Texas Department of Transportation

Digital Delivery Program

Using Bentley Infrastructure Cloud Platform (ICP) for Design Review

DRAFT- January 2025

Texas Department of Transportation

This documentation is in draft form and is currently being piloted by TxDOT's Digital Delivery Program. For any questions, comments, or feedback please send to digital-delivery@txdot.gov.

Table of Contents

Purpose

The purpose of this document is to provide a Standard Operating Procedure (SOP) for developing a Master iModel within Bentley's Infrastructure Cloud Platform (ICP), a digital design review application. A Master iModel is inclusive of all digital design files (DGNs) in the project including the files listed below, see Section 1 for terminology and additional information.

- Base design files
- Annotation files
- Alignment and corridor geometry
- Existing files
- Container files

The benefit of a Master iModel is creating a review experience similar to plan sheet review in which all disciplines can be reviewed in the same space. This SOP uses discipline specific Container Files and iModel Saved Views to avoid information overload and confusion for the reviewer.

The following workflow in Screen Capture 1 highlights the major steps for creating Container Files and Saved Views for review with Bentley's Infrastructure Cloud Platform. This document provides guidance on developing Container Files, syncing to ICP, and creating Saved Views for review.

Screen Capture 1: Major Steps for Creating the Master iModel

For detailed guidance on using Bentley ICP, see Appendix B.

Terminology

- **Alignment and corridor geometry** – files that include 3D geometry for roadway mainline and side street alignments and corridors, drainage corridors pertaining to pond and channel design, or bridge corridors for 3D proposed bridge models.
    - Corridor files may also be considered *base design files* as software interoperability evolves and 3D objects with *item types,* meta data on model elements, are able to be consumed by GIS applications and various construction software.
    - **Note**: Working alignments should not be included to avoid confusion during review.
- **Annotation files** – files that provide text information related to the design elements.
    - Annotation files used in the iModel should be the same files that are used in PDF Roll Plots to avoid discrepancies between the two.

- **Base Files –** files that are referenced into a container file containing design, annotation, and other linework to communicate design intent.
- **Container files** – also known as federated models, these files include multiple DGNs that are referenced into a single DGN for the purpose of organization and file delivery.
- **Design files** – files that show the layout of the design elements. Reviewers can get station and offset data, shape, and quantity information from these files.
    - Drainage and Utilities base design files will utilize DU modeling capabilities.
    - Includes all design files used for estimating where model elements have bid code, "Item types," associated with the element.
    - **Note**: These files may include 2D and/or 3D geometry and cells. Designers should refer to the TxDOT DDP website for guidance on the level of development (LOD) for a given element.
- **Existing files** – files that include existing topography, point objects, SUE data, and others.
- **iModel –** "specialized information container for exchanging data associated with the lifecycle of infrastructure assets. iModels encapsulate component information, business properties, geometry, graphics, and relationships in a format that is open, providing standard interfaces for applications from multiple vendors." https://developer.bentley.com/apis/imodels-v2/overview/.
- **iModel Connection -** A connection is the method of linking a CAD file to the iModel. For this SOP, we will be linking a container file DGN from ProjectWise.
    - iModels connections can be synchronized automatically at a scheduled frequency or manually using a 'sync now' function.
- **Saved Views -** A Bentley ICP tool within the iModel that allows users to create unique view displays of the iModel with unique names and folders.

Establishing a Project in ICP

Guidance for establishing a project in ICP is currently under development. TxDOT teams may reach out to digital-delivery@txdot.gov for more information. Consultants may refer to Bentley Communities.

Project Set-up

Standard File Naming Convention

An important element to model review is ensuring an established file naming convention is maintained throughout the project. With digital files becoming formal deliverables, it is critical to provide reviewers and contractors guidance on where design specific elements are located. A logical file nomenclature should be established by the Project Manager, Model Manager and/or Lead Designer, communicated with reviewers, and maintained throughout the life of the project.

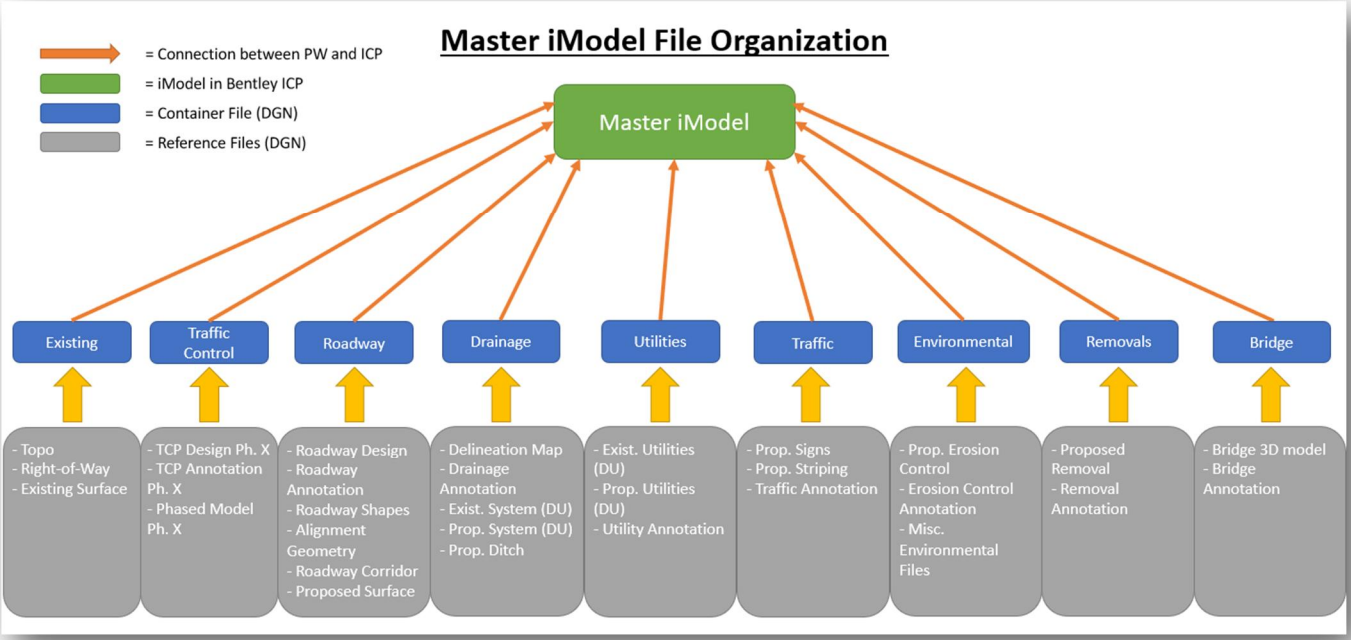
See the File Naming Convention Spreadsheet for guidance, located on the TxDOT DDP website.

Container Files

The TxDOT DDP is utilizing Container Files as connector files between DGN files stored in ProjectWise (PW) and the iModel stored in ICP. Project teams may decide to use alternative files as connector files but should ensure the ORD requirements discussed below are maintained.

For dynamic container file management, each discipline will have its own container file with the appropriate base files attached. See Appendix A for detailed version of Screen Capture 2 which outlines common discipline-specific Container Files and their references.

- Container files should include only the necessary files for review and draft or working files should not be included.
- No elements should be drawn directly in the container file.



Screen Capture 2: Overview Master iModel File Organization from Appendix A

OpenRoads Designer (ORD) Requirements

Below is guidance for the set-up of a DGN that will be used as a direct connection in the iModel. All Container Files should follow these steps. For additional Bentley guidance for creating files for iModel connection, refer to Bentley Communities.

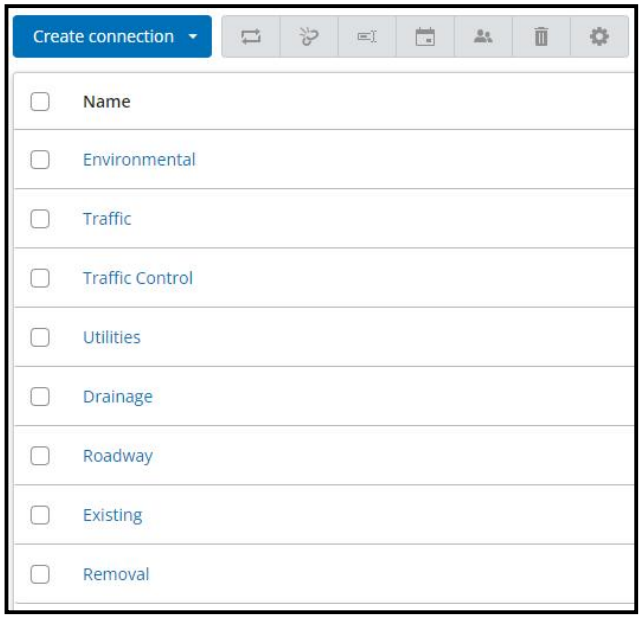
- Establish coordinate system in DGN

  - Taken from seed file or set within DGN
- Establish 3D model space in DGN.
  - This can be triggered with any civil tool – i.e. make terrain active
- DU workspace needs to be activated.
  - This can be done by starting the “place node” tool.
- After activating the 3D model space, attach applicable references
- From the 2D model space, set 3D model space reference to nesting level 1.
- References should not be container files (live nested). Connections have previously failed because of this file depth.

iModel Connection to Container Files

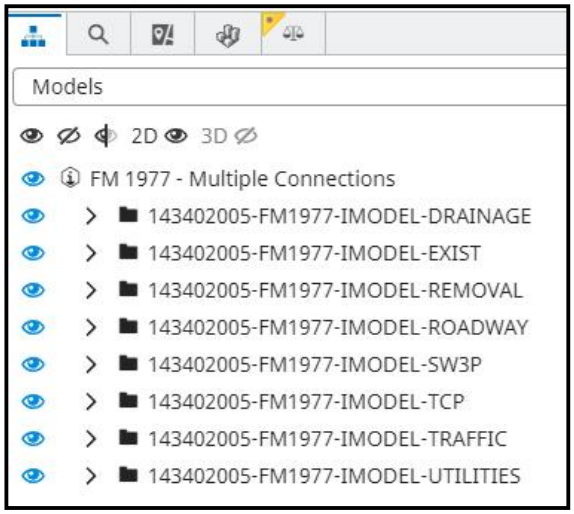
This section pertains specifically to iModel Connections and Container File organization. For detailed guidance on creating an iModel and Saved Views see Appendix C.

Once an iModel has been created in Bentley ICP, unique iModel Connections should be made to each Container File in ProjectWise as shown in Screen Capture 3.

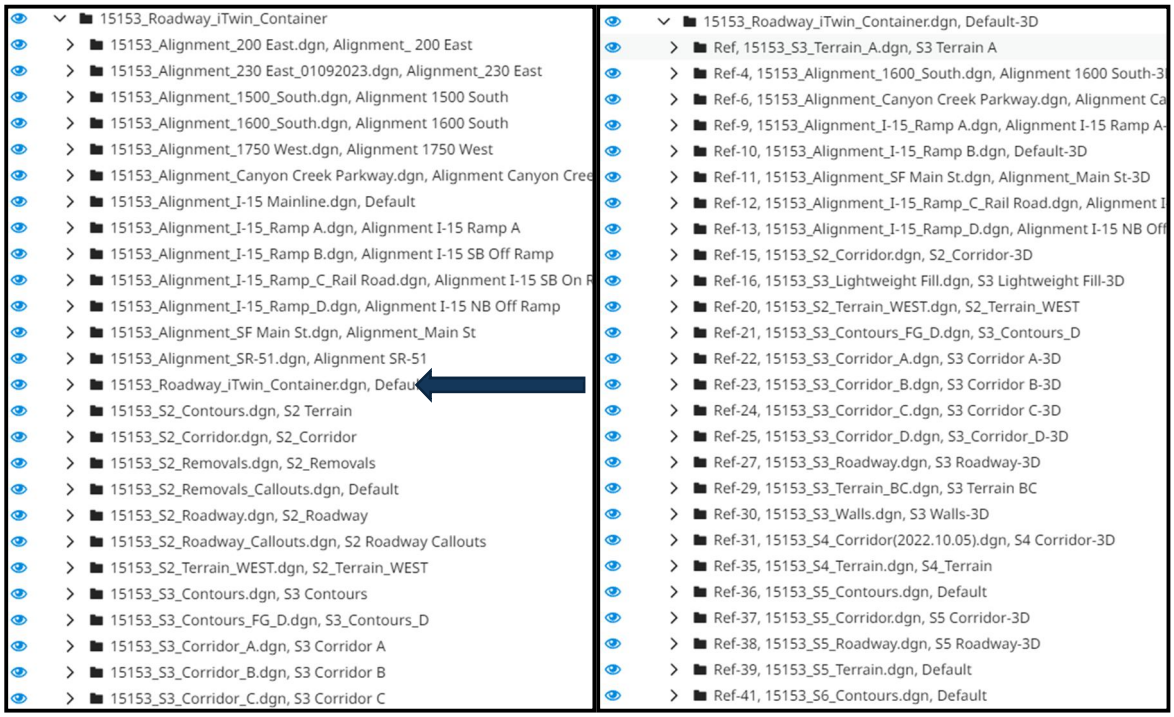


Screen Capture 3: iModel Container Connections

Unique iModel Connections allow the container files to be independent references within the iModel’s Model Tree as shown in Screen Capture 4. This allows users to easily turn on and off elements by discipline. The Model Tree is an important tool for users to sort through files quickly. The 3D model space is also shown in the Model Tree as shown in Screen Capture 5.



Screen Capture 4: Bentley ICP – iModel Tree Views



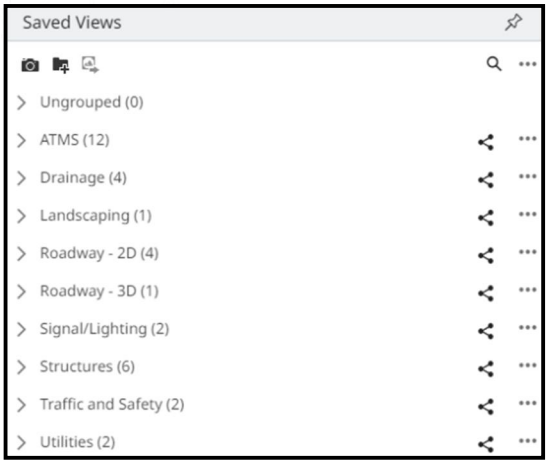
Screen Capture 5: Roadway 3D Container File References (UDOT)

Discipline Specific Saved Views

With a Master iModel for all disciplines, discipline-specific Saved Views should be created to establish discipline view preferences for review, see Screen Capture 6. This creates a similar experience to traditional plan review in which discipline specific annotation is only shown on its corresponding view

and other disciplines are deemphasized when they are not the focus. For detailed guide on creating an iModel and Saved Views see Appendix C.

- Teams develop discipline-specific Saved Views similar to traditional plan sheets.
- Saved Views control the amount of information displayed to the reviewer by limiting or emphasizing model elements.

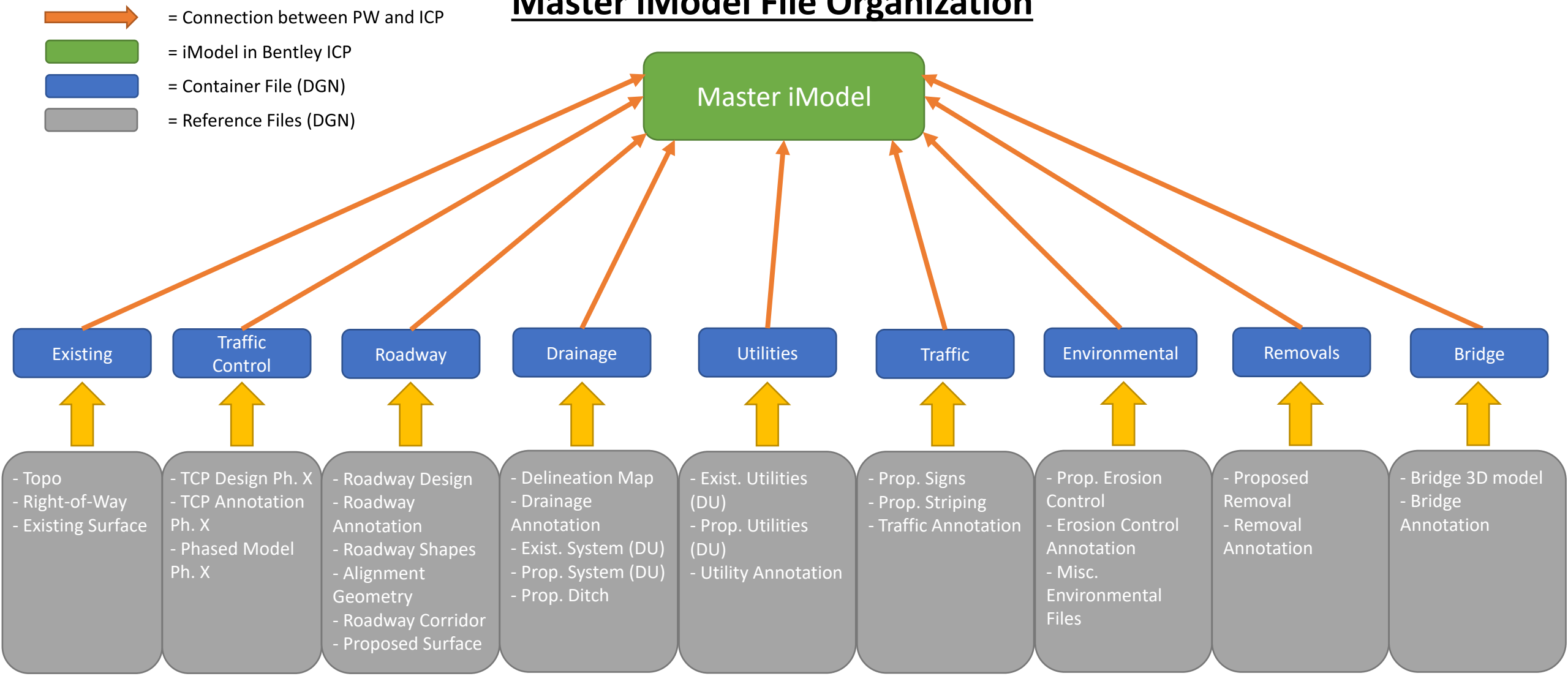


Screen Capture 6: Established Saved Views

Disclaimer: Bentley ICP is a web-based technology that undergoes regular upgrades. These upgrades should not affect production. Bentley's digital design review platform has been referred to as the following: iTwin, Design Review, Infrastructure Cloud, and ProjectWise Validate.

Appendix A

Master iModel File Organization



Notes:

1. The Master iModel File Organization diagram represents the majority of the disciplines and base files. Project teams should follow this diagram as a 'go by' and modify to meet the needs of the project related to scope and size.
2. 2D and 3D base files should be added to the same container file following the guidance provided in this document.

Appendix B

Quick Start Guide to Review using Bentley Infrastructure Cloud Platform (ICP)

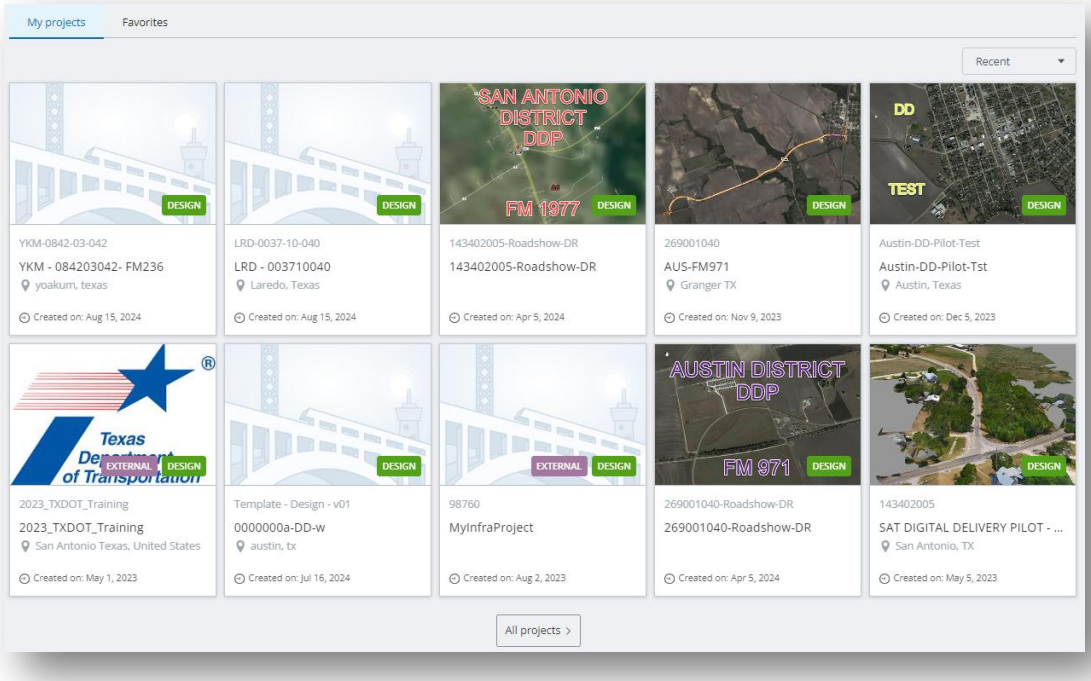
Purpose

This Quick Start Guide serves as a training document for Bentley's iTwin design review tool available on Bentley's Infrastructure Cloud Platform (ICP). Note that this technology is rapidly evolving, and the exact names and locations of specific tools may change with future versions, however, the workflows depicted are accurate as of the date of publishing. No major technology enhancements or changes are anticipated within the review period identified above.

Table of Contents

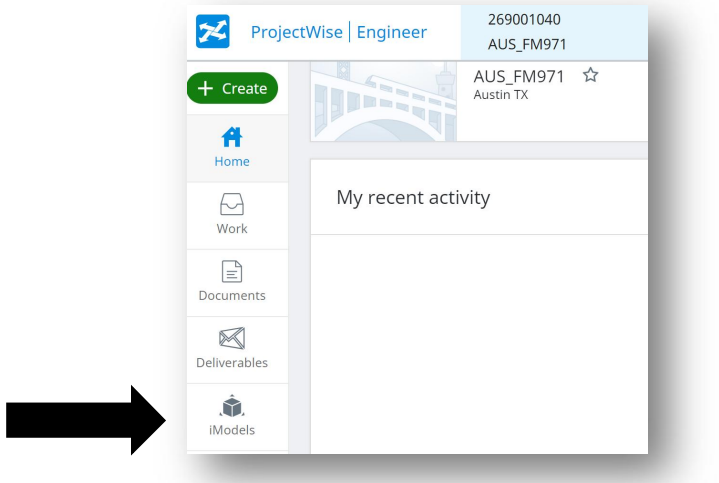
Accessing the submittal review material

1. Log on to https://infrastructurecloud.bentley.com/
2. Select the project specific card that you wish to review.

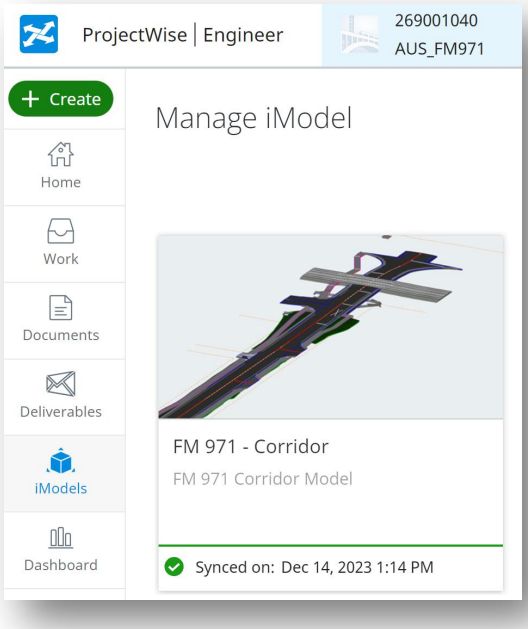


Accessing the iModels

1. Select the iModels tab.

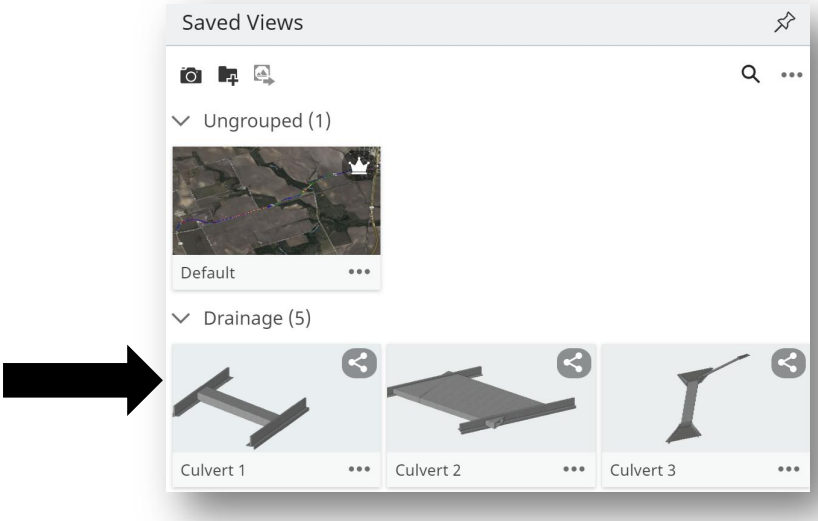


2. In the Manage iModel window, you will see a series of iModels for your review. Select the iModel that you want to review.



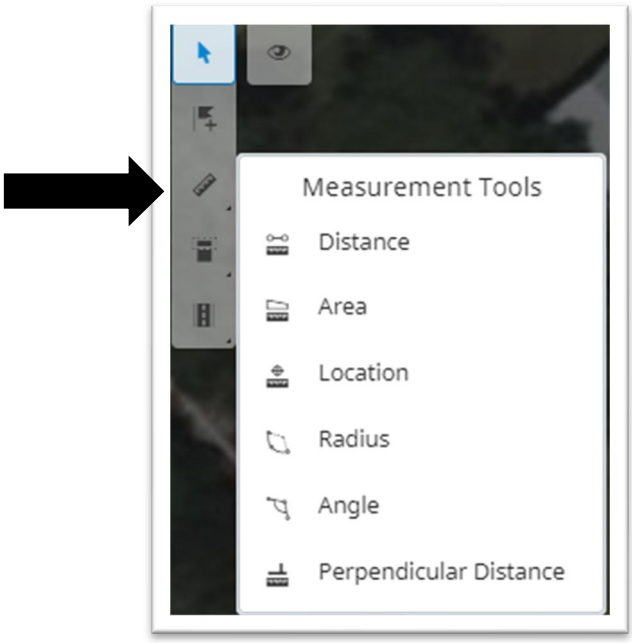
3. After the iModel is open, **select Views** tab at the bottom left section of the window.

4. Select the **Saved View** that you wish to review.

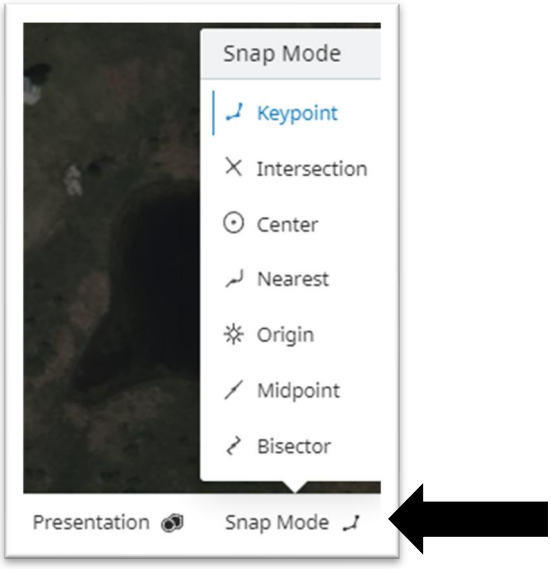


Basic Measuring Tools in the iModel – 2D

1. Within the iModel, select the **Measurement Tools** on the top right corner of the screen. Select the desired tool. Left click within the iModel to activate the tool. Right click to cancel the tool.

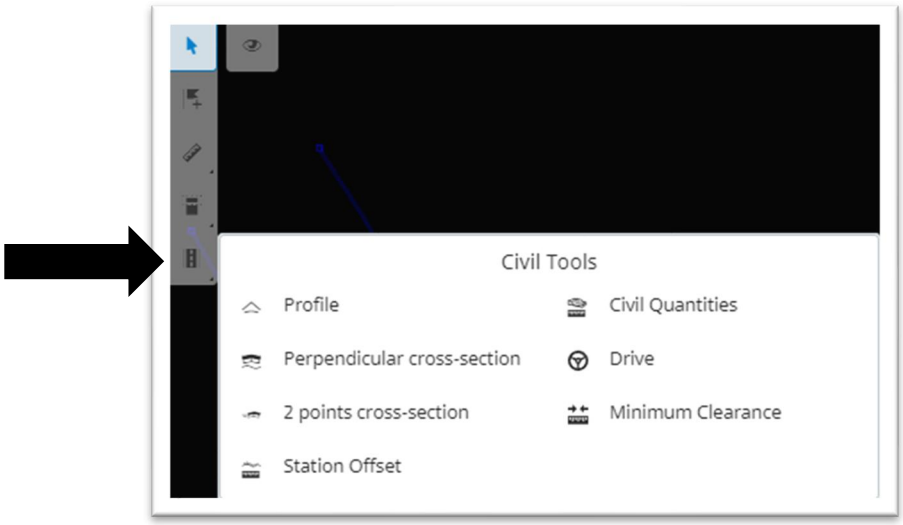


2. To update your Snap Mode (i.e. perpendicular), select the Snap Mode setting in the bottom right corner of the screen.

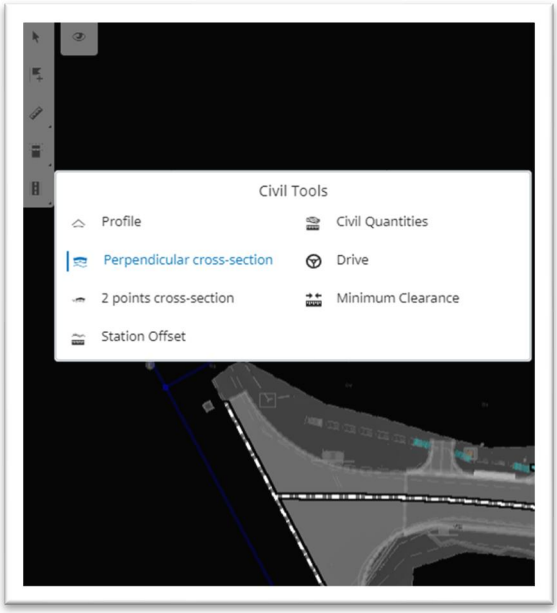


Basic Measuring Tools in the iModel – 3D

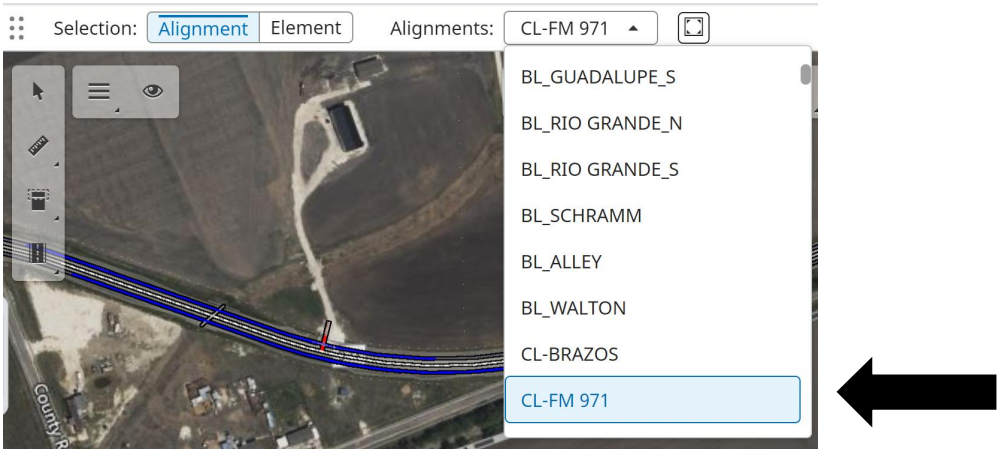
1. Within the iModel, select the **Civil Tools** on the top right corner of the screen.



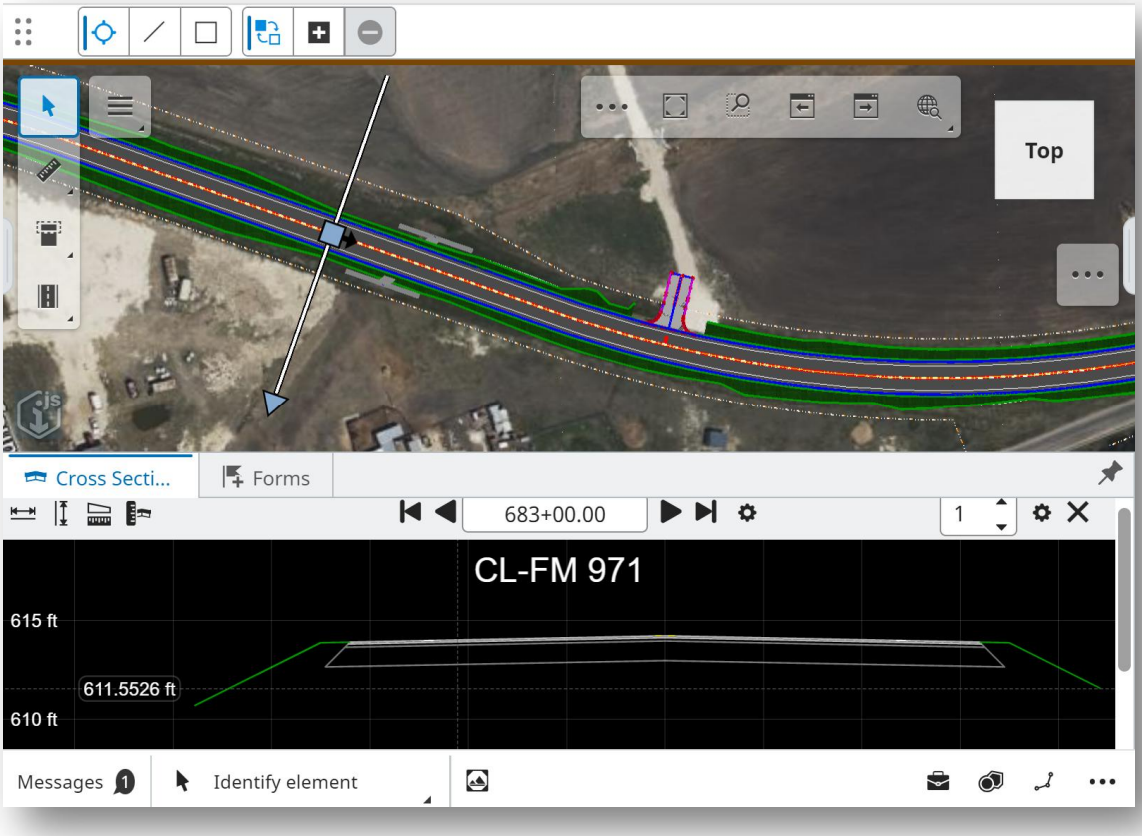
2. Select the Perpendicular Cross-Section tool to view dynamic cross-sections along the alignment.



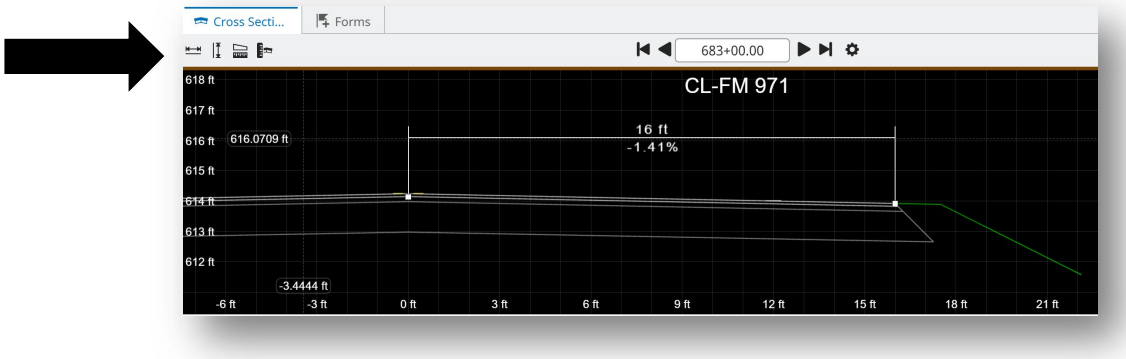
3. Select the desired alignment using the drop-down tool (CL-FM 971).



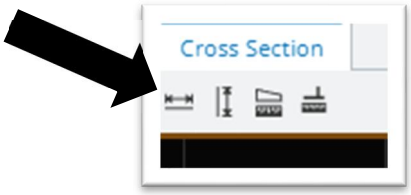
4. Move along the alignment by clicking the arrows in the cross-section viewer.



5. To measure within the cross-section viewer, select the measurement tools in the tool left corner of the cross-section viewer window.



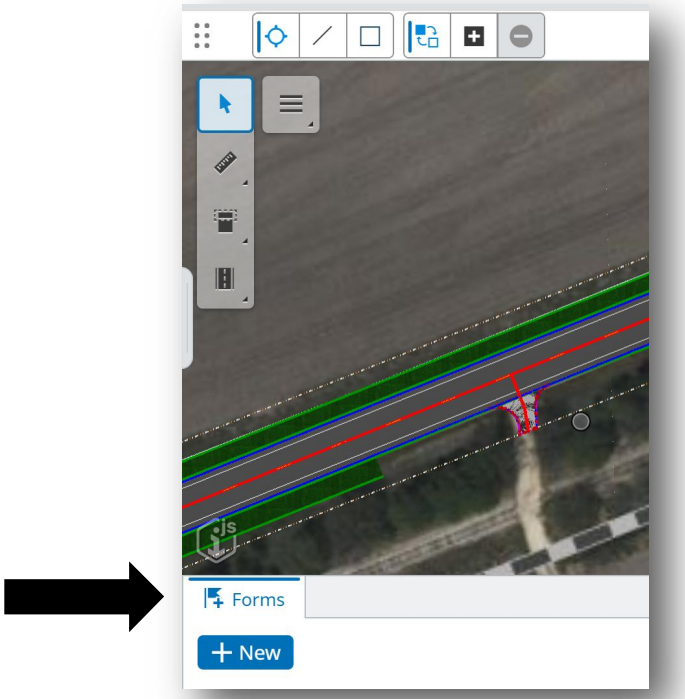
6. To measure within the cross-slope and width, select the horizontal measuring tool.



7. Select two points within the cross-section viewer to snap the dimension tool.

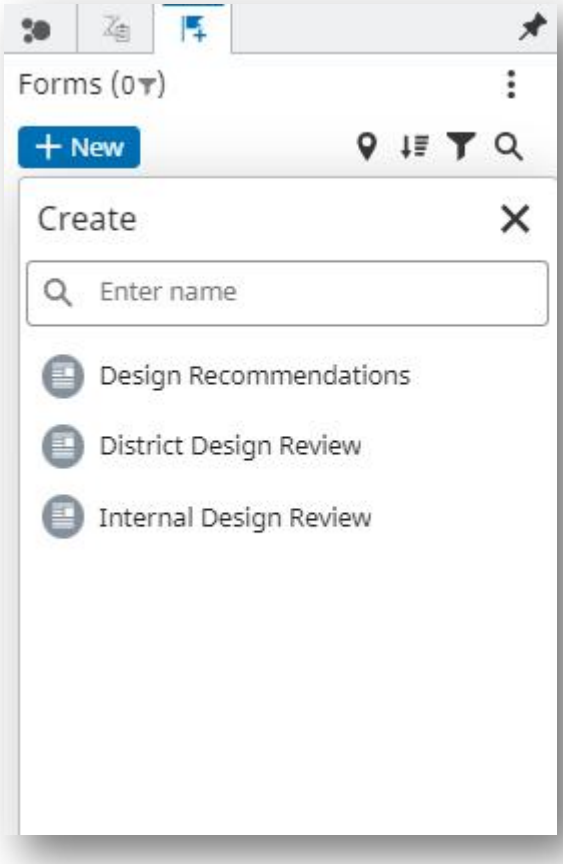
Creating a Comment on an iModel

1. Navigate to the ‘Forms’ tab in the bottom left corner of the screen.

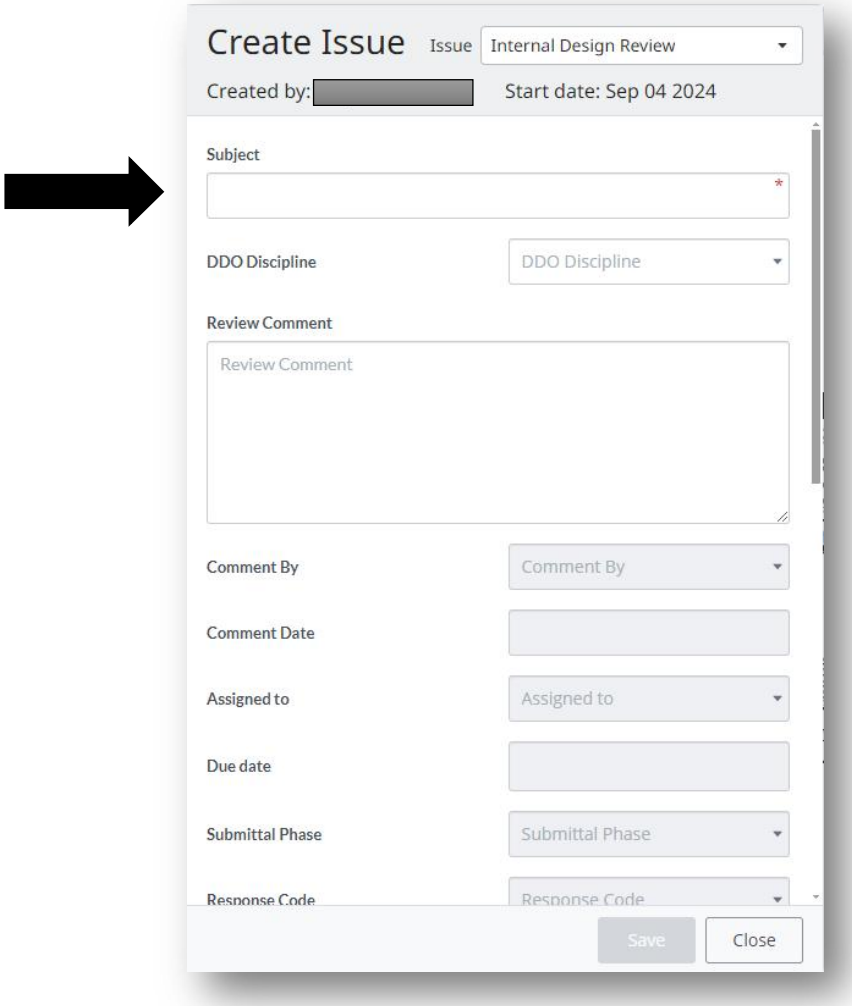


2. Select the ‘New’ button to create a comment.

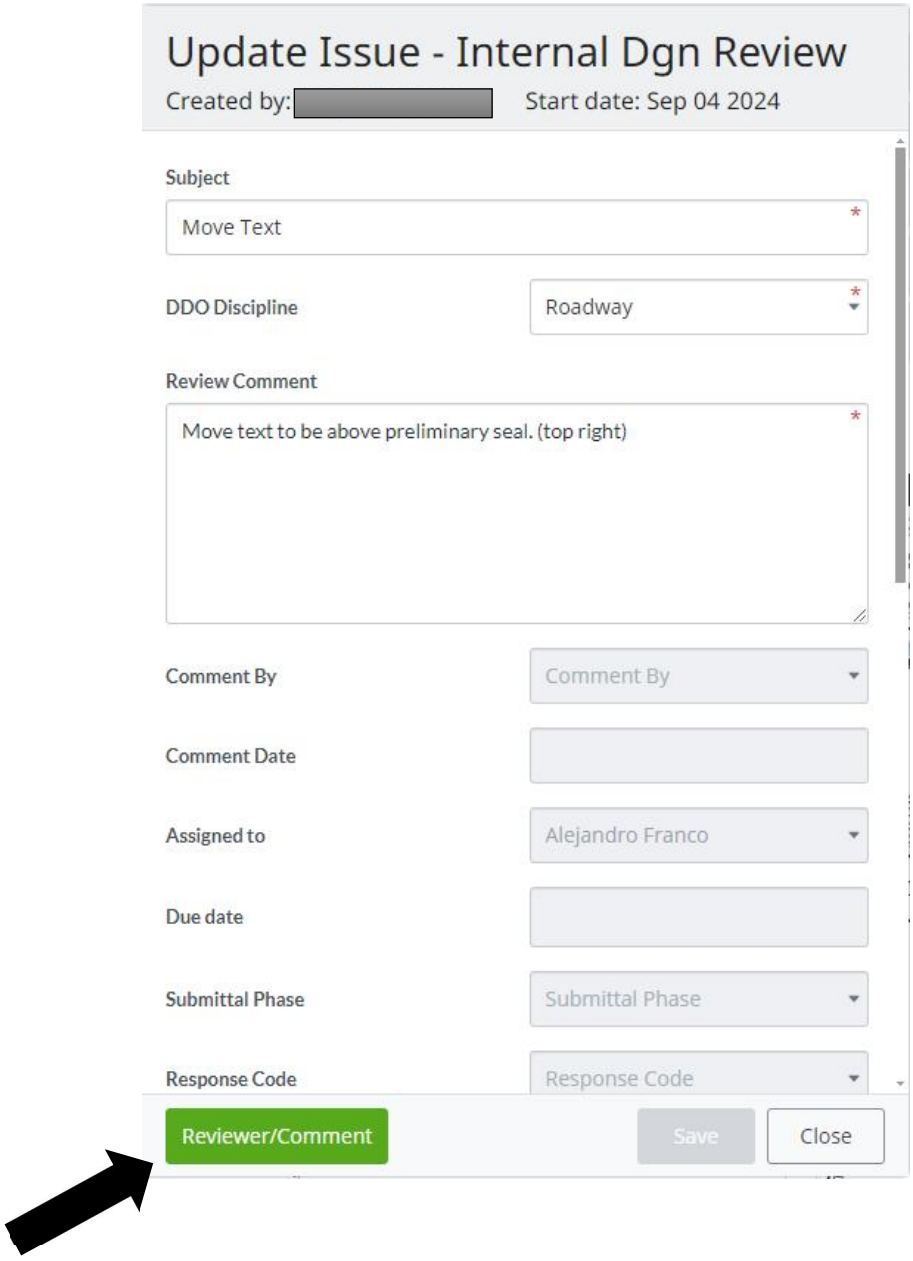
3. Select the design review comment form that matches the review phase.
    a. “District Design Review” form is reserved for official milestone review.
    b. “Internal Design Review” form is reserved for QC prior to official milestone review.
    c. “Design Recommendations” form is reserved for suggestions, cross disciplinary review, and other unofficial purposes.



4. Fill out the “Subject”, “DDO Discipline” and “Review Comment” sections, then click “Save”.

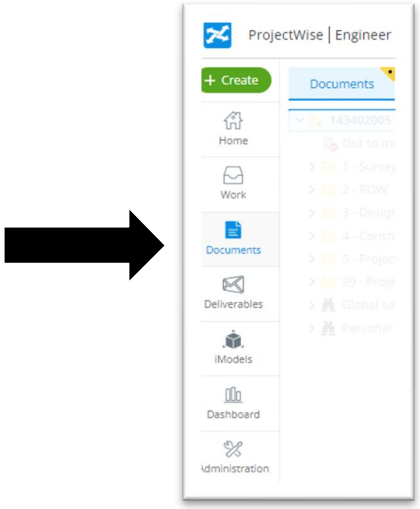


6. Reopen the issue. Click the “Reviewer/Comment” button, and the issue window will close.
   Note – all fields with an “” must be filled out.*

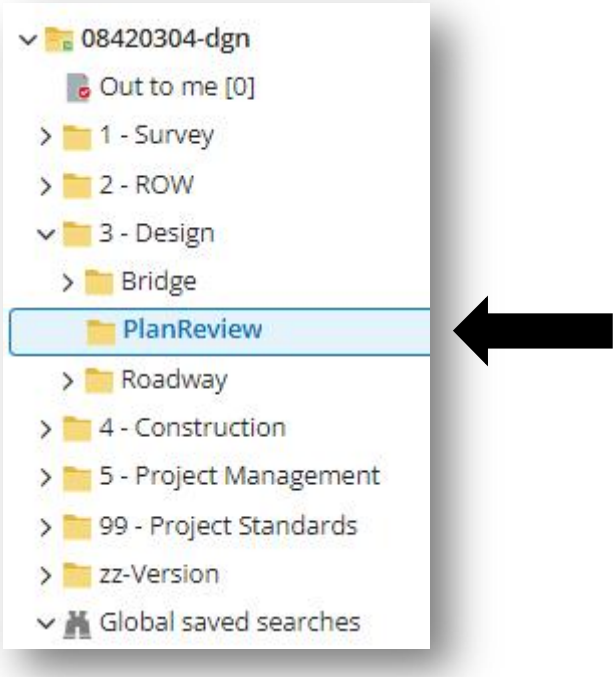


Accessing the documents

1. Select the Documents tab.

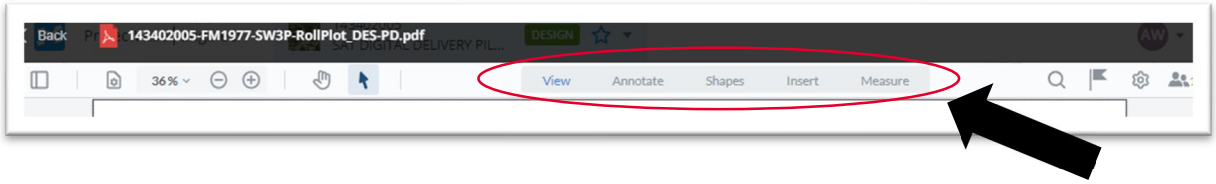


2. Navigate to the ‘Plan Review’ folder in the ProjectWise connected portal.

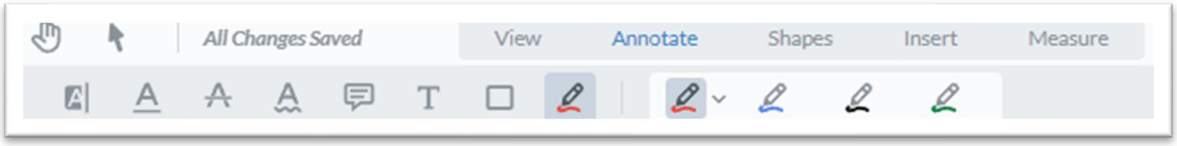


Creating a Comment on a Document

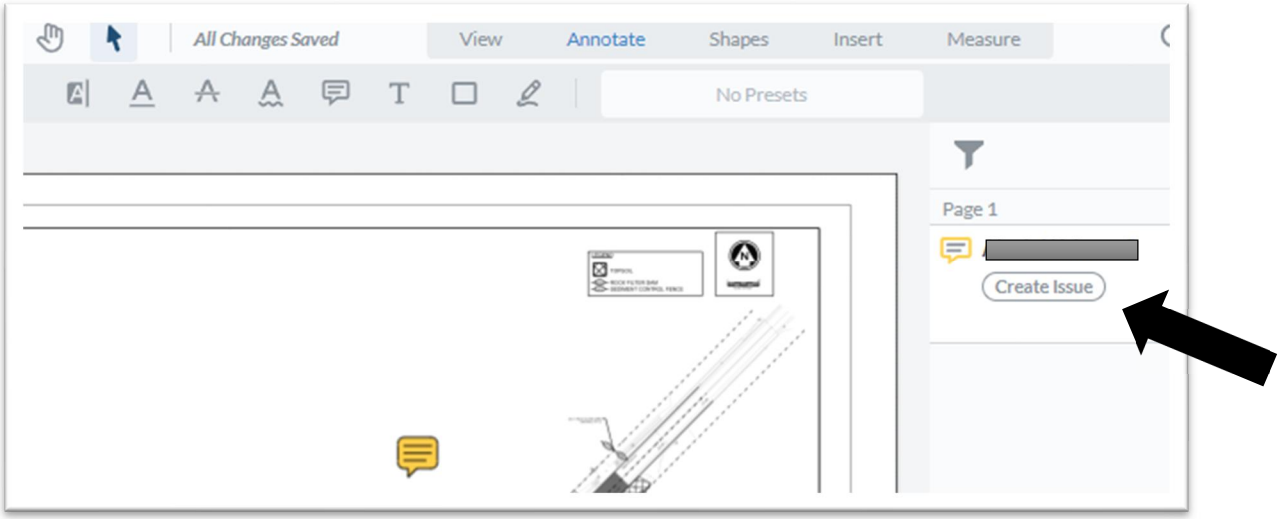
1. In the document, select the mark up tool.



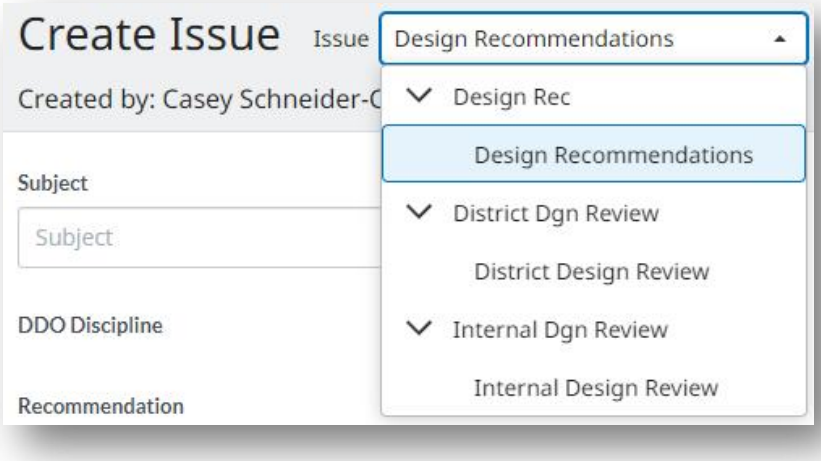
2. Use the mark up tools to add lines, or shapes to the document
   NOTE: Through "Free Text" tool, an issue cannot be created. Use other markup tools to create issue.



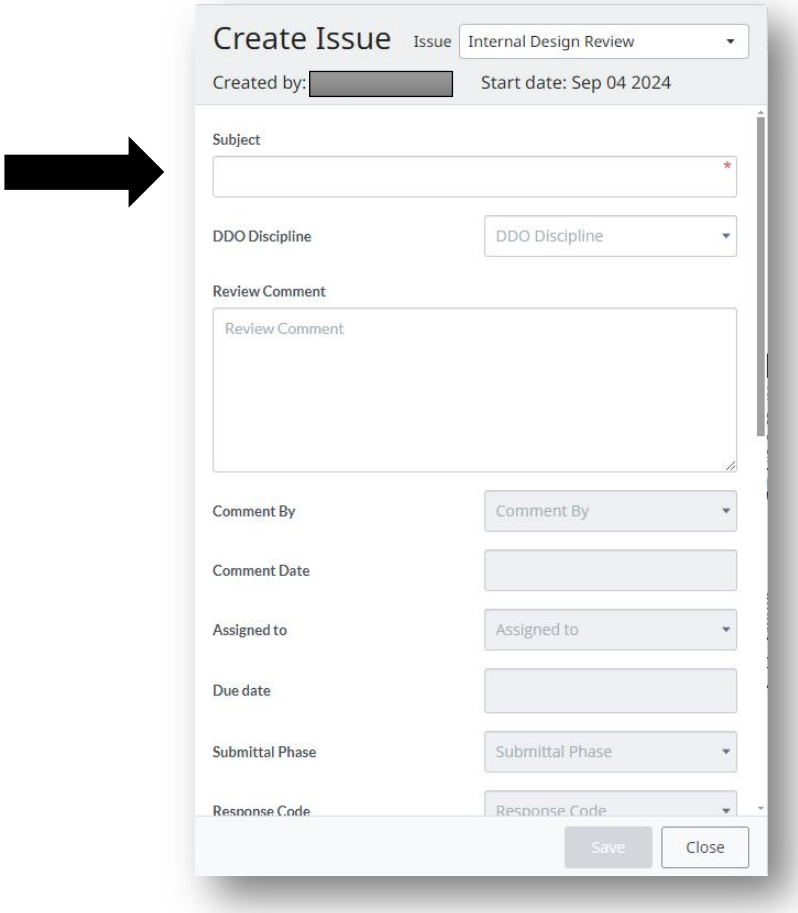
3. To create an official comment based on the mark up, **select the 'create issue' button** associated with the mark up.



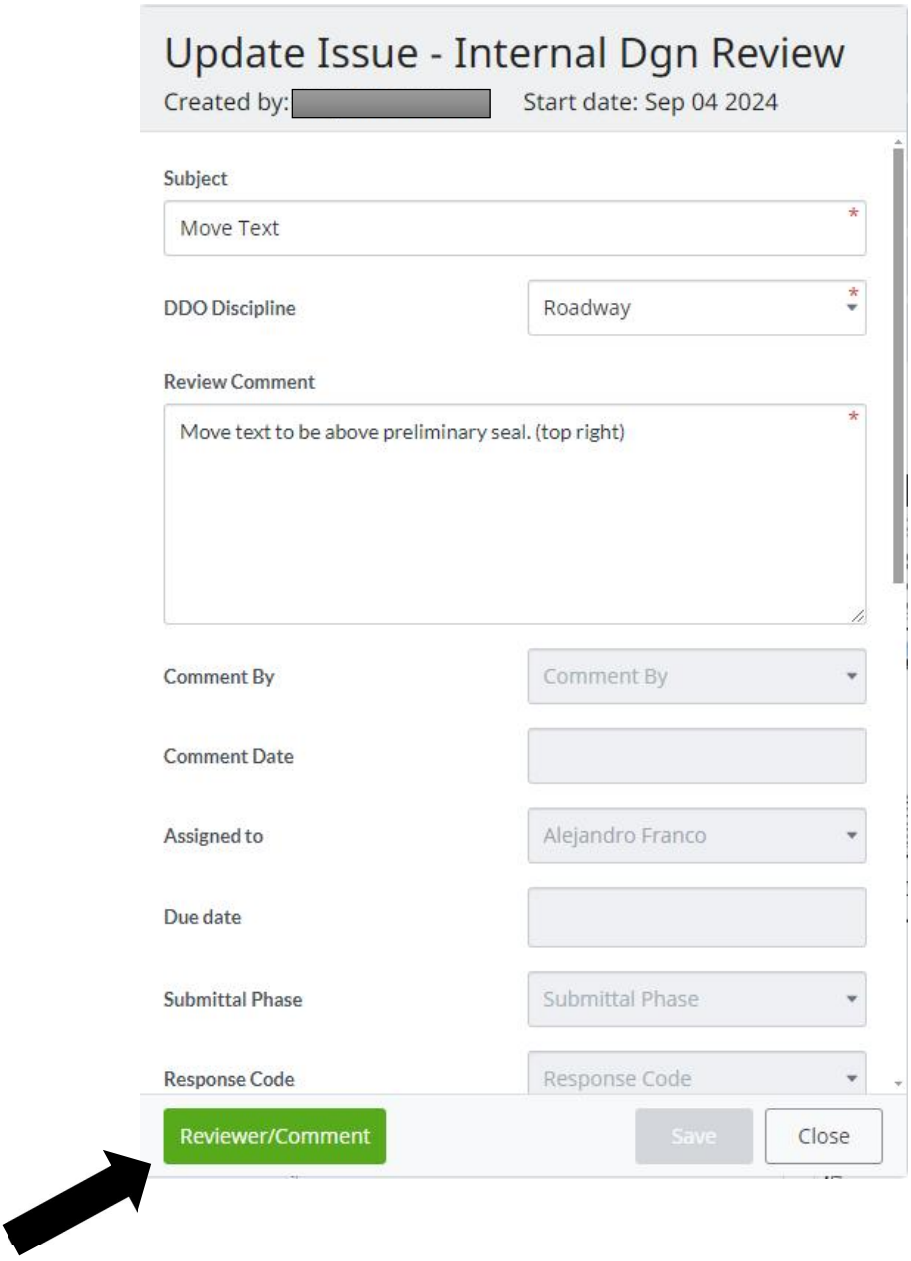
4. Select the design review comment form that matches the review phase.
    a. “District Design Review” form is reserved for official milestone review.
    b. “Internal Design Review” form is reserved for QC prior to official milestone review.
    c. “Design Recommendations” form is reserved for suggestions, cross disciplinary review, and other unofficial purposes.



5. Fill out the “Subject”, “DDO Discipline” and “Review Comment” sections, then click “Save”.

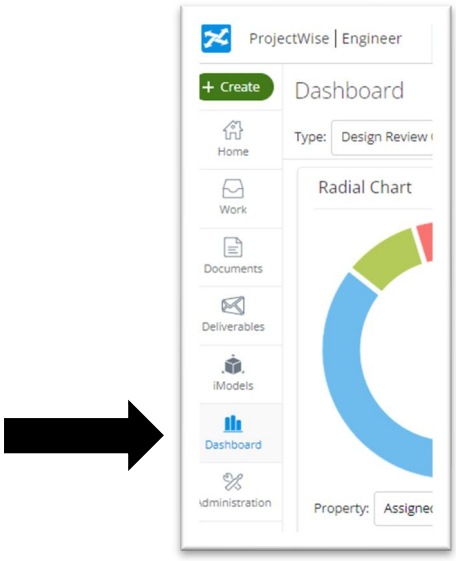


6. Reopen the issue. Click the “Reviewer/Comment” button, and the issue window will close.
   Note – all fields with an “” must be filled out.*



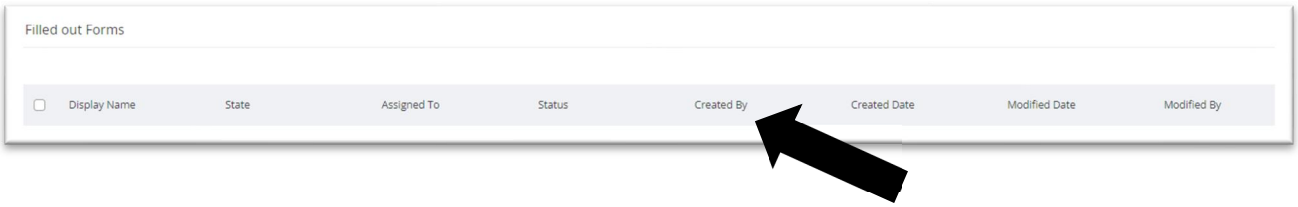
Reviewing and Tracking Comments

1. Select the ‘dashboard’ tab to review and track all comments.



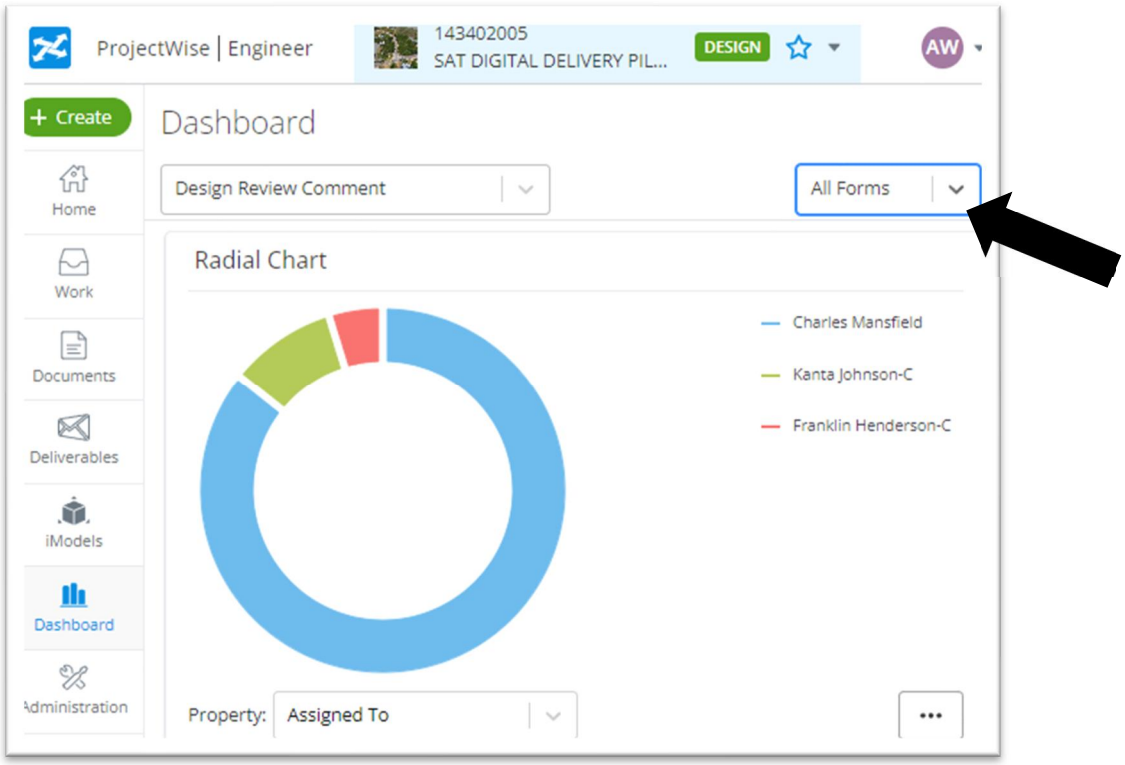
2. Select the desired comment form that you would like to review.

3. Sort by column data. To find comments created by a specific reviewer sort using Created by.

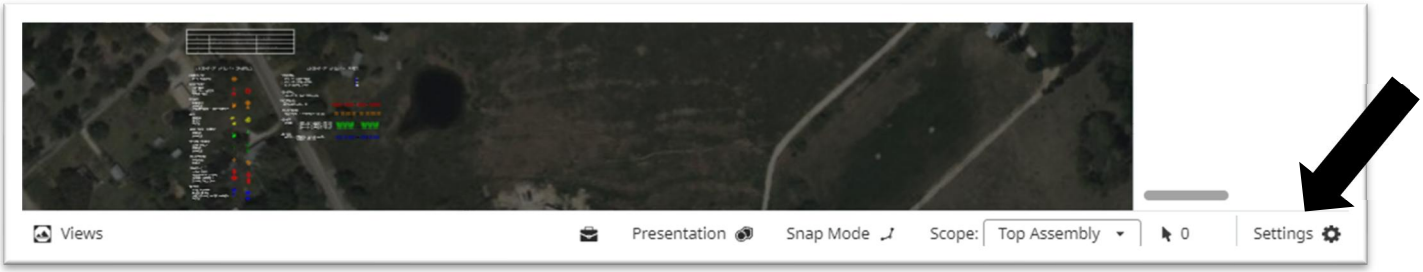


Tips and Tricks

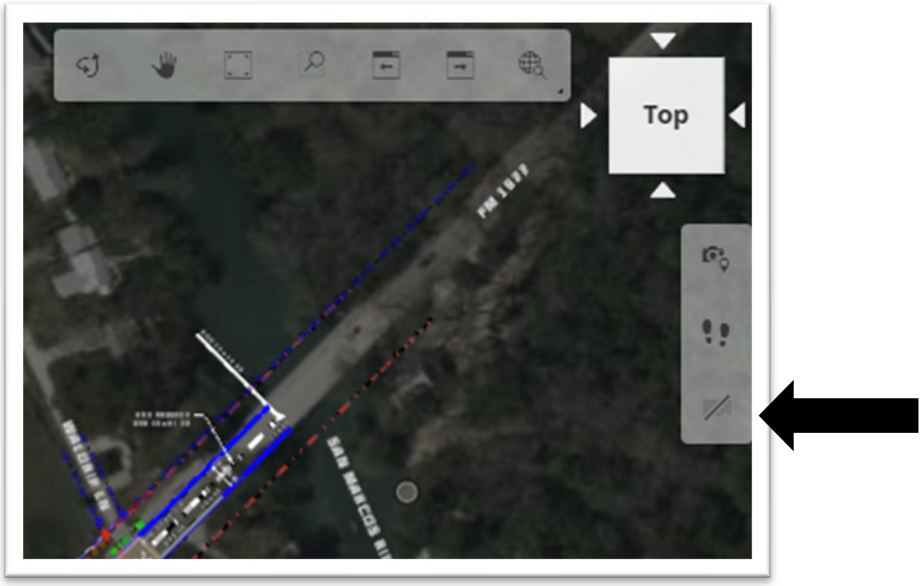
1. If you are missing comments in the dashboard, check that the filter in the top right is set to All Forms.



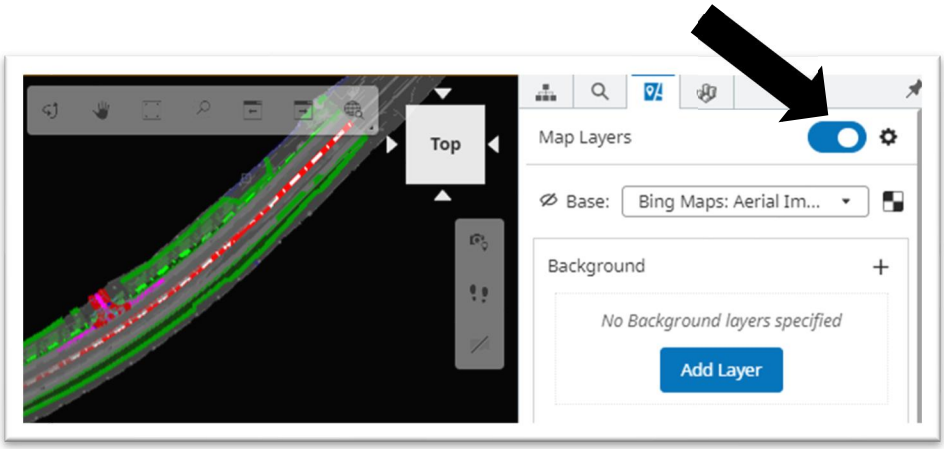
2. To measure with US Survey Feet within the iModels, change the setting for the unit of measurement to US Survey Feet in the Settings tool.



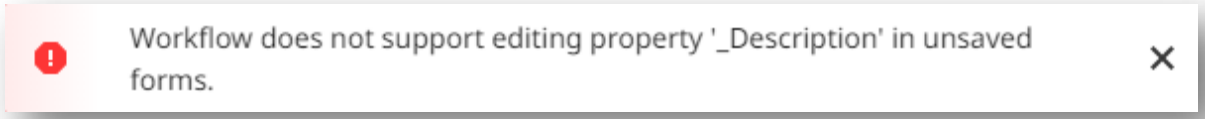
3. If the design does not align with the ariel, turn off the Camera Mode.



4. To turn the background map on or off, toggle the Map Layers on and off. Turning the map off can increase the processing time for loading the iModels.



5. When creating or updating an issue within a markup, an error message may pop up. If this occurs, it is recommended to delete the mark up and recreate the comment.



Appendix C

Quick Start Guide to Creating iModels and Saved Views in Bentley Design Review

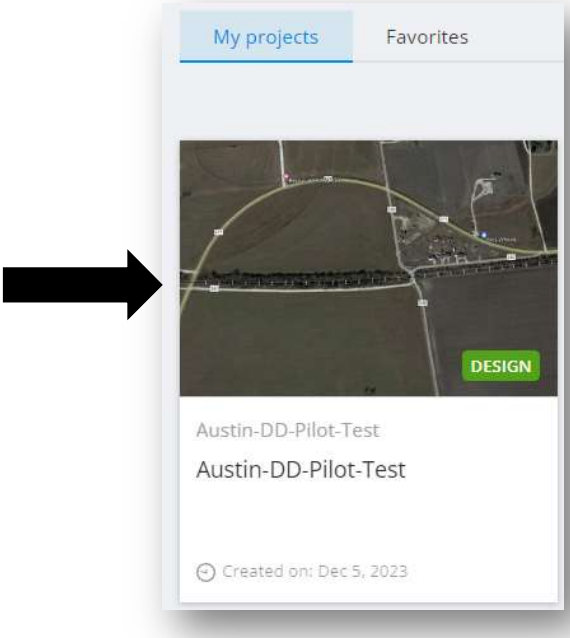
Purpose

This Quick Start Guide provide screen shots and steps for creating an iModel and Saved Views within Bentley's Design Review on infrastructurecloud.bentley.com.

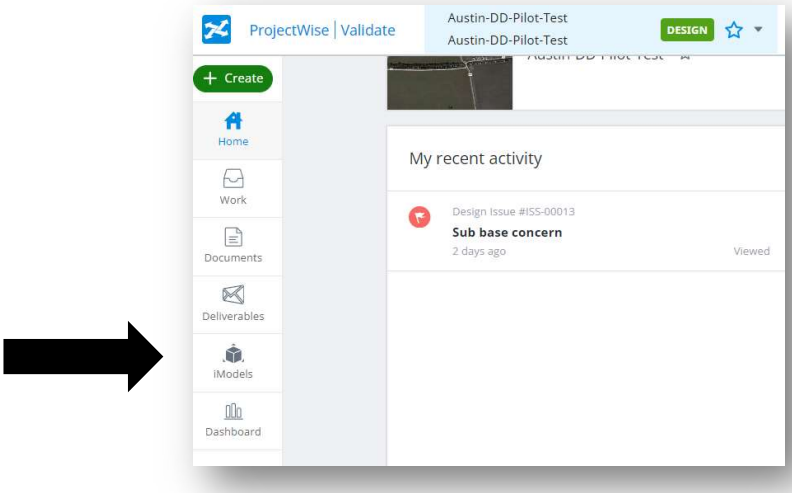
Table of Contents

Creating an iModel

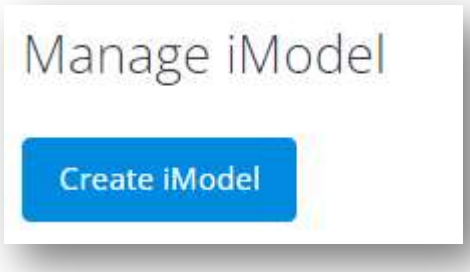
1. Log on to https://infrastructurecloud.bentley.com/
2. Select the desired project.



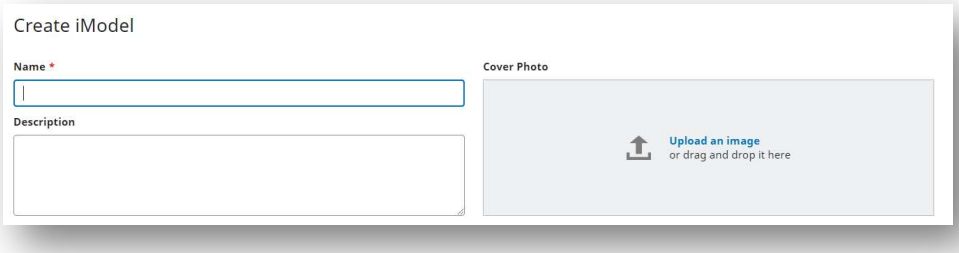
3. Select to the iModel tab.



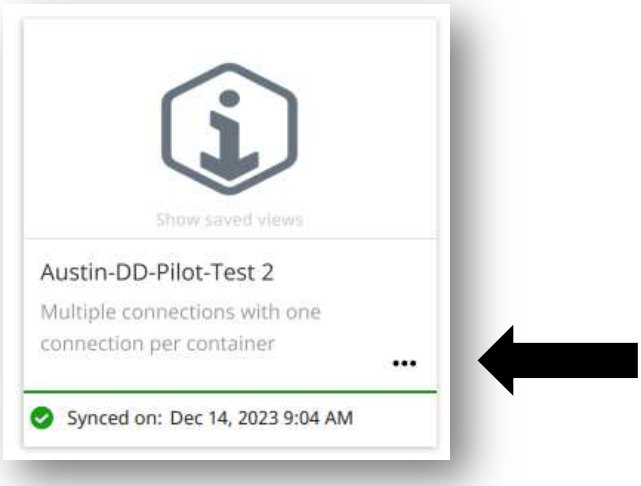
4. Select “Create iModel”



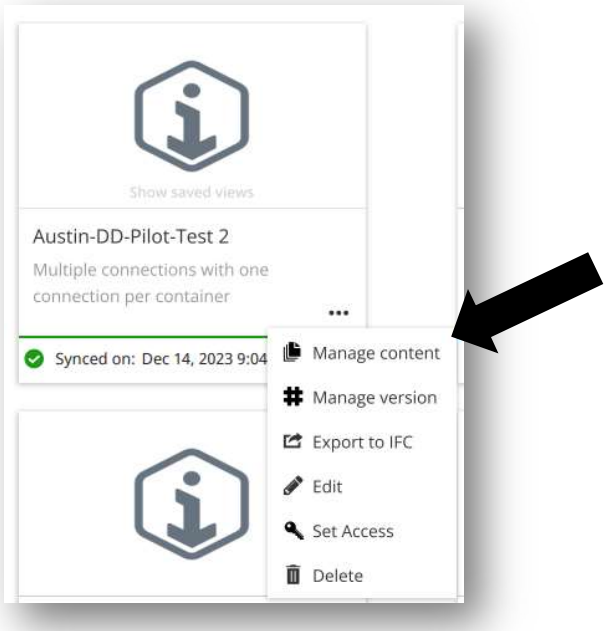
5. Fill out the information for Name, Description, and upload a picture if desired.



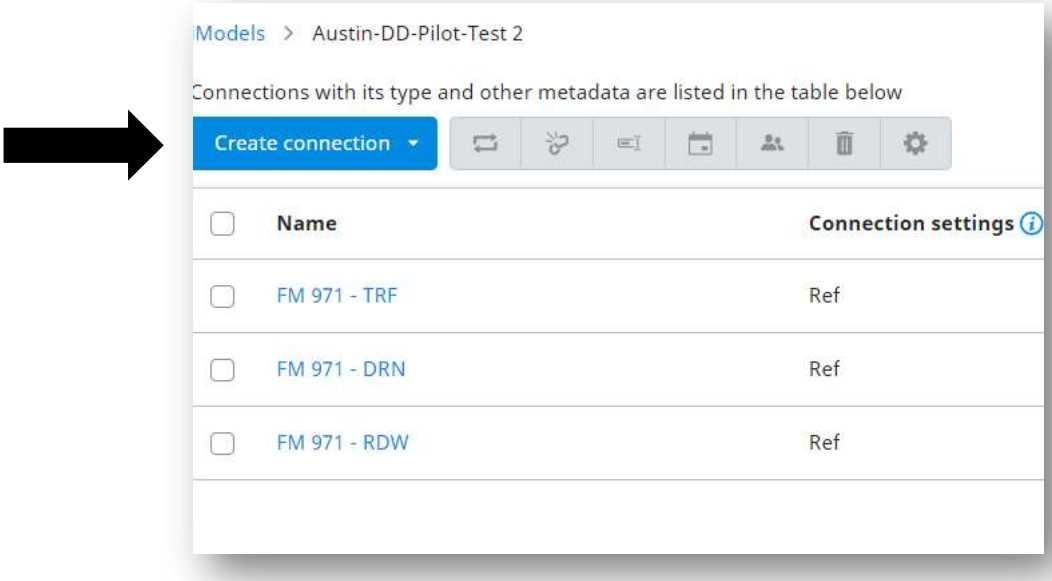
6. Select “…”



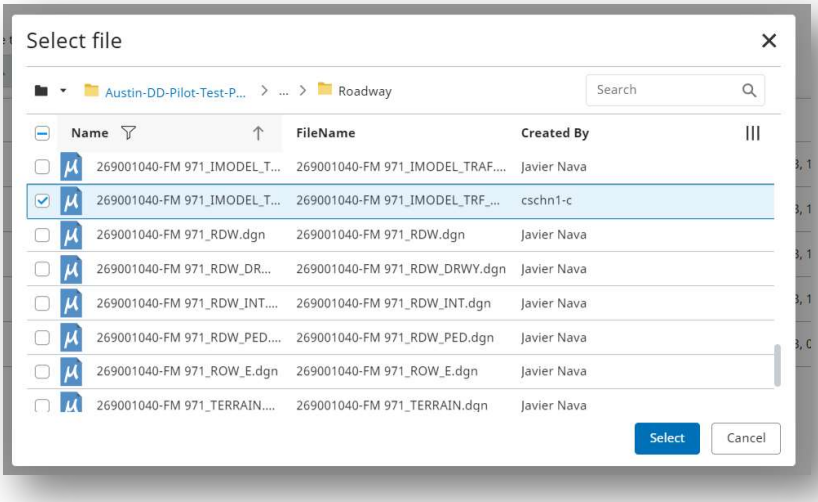
7. Select “Manage content”



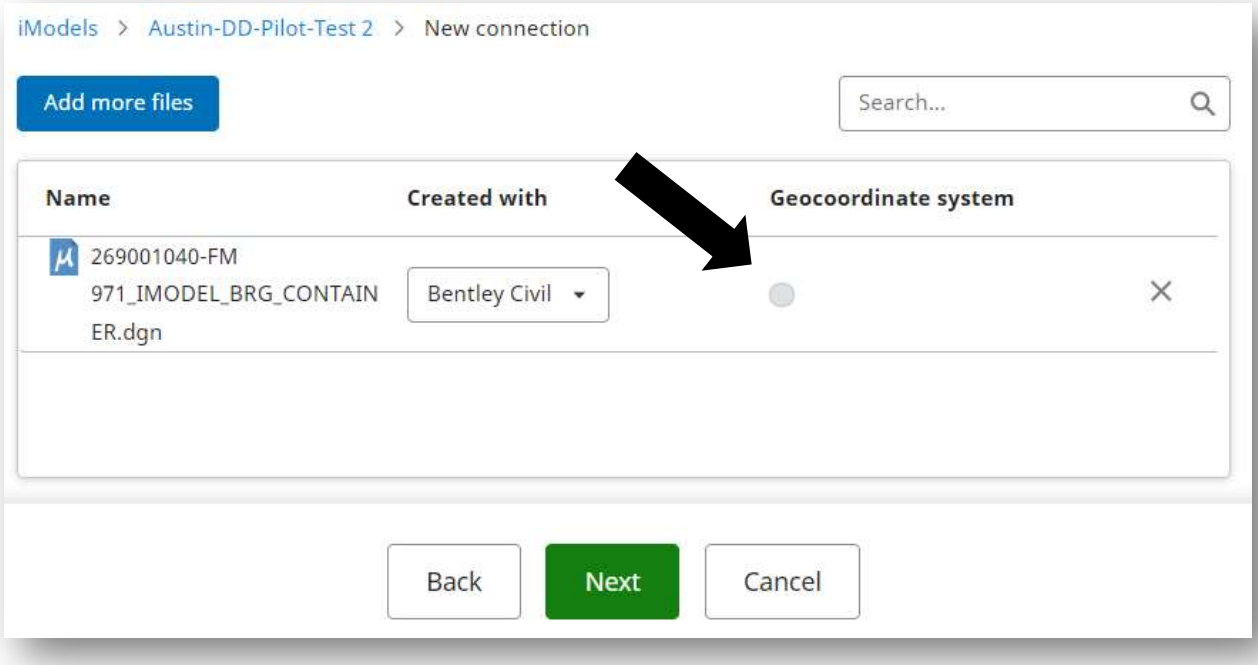
8. Select “Create Connection”



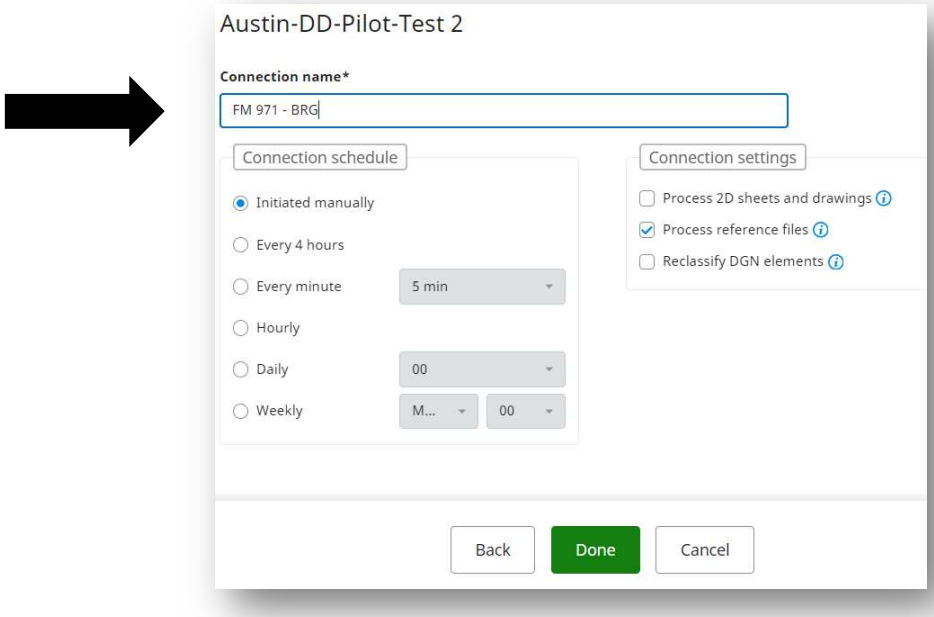
9. Select the desired container file from your PW folder.
    a. *Recommend only connecting ONE file per connection – needs further investigation.*



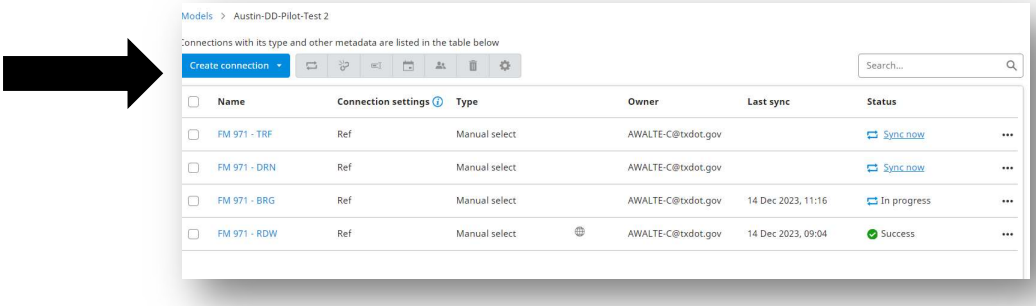
10. For the first connection in an iModel, you will need to select the ‘Geocoordinate system’. After the first connection is made, this button will be greyed out.



11. Section next to move on.
12. Name the connection. This name can be changed after it is created. It does not show up in the "Model Tree".
    a. Default settings shown below.
    b. These settings worked well for our test in combination with ensuring the container file used for the iModel has a 3D model space that was activated and live nested within the 2D space as well as the activation of a DU model within the container, see iModel Guidance document for more information on setting up a container file.



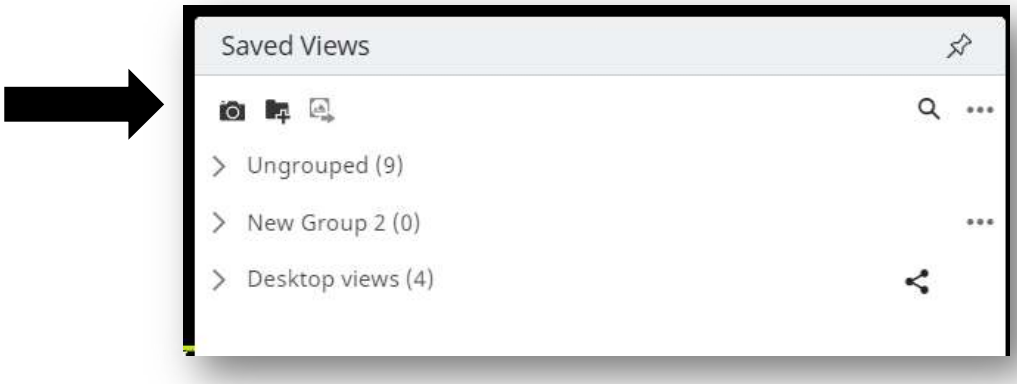
13. Sync the connection by selecting "sync now". You can sync multiple connections at the same time. They will be in a que.



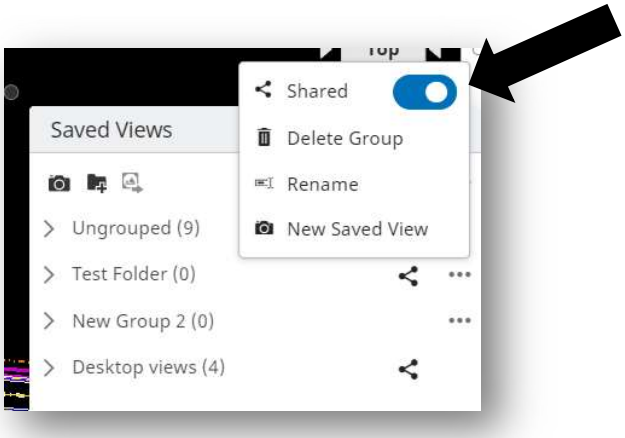
Creating a Saved View

1. Within the desired iModel, select the “Views” tab in the bottom of the screen.

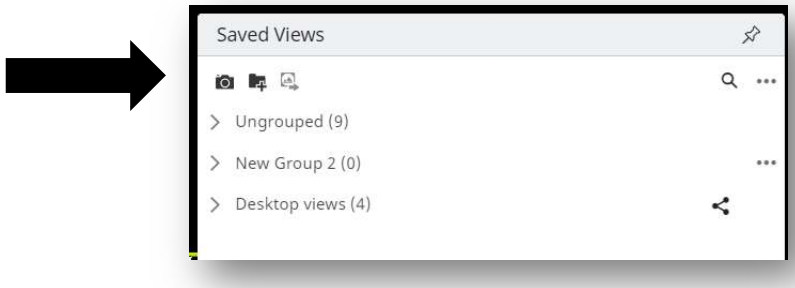
2. Select the Folder + icon if you wish to create a folder for your saved view.



3. Once you have created a folder, select the “…” and toggle on the “Shared” option to add to the project view.

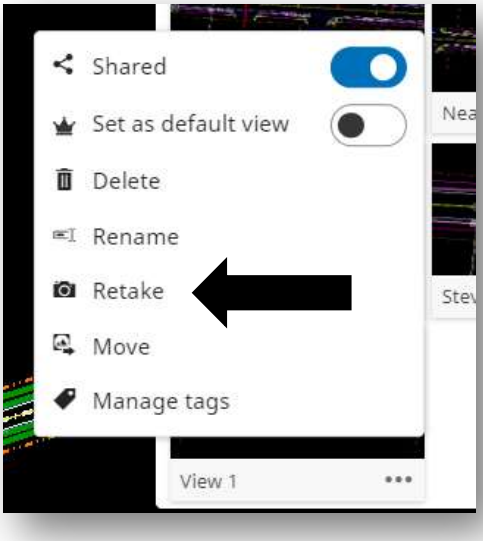


14. To create a save view, select the camera icon.



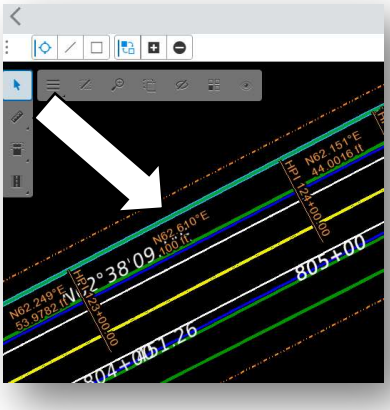
15. Name and share the saved view similar to the folder creation.

16. To retake your saved view, select the "…" and select "Retake.

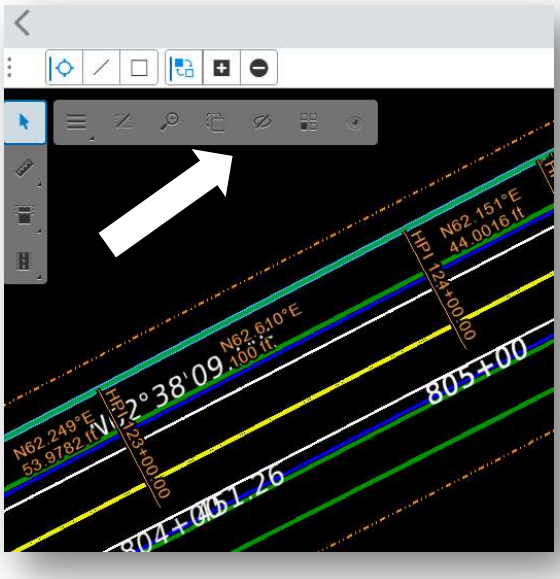


Changing the Display Styles for a Saved View

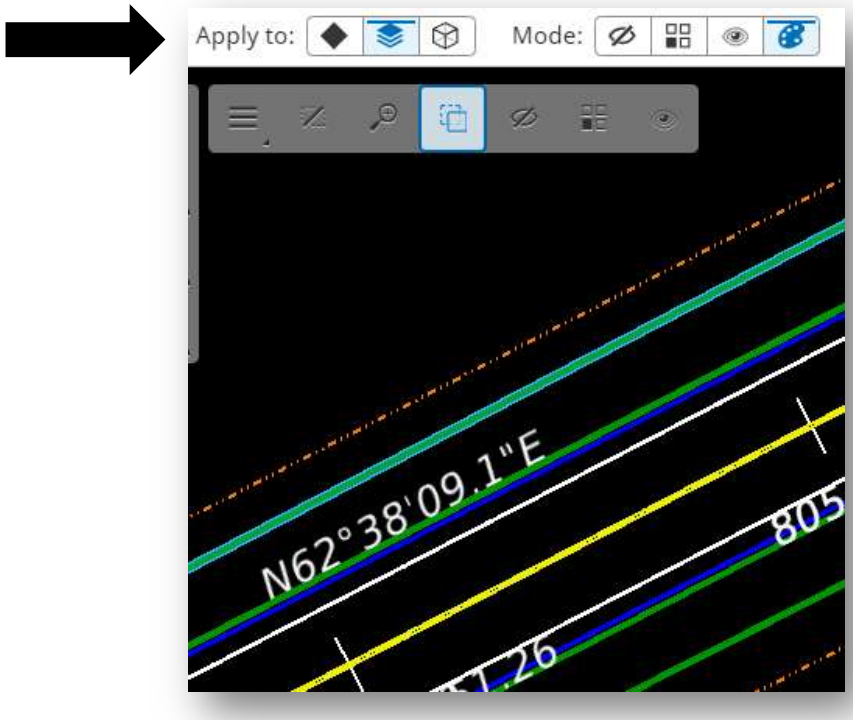
4. Once you have a saved view created, you can retake the saved view to reflect changes in the display styles.
5. To change a display style, first select the element you want to change. Element will show up highlighted.



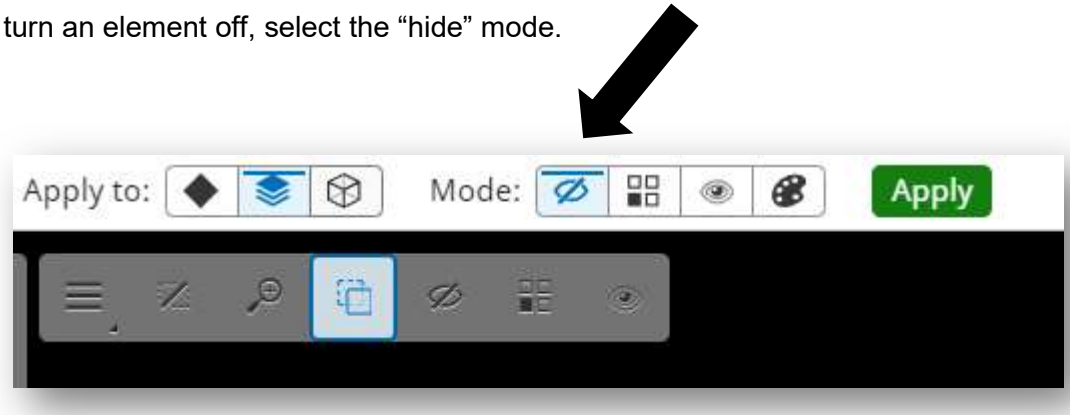
6. Select the “Change Visibility” tool.



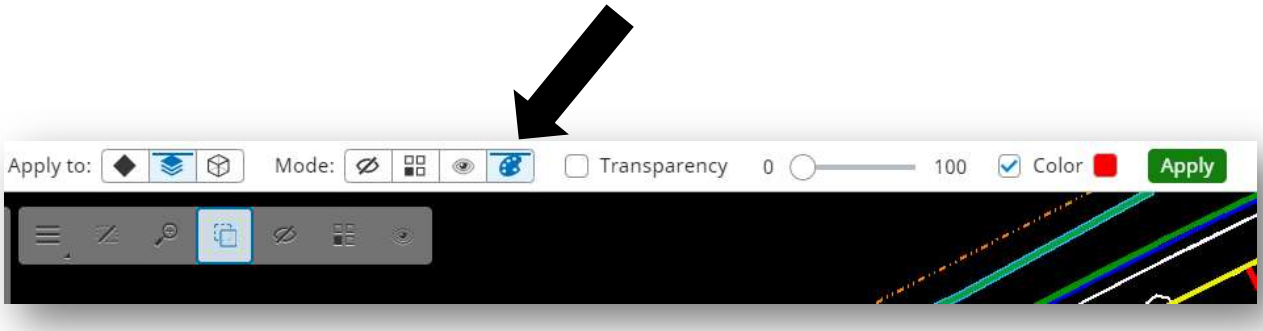
7. Use the “Apply to” tool to determine if you want to change by element, level, or model.
    a. Model is referring to the file is it associated with.



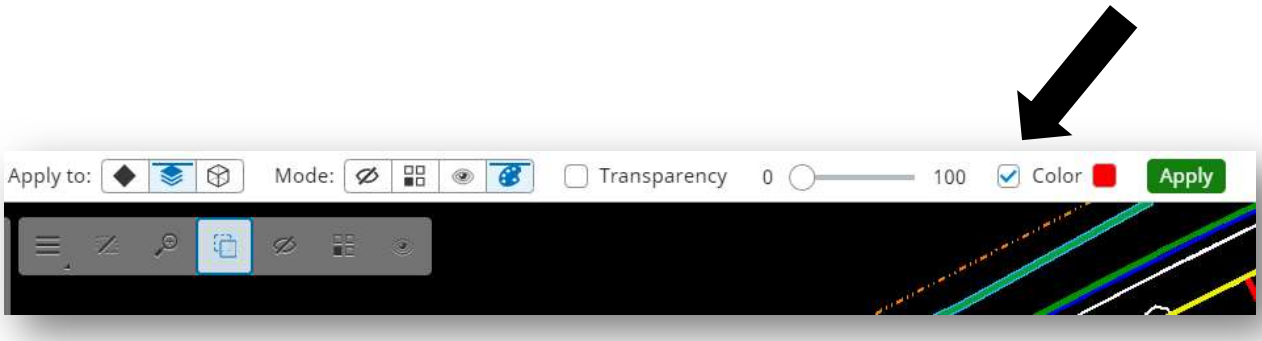
8. To turn an element off, select the “hide” mode.



9. To change the color or transparency, select the mode with the color pallet icon.



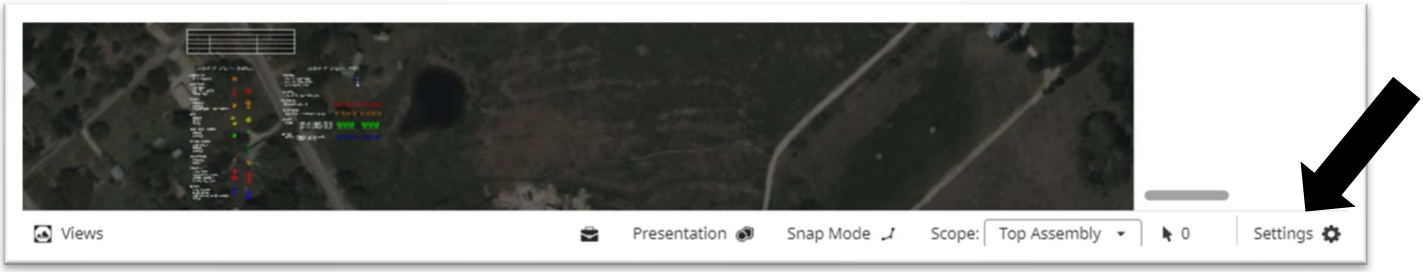
10. To change the transparency and/or color, select the check box next to the desired item. Then click to apply.



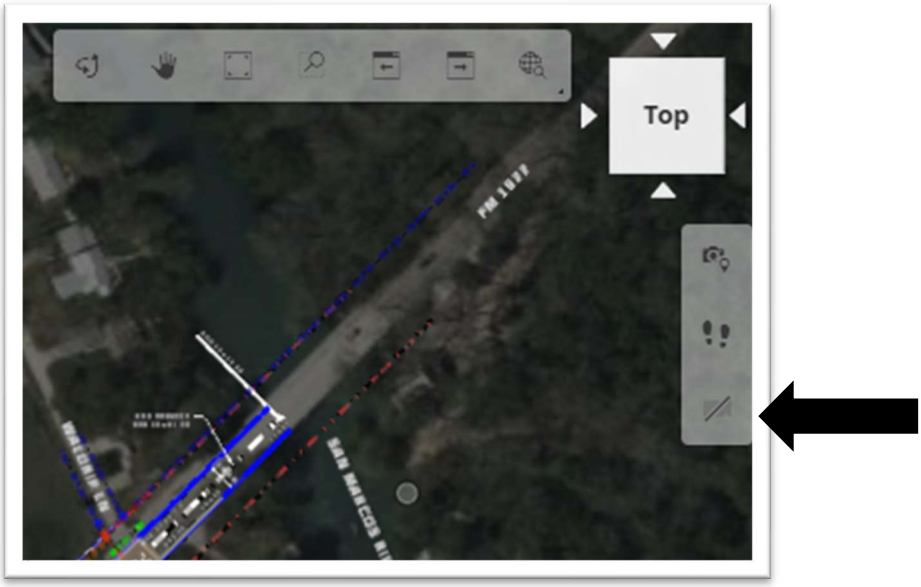
11. Retake saved view to save changes.

Tips and Tricks

1. To measure with US Survey Feet within the iModels, change the setting for the unit of measurement to US Survey Feet in the Settings tool.



2. If the design does not align with the ariel, turn off the Camera Mode.



3. To turn the background map on or off, toggle the Map Layers on and off. Turning the map off can increase the processing time for loading the iModels.