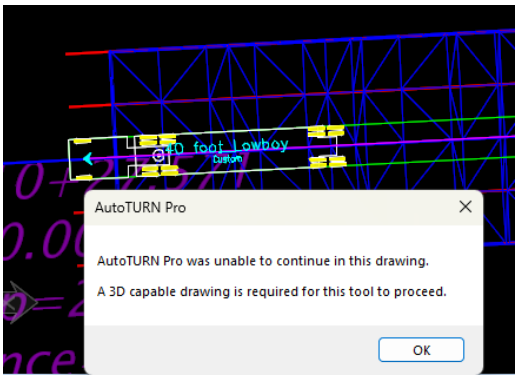
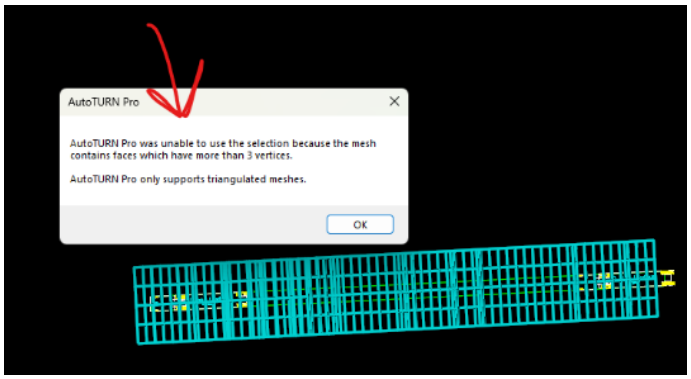




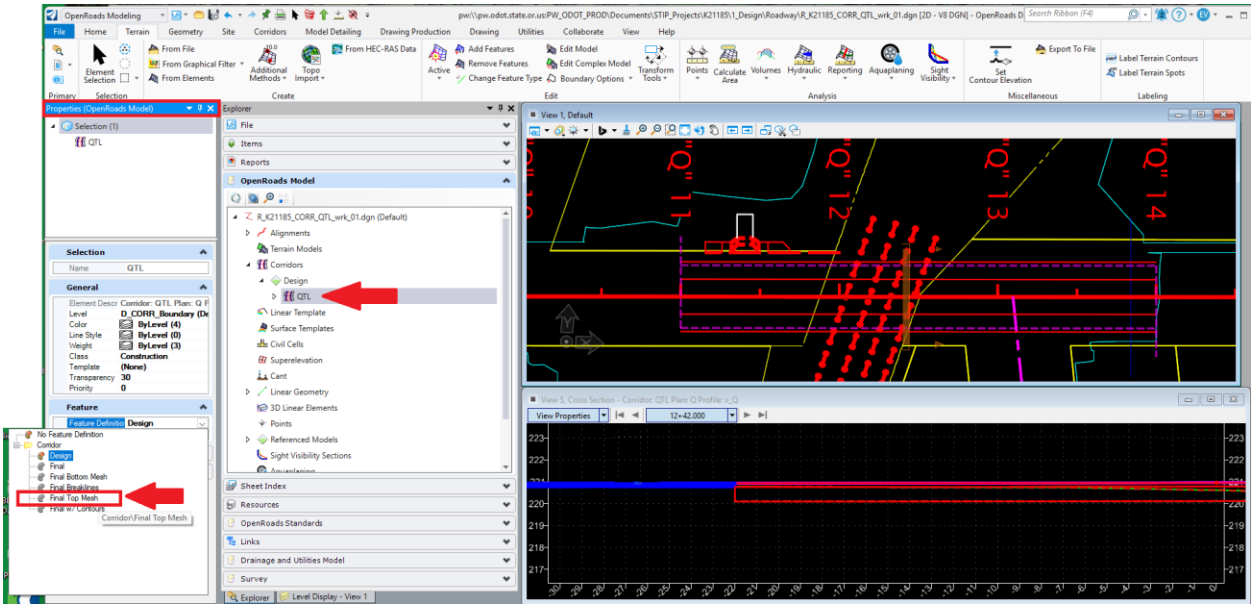
Begin with an ORD Corridor; then, this is a recommended workflow:

STEP 1 Change Corridor feature definition to Mesh (see screenshot below)

Ensure the **Corridor** is highlighted

Use the **Properties** menu

Change corridor **Feature Definition** to **Final Top Mesh**



STEP 2. Create a new ORD file

- This example uses a **2D Seed** file; however, the work is done in a **3D Model**
- Attach the ORD Corridor file as a reference to the newly created file.

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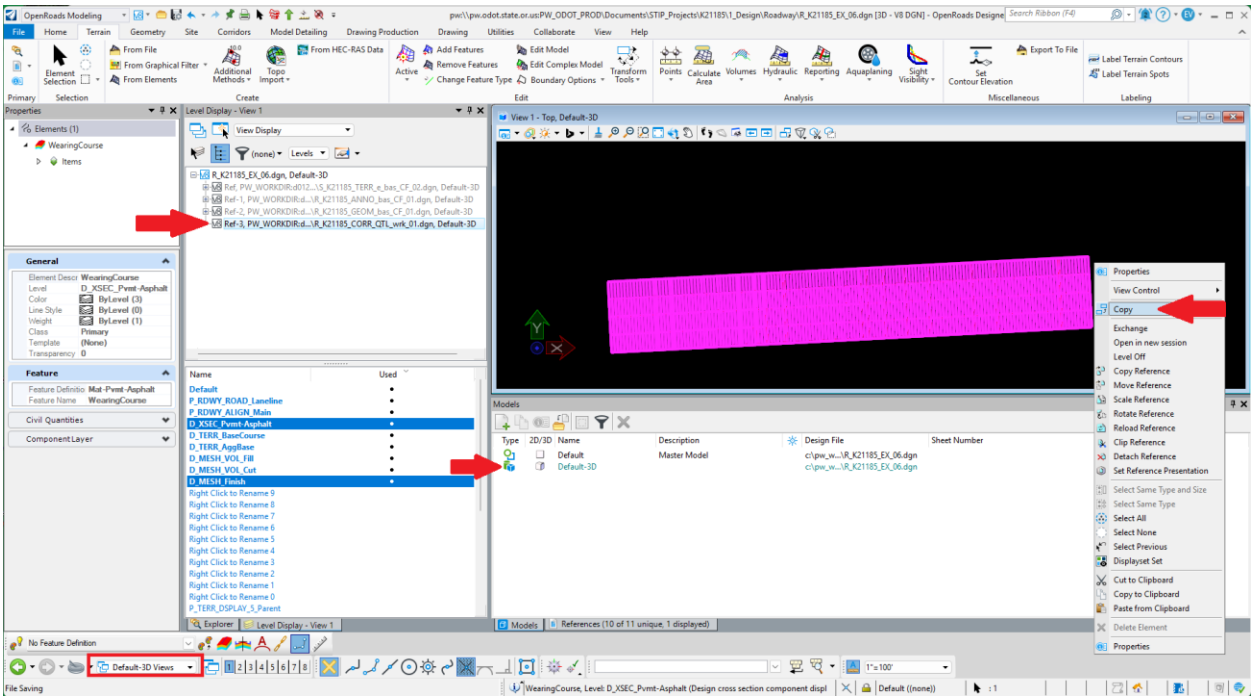
STEP 3 Copy the Mesh from the referenced corridor file (see screenshot below)

Change View 1 from Default (2D) to **Default 3D**

Verify indicators that Default 3D is set

Copy the referenced Mesh into the new file. Copy it precisely to its existing location



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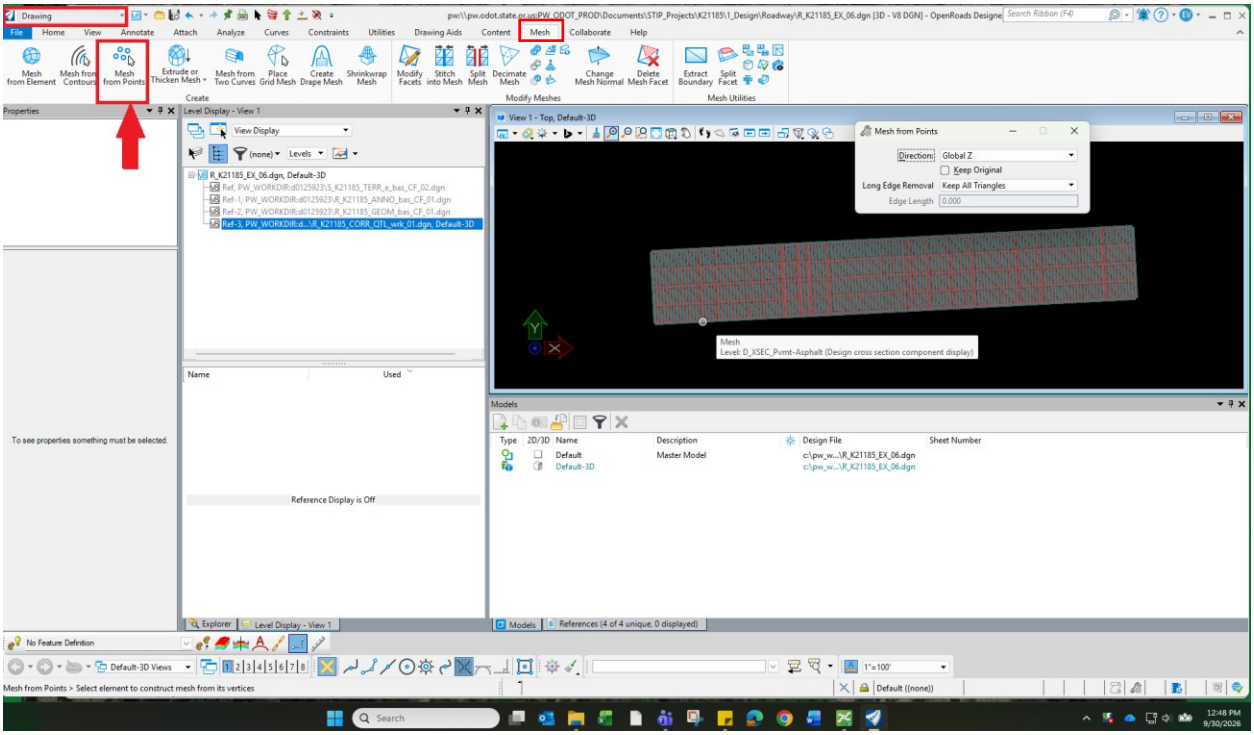
STEP 4 Create Mesh from Points (see screenshot below)

Navigate to **Drawing** workflow ribbon

Select **Mesh** tab

Select **Mesh from Points**

Follow prompts at screen bottom to perform to create the Mesh



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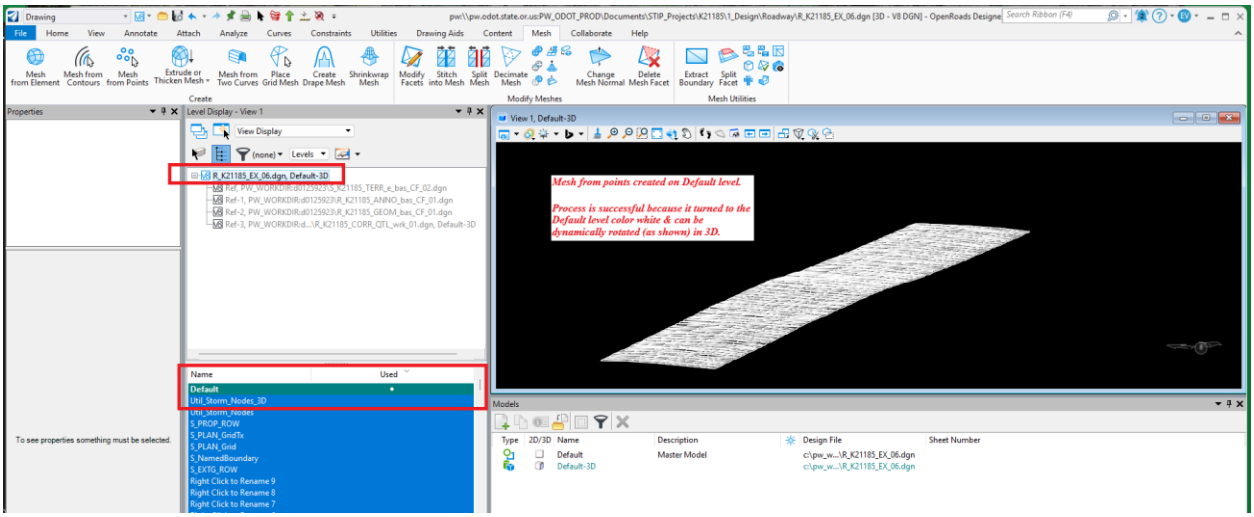
STEP 5 Verify Mesh from Points (see screenshot below)

Evidence that **Mesh from Points** successfully appears in this file



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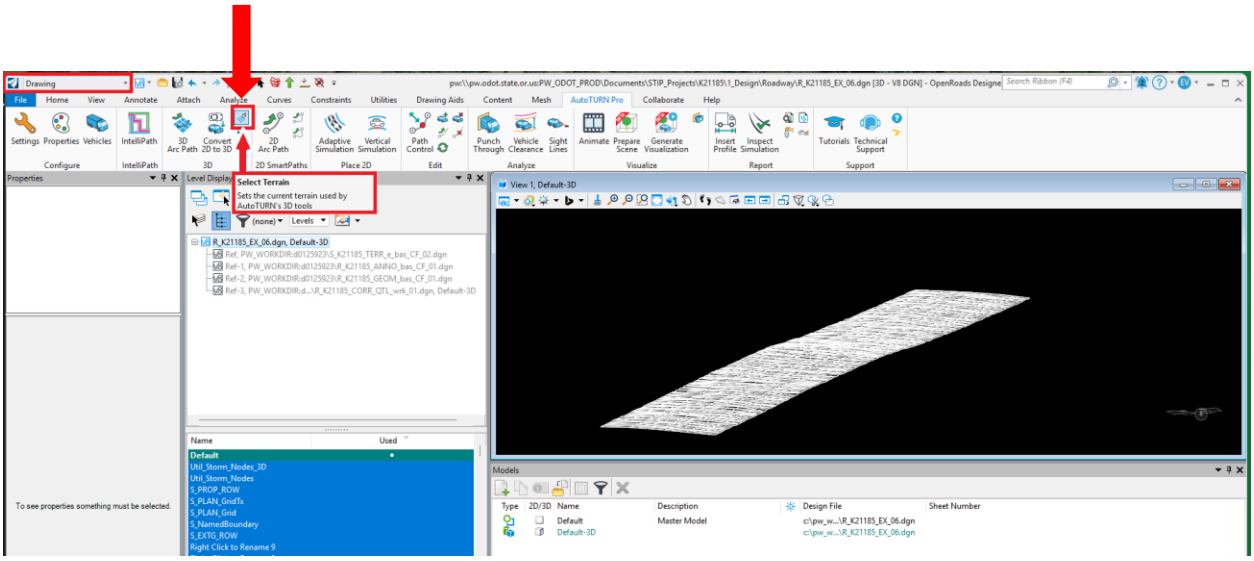
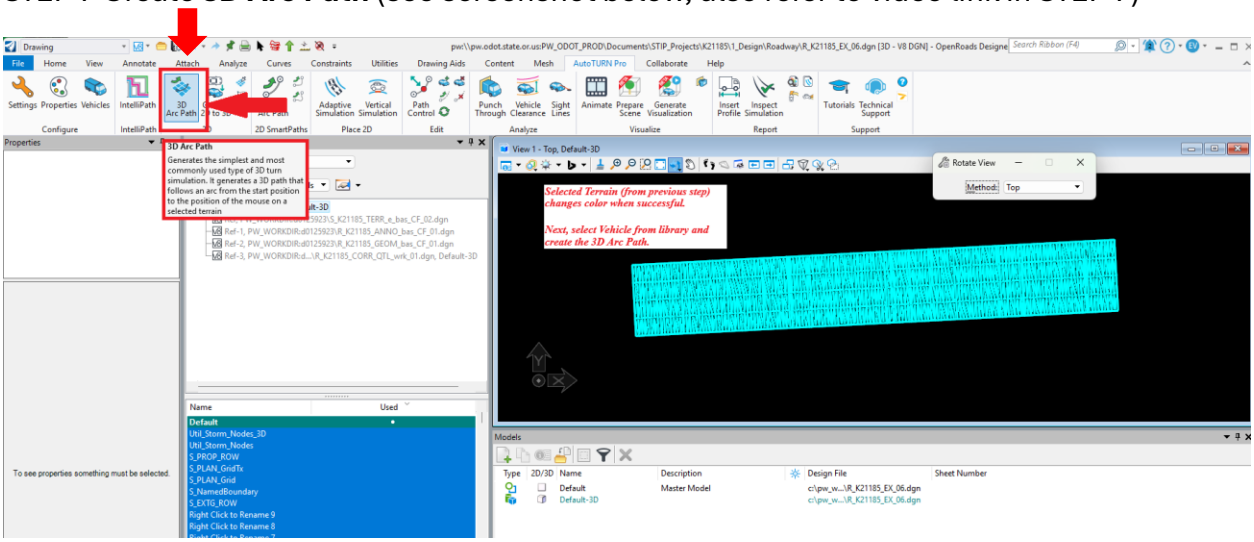
STEP 6 Using AutoTurn in 3D (see screenshot below)

Set design **Vehicles** and **Properties** as needed. See this demonstration using AutoTURN within Civil 3D software: *https://youtu.be/sSX5tzToEK8*

Select Terrain for AutoTurn to use the mesh



STEP 7 Create **3D Arc Path** (see screenshot below, also refer to video link in STEP 7)



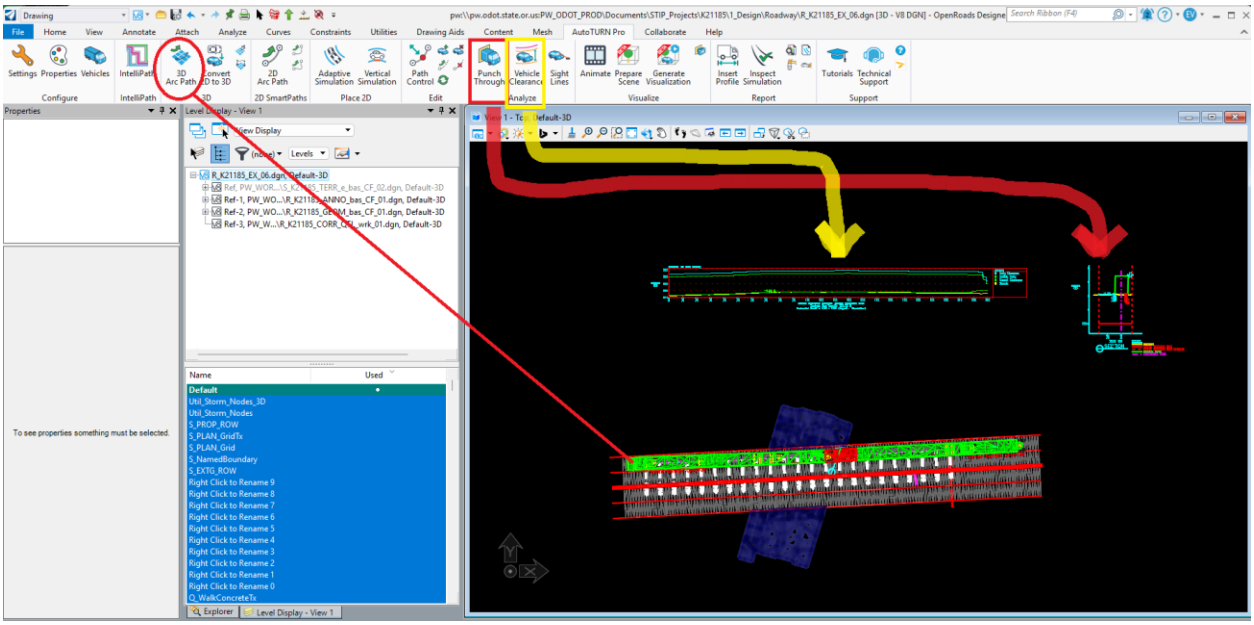
The entire vehicle must fit upon the 3D Arc Path insertion point; the trailer cannot be outside the terrain.

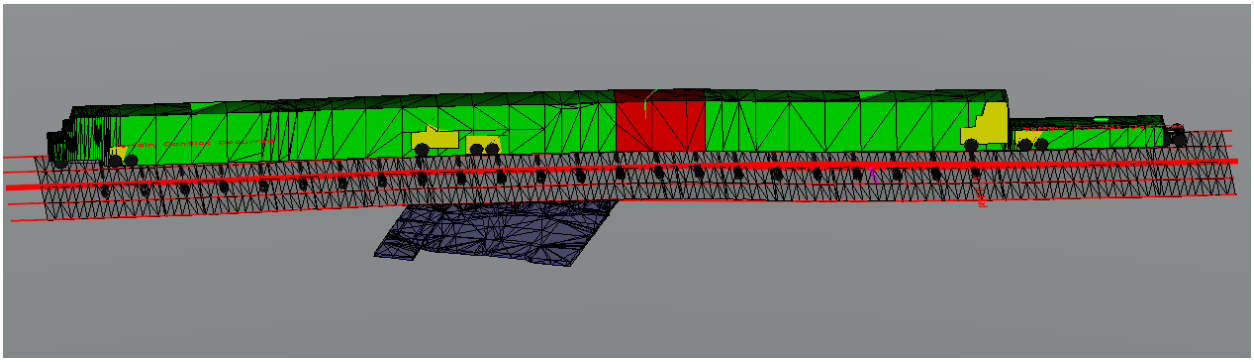
Note that the recommended video uses **Convert 2D to 3D** instead. Either way works.

STEP 8 Do 3D Conflict Analysis and review its output (see screenshot below and refer to video link in STEP 7)

In this example, AutoTurn 3D Conflict Analysis shows red along the path revealing a problem with the lowboy in conflict with the ORD corridor mesh. The attached corridor file shows the railroad crossing as a blue colored mesh.

A variety of tables, cross sections and other output diagrams can provide more data about the analysis.





A *.CSV file can be generated and opened with Microsoft Excel (see below).

The right column labeled ***Net Ground Cl. above Terrain*** is a user formula modifying the Excel workbook. In this example, the ORD corridor mesh (AutoTURN Terrain) is 0.03-feet higher than the trailer bottom at Sta. 0+73.0. In summary, the lowboy vehicle contacts the ground near the railroad crossing in this simulation.

AutoTURN Pro Vehicle Clearance Report
(Vehicle Clearance Analysis: Vehicle Centerline Path)
(Interval = 1.00)

Station	Terrain	Ground Cl.	Vehicle Body	Body Cl.	Obstacle	***Net Ground Cl. above Terrain***
0+1.0	218.22	218.53	231.82	233.83	N/A	*0.31*
0+2.0	218.32	218.55	231.84	233.85	N/A	*0.23*
0+3.0	218.27	218.64	231.87	233.88	N/A	*0.37*
0+4.0	218.21	218.64	231.89	233.87	N/A	*0.43*
0+5.0	218.29	218.68	231.9	233.91	N/A	*0.39*
0+6.0	218.35	218.66	231.89	233.9	N/A	*0.31*
0+7.0	218.37	218.69	231.91	233.92	N/A	*0.32*
0+8.0	218.44	218.72	231.93	233.94	N/A	*0.28*
0+9.0	218.48	218.75	231.95	233.96	N/A	*0.27*
0+10.0	218.37	218.78	231.97	233.97	N/A	*0.41*
0+11.0	218.38	218.8	231.99	234	N/A	*0.42*
0+12.0	218.49	218.83	232.02	234.03	N/A	*0.34*
0+13.0	218.51	218.86	232.05	234.06	N/A	*0.35*
0+14.0	218.59	218.88	232.08	234.09	N/A	*0.29*
0+15.0	218.6	218.89	232.11	234.12	N/A	*0.29*
0+16.0	218.55	218.9	232.14	234.15	N/A	*0.35*
0+17.0	218.56	218.91	232.17	234.18	N/A	*0.35*
0+18.0	218.59	218.95	232.2	234.21	N/A	*0.36*
0+19.0	218.61	218.99	232.22	234.23	N/A	*0.38*
0+20.0	218.63	219.02	232.25	234.26	N/A	*0.39*
0+21.0	218.67	219.05	232.27	234.28	N/A	*0.38*
0+22.0	218.78	219.08	232.29	234.3	N/A	*0.3*
0+23.0	218.82	219.11	232.3	234.31	N/A	*0.29*
0+24.0	218.84	219.13	232.32	234.33	N/A	*0.29*
0+25.0	218.87	219.16	232.35	234.36	N/A	*0.29*
0+26.0	218.89	219.18	232.37	234.38	N/A	*0.29*
0+27.0	218.86	219.21	232.39	234.41	N/A	*0.35*
0+28.0	218.89	219.22	232.42	234.44	N/A	*0.33*
0+29.0	218.83	219.24	232.45	234.47	N/A	*0.41*
0+30.0	218.87	219.26	232.48	234.49	N/A	*0.39*
0+31.0	218.98	219.29	232.51	234.52	N/A	*0.31*
0+32.0	219.04	219.31	232.55	234.55	N/A	*0.27*
0+33.0	218.99	219.34	232.58	234.57	N/A	*0.35*
0+34.0	218.93	219.36	232.62	234.6	N/A	*0.43*
0+35.0	218.97	219.38	232.65	234.63	N/A	*0.41*
0+36.0	219.07	219.41	232.68	234.66	N/A	*0.34*

0+37.0	219.12	219.43	232.71	234.7	N/A	*0.31*	
0+38.0	219.03	219.44	232.73	234.72	N/A	*0.41*	
0+39.0	219.12	219.46	232.75	234.75	N/A	*0.34*	
0+40.0	219.19	219.48	232.76	234.77	N/A	*0.29*	
0+41.0	219.28	219.51	232.8	234.8	N/A	*0.23*	
0+42.0	219.31	219.56	232.83	234.83	N/A	*0.25*	
0+43.0	219.29	219.61	232.87	234.86	N/A	*0.32*	
0+44.0	219.33	219.66	232.91	234.89	N/A	*0.33*	
0+45.0	219.37	219.7	232.94	234.94	N/A	*0.33*	
0+46.0	219.41	219.75	232.98	234.98	N/A	*0.34*	
0+47.0	219.43	219.79	233.01	235.03	N/A	*0.36*	
0+48.0	219.39	219.81	233.07	235.08	N/A	*0.42*	
0+49.0	219.49	219.83	233.13	235.13	N/A	*0.34*	
0+50.0	219.54	219.85	233.19	235.18	N/A	*0.31*	
0+51.0	219.53	219.89	233.25	235.23	N/A	*0.36*	
0+52.0	219.61	219.93	233.3	235.29	N/A	*0.32*	
0+53.0	219.69	219.97	233.35	235.36	N/A	*0.28*	
0+54.0	219.74	220.02	233.4	235.41	N/A	*0.28*	
0+55.0	219.79	220.07	233.42	235.43	N/A	*0.28*	
0+56.0	219.85	220.13	233.45	235.46	N/A	*0.28*	
0+57.0	219.98	220.18	233.47	235.49	N/A	*0.2*	
0+58.0	220.06	220.23	233.52	235.54	N/A	*0.17*	
0+59.0	220.04	220.27	233.58	235.59	N/A	*0.23*	
0+60.0	220.01	220.31	233.63	235.64	N/A	*0.3*	
0+61.0	220.05	220.35	233.68	235.7	N/A	*0.3*	
0+62.0	220.1	220.39	233.74	235.75	N/A	*0.29*	
0+63.0	220.19	220.42	233.79	235.8	N/A	*0.23*	
0+64.0	220.33	220.46	233.85	235.86	N/A	*0.13*	
0+65.0	220.29	220.49	233.9	235.91	N/A	*0.2*	
0+66.0	220.34	220.52	233.95	235.96	N/A	*0.18*	
0+67.0	220.39	220.55	234.01	236.02	N/A	*0.16*	
0+68.0	220.44	220.59	234.04	236.04	N/A	*0.15*	
0+69.0	220.52	220.62	234.07	236.07	N/A	*0.1*	
0+70.0	220.64	220.66	234.11	236.09	N/A	*0.02*	
0+71.0	220.68	220.69	234.13	236.12	N/A	*0.01*	
0+72.0	220.73	220.73	234.15	236.14	N/A	***0***	
0+73.0	220.8	220.77	234.17	236.16	N/A	***-0.03***	**CONFLICT**
0+74.0	220.74	220.8	234.19	236.19	N/A	*0.06*	