# Module 02
VISUALIZATION
OF InRoads DATA

Introduction

Visualization is the utilization of any technique for creating or presenting images, models, animations or diagrams in some way in order to communicate a particular message.

InRoads constructs its models in a non-visual, mathematical layout. Surface DTMs are N, E, Z, or X, Y, Z data that encompasses an area and then systematically interrelates that data using a set of connectivity rules. And while it's true that MicroStation can feed data into an InRoads surface, it really has nothing whatsoever to do with the formation process, and plays no role in its final format or structure.

The format and actual content of the InRoads DTM provides very few clues to its validity if you isolate it from the visualizing world of MicroStation.
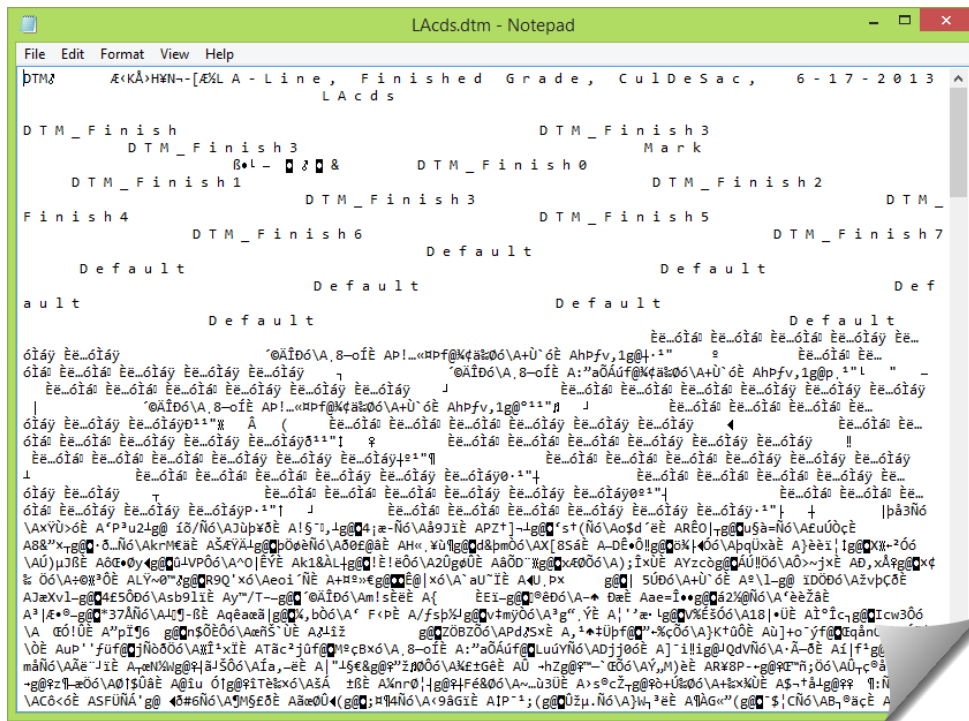
While the image above is extreme, it is intended to illustrate the contrast between a world without visualization (because it isn't required for the construction of the model) and one with valuable imaging tools that can be used as a mechanism of model validation that isn't otherwise possible.

Luckily, the InRoads software has a specific set of tools to take its 'mathimagical' surface model into the visual container.

Enter MicroStation.
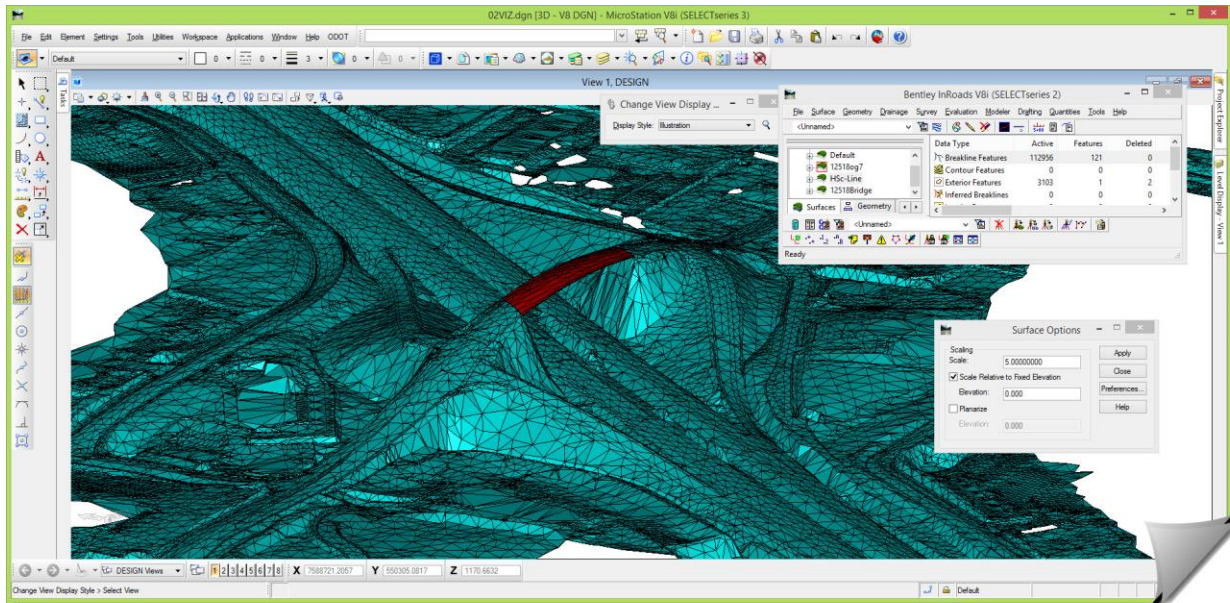
MicroStation has a robust set of tools specifically designed to illustrate things visually, and this module will touch on some of them as they relate to using InRoads. Specifically this module will cover the movement of InRoads surface data into MicroStation and then how to obtain a visual 'assist' with the MicroStation tools to help understand your model, and your project design, better.

Purpose of this Module

The purpose of this module is to familiarize the students with the different methods of displaying InRoads information and to illustrate the process and tools to be able to create a quick "rendered" view by using MicroStation **Display Styles** with the displayed information coming from InRoads.

As an additional benefit, displaying and reviewing InRoads surface data in 3D will be seen to be a valuable check to verify the validity of the model and reveal potential problems that might not have otherwise been readily noticed.

Objectives of this Module

At the end of this module you will be able to display InRoads 3D data and look at it in various rotated views using a variety of rendered displays to enhance the information, validate its construction and accentuate any potential problems and issues.

Definition of Audience for future Modules

Before moving forward, it needs to be stated that each module in this series will have its own prerequisites and skill level requirements. The skill level requirements will be based on instructor-led classes taught at ODOT and will be primarily focused on the InRoads series classes. Additional prerequisites may also include various modules within this particular series. Each individual module will list the applicable module requirements in this section if there are any.

Please do not take these prerequisites lightly, each module assumes that you have achieved a certain level of competency with the software tools and you may be asked to execute a command with very little instruction. If you are unable, you will likely not be able to successfully complete the module and achieve its intended objectives.

For example, after completing this module, it will be expected that you can perform the visualization techniques covered. In later modules, you may be asked to perform a quick rendered view in order to observe something related to the later module being executed. At that point you will either be able to perform the step and move forward, or you will have to skip that step, or you will have to return to this module and review how to accomplish the step being asked of you. For that reason, if you feel that after completing a module, you are still unsure of your skill, simply go through the module again, and do some additional outside practice.

Skill Level / Prerequisites:

The required prerequisites for this module are:

- Module 1 – Introduction to the Training Modules
- MicroStation Basics
- InRoads Level 1

Refer to the course content or description for each of the instructor-led classes above for a detailed breakdown of the subject matter covered in each of those classes.

In addition to the classes above, if you would like to know more about MicroStation 3D, sign up for the State offered 1-day or 3-day MicroStation 3D class.

Module Files and Folders

The activities of this module will be a combination of study and hands-on. The hands-on will work you through the process so you see how it is accomplished with the guidance of the module material. The study portion is there to strengthen the hands-on activities and add assurance that you will be able to apply it to your project, and not just the sample project.

Training Folders

As noted in Module 1, you will be working on your own local hard drive during this training.

At this point you should have a copy of the **02_Visualization** training folder and files on your local hard drive. The module folder and related files should be placed under the ***C:\WORK\Train*** folder, and should look like this:
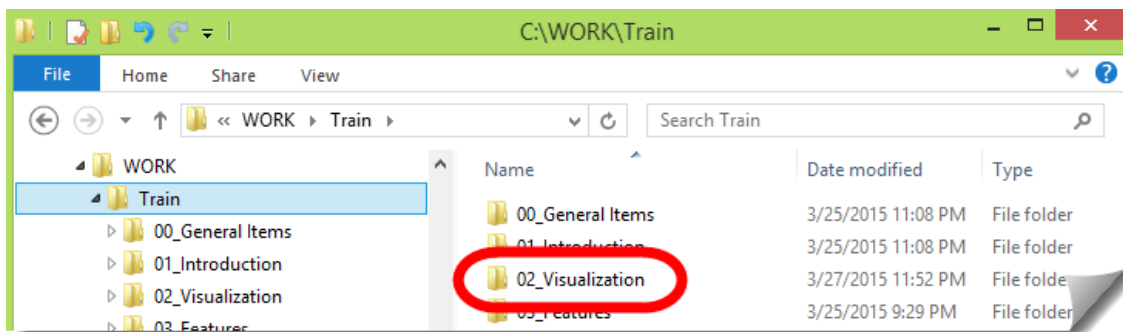
Training Files

The module folder contains any training files (DGNs, DTMs, ALGs, ITLs, IRDs, XIN and so on) that might be used during the module exercises. In this module folder you should have these files:
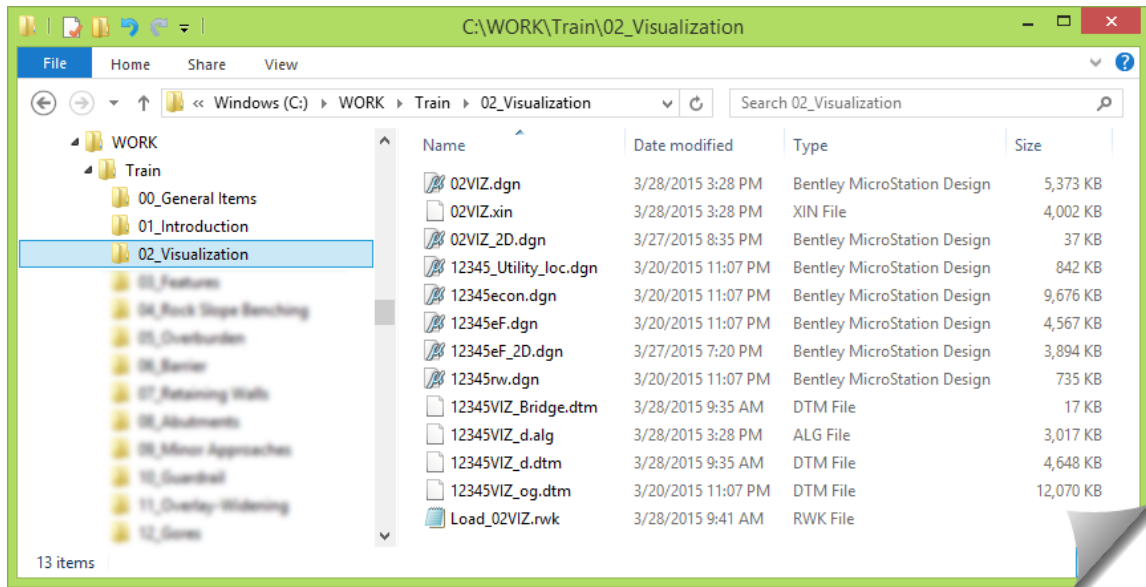
Glancing at the files you should see familiar InRoads file types, as well as the DGN files for this module.

DGN files starting with **12345** are support files, or reference files. You will see these files, or similarly named files, in many of the modules. Likewise, InRoads files starting with **12345VIZ** are also support files that may be used within the hands-on exercises at some point as directed.

Files starting with the module identifier, in this case **02VIZ**, are files that will typically be opened during the launch of the hands-on work and include:

- **02VIZ.dgn**, the initial MicroStation file used at the start of the exercises
- **02VIZ.xin**, the InRoads configuration file for this work

All of the modules will have two similarly named files that will be opened at the start.

And there will oftentimes be an **RWK** file included in the module folder to assist in opening the InRoads files using that **Project** file technique.

Technical Content of Training:

This training is primarily focused on educating the user in displaying InRoads surface data into MicroStation and then augmenting and manipulating that display for enhanced visual review.

Just as an added note here, it needs to be said that the material of this module is unlike other modules in the sense that it requires more practice. Some of the tools are just that, tools. Learning how to display surface triangles is a simple activity once you know *that* it can be done, along with *where* the command is. As you will come to discover, the subject of visualization requires more than just knowing where a tool is within the menu structure. Manipulating a 3D MicroStation view takes practice because it sometimes involves very gentle and specific mouse movements that aren't as natural as manipulating a 3D object with your hands. And the amount of practice will be different for every user. Therefore, take this time to really practice your 3D rotation skills and it will all be worth it the next time you are showing your manager your new design model.

Project Orientation

REVIEW WORK AREA

This module will be primarily using a large existing surface DTM, a much smaller bridge surface, and a newly modeled road design surface. The areas of coverages for these surfaces are shown below.
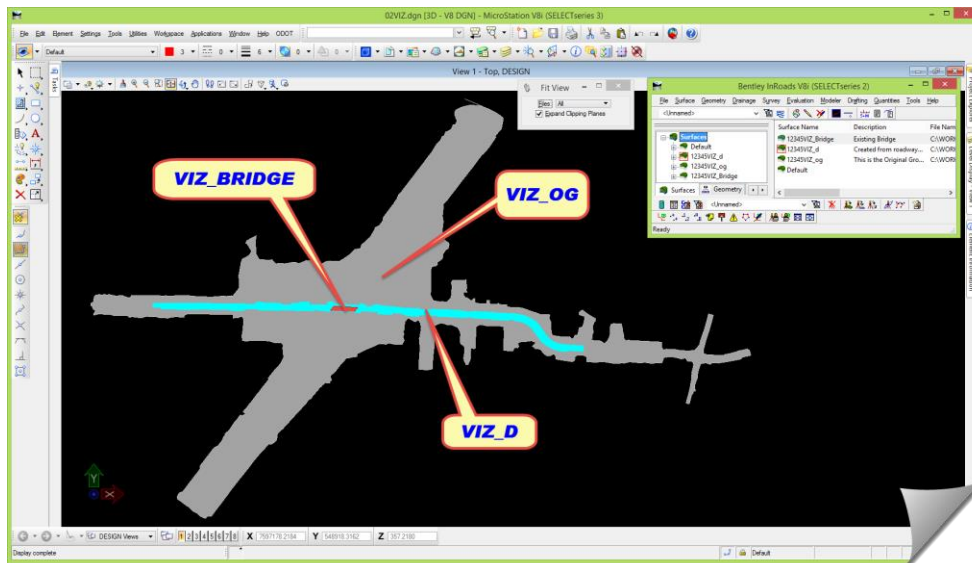


PREPARE MICROSTATION / INROADS DATA & FILES

As part of the module start-up, get into the correct DGN, load the module specific XIN and other data files and make sure everything is ready to go.

1) Launch InRoads

   Using whatever mechanism that you are familiar with to get the software started.

2) When the **MICROSTATION MANAGER** opens, set the **User** and **Interface** to **ODOT**.

3) Then browse to the *C:\WORK\Train\02_Visualization* folder and select the **02VIZ.dgn** file and click [**Open**].
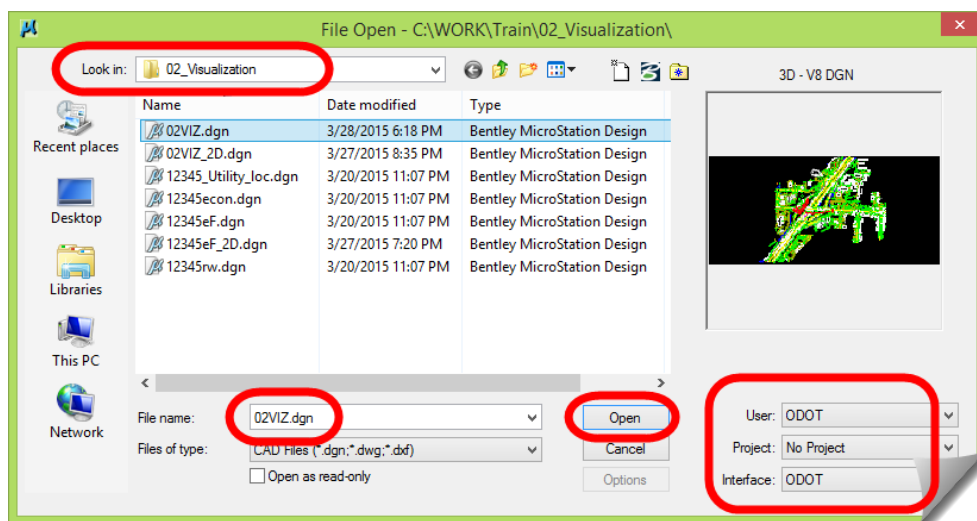
Eventually, MicroStation and then InRoads will open.

4) When the drawing opens you should see something like this.
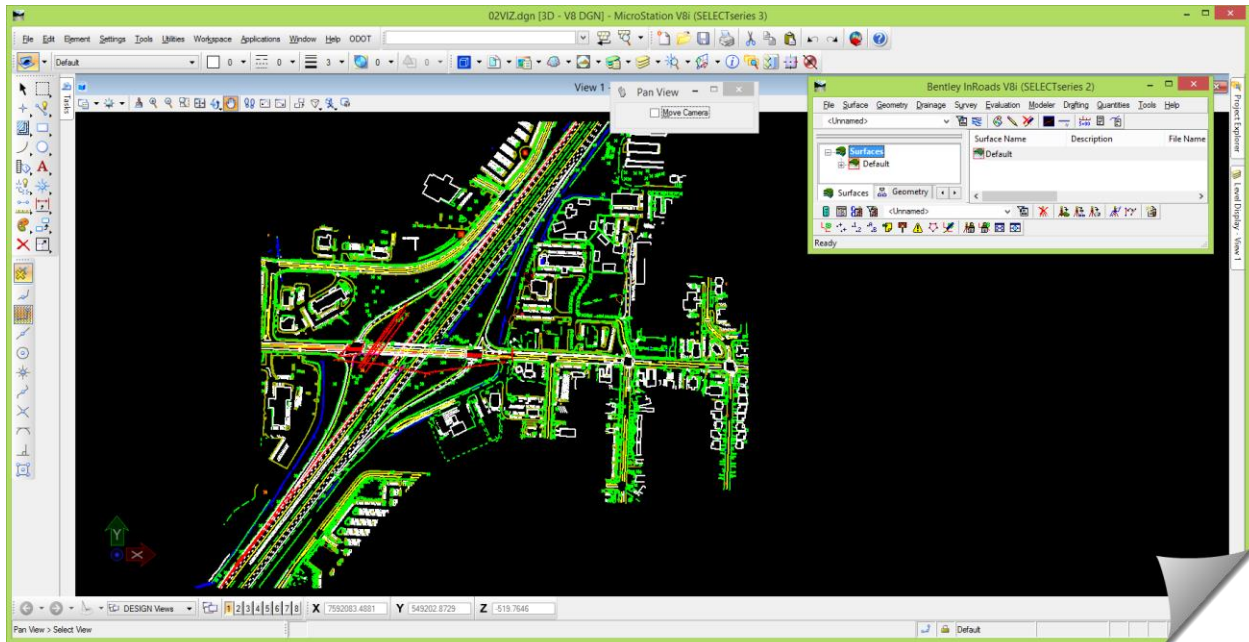
5) Open up a Windows **File Explorer** and browse to the `02_Visualization` folder.

6) Drag and drop the `Load_02VIZ.rwk` file into the InRoads interface to load the module data files.

7) Verify inside InRoads that the following files have been opened:

- `02VIZ.xin`
- `12345VIZ_d.dtm`
- `12345VIZ_og.dtm`
- `12345VIZ_Bridge.dtm`
- `12345VIZ_d.alg`

8) Now move forward into the study portion of this module. Feel free to interact with the software as needed during your study in order to solidify any of the items under discussion.

Following this upcoming study section, there will be a guided hands-on that will walk you through the application of the important tools and work processes.

Theory - Study

This module will be a mix of both MicroStation and InRoads activity with the InRoads files used to display MicroStation graphics, and then using various MicroStation tools with the viewing.

PROCESS OVERVIEW

This section will continue with additional orientation to 3D as well as discussing specific tools and work processes.

Things to Consider

Some of this may be low level subject matter; however certain topics have to be touched on at least superficially in order to introduce this topic and gear up for our specific applications. If some of this appears very basic to you, just consider yourself ahead of the curve, and continue through.

2D versus 3D Overview

Regardless of your locale or project role, Engineers and Designers have been thinking in 3D from the start; long before computers. And with the introduction of computers it might have appeared to some that things where changing. The only thing that has changed is the calculator that is now being used. It's much more powerful and has a much larger screen.
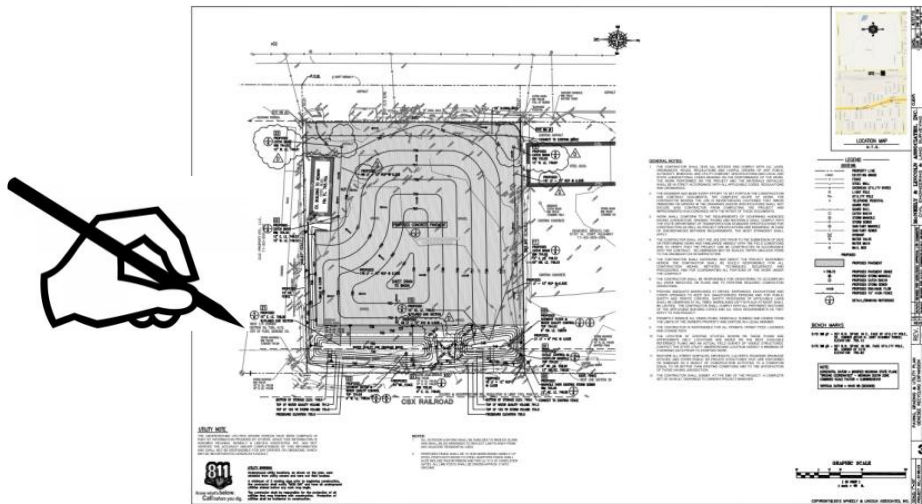

From an InRoads perspective the **SURFACE** DTM is always in 3D. The **GEOMETRY** contains the 3D piece in the Vertical alignment. The **TEMPLATE LIBRARY** is a 3D developmental stage, and combined with the **ROADWAY DESIGNER**, the output is a 3D design DTM.

From a MicroStation perspective the DGN file can be either 2D or 3D, and in fact, it shows you that fact at the top of the MicroStation window next to the file name.
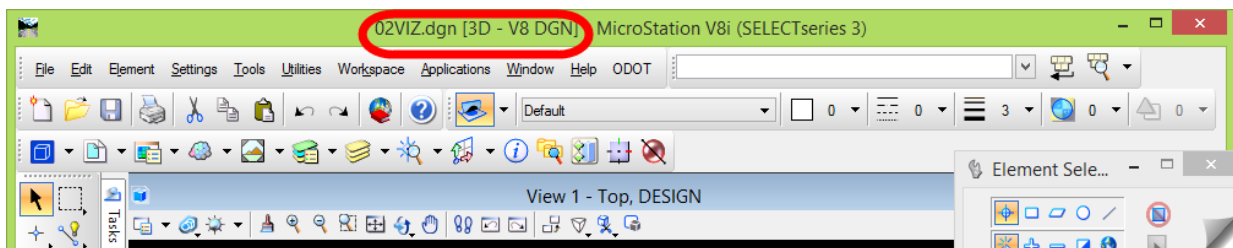
This is important because if you are not in a 3D file the content that we are covering here will not be able to be done.

If you want to know a lot more about MicroStation 3D you should sign up for one of ODOT's MicroStation 3D classes. Very briefly here, a 2D file is a simple X / Y plane.
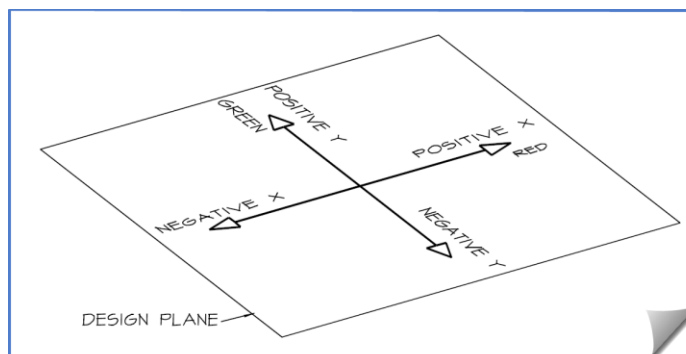
Imagine that a 3D file is a cube of space with an additional Z plane.
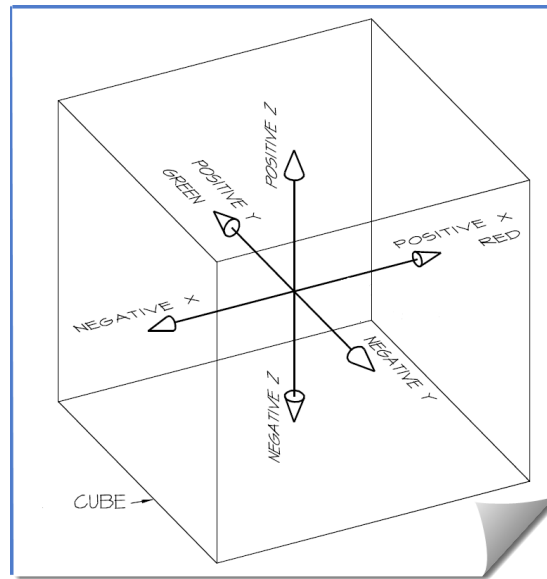
All that this means to you is that you have an expanded capability for rotation when you are dealing with a cube versus a two-dimensional sheet of paper, with respect to viewing. Of course constructing something in 3D versus 2D is another subject entirely. The topic in this module is mainly regarding "viewing".

Rotating Views

Yes, this is very basic, but that's where it starts.

When you have a flat piece of paper, or a drawing that is just in a 2D file, the rotation is very limited and restricted.
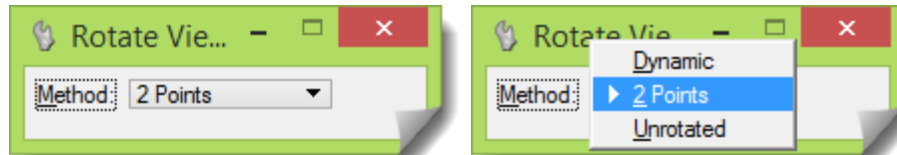
And the rotation is only able to spin the view like it's a piece of paper lying on a table.

Feel free to take a piece of paper and place it on your desk. Place your hand on top of the paper and turn your hand clock-wise and then counter-clockwise. This is the only rotation that is allowable when working in two-dimensions.
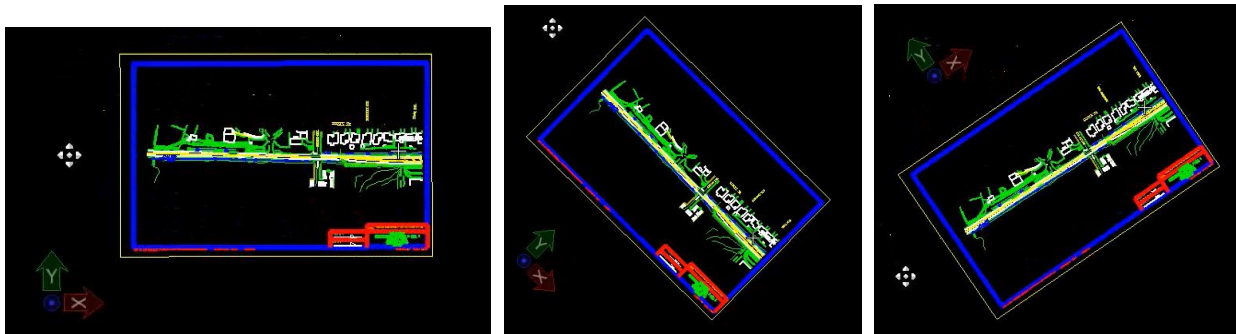
In a three dimensional drawing you can rotate the view in any direction like holding a Rubik's cube in your hand and spinning it around to look at it from any angle.
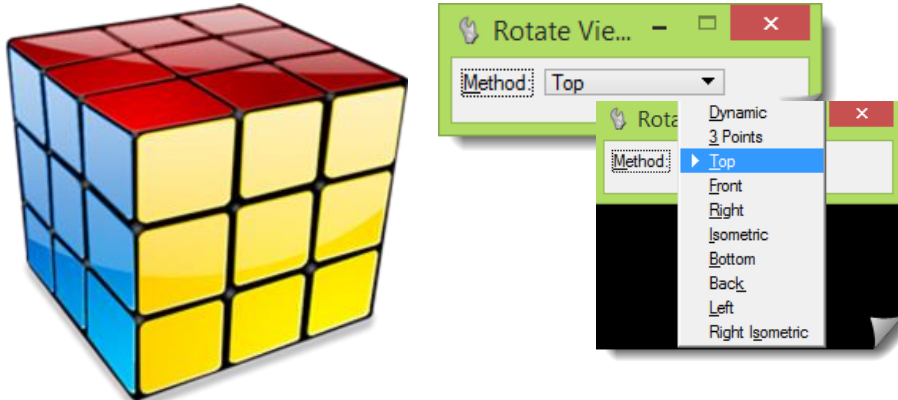
So another 3D trigger to be aware of is the **VIEW CONTROL** tools on the MicroStation view frame. First, there are a lot more of them, and second, the **ROTATE VIEW** tool has many more optional **Methods** available when in 3D versus 2D. (Compare the image above with the one on the previous page.)
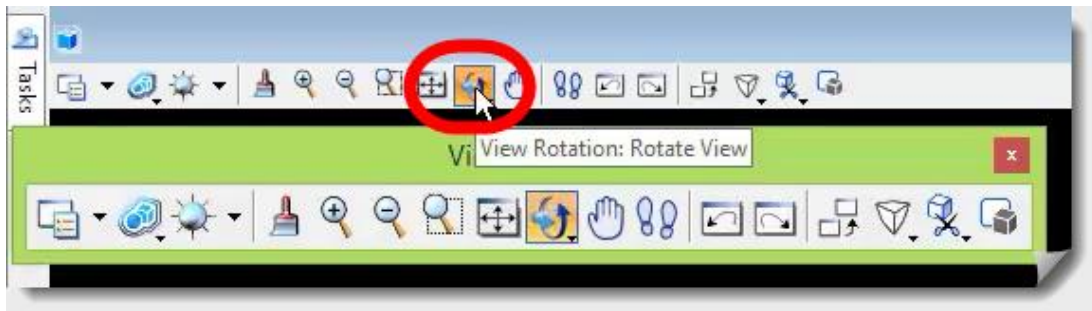
And for anyone that has ever taken a drafting class in school, the idea of looking at something in **Top** view, versus **Front** view, versus **Right** / **Left** side view, versus **Isometric** should be very familiar. Mechanical parts are more conducive to this type of viewing, and it might be a stretch to apply it to a civil project, but 3D is 3D and a view is a view regardless of the 'object'. In the Civil world the 'object' is just <u>really</u> big, like an intersection or bridge.

Rendering Modes

Rendering modes, or what MicroStation calls **Display Styles** are just view settings, similar to choosing to view line weights or not. Nothing is actually happening to the drawing itself, it's only changing something related to the presentation of the information that is already there.

The latest versions of MicroStation have added quite a few new **Display Styles**, and are worth experimenting with to find ones that really accentuate what you are trying to show or find.

One place these **Display Styles** can be found is under the **VIEW ATTRIBUTES** on the view frame.

The normal **Display Style** that is on by default is the **(Wireframe Display)**.

If you select the **VIEW ATTRIBUTES** you'll see that there are quite a number of predefined **Display Styles** available for immediate use on your 3D display.
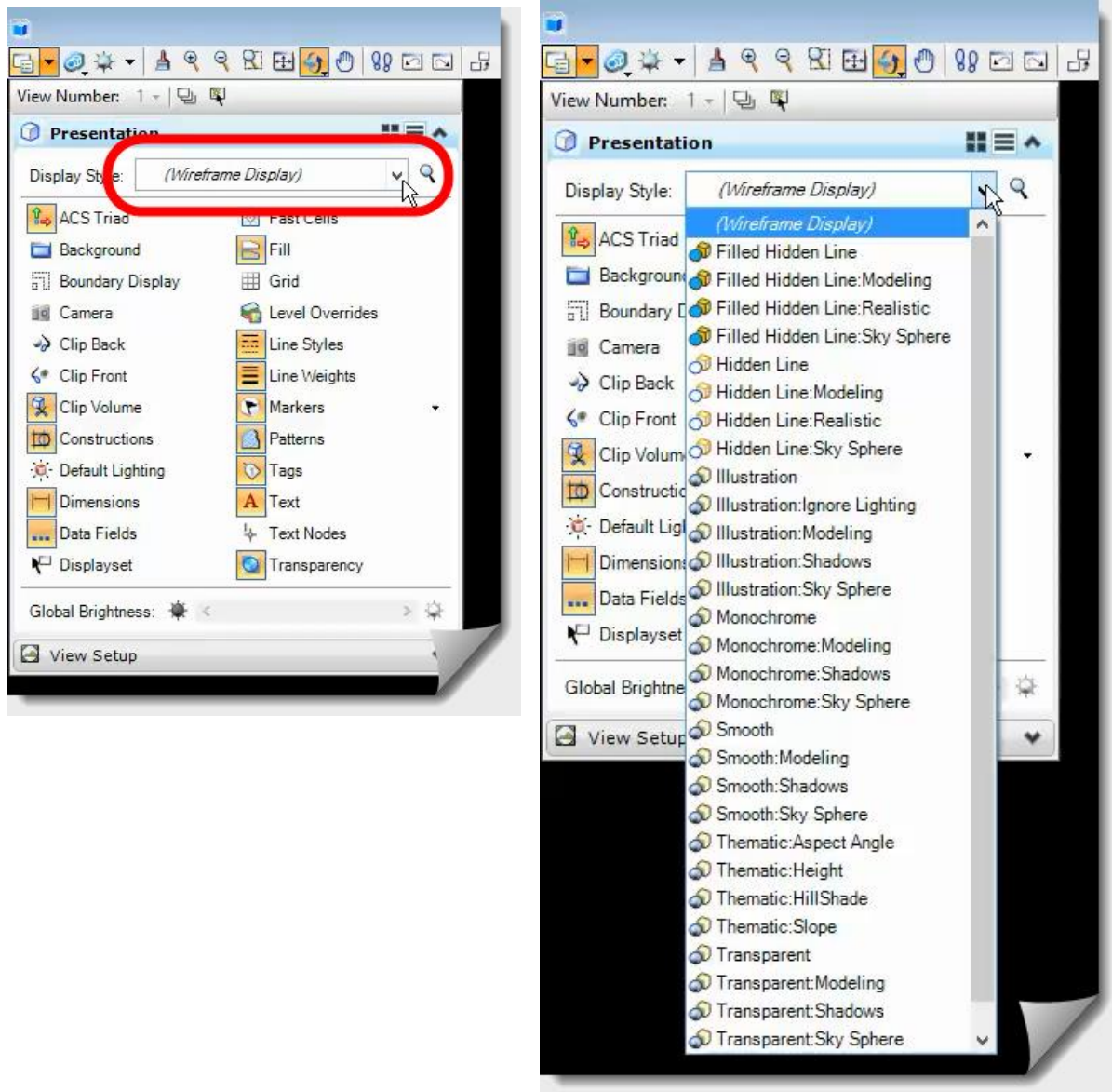

Now, keep in mind that these **Display Styles** can only be 'applied' on certain types of display elements, and don't always work on all elements.

For instance, you can't just draw two parallel lines and create rendered shading between those two lines. There is more to it than that, and there has to be some sort of surface, or plane, or mesh created in some cases.

In this module we'll be covering some of the basic out-of-the-box rendering modes and will not be adjusting any of their settings. The focus here will be how to use typical InRoads viewing tools and out-of-the-box rendering capability and seeing how this existing, fairly straight-forward functionality can be used to our advantage.

You will have a chance to try out the **Display Styles** shortly, but here is a glimpse at a few:
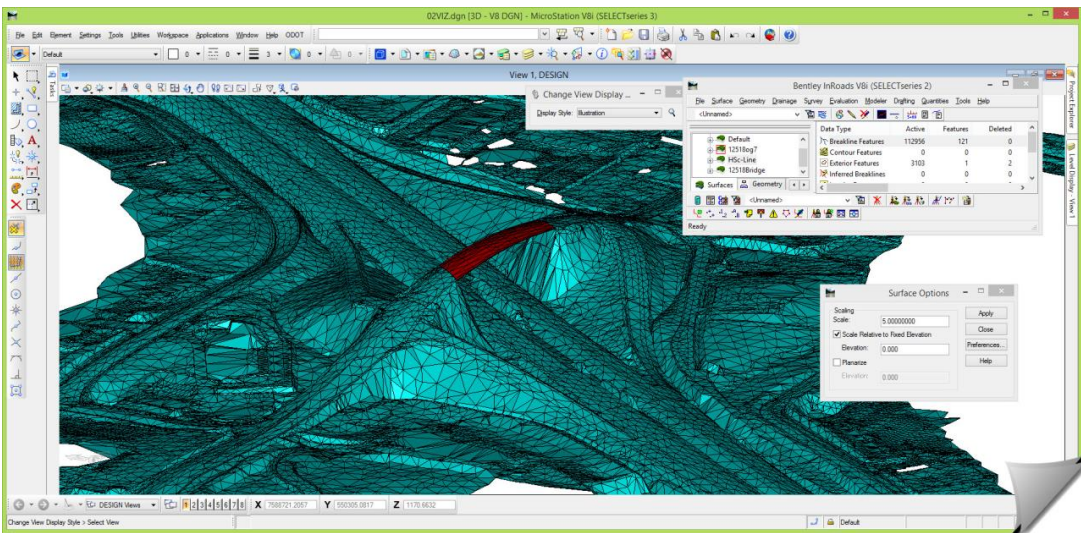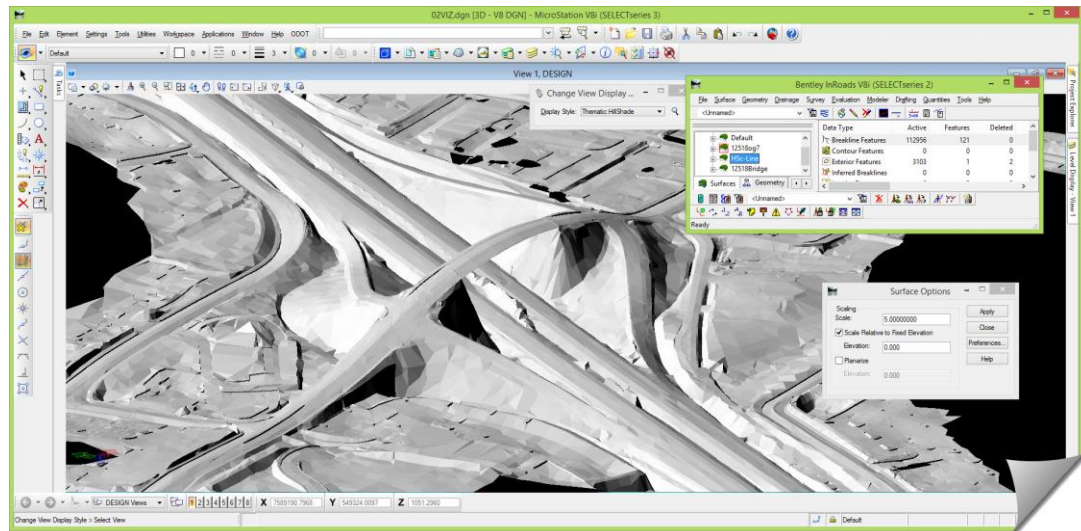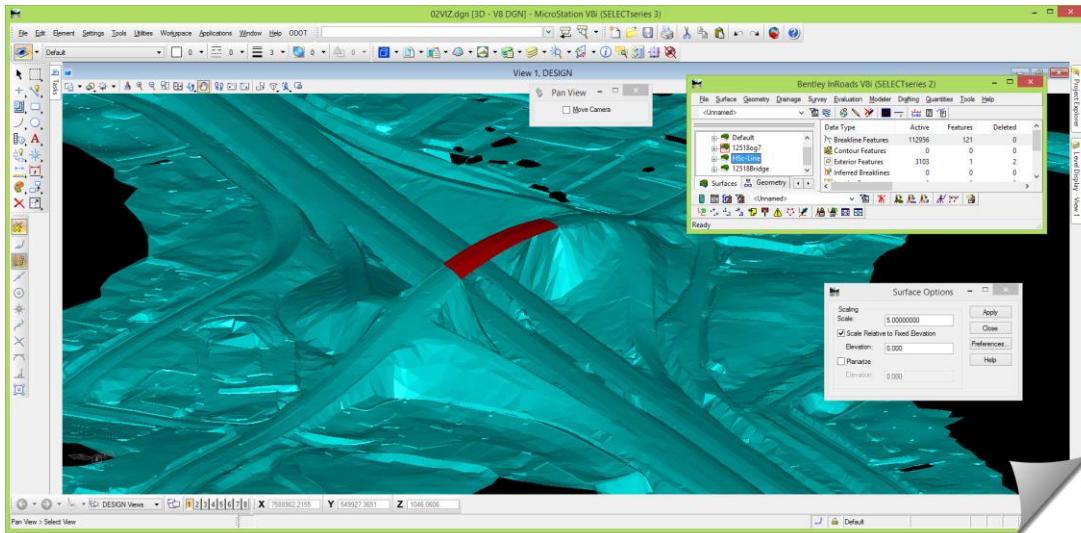
There will be more about applying **Display Styles** later on in this module.

Adjusting the Colors / Brightness

Of course, like most things within MicroStation and InRoads you'll have some flexibility to adjust colors and image brightness. This is really a personal thing that is heavily dependent on your monitor, the resolution of your screen, what you are trying to show as well as just personal aesthetic and visual taste.

One of the tools that you will be working with, to adjust the brightness, is also on the **VIEW CONTROL** tools called **Adjust View Brightness**.
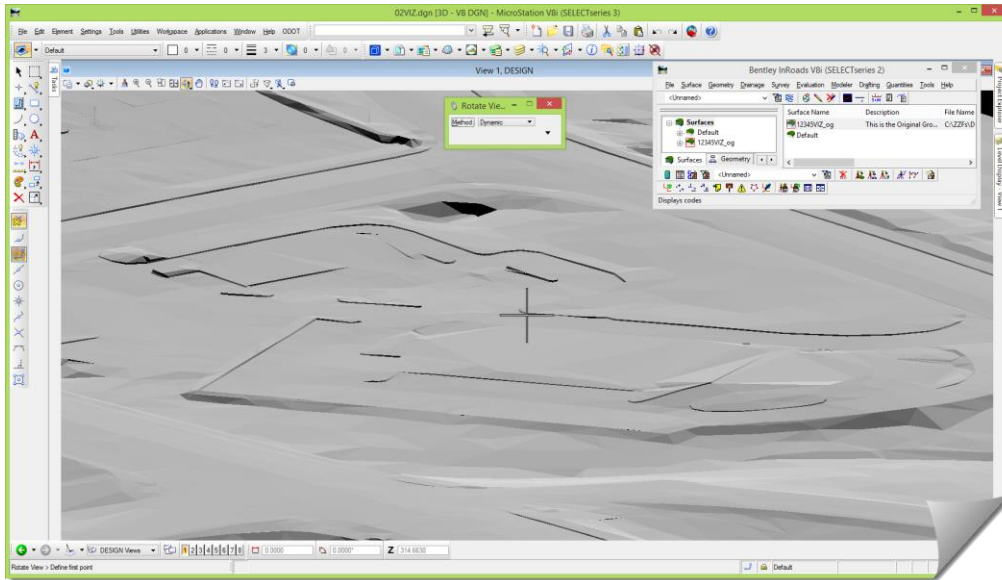

You will find yourself doing this whenever the element colors and shading just don't have enough contrast, resulting in poor readability.

Compare these two examples:
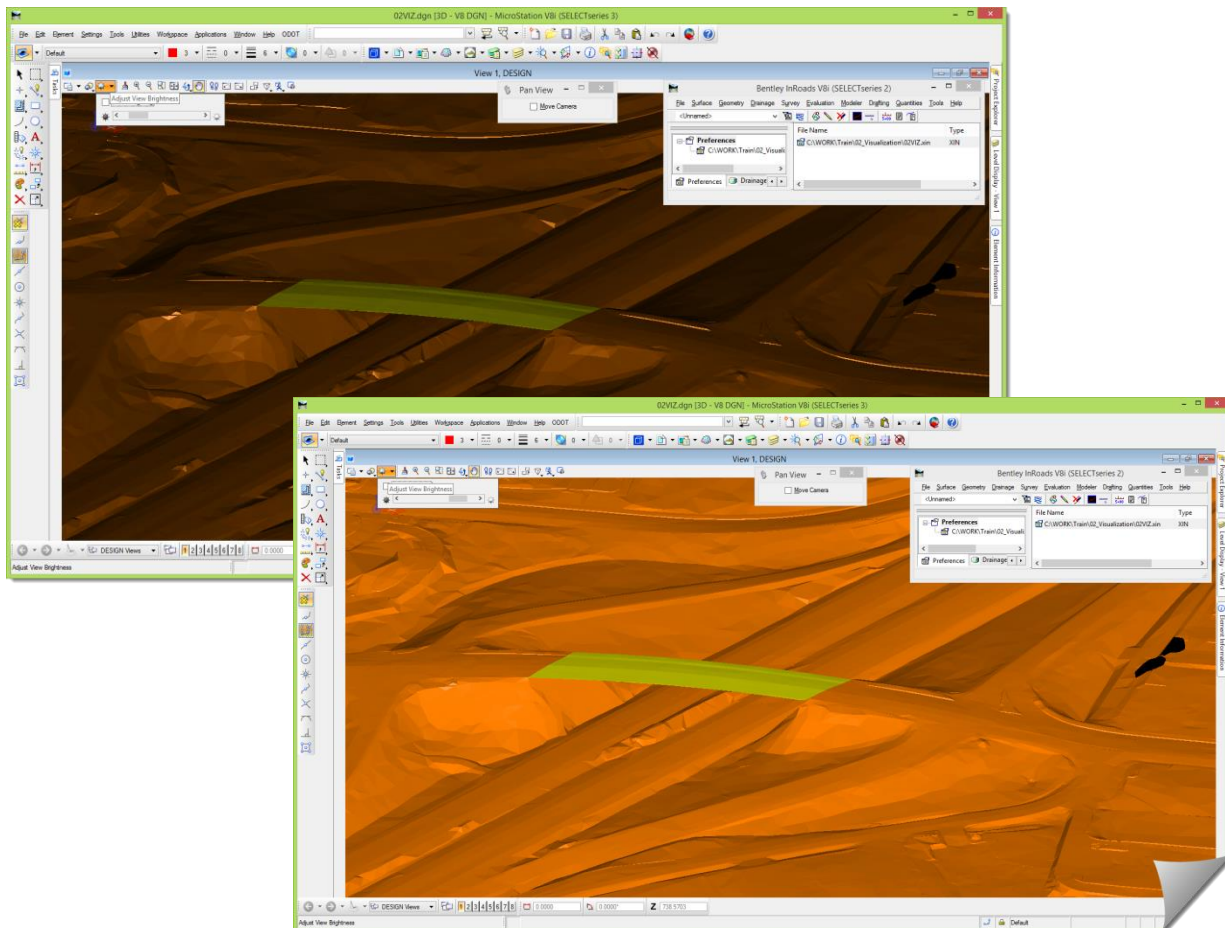
Vertical Exaggeration / Z Scaling

Some projects have very little elevational relief to them, and when you view the actual real-world data in 3D it's not too revealing.

The technique you will practice later is the exaggeration, or **Scaling** of the display of the InRoads data. This combined with the various **Display Styles** will really help the surface review process.
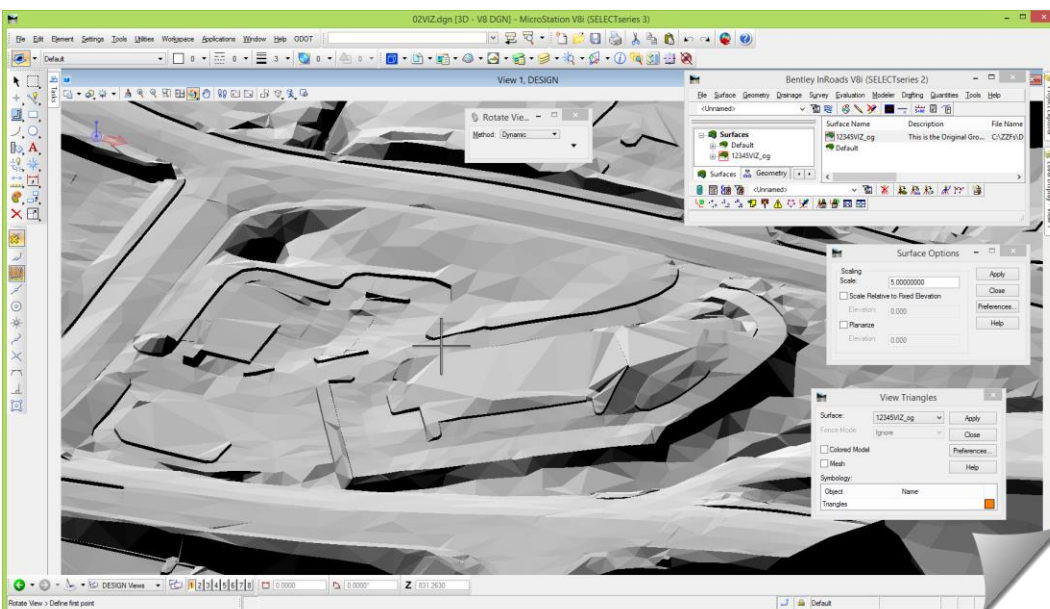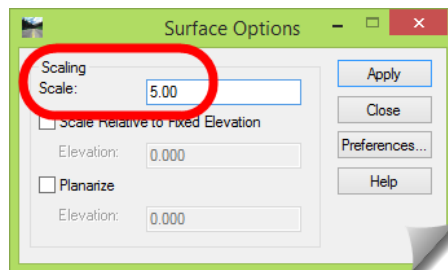
And the **Display Style** that adds the layer of triangulation on top increases the ability to locate surface anomalies and oddities.
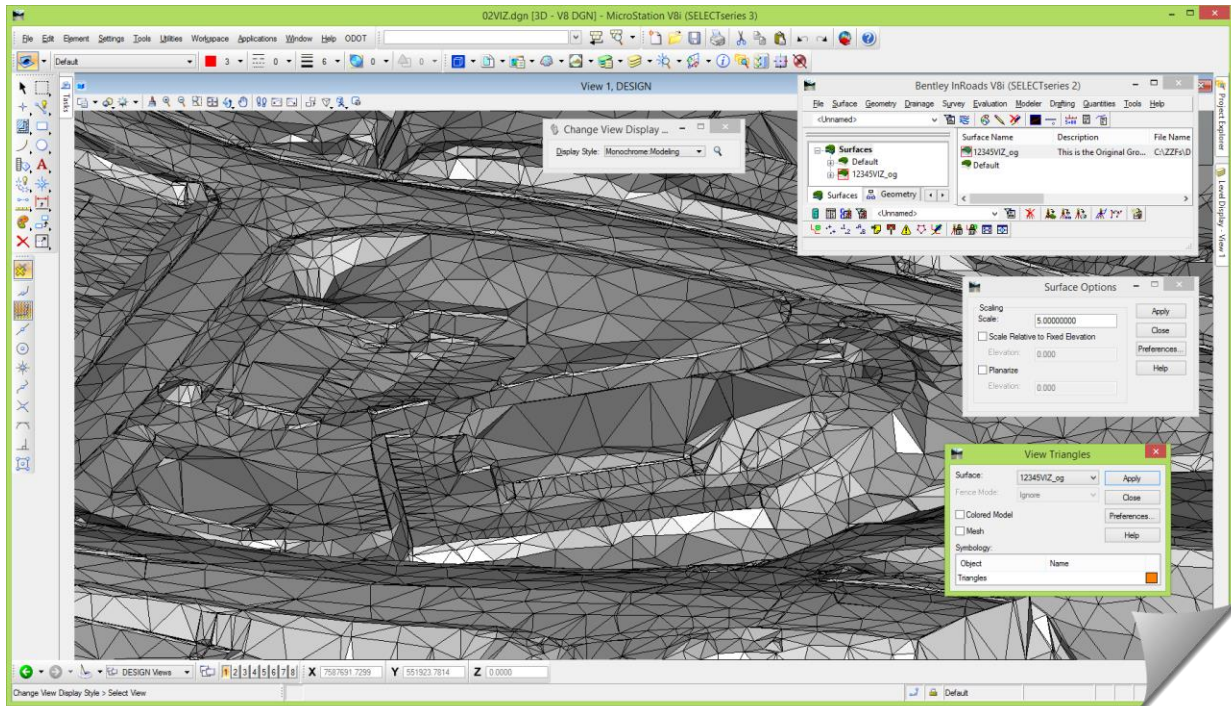
Techniques and Tools

Let's discuss a little bit about what you will be doing with InRoads relative to addressing the subject matter of the module and talk about the techniques and tools that will be used, and how they will be used within the workflow or process.

The MicroStation level tools will basically be focused on the topics just covered:

- Working in a 3D file versus a 2D file
- Applying different **Display Styles** to the InRoads display
- Modifying the **ADJUST VIEW BRIGHTNESS** setting for improved viewing
- Using the **ROTATE VIEW** to get the right point of view of the surface

At the InRoads level we have these few items:

- Adjusting the **Scale** of the displayed InRoads data
- Viewing **Triangles** of a surface
- Viewing design surface **Components**
- Viewing surface **Features**

Of course on the InRoads side of the fence the display is 100% contingent on the level of accuracy and detail within the surface model DTM itself.

Let's briefly discuss a few InRoads related items and then get into the hands-on. This will be rather simple because from an InRoads perspective you will not be doing anything that you haven't already been doing, namely, using the **VIEW TRIANGLE** command and the **VIEW COMPONENT** command. (If you haven't used the **VIEW COMPONENT** command, it's very simple and not much to it at all as you will find out.)

Viewing Triangles

Even though contours are held in high esteem in the Civil Engineering world, it's the triangles that are probably the most revealing. That is, if you understand what they represent and shift your visual (and mental) acuity from contour 'lines' to triangle 'faces'.

Here's a good example:

This is a 0.50' contour interval in the same area that has been shown earlier.
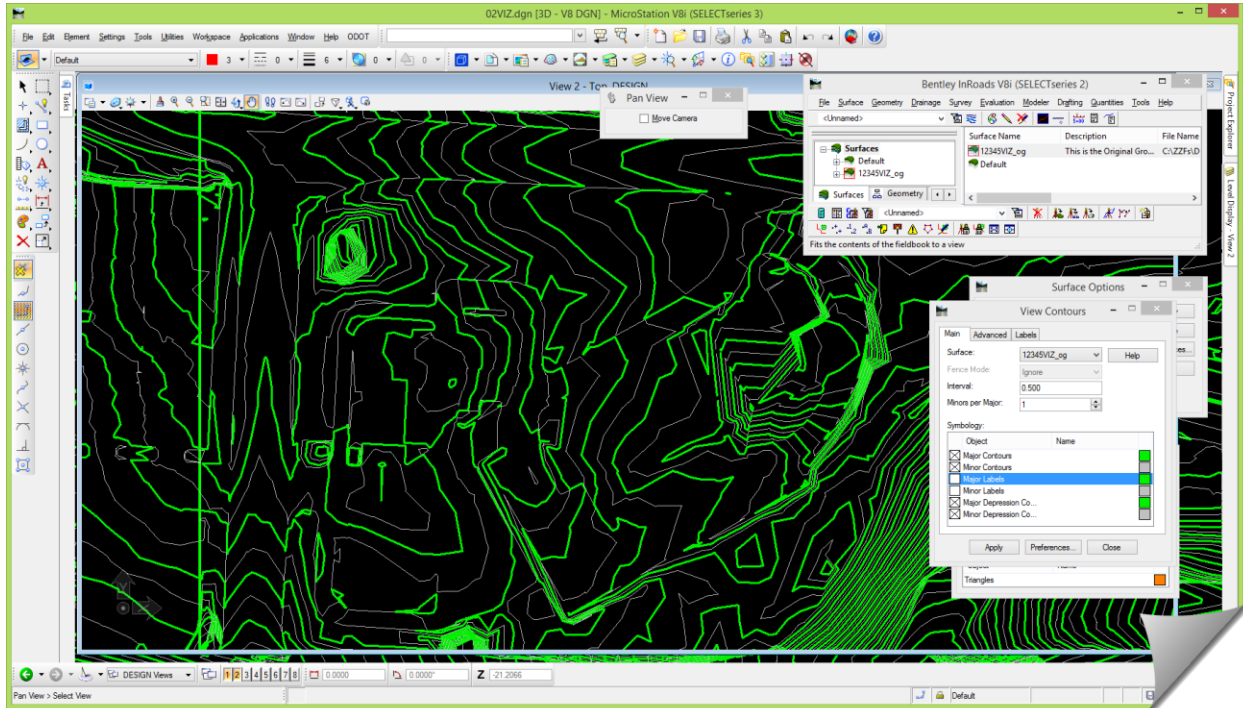
What can you see from these contours? List out what you can decipher from the contour patterns in the picture above:

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

7) _____

8) _____

9) _____

10) _____

If you are pretty savvy with reading contours you will definitely see some things. But can you make out the details of the site? Not just the 'lay of the land', but details like site features.

There are some obvious contour patterns that depict certain features and conditions. What can you see?

How about with this view?
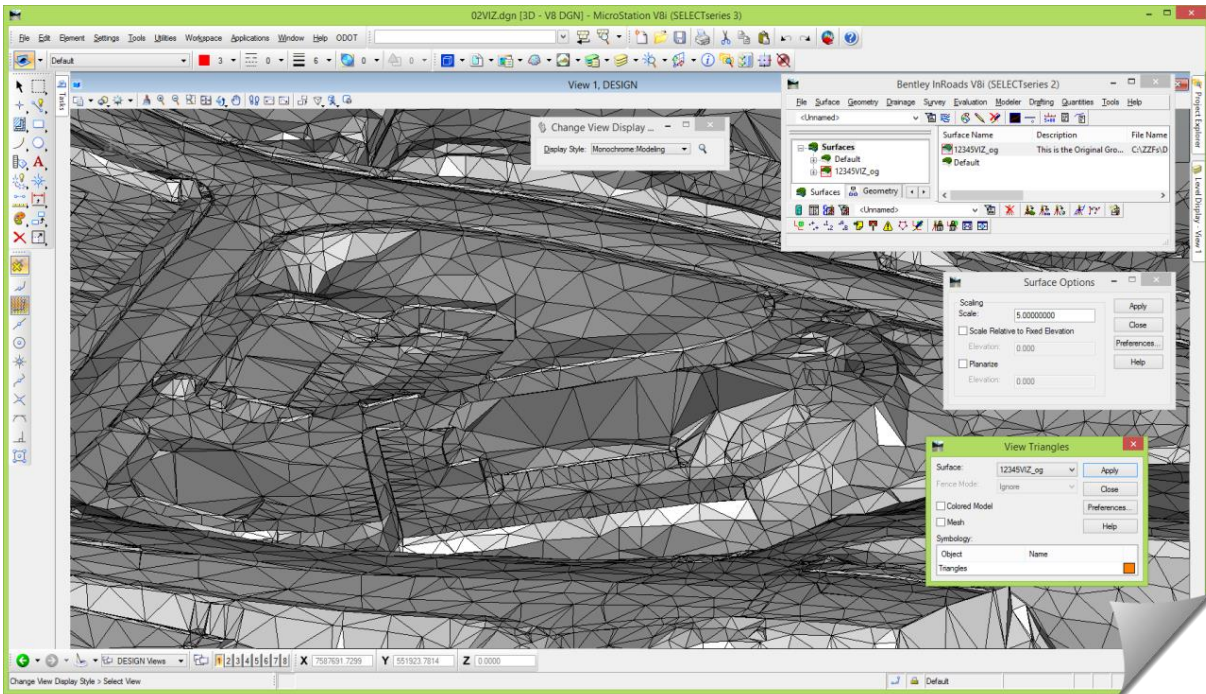
Looking at 'solids' is a different style of ground representation than 'old school' contours and you have to start training your eye to read 'facets'.

With this type of viewing, the sequence will be:

- Start with either a blank DGN, or turn off any levels that might cloud the view.
- View the triangles of the DTM, applying vertical **Scaling** as appropriate for the terrain.
- Start rotating your view and focusing on familiar areas of the design so you can start training yourself to recognize and correlate elements of the design with the display.
- Try different **Display Styles** to change the render mode to accentuate aspects of the surface as desired

Viewing Components

Components are a result of modeling with templates and the **ROADWAY DESIGNER**. Components are basically shapes or parts of a design like a roadbed, or aggregate layer, or sidewalk, or curb.

These **Components** are most often configured and viewed in Cross Section; however they can also be viewed in **Plan View** and this will be discussed later in this module.
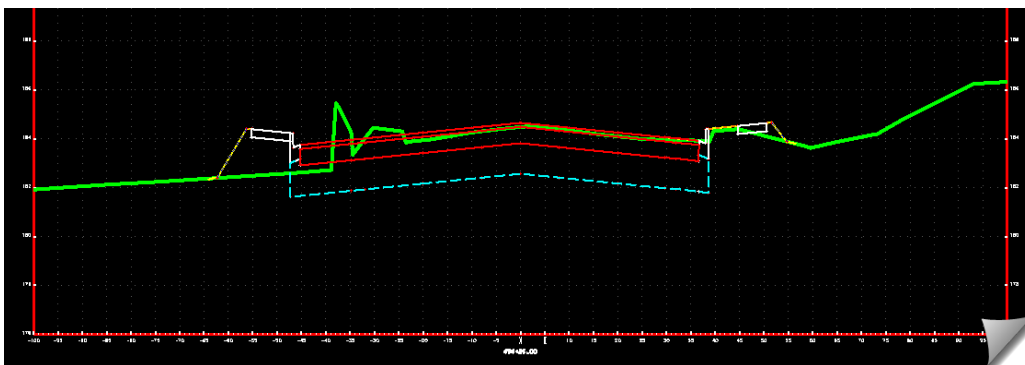
<u>Viewing Features</u>

Viewing **Features** takes a back seat to viewing **Triangles** and other planar elements for the reason mentioned earlier. Features are not 'render-able'.

For example, how readable or valuable are these **Features** in this rotated view?
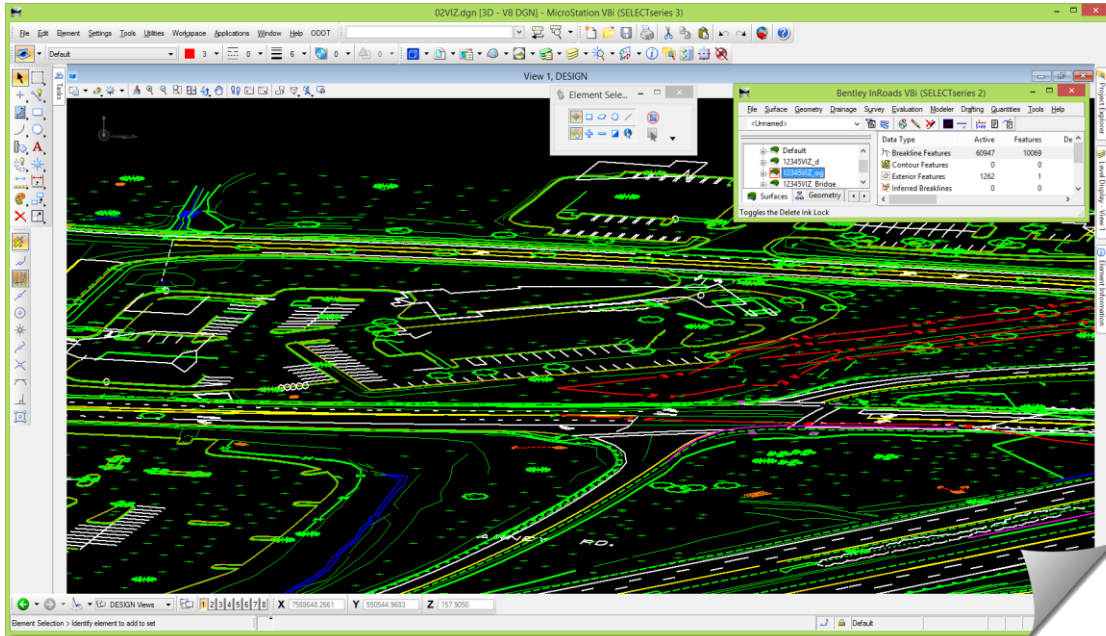
The displays that contain the most value are those that display shapes and surfaces like a **Mesh**, **Triangles**, **Gridded Models**, or **Components**.

But don't write-off the actual surface **Features**, because those entities are the keys to constructing the triangulated model. When something incorrect is located in a rendered view, you will find yourself going back to the individual **Features** to make any needed edits. Features can be viewed in conjunction with the triangles to look for discrepancies.

Practical Application - Hands On Lab Exercises

This following section consists of the guided application of the tools and techniques. This will require you to use the applicable sample files and work through the exercise while studying any additional content integrated into the steps. Refer back to earlier material as needed.

UNDERSTANDING THE DETAILS

Now that you've gone through a study of the basic theory, this section will be taking that knowledge and combining it with application.

Review any relevant project data

Let's start by doing a quick review of the relevant MicroStation and InRoads files, which in this case are fairly lean.

At this point, just as a recap, you should be in MicroStation and have the **02VIZ.dgn** file open. You should also have InRoads open, and having loaded the RWK, should have the **02VIZ.xin** open, as well as the three surface DTMs and the **12345VIZ_d** Geometry Project.

If you don't have these open, please open this information now. Feel free to refer back to pages 5 and 6 of this document if needed.

1) You should be looking at something like this:

   If you aren't, don't worry, just follow along and jump in whenever it makes sense.
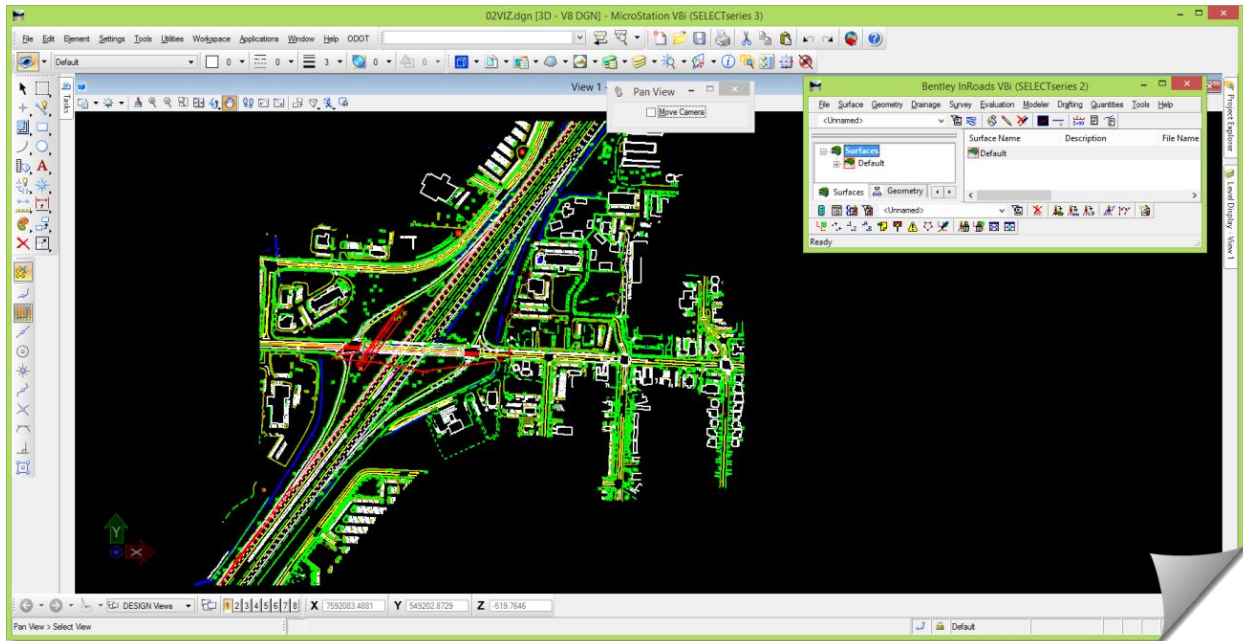
2) Open up the MicroStation REFERENCE dialog box and you'll see that there are a number of references attached to the drawing that you are in.
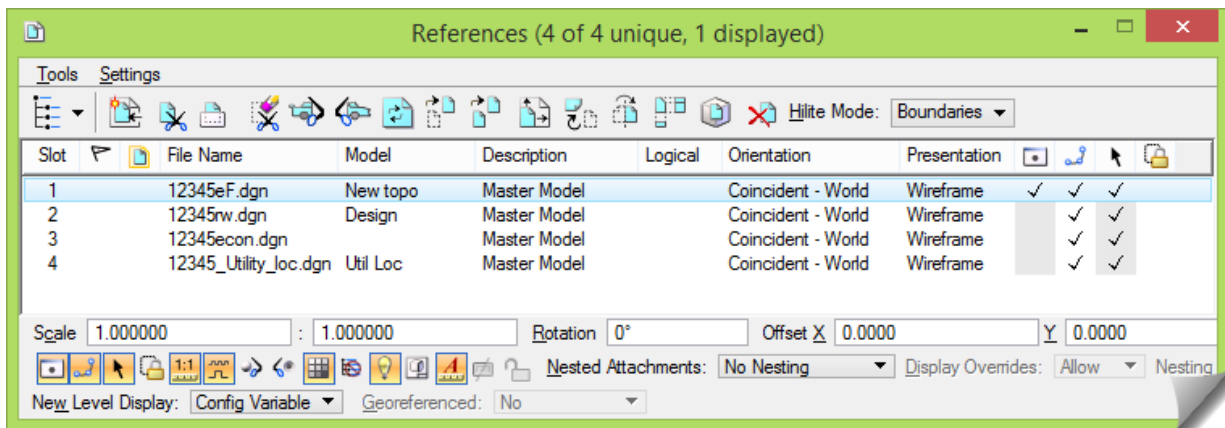
The references contain information about the base drawing, utilities, existing contours and the right-of-way. We won't be using these references during this module, but what you are seeing here will be similar in future modules. So if you feel the desire to explore these references, go ahead.

3) Toggle *off* all of the **References** for now.

   The MicroStation file that you are in right now is more or less completely empty. And when it comes to the display exercises that will be coming up, it's very common to be in an empty file with all of the levels on. This way there isn't a lot of potential clutter in your 3D view. If there is something that you want to see in your MicroStation view, the best thing to do is to reference it.

   Now let's take a look at the limits of the surface data that is currently loaded into InRoads.

4) Go to the **PERIMETER** command under *SURFACE > VIEW SURFACE*.

5) View the **PERIMETER** of each of the 3 surfaces that are loaded, and load a unique **Preference** for each one so that the colors and symbologies are different for each.

It should look something like this once you are done.
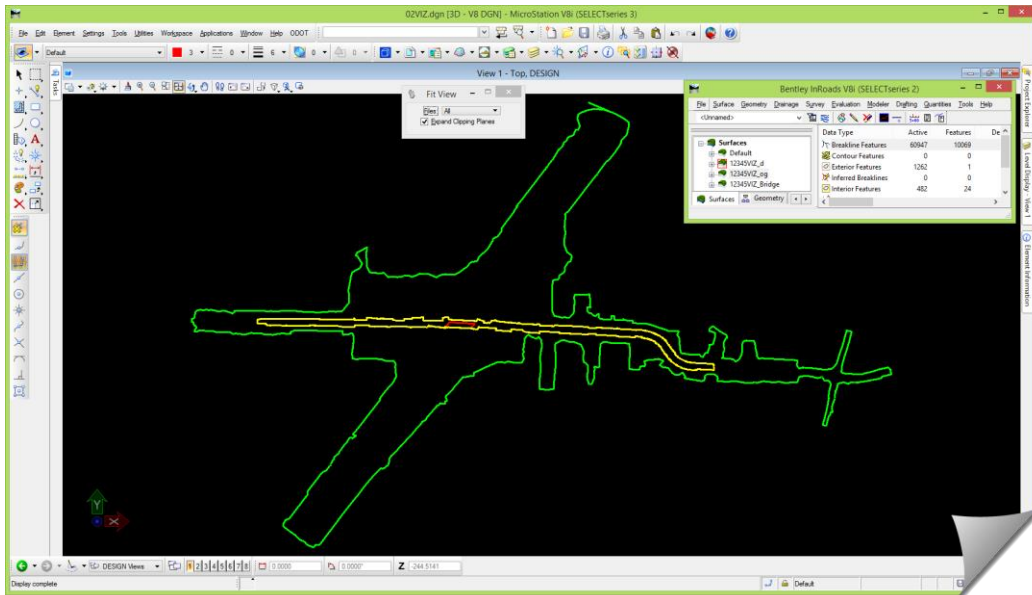
Later in this module we'll need an alignment in the **Geometry Project**, so let's take a look at that.

6) Go to the **GEOMETRY** tab on the **Workspace Bar** and expand `12345VIZ_d`.

7) Scroll down until you see the `HSc` alignment (Hillsboro-Silverton Hwy). Right-click on that alignment and **View** it.

You should see the alignment appear running East-West, and also notice that it's running right through the `12345VIZ_d` surface. That surface is a design surface that was created along the `HSc` alignment.
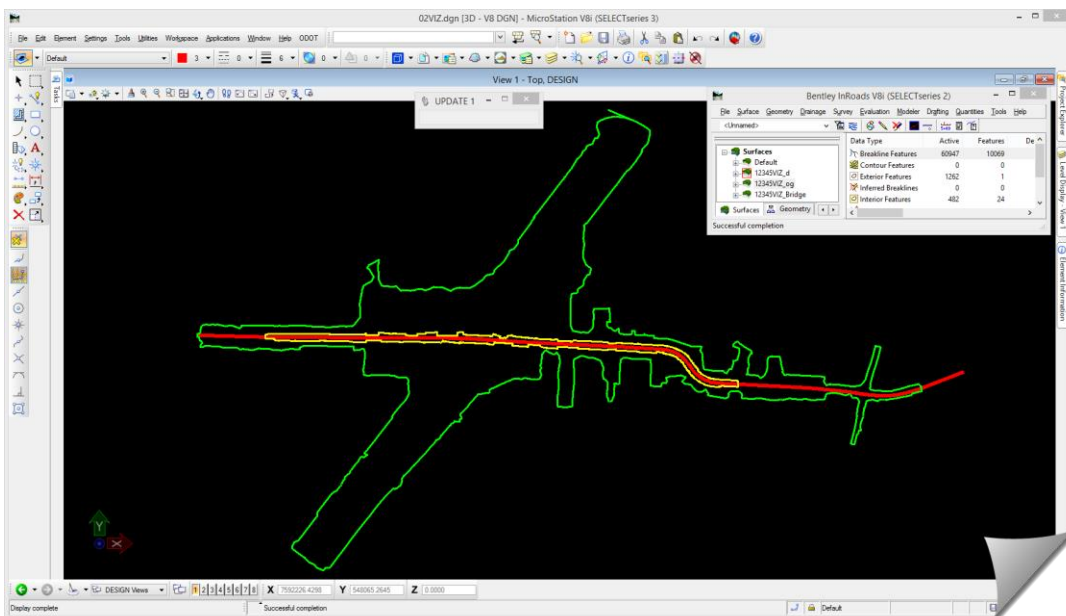
8) Now that you are familiar with the areas of each surface, along with the alignment that we'll be using later, go ahead and delete those graphics.

Review any relevant ODOT CAD / InRoads ITL / XIN information

This module is not really focusing on any particular aspect of the ODOT CAD standards from either a MicroStation or InRoads perspective. In these exercises you will be using some pre-made surfaces and geometry that were created using the ODOT standards. These InRoads files have the usual **Styles** and **Named Symbologies** applied to them, and you will be just moving ahead with the work that has been done on these files.

If you have the interest to look at these models and their **Features** in more detail, feel free to review them in the **FEATURE PROPERTIES**, or **SURFACE PROPERTIES** tools.

Also, regarding the **Preferences** that were used earlier, or will be used later, they are of little importance in the grand scheme of what you need to learn from this module. It is expected that when you go to the **VIEW PERIMETER**, or **VIEW TRIANGLE** command, that you know what **Preference** to load for a particular surface. The focus here in this module is what you can do after you've viewed that information.

If there is any relevant correlation between the ODOT CAD Standards and these exercises it will be pointed out at that time.

SCENARIO 1 - TRIANGLE DISPLAY

This section will continue from where the module left off earlier, and walk you further into this topic of visualization.

Viewing Triangles

Let's start where you get the most for your efforts. **VIEW TRIANGLES**.

1) Make sure all of the graphics in your DGN file are deleted.

2) **VIEW TRIANGLES** for the `12345VIZ_og` surface.

Other than your color may be different, it should look like this.
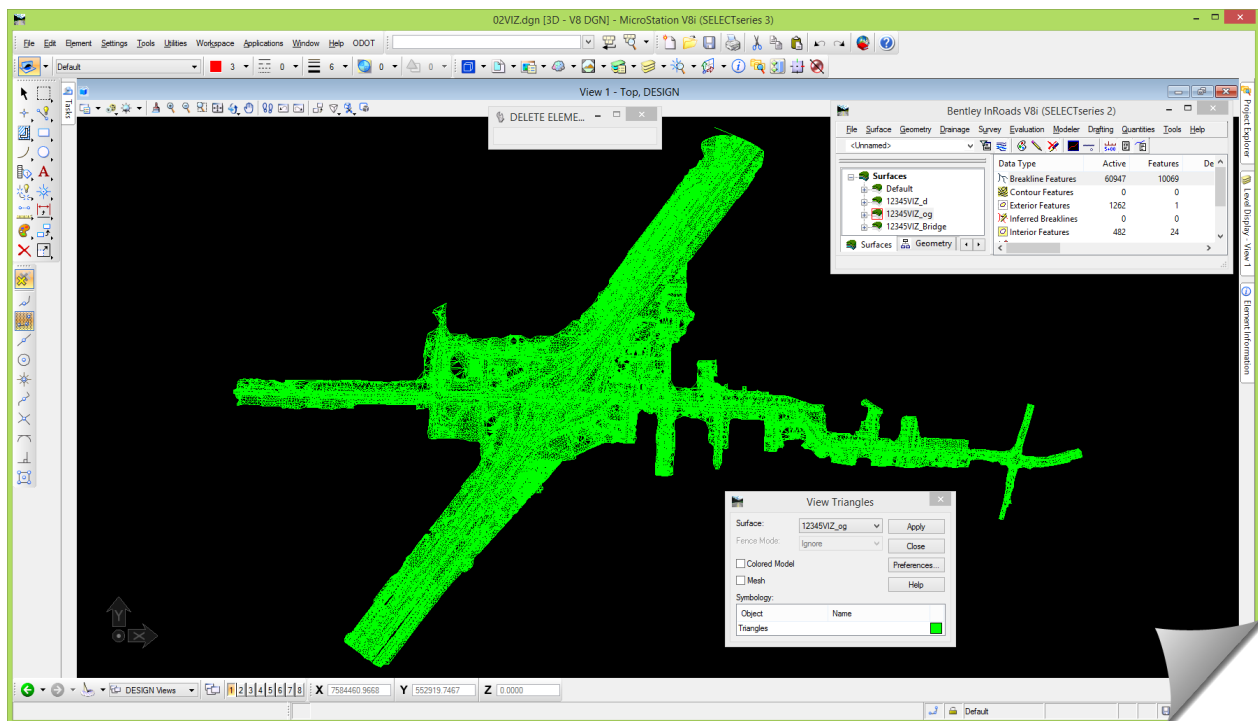
TIP: The VIEW TRIANGLES command has an option to display the triangles as a **Mesh**. This option 'weaves' the individual triangles together. The benefit of this is the display is graphically leaner, and hence faster. The drawback is that it can't be scaled vertically.

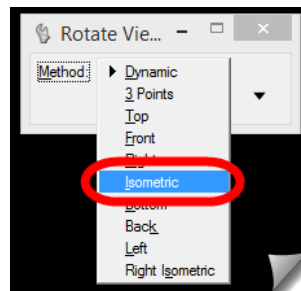Now comes the part that will require the most practice – **View Rotation**.

3)   Select the ROTATE VIEW command on the view border.
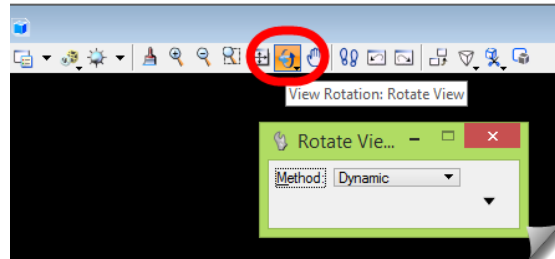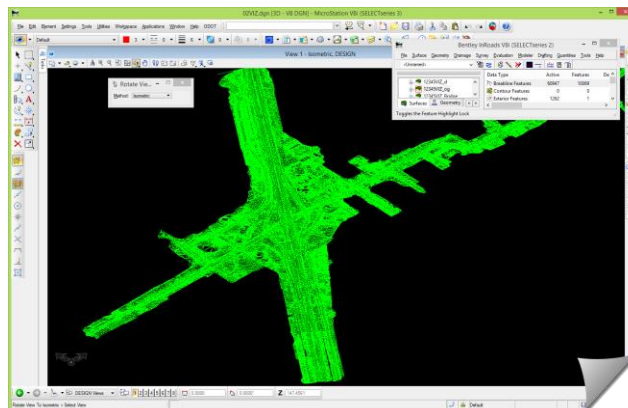

To get started with the rotation, you'll use the **Method** called **Isometric**. Not that it's very important, but **Isometric** is just a fixed, built-in rotation that aligns the model like this:
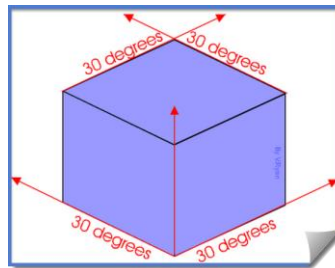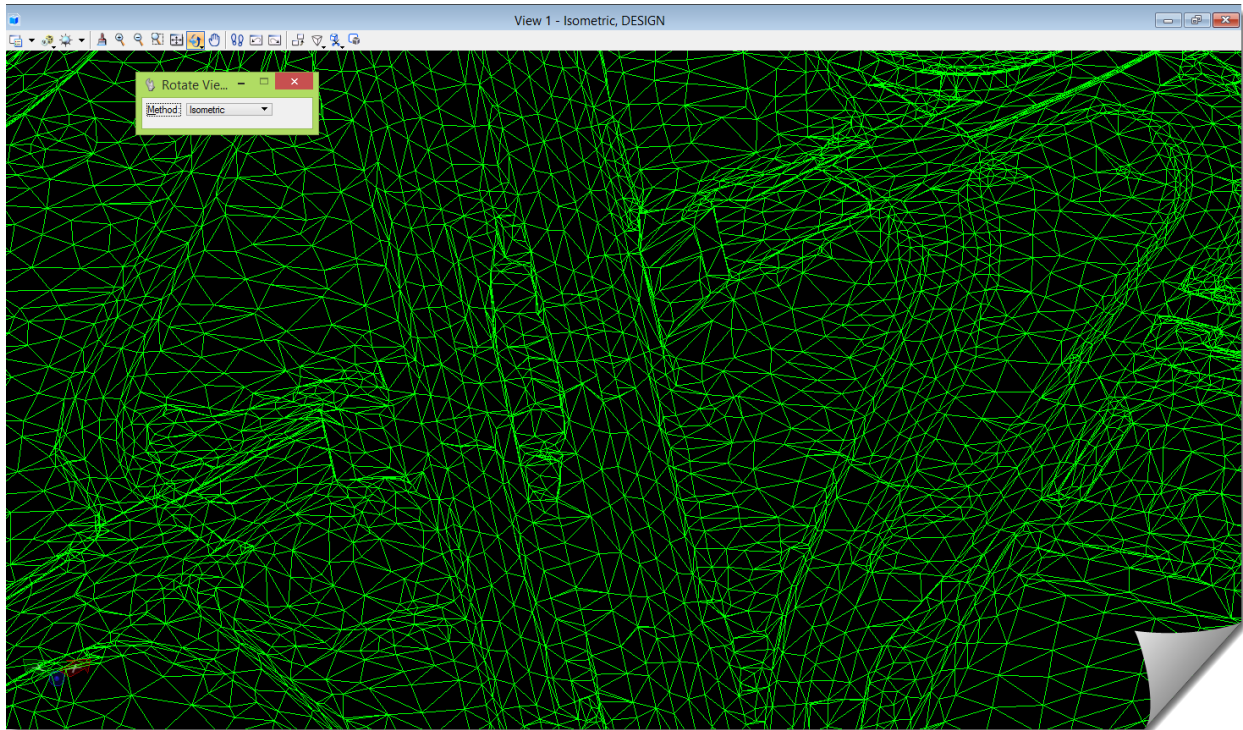

4)   Set the **Method** to **Isometric**.


The view should look something like this:

5) If you zoom in and out you won't see very much 3D viewing. That's because the angle of rotation just isn't positioned well enough to see anything interesting. And it almost just looks like a top view.

6) **Fit** the view, go to the **ROTATE VIEW** command and set it to **Dynamic**.

You should see a large white plus sign in the view. That's the **Pivot Point** for the view rotation.
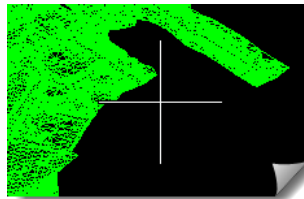

7) Hover your mouse over the **Pivot Point** and you should see it highlight. If you hold your mouse down on it, you can grab it and move its position.

8) Try to move it around.

The position of the **Pivot Point**, and the ability to move it around is valuable when rotating the view because it provides a level of rotational control that can't be achieved easily any other way.
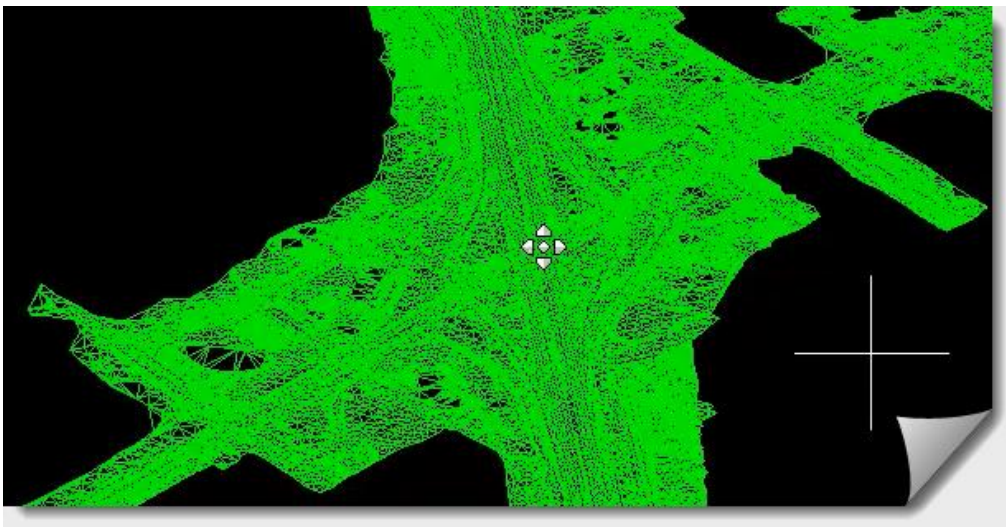
9) Leave the **Pivot Point** off the surface somewhere.
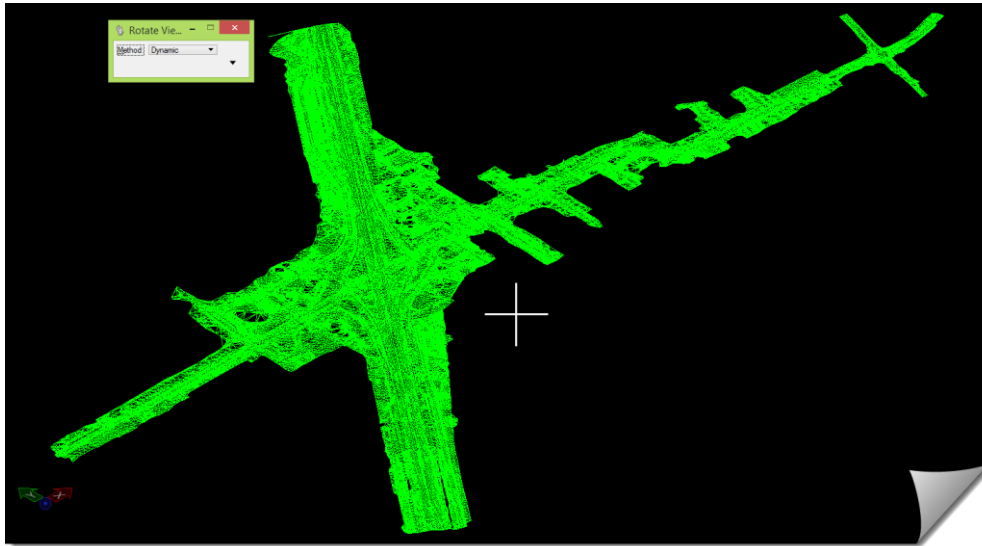
10) When the **Method** is set to **Dynamic**, you should see a special looking cursor at your mouse position that looks like a 4-way directional arrow with a central point.

11) Move your mouse to the center of the triangle display.

12) Data Point (left-click) in the middle there somewhere. Now move your mouse slowly up and then down. Move it to the left and then to the right. Notice as you move your mouse that it's pivoting about the **Pivot Point** plus sign.

13) You can actually swing your mouse in an arc and you will see how it is moving relative to that plus sign.

14) Clicking another data point (left-click) freezes that rotation and locks it into that position.

15) Clicking another data point somewhere, resumes the rotation operation.

16) Experiment with this for a little.

17) Freeze the rotation with a data point and then move the plus sign.

18) Now data point again somewhere and resume the rotation and see if you can reinforce the pivoting about the plus sign position.

   This might appear to be a very random set of exercises, but this should be practiced until your movements become more predictable.

19) Set the **Method** on the **Rotate View** tool to **Top** and **Fit** the view.

> 💡 **TIP**: If you ever get lost while rotating a view, and lose track of where you are, not knowing which way is up and which way is down, just data point somewhere to freeze the rotation, and set the **Method** to **Top** or **Isometric**. That will bring you back to a '*home'* position.

20) Set the **Rotate View** to command to **Dynamic** and position the Pivot Point in the center of the triangle display. (Shown below)
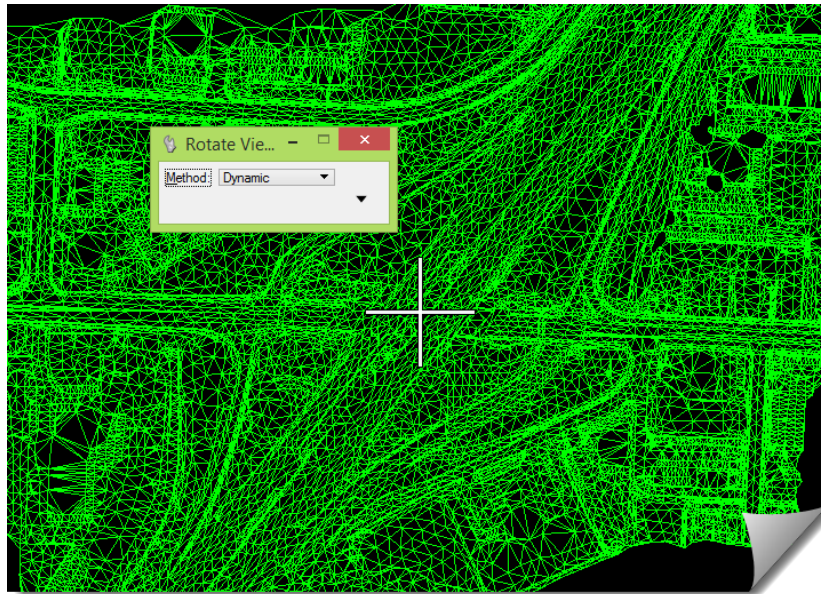

Also, you may notice that as you move the **Pivot Point** around, it is snapping to the triangle vertices as you move it. This is very handy sometimes when you want to rotate the view about a very specific point in your model to get an optimum viewing angle.
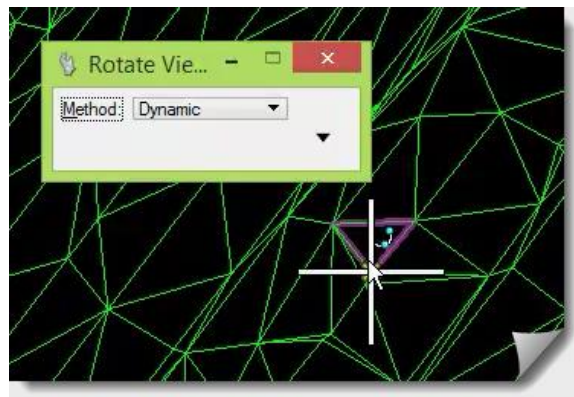
21) Once the **Pivot Point** is placed in the center area, data point somewhere and repeat the mouse movement exercise above. Moving the mouse up and down, left to right, and in an arcing motion. Notice the pivoting about the plus sign?

22) Click a data point to freeze the rotation, use the mouse wheel to zoom into the center area, data point again to resume the rotation, and see if you can get it into a position that looks something like this shown here.
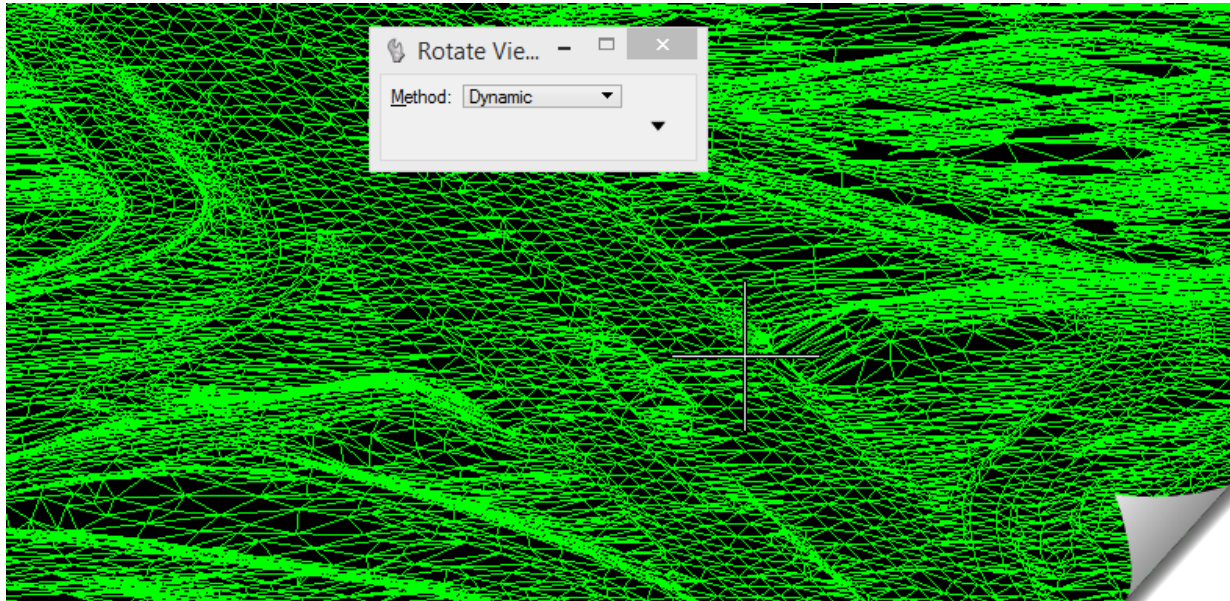
23) Hold on to that view for a moment, and go to the VIEW ATTRIBUTES in the corner of the view window.
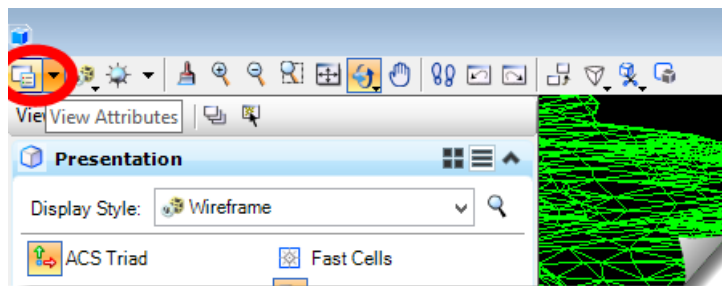
24) Change the **Display Style** from **Wireframe** to **Smooth Shadows**.

25) Click on the ADJUST VIEW BRIGHTNESS and adjust the brightness for a better view.
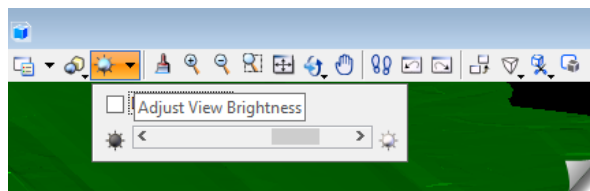
> **NOTE**: When adjusting the **View Brightness**, you can slide the slider bar back and forth, but you have to release the mouse button on the slider bar before that adjustment is applied to the view. So, slide it, then release, then slide it again if more adjustments are needed.

26) Eventually you should start to see a nicer rendered view like this one.
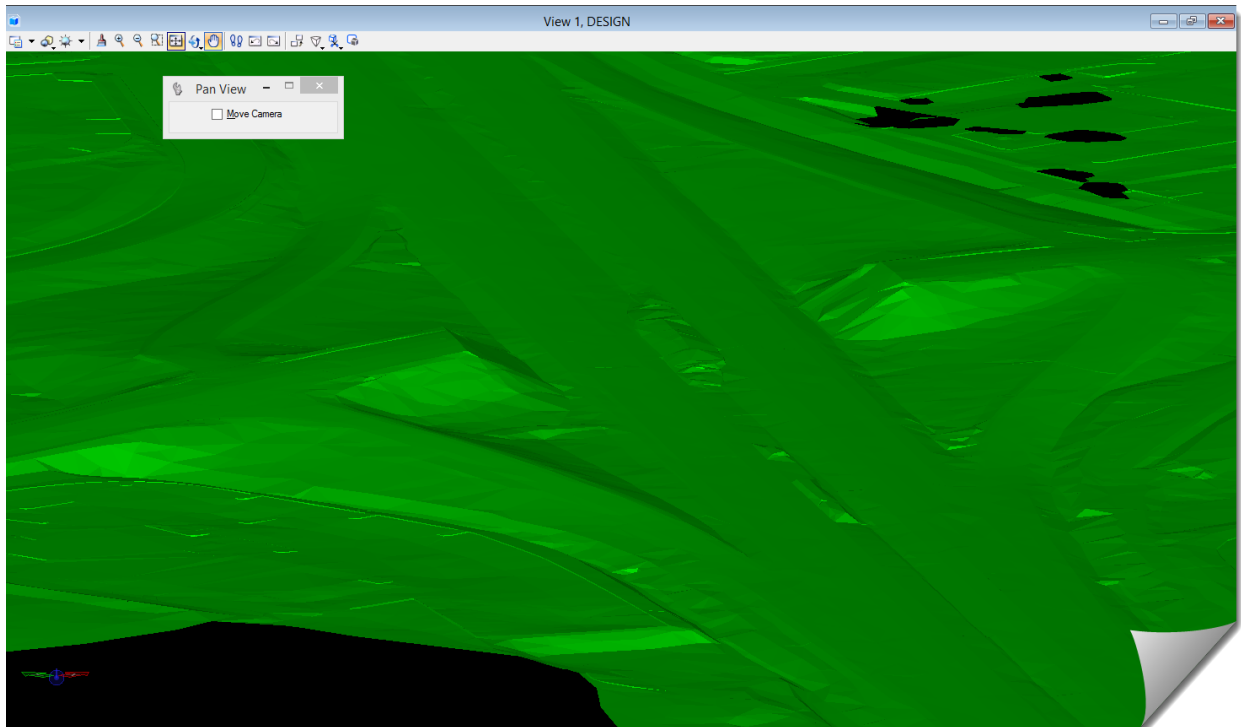
Feel free to take what you have just learned and practice a bit more. In this module never fear to deviate from the directions, it's easy to get back on track.

This existing surface has two abutments with a bridge going over the lower roadway.

27) View the **Triangles** of the `12345VIZ_Bridge` surface using the **Preference** called `DTM_BaseRock`.

If your view is similar to above, you should be looking at something like this shown here.
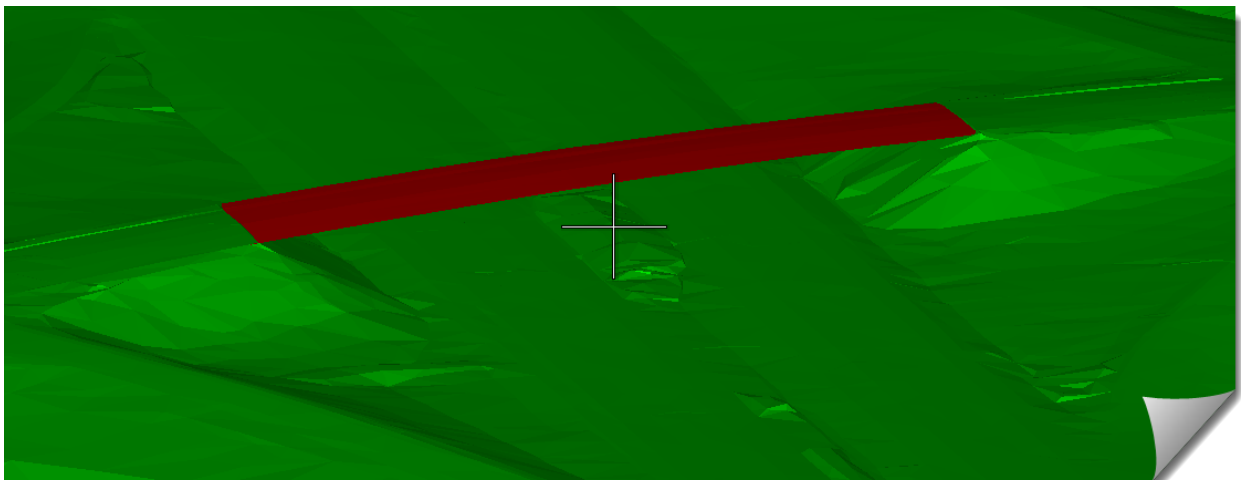
28) Practice positioning the **Pivot Point** and Rotate View around points relative to the bridge.

As you reposition the **Pivot Point** and rotate the view, you will very often use the mouse wheel to zoom in and out, as well as **Pan** holding the middle mouse button down. This mouse action may or may not work depending on the configuration of your settings.

TIP: When you **Zoom In** or **Zoom Out** while in the **Rotate View** tool, the **Pivot Point** still applies, and the zooming in / out is relative to the location of the **Pivot Point**, not the position of your mouse cursor like it usually is.

29) While practicing the **Rotate View** tool and **Pivot Point** placement, pause at a particular view and take some time to try a few of the other **Display Styles**. Try:

- **Illustration** (upper left)
- **Monochrome** (upper right)
- **Hidden Line** (lower left)
- **Wireframe** (lower right)

These are shown here for later reference:
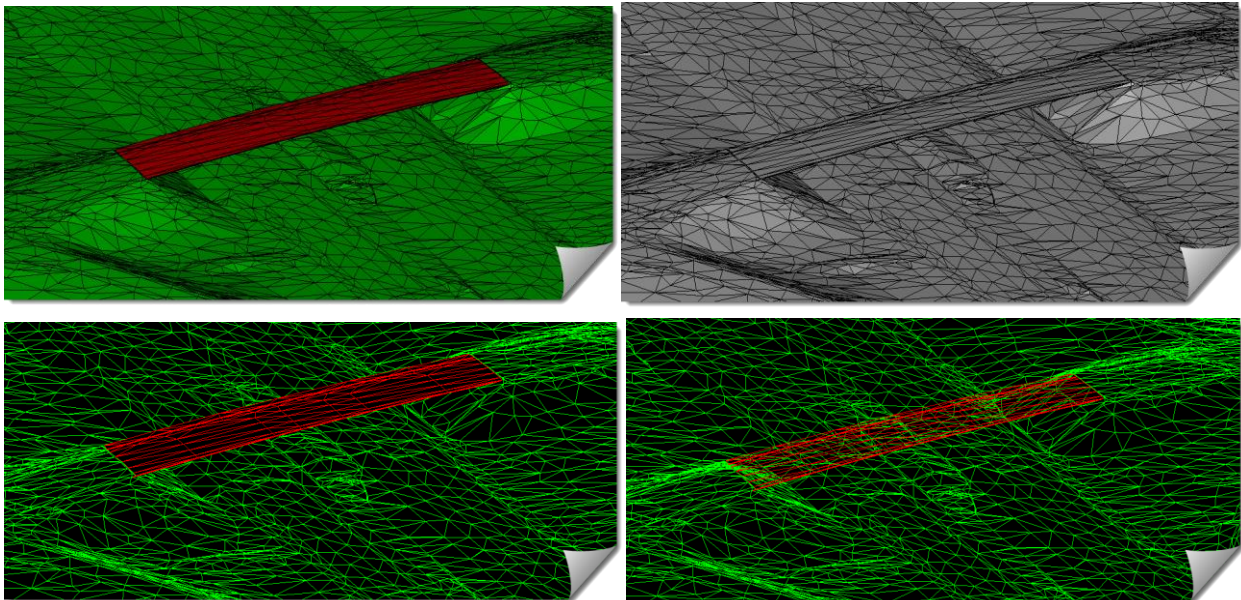
With this particular existing surface there is a bridge that has some prominent abutments that have probably had most of the attention since they pop out amongst the other relatively flat areas of this surface. Let's modify the triangle display of the surface so that other areas of the site with gentler grade changes are accentuated.

30) Open the **Surface Options** dialog box under *Surface > View Surface > Options* on the InRoads menu.
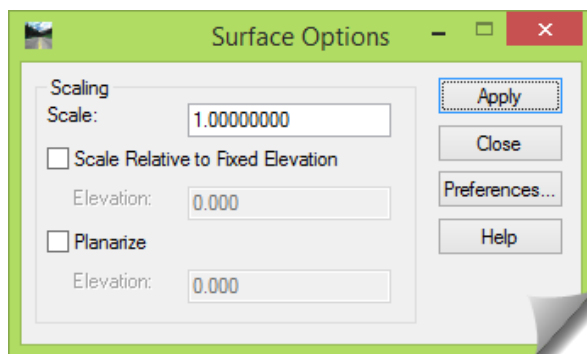
The items on the **SURFACE OPTIONS** dialog box used to be on each surface view tool, but in a recent version they were stripped off and place on this independent dialog box. These settings are now common to all of the surface viewing commands.

The way that this tool is used is this – let's say that you wanted to exaggerate the display of a surface. In that case, this dialog box is opened prior to viewing any surface data.

The **Scaling** area of this dialog box has a few different settings on it which will be talked about in time, but let's start with the **Scale:** setting. You know your terrain is very flat and you want to exaggerate it. The **Scale:** setting here will distort the vertical exaggeration of the display like the vertical exaggeration that gets applied to a profile or cross section. It's not changing the data in the surface in any way; it's just distorting the display of that data, just like applying a MicroStation **Z Scale** to the graphics.
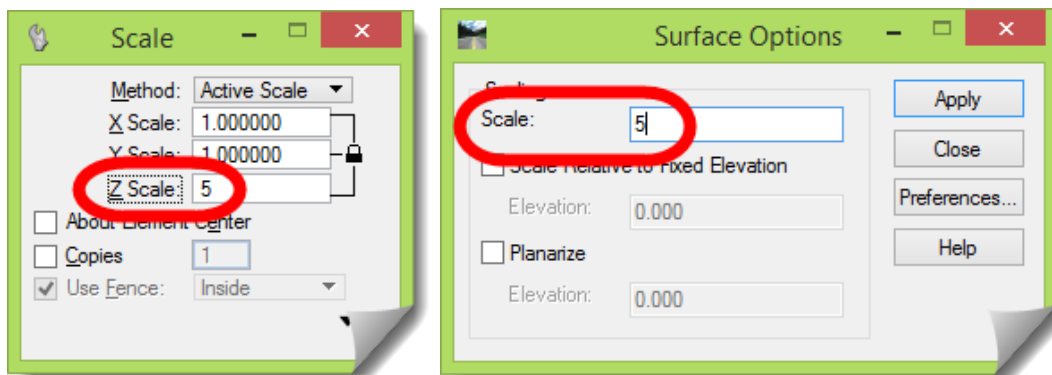
In establishing this setting you may over-exaggerate it, but that's okay. Just change the **Scale:** and view the surface data again. If you are in **Pencil** mode (on the InRoads **LOCKS**) the graphics will refresh as they always do.

So here is the basic process:

- You are reviewing the display of a surface model
- You decide to exaggerate the InRoads display to accentuate the view
- Open the **SURFACE OPTIONS** dialog box and enter a vertical **Scale:** value
- Click [**Apply**] on that dialog box. This locks in that **Scale:** from that point forward.

    At this point it's okay to leave this dialog open. Seeing it sitting there is a good visual trigger that you have activated a vertical exaggeration to your surface viewing.

- Go to the surface viewing command that you intend to use – **VIEW TRIANGLES**, **VIEW FEATURES**, **VIEW COMPONENTS**, **VIEW WHATEVER**. The **SURFACE OPTIONS** that are now 'active' will apply to all surface viewing commands now.
- View the surface data and it will be vertically scaled per the entered **Scale:** value
- Return to the **SURFACE OPTIONS** dialog and reset the **Scale:** to `1.00` if you are done with that level of scaling and [**Apply**],

    Or

- Change it to a different value if your initial scaling attempt was either too small or too large. And then [**Apply**] on the **SURFACE OPTIONS** to lock in the new entry.
- Then go back to your surface viewing command and reapply it to view the data at the revised scaling. If you are in **Pencil**, the previous display will refresh with the new one.

Now let's do that.

31) Set your MicroStation rotated view to **Top**.

32) In the S𝗎ʀꜰᴀᴄᴇ Oᴘᴛɪᴏɴꜱ dialog enter 5.00 for the **Scale:** Also toggle on the option to **Scale Relative to Fixed Elevation** and then [**Apply**].

> Those settings are now *active* and will hereafter be applied to any surface view command.
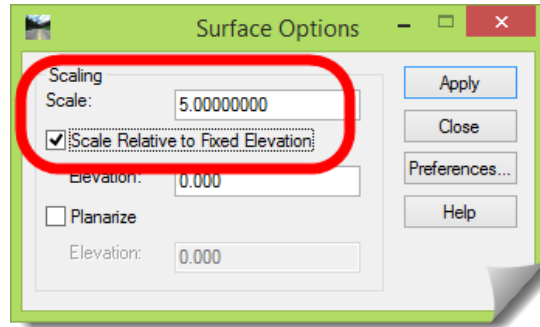
The option to **Scale Relative to Fixed Elevation** is fairly self-explanatory, but we'll explain later why it's being used here. And this will be made very simplistic for now.

But first, let's take a slightly related technical departure from the discussion about this option.

If you have ever scaled something in MicroStation, you know that it has to be distorted (scaled) from some reference point. If you are scaling in the **Z** direction, you are stretching it along that axis. It's the same way with this setting in InRoads. If you are viewing triangles, they are being stretched in the **Z** direction. Do you understand the implications of this here?
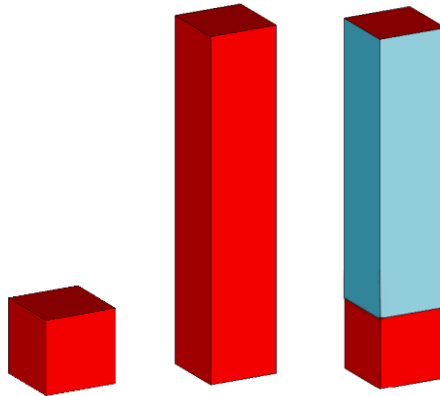
If you view triangles from an InRoads DTM, can you snap to one of those triangles and get an accurate elevation from the triangle vertex? Yes.

If you view triangles from an InRoads DTM, and you distort the vertical exaggeration, can you snap to one of those triangles and get an accurate elevation from the triangle vertex? No.

> ⚠️ **ALERT**: If you apply a vertical **Scale:** greater than 1.00 through the **Surface Options** prior to viewing your InRoads surface data, that data will be vertically exaggerated in MicroStation and snapping to those graphics will give you a false, distorted elevation.

Later you can test this by applying a **Scale:** of 1.00 and doing some measuring and elevational checks in a specific area. Then applying a **Scale:** of something greater than 1.00, displaying the graphics and performing the same measurement and elevational checks in that area.

If this concept is not firmly planted in your understanding after the brief earlier explanation, then you are strongly encouraged to test this for yourself while working with this module.

And here is what you should do:

● Take the **OG** and **Bridge** surfaces and view the triangles of each surface with the **Scale:** setting on the SURFACE OPTIONS set to 1.00

  ○ Find an area of the display where the Bridge is and confirm that the elevations of the triangles of both surfaces are the same as the elevations in the DTM surfaces.

  ○ Rotate the view so you can see the bridge and roadway and measure some distance between the two triangle displays. For this work it doesn't have to be super-precise.
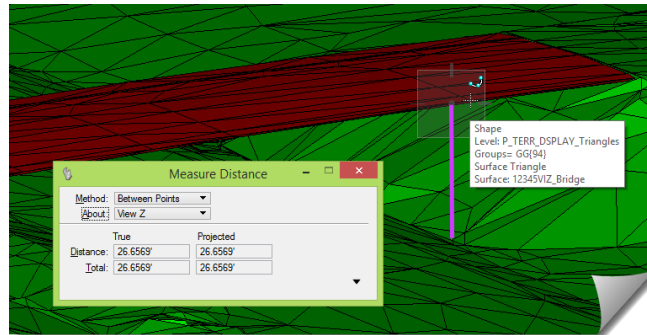
● Now go to the SURFACE OPTIONS and set the **Scale:** to maybe 5.00, but do <u>not</u> toggle *on* the option to **Scale Relative to Fixed Elevation**. Click [**Apply**] to activate those settings.

● Once that is done, view the triangles of both the **OG** and **Bridge** surfaces again.

  ○ You will discover that these surfaces are now in 'different' places, vertically. That's because they've been scaled relative to themselves, not a *common* reference point.

● Go to the SURFACE OPTIONS and toggle *on* the option to **Scale Relative to Fixed Elevation**, making sure to click [**Apply**] to activate those settings.

● View the triangles of both the **OG** and **Bridge** surfaces again.

  ○ You will discover that these surfaces are now relative to each other, because they have been positioned from a *common* reference point.

  ○ Go back to that initial area of the display where the Bridge is and snap to the elevations of the triangles. Are they the same as the elevations in the DTM surfaces?

  ○ Rotate the view so you can see the bridge and roadway and measure that same position between the two triangle displays that you measured earlier. What did you discover? What did you learn from this?
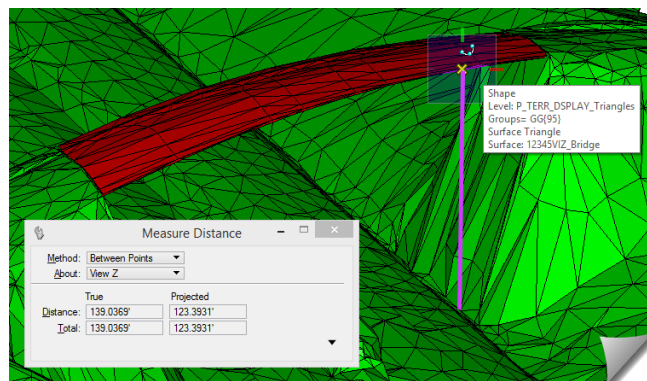
Getting back to the **Scale Relative to Fixed Elevation** option – surface display scaling is distorting the display from a reference location. Does it matter exactly where that point is? For now, no. What's important, is that if you are going to view and scale several surfaces, and you want them to all be 'relatively' scaled and in the same 'relative' position, they need to be scaled from the same reference point – hence this toggle option. Turning it *on* simply forces all surfaces being scaled to use the same reference location so they display in a proper position in relation to one another.

Again, if this is still a little unclear, test it using the process defined earlier. Turn this option off, apply a **Scale:** and display the triangles for the **OG** and the **Bridge** and see what happens.

Keep in mind, this topic is Visualization. Its purpose is to communicate a message, and is not necessarily the end-all, but sometimes just an *analysis* stepping stone.

Now, geting back to the hands-on activity. You should have the **SURFACE OPTIONS** dialog box open, the **Scale:** set to `5.00` and the **Scale Relative to Fixed Elevation** toggled *on*. And the [**Apply**] button was clicked to activate these options.

33) Now, once again, view the **Triangles** of the `12345VIZ_Bridge` surface using the **Preference** called `DTM_BaseRock`.

34) Then view **Triangles** of the `12345VIZ_og` surface using the **Preference** called `ODOT.`

35) **Fit** the MicroStation view and get to a view orientation that looks similar to the one here.

Depending on your view, you will probably need to be using the **ROTATE VIEW** tool, potentially moving the **Pivot Point** for better control, zooming in and out as needed, and changing your **Display Style** and the **ADJUST VIEW BRIGHTNESS** if necessary.
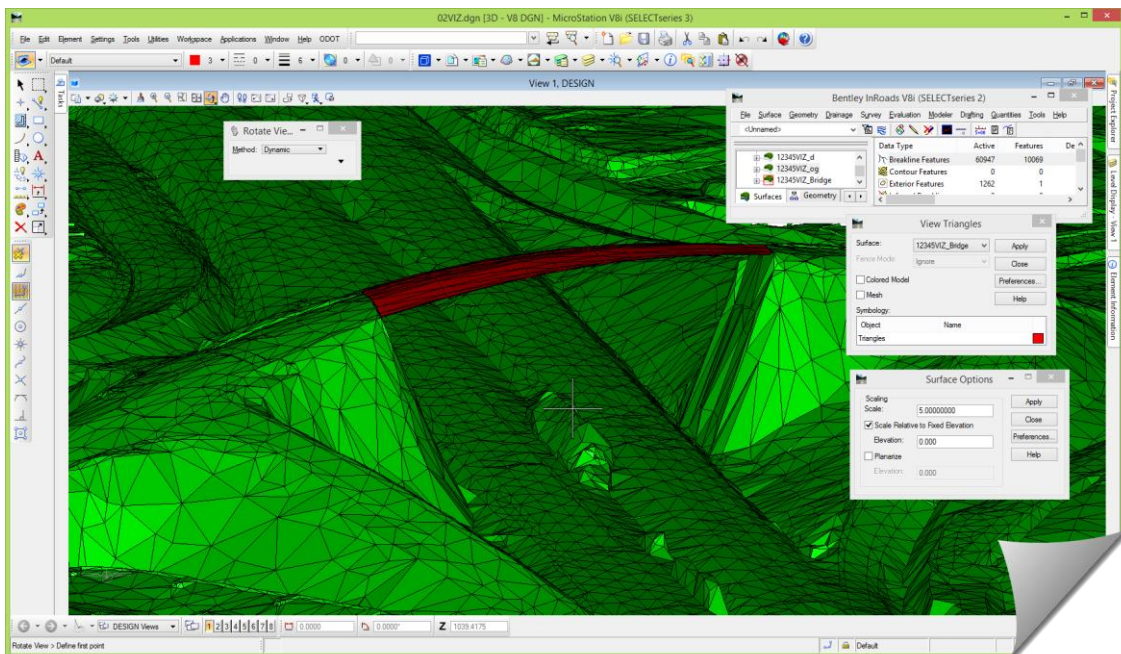

If you were able to do this, and get into a view that looks like the one above, you have come a long way and your skills are obviously improving. If you were unable to get to a view that looks like this, then you should stop here. Back up to an earlier part of this module where you thought you were doing fairly well and restudy forward and practice more.

This section will wrap up with a few general areas for you to practice. Do these over and over until your comfort with view manipulation and surface data display increases.

36) Using the surfaces that you have available for this module, do the following:

- Apply different **Scale:** settings under the **SURFACE OPTIONS** and view the triangles of the surfaces that you have loaded

- Find **Scale:** settings on the **SURFACE OPTIONS** that you feel are either too small, too large, or just right for various areas of the **OG** surface.

- Test out different **DISPLAY STYLES** on a particular triangle display of the **OG** Surface and find one's that you like, and others that don't add value at this time (keep in mind that you are using **DISPLAY STYLES** 'out-of-the-box' and these can be configured to present certain data in much better ways than you might be seeing).

- Make sure you remember the **ADJUST VIEW BRIGHTNESS** tool settings and apply that as needed to help with the visual contrast.
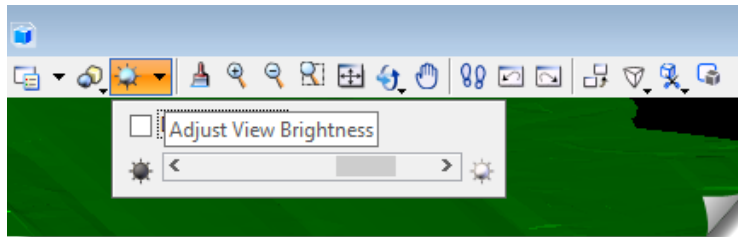
- Don't forget the function of the **Pivot Point** when rotating the MicroStation view
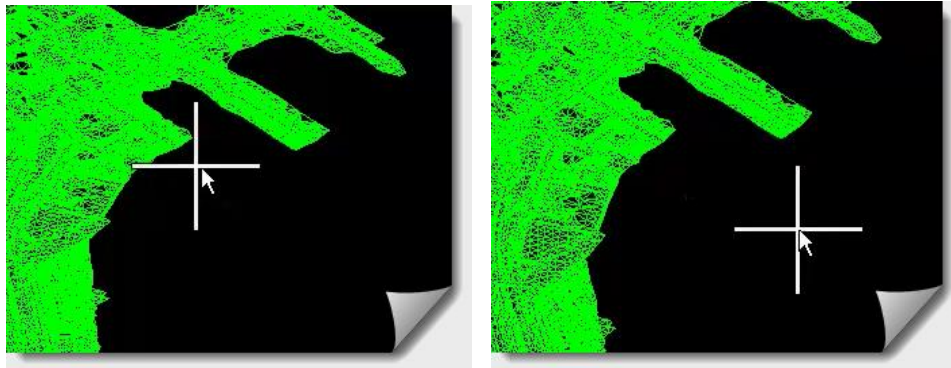

- Also keep in mind that if you lose your 3D orientation while rotating a view, you can always select one of the default view rotations like **Isometric** to get yourself reoriented.
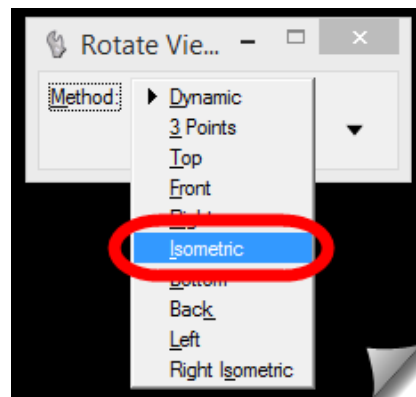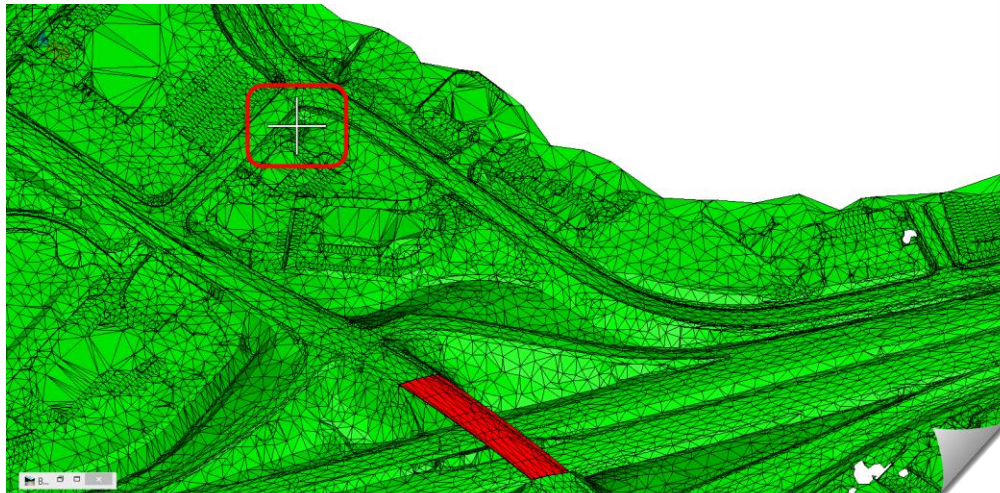

- This is 'visualization' so change the color of the triangles to see how that affects the readability of the rendered display.

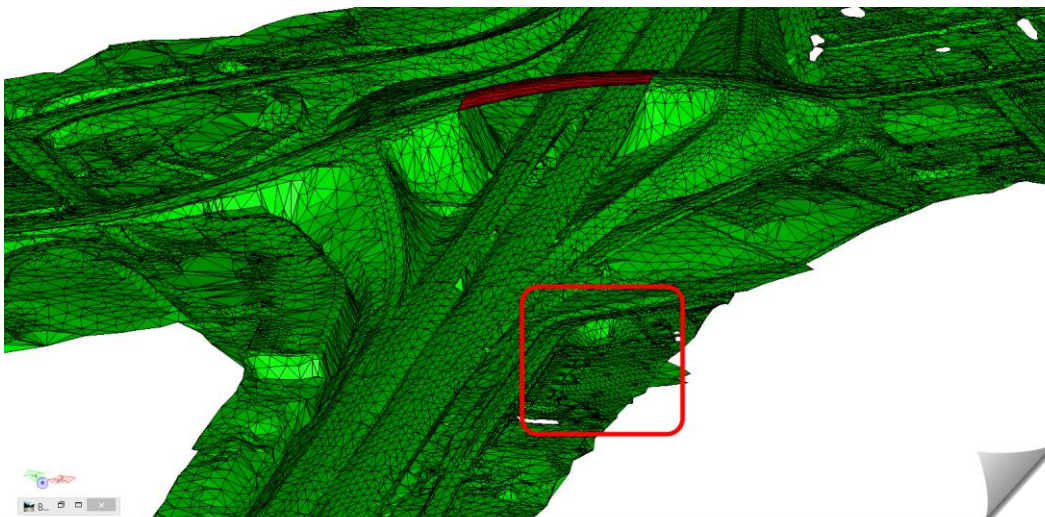37) Try your best to either recreate these views or locate something similar:
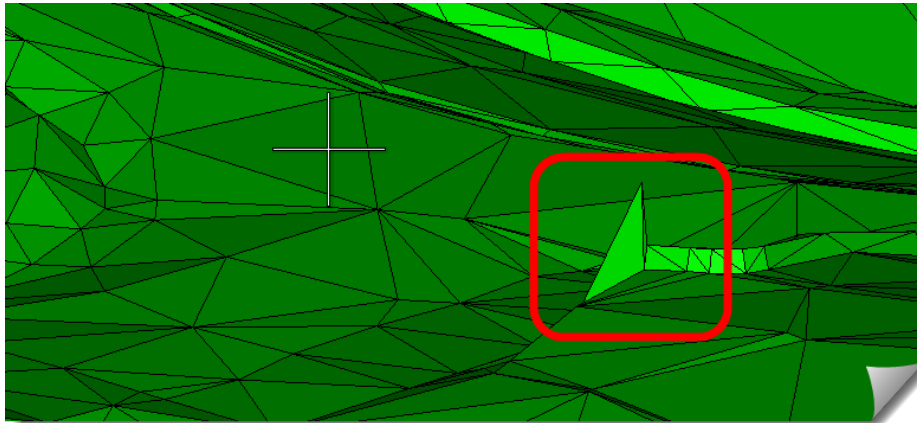   ● View the Bridge and abutment from the other side, looking toward the south
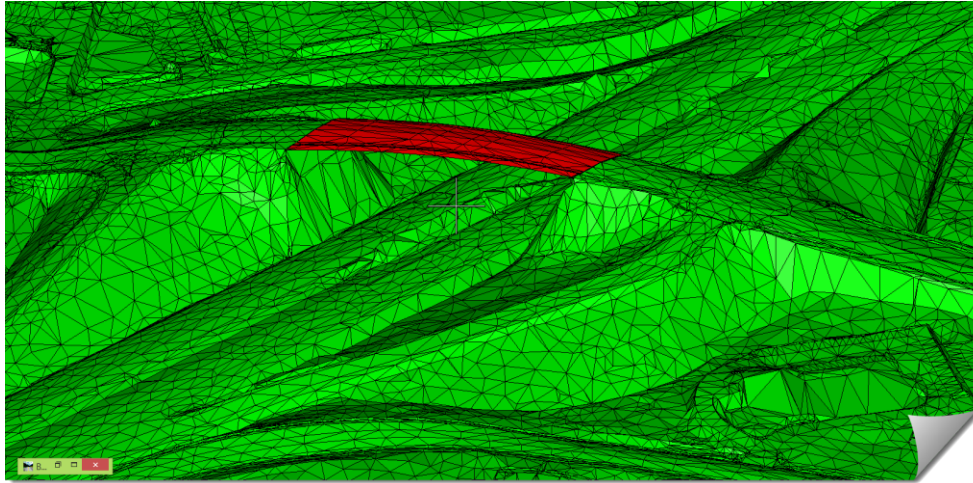
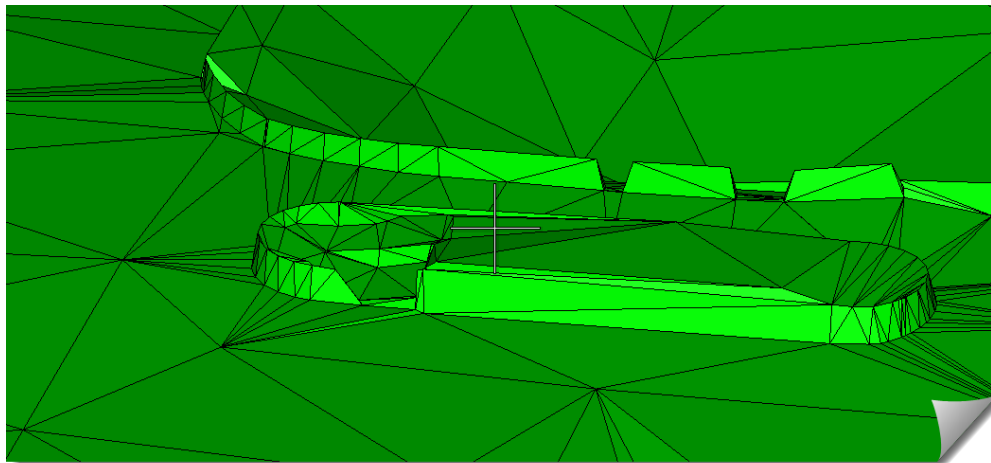   ● What is that big hole west of the bridge?

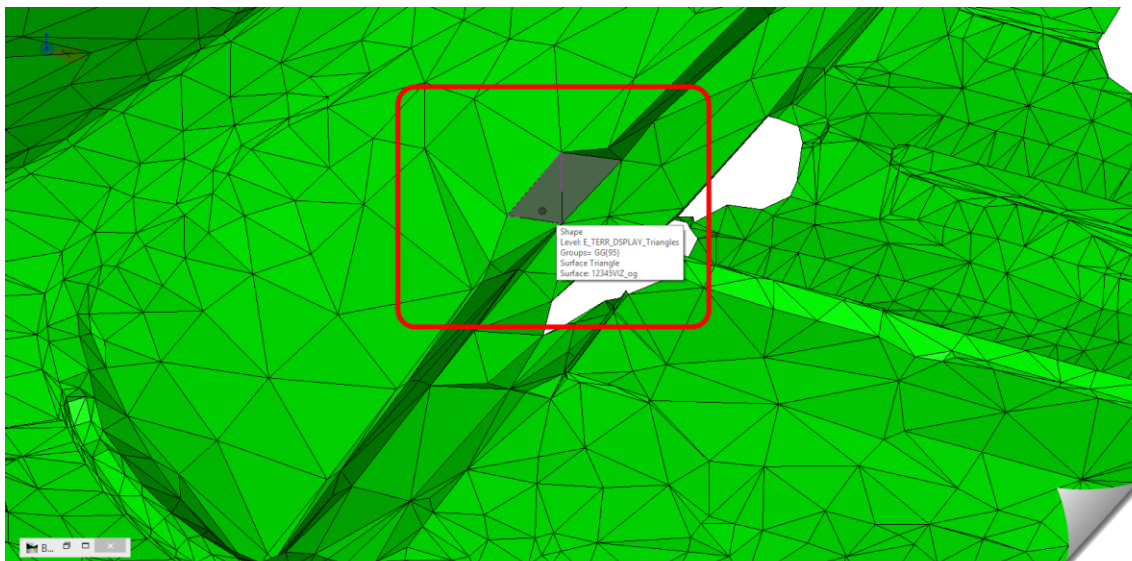   ● It looks like a parking area and drainage basin in the SE corner …take a look.

● Does this look natural? Definitely worth investigating in the DTM.

● What about this median? Is that a ramp on the west side of the median?

● Yes, there is quite a bit of vertical exaggeration applied here, but what is this?

Displaying the surface triangles is simple; changing the **DISPLAY STYLE** is easy; but it takes practice to get good at rotating and positioning your views.

NOTE: Viewing and deleting triangles as done in this module will bloat the size of the DGN file and make it less responsive. The answer is to periodically go to the MicroStation command *FILE > COMPRESS > DESIGN* to purge those deleted elements from the DGN.

TIP: Triangles can be removed from the MicroStation drawing using either the MicroStation DELETE tool or the InRoads UPDATE 3-D PLAN DISPLAY command. Both techniques produce the same results so use whichever you find easier and more convenient.

SCENARIO 2 - COMPONENT DISPLAY

In this version of InRoads, the two main displays that are used during visualization are triangles and **Components**, with triangles taking the more dominant position. But **Components** can be used, and present another type of visual display so they will be touched on next.

Remember that **Components** are very likely not to be found in an existing surface due to the way **Components** are constructed. And as of now, the only way to create **Components** in a surface is by using a **Template** that was constructed within the CREATE TEMPLATE tool, and then utilizing those **Templates** in either the ROADWAY DESIGNER, or the APPLY TEMPLATE tool.

Here is an example of a **Template** that consists of a number of **Components**. This info is just a recap of material presented in the *InRoads Level 1* class, but repeated here for orientation to this topic.
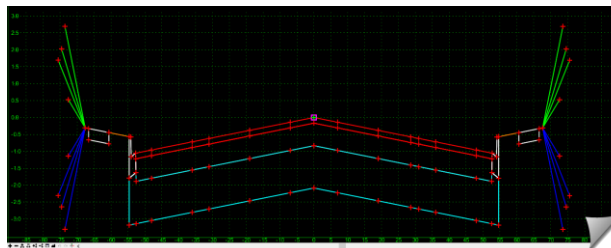
A template such as this will produce a surface DTM that contains **Components** whereas surface data collected from a ground survey, or aerial mapping will not contain any **Components**.

The data within a design surface can be reviewed a number of ways – using SURFACE PROPERTIES and FEATURE PROPERTIES are the most common. But the tool COMPONENT PROPERTIES focuses within a surface and shows what **Components** it contains.

The design surface in this module, `12345VIZ_d.dtm` contains **Components** since it was produced by the ROADWAY DESIGNER and a template such as the one above.
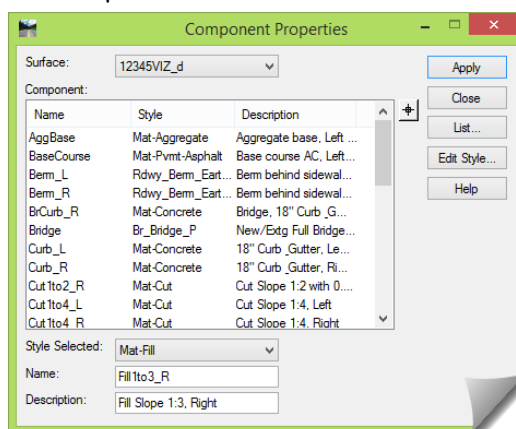
Viewing Components

Scratching the surface of this topic, an individual component has a certain level of intelligence relative to its creation. Reviewing a particular **Component** reveals this:
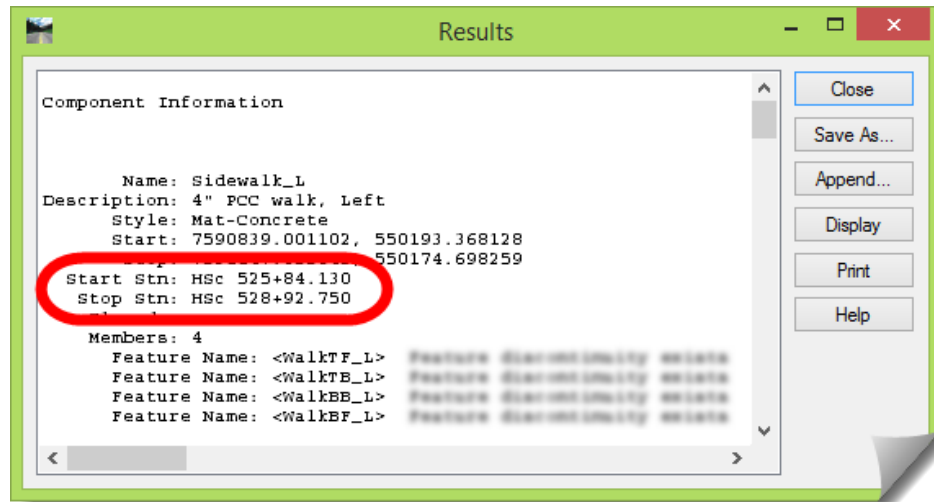
It knows its construction relative to the alignment stationing from whence it was modeled.

Because of this, in order to display these **Components**, they need to be able to see that horizontal alignment. Otherwise:
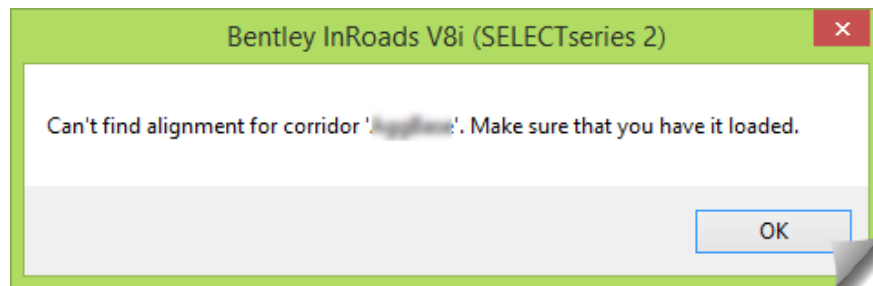
1) Verify in InRoads that the **12345VIZ_d Geometry Project** is open.

> ⚠ **ALERT**: In order to **VIEW SURFACE COMPONENTS** in a DTM, you have to have the horizontal alignment loaded that was used in the **ROADWAY DESIGNER Corridor** that originally created that design DTM; otherwise the **Components** will not be able to be viewed.

2) Set your MicroStation **ROTATE VIEW** to **Top**

3) **Fit** the MicroStation view and select and delete any graphics

We want to start with a completely clean file.

Understand that this is not a requirement for doing displays such as this, and this work could also be done in a file that already contains graphics. And those other graphics can also be easily controlled using the **LEVEL MANAGER** and simply turning *on* and *off* the **Levels** that you don't want to see. This 'clean file' philosophy is strictly for extra clarity while working through these exercises. It will be up to you later whether or not you perform your visualization in a new empty file, or within one of your existing files.

4) First, go to the **VIEW OPTIONS** and set your **Scale:** to `1.00`, and click [**Apply**]

5) Go to *SURFACE > VIEW SURFACE > COMPONENTS* to open the **VIEW SURFACE COMPONENTS** dialog box.

6) Make sure the **Surface** at the top is set to `12345VIZ_d`, then right-click in the lower **Component** list window and choose **Select All**, then [**Apply**].

> **TIP**: **Stitch Mesh Faces** can be toggled *on* at your discretion to increase the viewing performance. In addition to the performance on larger surfaces, the components on the end become filled like a solid object versus the end being open, and appearing hollow.
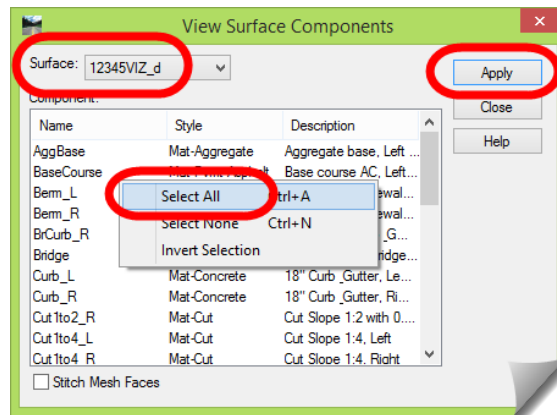
7) [**Close**] the **VIEW SURFACE COMPONENTS** dialog box.

What you are looking at here is not the surface triangulation; it's the display of physical breakline to breakline to breakline connected shapes built by rules placed on these breakline points during **Template** construction.

8) **Fit** the MicroStation view so you can see the full display.
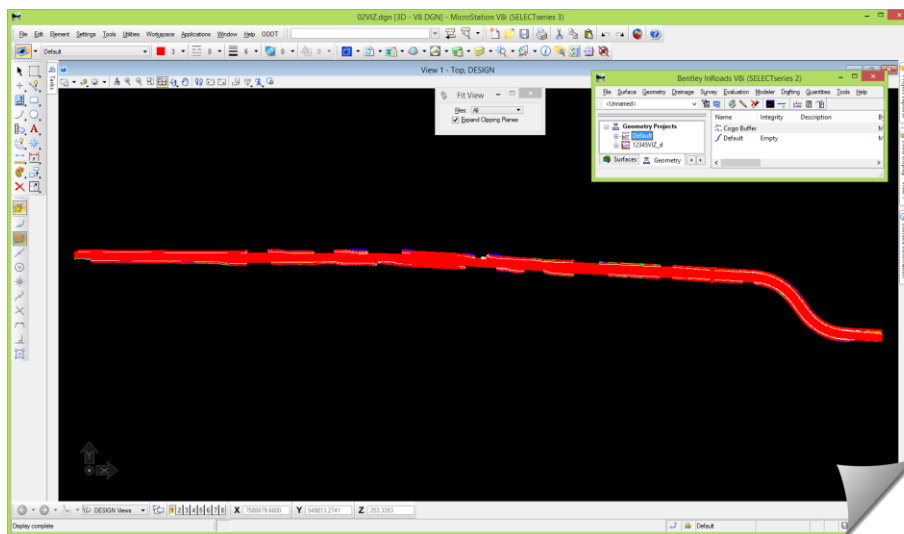

This is not as full and robust as the **OG** surface that you've been viewing, and the amount of information that you will eventually see here shortly pales in comparison to a larger surface, or a fully designed interchange. But that will be coming in a later module, so please, for now, develop these skills so you can easily apply them later when you need to.

Okay, you know the drill by now.

9) Using what you know, see what you can see with this display. Start by looking at the farthest West end (to your left) and look Eastward.

With relatively proportionally long thin strip of information your skills will be put to the test. Also, this is modeled with a 5' interval so the density of the data is very close, making the 3D rotated view a little bit obscured.

This is a view with an **Illustration DISPLAY STYLE** and **ADJUST VIEW BRIGHTNESS** pushed fairly high.
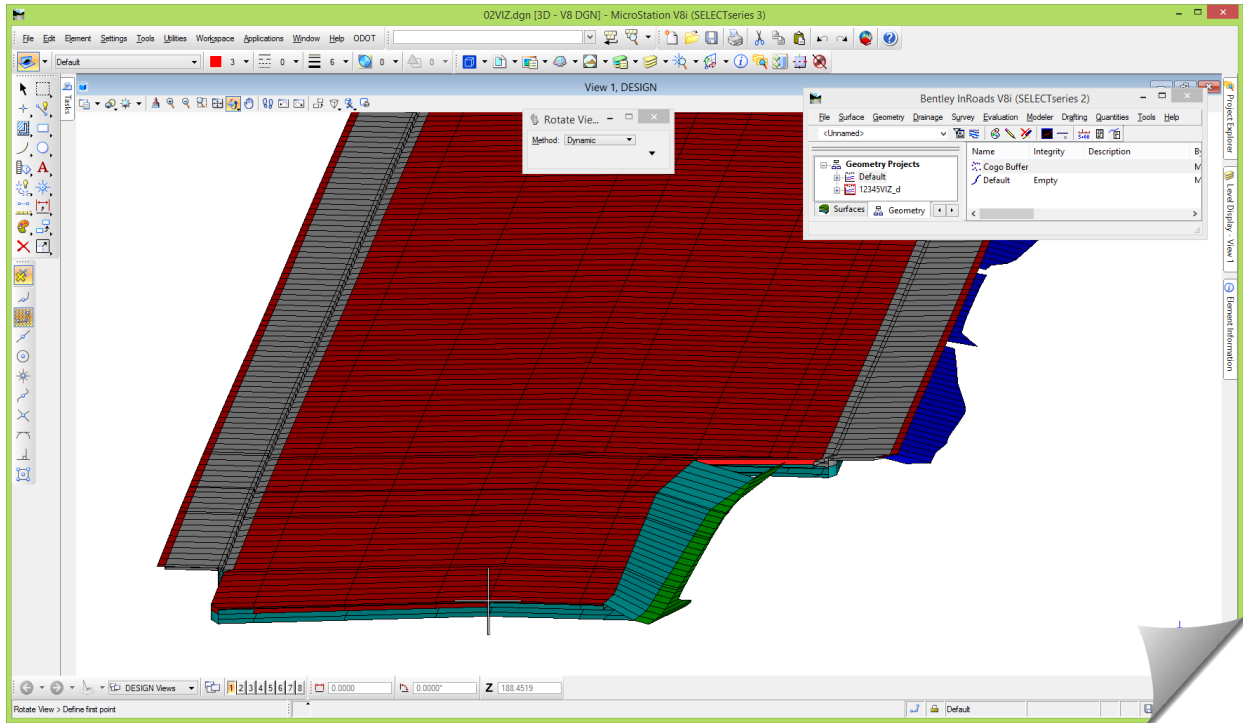
10) When the structural section is modeled, the closer you look the more you might see.
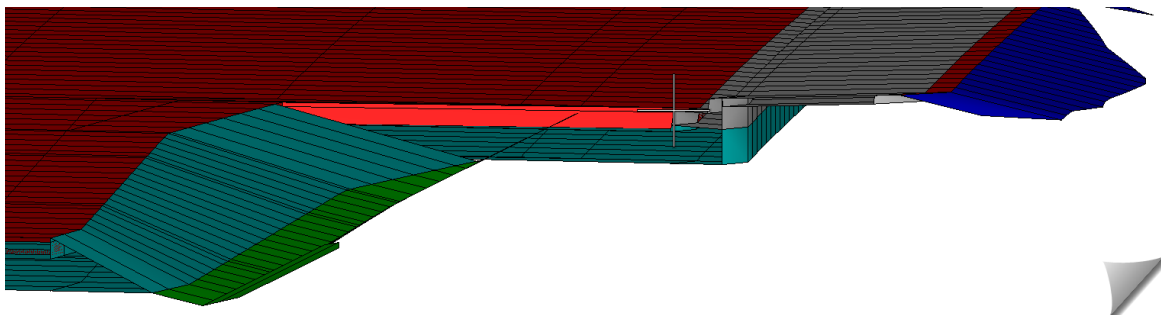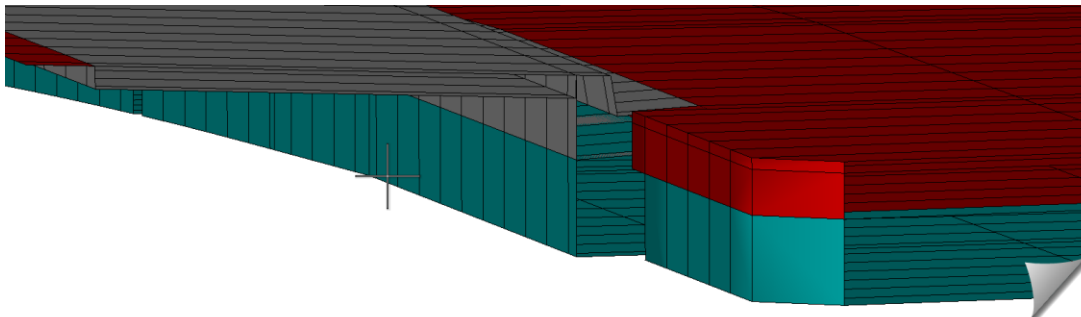
11) Scan around to other areas of this model and see what you can find that you would consider valuable information or feedback.

It is admitted here that this sample exercise is not as engaging as an actual project that you might be actively working on. But try your best to put yourself in your Engineer / Designer / Technician role as you review these models. It's understood, and expected, that if this was your project you would have the ability to know what areas require closer inspection.

12) Find an area where there are side slope gaps – places where the **Components** are starting and stopping and appear incomplete or unconstructed.

When looking at the **Components** in an area such as this, it's true, there are gaps in the modeling of the **Components**. If those **Components** were used for quantity take-offs, there would be a problem here.

But what about the surface triangulation in this area? Is it also missing information?
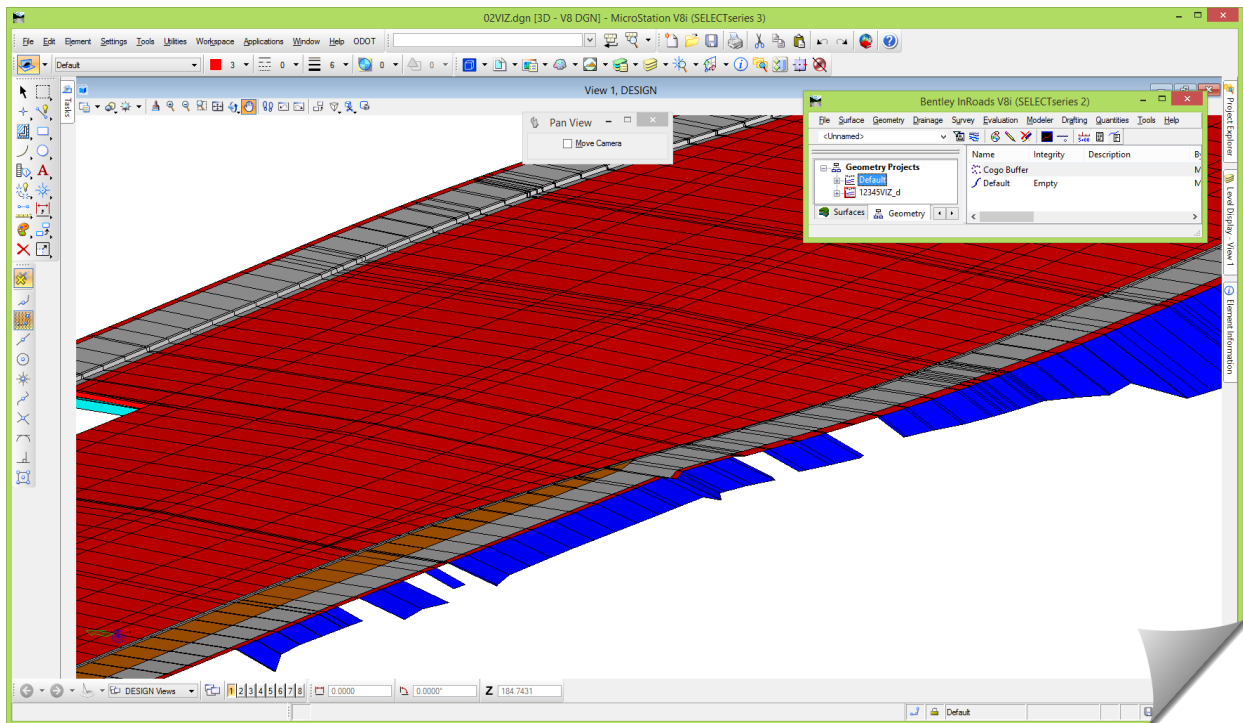
In the *InRoads Level 1* class, you should have learned that Surfaces contain two fairly distinct classes of content – **Triangulation** and **Features**, with the **Features** being the actual pieces of data, and the triangulation being the network formation of their relationships.

Then where do **Components** fit in?

Components are just an assigned relationship of the **Features**. That should tell you that they don't have any direct influence on the resulting triangulation.

So there are two things to look at with a design DTM, it's **Components** (shown above) and its triangulation.

13) Keep that view (pictured above) frozen on your screen.

14) Turn the **Levels** *off* for the `P_TERR_DSPLAY_General`, `P_RDWY_ROAD_Berm` and `P_BR_SUPER_General`.

The MicroStation view should go blank. If there are other levels in use at the moment turn those off as well. (Except for `P_TERR_DSPLAY_Triangles` because we're about to use that Level.)

15) **VIEW TRIANGLES**, loading the `DTM_Finish` **Preference** for the `12345VIZ_d` surface.

You should see the triangle display appear in that area. And also notice that there are no missing side slopes in that area. You can now conclude that there are only missing **Components** there, the surface appears fine and complete.
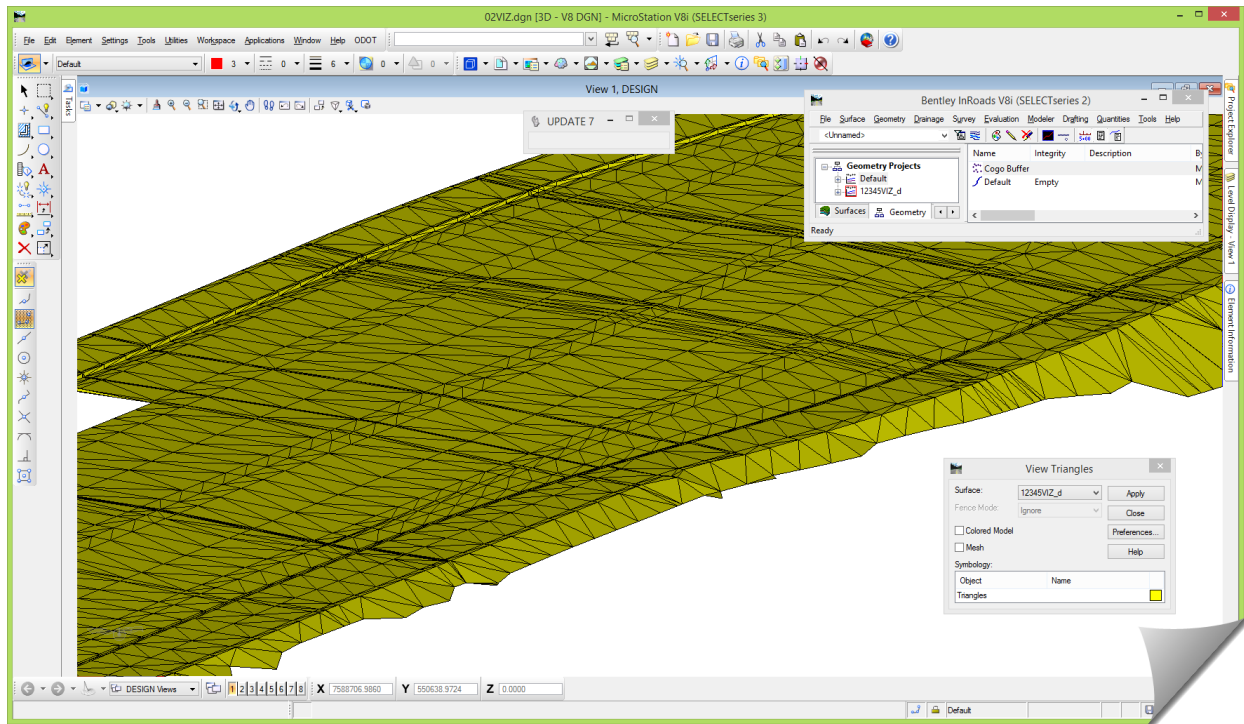
16) Make your way down the rest of this roadway design, toggling the levels back and forth from the **Components** to the **Triangulation** until you are comfortable with manipulating the MicroStation views. Don't cut your practice short; it will be needed and used in future modules.

OTHER DETAILS - MATERIALS & COLORS

As you may have already noticed, changing the colors of your triangles can change the readability of the surface in a 3D view when you go into a rendering mode. In some cases you may have the luxury of adjusting the colors, but in some instances because of ODOT driven CAD Standards you may not. If there is something that you would like to see regarding colors for rendering purposes you should speak with your CAD support group and share your thoughts on any improvements. I'm sure they would be supportive of any good suggestions that come their way.

Assigning Materials

The last topic here will be a very brief introduction to assigning materials. This topic sets the stage for creating a much more sophisticated and visually strong rendering.

MicroStation has the built-in capability to assign materials to the content displayed or drawn inside the software, and it is driven by the Level on which something is drawn.

To support this capability, MicroStation has a very large library of all sorts of materials that you can use at the click of a mouse.

I'm sure that most all of you have seen what's possible with the modern rendering capabilities of MicroStation. Some very realistic models can be created once the tools are understood.
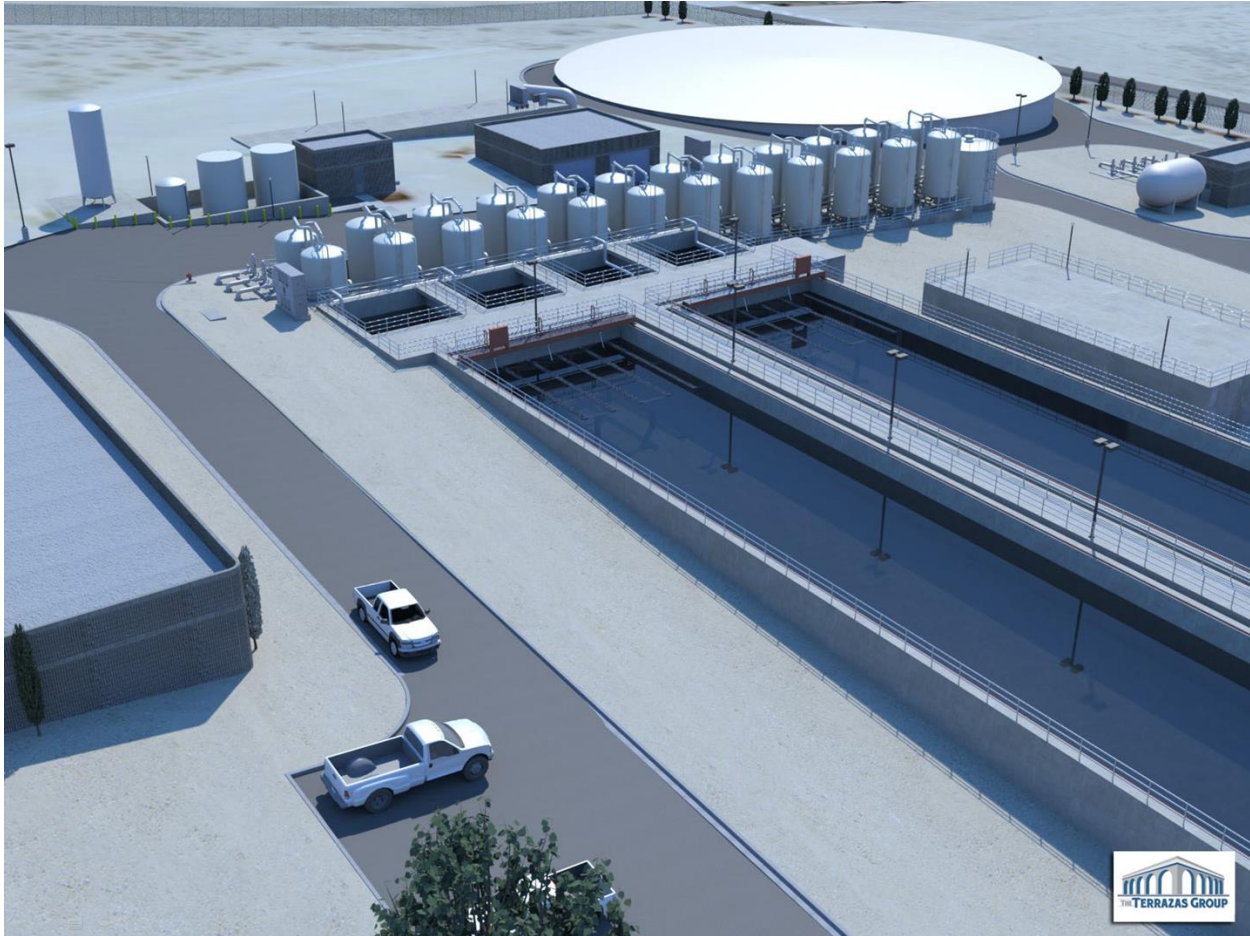
Model Credit: Charlie Terrazas

Of course this module will not supply you with the knowledge to create this level of visualization; however it is only a matter of time before improved visualization begins taking place at ODOT.

If this is an area of strong interest you should sign up for the MicroStation 3D class to learn more.

At this point the formal hands-on is completed. Feel free to review any material within this module and practice with the files provided.

17) When you are done, [**Exit**] InRoads and MicroStation. Don't bother saving any of the surfaces since nothing should have been done to them anyway.

Conclusion

Congratulations, you have completed the Visualization module.

Again, you are left with a final thought – Do these modules with an attitude of application. Study them with the viewpoint that you are going to apply these new skills on your current or future project. Look into and beyond the exercise steps and motivate yourself to momentarily pause and consider past, present and future projects and how this information could be put into practice.