BUSINESS CENTER – HCE
Powered by Trimble

# Bentley-Trimble Workflow Help

Version 3.13

September 2014

## Corporate Office

Trimble Navigation Limited
Engineering and Construction Division
935 Stewart Drive
Sunnyvale, California 94085
U.S.A.
Phone: +1-408-481-8000
Toll free (in USA) +1-800-874-6253
Fax: +1-408-481-7744
www.trimble.com

## Copyright and Trademarks

# Contents

# Understanding Bentley i-model (.icm.dgn) Files

Like Bentley i-models (.i.dgn) before them, i-model (.icm.dgn) files are containers for the open exchange of infrastructure information. Bentley's i-model technology is used to write an Infrastructure Consensus Model (ICM) file that contains civil engineering objects. This new i-model (.icm.dgn) functionality is available in these Bentley civil design products with OpenRoads SELECTSeries 3 technology (SS3):

- InRoads
- MXROAD
- GEOPAK (SS3; Maintenance Release 2 (MR2))

In these programs, you can create an i-model (.icm.dgn) file that can contain these civil objects:

- Points
- Linear entities 3D (3D polylines)
- Horizontal alignments (3D lines that may or may not be associated with a corridor)
  - Profiles
  - Station equations
- Meshes
  - Surface meshes (on page 25) (open meshes)
  - Component meshes (on page 23) (closed meshes)
- Corridor Meshes (meshes that are associated with a corridor)
  - Surface meshes (on page 25)
  - Corridor top mesh (on page 23)
  - Corridor bottom mesh (on page 23)
  - Corridor default surface mesh
- Terrain models (typically original/existing ground, but possibly site designs).
  - DTM/TIN models (can include islands, voids, and holes)
  - Boundaries and breaklines (can be soft or hard)
  - Corridor alternate surfaces (not to be confused with meshes)

**Note:** Templates may include information on alternate surfaces. These can be generated by the ***Create Corridor Alternate Surfaces*** command in the ***Terrain Model*** section of ***Civil Tools***. While these surfaces are terrain models (TIN surfaces), they are alignment-based and, therefore, are exported with design model information in the i-model (.icm.dgn), as opposed to the Terrain Model group.

- Corridors
  - Master alignment
  - Top and bottom surface alignments
  - Boundary/hull
- Attribute information
  - Names
  - Levels (layers)
  - Colors
  - Line styles (defaults) - These are based on the standard 8 line styles available in all Bentley civil products; custom styles are not supported. Each line style name is prefixed with "i-model". Line style scale information is not included in the i-model (.icm.dgn) file, so a value of 1.0 is used.

### i-model (.icm.dgn) Files in Relation to i-model (.dgn) Files

While similar technology is used to create i-model (.icm.dgn) files, the previously released i-model functionality is not specifically related to i-model (.icm.dgn) files. The ***Publish i-model*** command in various Bentley products will not produce an i-model (.icm.dgn) file; the ***Create i-model (.icm.dgn)*** command must be used. i-model (.icm.dgn) files use newer i-model technology that is not compatible with any of the publicly available Bentley i-model readers. Currently, Business Center - HCE is the only released product that can read i-model (.icm.dgn) files. Existing i-model (.i.dgn) files are not importable into this program.

### Related topics

- Bentley-Trimble i-model (.icm.dgn) Workflow (on page 2)

# Bentley-Trimble i-model (.icm.dgn) Workflow

The goal of this Bentley-Trimble workflow is to guide you through an enhanced connection between the virtual and physical environments for infrastructure and construction site projects. When design and engineering teams use Bentley ***ProjectWise*** and ***Business Center - HCE*** to link design offices to construction sites, designers and contractors can collaborate more effectively on constructible models. This integrated and managed workflow enables more efficient bidding and estimating, faster project approvals, reduced change orders, and shortened construction timelines.

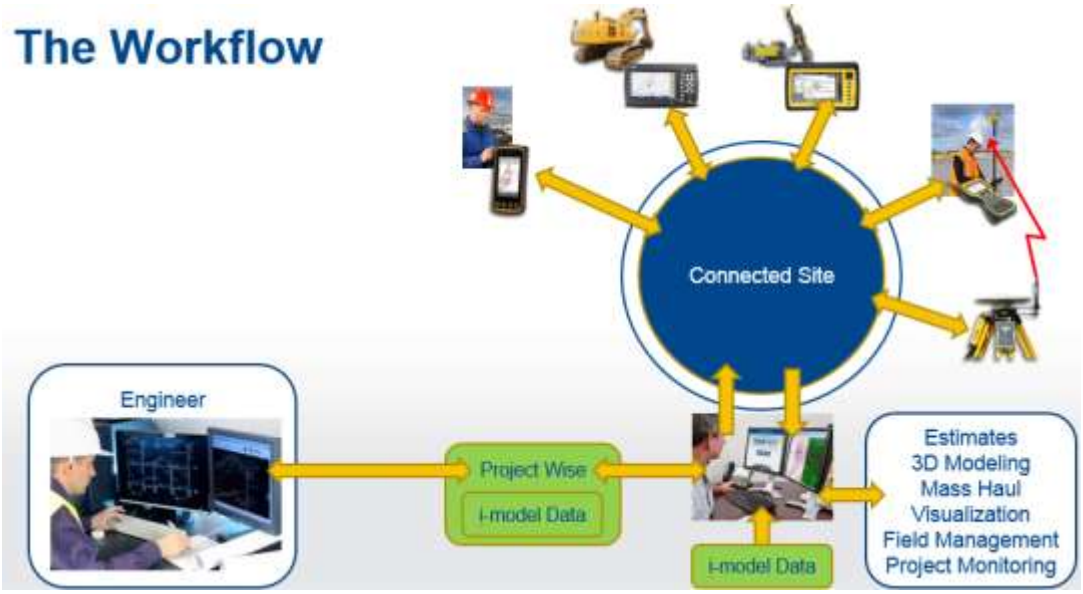
Bentley's V8i (SELECT Series 3) civil engineering software generates i-model (.icm.dgn) files from detailed designs. These designs, when managed in Bentley ProjectWise, can then be easily imported into Business Center - HCE for construction preparation and management. To optimize construction management processes and maximize information transfer, Trimble® Connected Site® technology can then be used to send these designs wirelessly to machines and field systems on a construction site, thereby increasing productivity and reducing data exchange problems (where data was lost or could not be read directly by contractor's tools).

Key components of the workflow include:

- ***Bentley ProjectWise*** - ProjectWise is a system of project collaboration servers and services that provides an environment for work-sharing, content re-use, and dynamic feedback for the design and construction of architecture, engineering, construction, and operations (AECO) of infrastructure projects.
- ***Bentley i-model (.icm.dgn)*** **Files** - Infrastructure Construction Models (ICMs) provide a rich data exchange format for Bentley civil design products based on the OpenRoads SELECTSeries 3 (SS3) platform, facilitating the exchange of both CAD information (layers, colors, line styles, names, etc.) and civil design objects (alignments, surfaces, corridors, meshes, linework, points, etc.) within a single transfer mechanism.

***Business Center - HCE*** - Features that support i-model (.icm.dgn) files in this program include:

- ***i-model (.icm.dgn) importer*** - This importer enables the import and the intelligent reading of an i-model (.icm.dgn) files contents, along with accurate mapping of civil design objects to constructible objects that can be readily moved out to Trimble field systems using standard field data management tools.
- ***External services connection to ProjectWise*** - This feature allows you to set up ProjectWise as an external service, including the ProjectWise server name, your user name, and password, which can then be used in the commands below:
- ***Open Remote File*** - This command allows you to open i-model (.icm.dgn) files, as well as native VCE project files, from ProjectWise servers. You can also locate, retrieve, and import other file types from the ProjectWise servers, including PDF, DXF, DWG, DGN, LandXML, CSV, TXT, GENIO and other supported file formats.
- ***Save File Remotely*** - This command enables you to save native VCE projects to the ProjectWise servers, allowing Business Center - HCEto join the software ecosystem deployed by the contractor or engineer on the ProjectWise server. This information sharing with the ProjectWise community allows for the passing of RFIs or as-built records back to the original engineer or owner upon completion of construction processes. You can also export directly to an external service using the Export command.



## Workflow

1. Prepare your data in a Bentley civil product with OpenRoads technology (InRoads, MXROAD, or GEOPAK that has been upgraded to SELECT series3 MR2):

   **Note:** These first steps are not intended to replace Bentley documentation on preparing your design data to create an i-model (.icm.dgn). Please see the help for your specific Bentley civil product. The steps should be similar in the Bentley civil products mentioned above.

   a. Create the existing terrain and/or infrastructure design data that you want to send to the field via Business Center - HCE.

   b. Ensure that the objects you want to export to the i-model (.icm.dgn) are civil objects (on page 22):
   Select ***File > Project Explorer***. Click the ***Civil Model*** tab and expand groups to see which object are included in the civil model.

   c. Set an appropriate ***Design Stage*** (on page 23) for each corridor section you want to include in the ICM:
   On the ***Civil Model*** tab in the ***Project Explorer***, expand the groups under a civil object that contains a corridor. Under ***Corridors***, identify a corridor section that should be assigned a design stage. Select ***Tools > Selection > Element Selection***, and graphically pick the corridor section. Select ***Element*** > ***Information***. In the ***Corridor*** section of the ***Element Information*** pane, select a design stage.

   d. If needed, specify to include a corridor and/or component meshes in the i-model (.icm.dgn):
   In the ***Project Explorer***, click the ***Civil Standards*** tab. Expand the groups under the civil object that contains the corridor, and then expand ***Project Settings*** and ***Corridor Design Stages***. Select a design stage. In the ***Element Information*** pane under ***Output Settings***, set ***Create Top Mesh*** and/or ***Create Bottom Mesh*** to ***True***. Edit any other output settings, as needed.

   e. Process the objects for the i-model (.icm.dgn):
   Click the ***Civil Model*** tab in the ***Project Explorer***, right-click the parent civil design objects that you want to include, and select ***Process All Objects***. Processing can also be done on individual civil objects using the ***Process Corridor*** command.

2. Create and save the i-model (.icm.dgn) to ProjectWise:

   a. Once all of the civil objects have been processed, select ***Tools > Tasks***. Expand ***Corridor Modeling***, and click the ***Create i-model (.icm.dgn)*** icon  .

   b. Check the boxes for ***Design Model*** and/or ***Terrain Model***, and ***click Ok***.

   - ***Include Design Models*** - Select this to export horizontal and vertical geometry, including station equations, corridor models, and civil cells (blocks) along with their resulting geometry and surfaces meshes (including alternative surfaces, where created).

**Note:** Existing corridor data produced prior to SS3 MR2 requires reprocessing to ensure that required corridor data (denoting top and bottom features and top and bottom meshes) is included.
**Note:** Area templates that are common in civil cells may require turning on linear features to generate the required geometry associated with the surfaces.

- ***Include Terrain Models*** - Select this to export all terrain data stored in the current and referenced models. Native MicroStation graphics are not automatically included in the i-model (.icm.dgn) exchange. However, if they are promoted into the civil model by applying a civil feature definition, then they are included as geometry in the i-model (.icm.dgn).

**Tip:** Since terrain models can be large, consider separating the Design Model and Terrain Model into two separate i-model (.icm.dgn)s.

a. In the ***Create i-model (.icm.dgn)*** file dialog, add a name, confirm the .i-model (.icm.dgn).dgn file extension, and click ***Save***.

b. When the program finishes creating the i-model (.icm.dgn) repository, open ProjectWise Explorer and upload/save it to ProjectWise.

**Note:** By default the i-model (.icm.dgn) will be called <filename>.i-model (.icm.dgn).dgn. You cannot rename the file to *.i.dgn or *.dgn and successfully read the file using i-model readers nor DGN readers.
**Note:** i-model (.icm.dgn)s cannot be created by the ***Publish i-Model*** command.

3. In Business Center - HCE, configure ***External Services*** (on page 7) with a ProjectWise username and password.
4. Open/import (on page 6) the i-model (.icm.dgn) from ProjectWise to a local folder using the ***Open Remote File*** (on page 9) command. If you have an i-model (.icm.dgn) file outside of ProjectWise, you can simply import (on page 10) it into Business Center - HCE. For details on how i-model (.icm.dgn) data is handled using either method, see ***Import Bentley i-model (.icm.dgn) Files*** (on page 10).
5. Explore the various objects that were created on import and the layers they reside on to confirm that the model has been formed as expected.
6. Create and/or edit additional objects (points, surfaces, alignments, corridors, etc.) as needed.
7. Run takeoff and mass haul calculations and reports.
8. Visualize your project in various views (Profile, Cross-section, 3D, 3D Drive, Walk-Through).
9. Prepare field data for use by construction crews on the job site. This data might include site data, design data, and work orders to be used on SCS site controllers and site and design data to be used on GCS machines.

   Using site controllers, you can then measure material volumes, monitor grades and laid material thickness, and perform other site-related tasks, such as point, line, roadway, and surface stakeout. With machines, you can perform scraping, grading, excavation, and compaction activities with accurate guidance, and blade and bucket positioning.

10. Make the data available to field workers on the Connected Site via the Connected Community.
11. Import measured and as-built results from the field back into Business Center - HCE.
12. Export (on page 19) data files or save (on page 20) your Business Center - HCE project back to ProjectWise so engineers and other stakeholders can review the construction project's status and make design changes.

### Related topics

- Open and Save Files from/to Bentley ProjectWise (on page 6)

## Open and Save Files from/to Bentley ProjectWise

After you have used the ***External Services*** command (on page 7) to set up your account information for ***Bentley ProjectWise***, use the ***Open Remote File*** command (on page 9) to download i-model (.icm.dgn) files (as well as PDF, DXF, DWG, DGN, GENIO files) from ProjectWise. This data can then be prepared for use by survey and construction crews on a job site, creating an integrated workflow for the engineering and then construction of roads and sites.

Use the ***Export*** and/or ***Save File Remotely*** (on page 20) commands to save files projects and data files back to ***ProjectWise***. This workflow will help you share civil design data for Bentley InRoads, MXROAD, and GEOPAK between ProjectWise and Business Center - HCE while preserving data fidelity. You can export/upload any supported format that creates a single file, i.e. ESRI shape files and Geodatabase XML files are not supported.

**Note:** Business Center - HCE allows you to establish multiple "External Services", as well as multiple user profile for each service. Each account connects to a different instance of a service, e.g., Connected Community or ProjectWise. If your ProjectWise instance connects automatically to datasources provided by your project partners, but shows up in your ProjectWise instance as a locked datasource (which would require an additional login to your partner ProjectWise instance), Business Center - HCE requires that you set each ProjectWise connection as a separate External Service. You cannot carry out a second login from within an external service.

Prerequisites:

- Bentley ProjectWise account

To access the commands:

- Select ***Options*** > ***External Services***.
- Select ***Open Remote File***.
- Select ***Save File Remotely*** or ***Export***.

### Related topics

- Import Bentley i-model (.icm.dgn) Files (on page 10)

# Log In to External Services

The ***Enter Login Information*** dialog displays when you attempt to access an external service (such as the ***Connected Community, InSphere Market Place,*** or ***Bentley ProjectWise*** (on page 21)) without completing all of the required user profile fields for the service in ***External Service Options (on page 7).***

To log in to an external service:

- In the ***Enter Login Information*** dialog, complete the required fields and click ***OK***.

As long as ***Business Center - HCE*** remains open, you do not have to re-enter the login information each time you access the external service.

## Related topics

- Open a Remote File (on page 9)
- Save a File Remotely (on page 20)

# External Service Options

Use the ***Options*** dialog to set up user profiles for logging in to external services, such as the ***Connected Community, InSphere MarketPlace***, ***Bentley ProjectWise*** (on page 21), and other web sites/services that work with this software. For additional information on getting an account with an external service, contact your dealer. Using the ***New*** button, you can create multiple user profiles with their own user names and passwords for any external service.

To specify external services options:

1. Select ***Options.***
2. Under ***General*** in the left pane, click ***External Services***.
3. Click ***New*** to create a profile.

   **Note:** Business Center - HCE allows you to establish multiple "External Services", as well as multiple user profile for each service. Each account connects to a different instance of a service, e.g., Connected Community or ProjectWise. If your ProjectWise instance connects automatically to datasources provided by your project partners, but shows up in your ProjectWise instance as a locked datasource (which would require an additional login to your partner ProjectWise instance), Business Center - HCE requires that you set each ProjectWise connection as a separate External Service. You cannot carry out a second login from within an external service.
4. In the ***Service*** list, select the service that you want to access.
5. Enter your name or the name of the profile, and click ***OK***.
6. In the ***Service profiles*** list, select the profile you created.
7. Enter the ***Server***, ***User name***, and ***Password*** you received from the external service provider in the required fields.

   **Note:** The options will vary depending on the external service selected. If you do not complete the required fields, you will be prompted to enter profile (login) information when you select to use an external service.
   **Note:** If there are no options available in the ***Service*** list, contact your dealer to learn more about external services.
8. Click **Test Connection** to verify you are able to connect to the selected service.
9. When you are done, click ***OK***. Now, when you connect to external services using Open Remote File, Save File Remotely, Export and other commands, the information you set up for your accountprofile will automatically populate the needed fields.

## Related topics

- Log In External Services (on page 7)
- Open a Remote File (on page 9)
- Save a File Remotely (on page 20)
- Download and Upload Files to/from Bentley ProjectWise (on page 6)

# Open/Import a Remote File

Remote files are those that are stored in folders hosted by external services, such as the ***Connected Community*** (TCC) and ***Bentley ProjectWise*** (on page 21). You can open a remote project or import a remote data file directly into your current project.

**Note:** When you open a remote project from an external service, only the .vce file is opened; supporting files that are usually stored in the project's subfolder are not available.

You can also check out a remote file so that no one else can change and save it over the original file. When you check out a file, an icon appears next to the name, indicating that it is locked. A copy of the locked file is created; the file name is appended with ***(Working Copy)***. The working copy can be modified and saved to the remote location by anyone, but the original, locked version can only be overwritten by the person who checked the file out (using their working copy).

**Note:** File locking/check out is supported in ProjectWise, but not from within Business Center - HCE. In this program, you can see which files are locked, open them, and resave them with the same name. The most recent/newest file overwrites any other file of the same name, but there is file versioning.

For additional details, see ***Maintain Project Files Remotely.***

**Note:** Some external services, including TCC, require that you set up a user profile before you can access them through this command. To set up a user profile for services, see ***External Service Options*** (on page 7).

To open/import a remote project:

1. Select ***Open Remote File.***

   The *Open Remote File* dialog displays, showing a list of the folders, projects, and files that are accessible to you.

   **Note:** The paths displayed depend on the permissions you have been granted by the administrator of the external service. For access to other locations, contact your administrator.

2. Double-click folders to navigate to the project or files you need. To navigate up in the folder structure, double-click the folder named "...".

3. Double-click a project to open it, or data files to import them. Remote projects that you open are automatically saved to your local project folder. Data from remote files that you import is added to your current project.

   **Note:** If you import a remote file, the settings specified in the ***Import*** command pane for that file type will apply to the import. Therefore, you may want to confirm those settings before you import each type of file.
   **Note:** For information on how specific types of files import, see the help topic on importing the file format (on page 19).

To check a remote file out or in:

- Right-click the file in the *Open Remote File* dialog, and select ***Check Out*** or ***Check In*** from the context menu.

### Related topics

- External Service Options (on page 7)
- Save a File Remotely (on page 20)
- Save a File Remotely (on page 20)

## Import Bentley i-model (.icm.dgn) Files

Import Bentley i-model (.icm.dgn) files to bring Infrastructure Concensus Models (ICMs) containing civil engineering objects into your project. For more information, see ***Understanding Bentley i-model (.icm.dgn) Files*** (on page 1).

**Note:** This topic refers only to the newer i-model (.icm.dgn) versions of i-models, not the older i-model (.i.dgn) file format.
**Note:** Although i-model (.icm.dgn) files are intended to contain civil objects, it is possible to have a combination of civil and non-civil objects in the file. Importing non-civil objects is not recommended.

### Importable Data

Here is a simplified view of how the civil objects (and their names) are mapped when they are imported from a Bentley civil product into Business Center - HCE via an i-model:

**Note:** The i-model (.icm.dgn)'s contents and the import settings you choose determine which objects are imported, and whether alignments that that are not associated with a corridor are imported as linework (on page 25).

| Bentley Civil Object | | i-model (.icm.dgn) Object | | Business Center - HCE | Notes |
|---|---|---|---|---|---|
| Point | > | Point | > | Point | Points can be either 2D or 3D. |
| 3D Linear Element | > | Linear Entity 3D | > | 2D or 3D polyline, arc, circle, spline, linestring (depending on what the original object was) | The original line styles are preserved, but all line style scales are set to 1.0.<br>**Note**: Vertical arcs in 3D linear elements are not supported in linestrings; a straight line is drawn between the start and end points of the vertical arcs. Tilting of the plane of horizontal arcs is handled consistently.<br>**Note:** For line styles, the ***Project Setting > View > Display Options > Show all lines as solid*** is honored. Other settings that affect line styles include ***Project Settings > View >Plan View > Plot Scale***, and ***Properties> Linetype Scale***. |
| Complex Element | > | Alignment | > | Alignment | Line, Bspline, spiral (clothoid), and arc segments in the horizontal plane are supported.<br>Alignments with profiles that are not associated with a corridor can be imported as either alignments and profiles or as linestrings. See ***Import Options*** below. |
| Profiles | > | Profiles | > | Profiles | Line, arc, and parabola (symmetrical) segments are supported.<br>Profiles are expected to be associated with an alignment, and an alignment can have multiple associated profiles. |
| Active Profile | > | Active Profile | > | Active Profile | Only one profile can be set as the active profile for the alignment. |
| 3D Linear Element (chorded) | > | 3D Linear Element (chorded) | > | These are not supported. | |
| Station Equations | > | Station Equations | > | Station Equations | |
| Mesh | > | Mesh | > | | |
| Mesh Surface (no depth) | > | Surface Mesh | > | Surface (TIN) | Surface meshes do not generate linework and corridor surface meshes are not imported if corridor linework is present. |
| Mesh Component (with a volume) | > | Component Mesh | > | Linestrings | The importer creates a closed linework polygon to represent each face of a component mesh. These faces are then shaded according to the imported mesh color. |

| | | | | | |
|---|---|---|---|---|---|
| Mesh with a corridor relationship | > | Corridor Mesh | > | | |
| Mesh Surface (no depth) | > | Surface Mesh | > | Surface (TIN) | |
| Mesh Component (with a volume) | > | Component Mesh | > | Linestrings | The importer creates a closed linework polygon to represent each face of a component mesh. These faces are then shaded according to the imported mesh color. |
| Terrain Model | > | Terrain Model | > | Surface (TIN) | |
| Hull/Boundary | > | Boundaries | > | Boundaries | |
| Breaklines | > | Breaklines | > | Breaklines | Hole, island, and void boundaries are imported as breaklines.<br>Contours and soft breaklines are imported with soft surface sharpness. Other breaklines import with sharp or sharp and texture boundary surface sharpness.<br>The distinction between a void and a hole is only apparent when surfaces are merged. A void persists after the surfaces are merged, even if the other surface contains triangles over that area. A hole is filled in if the surface being merged contains triangles for that area. |
| Corridor | > | Corridor | > | Corridor | |
| Corridor Baseline | > | Corridor Baseline | > | Alignment (main) | |
| Hull/Boundary | > | Hull/Boundary | > | Boundary | |
| ID of Top/Bottom Elements | > | ID of Top/Bottom Elements | > | Breaklines to form top and bottom surface | |

### Non-importable Data

Data that is not included in the i-model (icm.dgn) format includes:

- Non-civil objects (e.g., native MicroStation objects)
- Corridor templates
- Superelevation tables
- Coordinate systems

To import an i-model (.icm.dgn) file:

- Follow the instructions in ***Import Data***.

| **Import Options** | |
|---|---|
| ***Data to import*** | ▪ ***All*** - Select this to import every object in the file, whether it is a civil or non-civil object.<br>▪ ***Civil Objects Only*** - Select this to import every object that is not a component mesh.<br>▪ ***Component Meshes Only*** - Select this to import only the component meshes in the file. |
| ***Import non-corridor alignments as*** | ▪ ***Alignments*** - Select this to import all alignments that are not associated with a corridor as alignments.<br>**Note:** Alignments cannot be converted to linestrings after import,but alignments can be created from linestrings; either can be included in a surface.<br>▪ ***Linework*** - Select this to import all alignments that are not associated with a corridor as linestrings.<br>**Note:** See the ***Imported Non-corridor Alignments*** table (next) for the effect of these options on different types of linear objects. |

| | |
|---|---|
| ***Create the corridor's top surface from*** | ▪ ***Linestrings*** - Select this to use corridor sub-alignment strings (alignments and/or linear entities 3D) to form the corridor surface.<br>Forming a corridor from linestrings has these advantages:<br>▪ The corridor is suitable for densification (although this is not turned on by default)<br>▪ The corridor includes the sub-alignment names<br>And this disadvantage:<br>▪ When two corridors intersect each other, the linestrings get clipped but the boundary does not. The surface formation in this area can be poor.<br>**Tip:** Both surface representations benefit from frequent template drop settings to increase the fidelity of the data written to the i-model (.icm.dgn) and consequently Business Center - HCE. See the ***Design Stage*** (on page 23) topic for more information.<br>▪ ***Surface Mesh*** – Select this to use the top surface mesh, if present in the file, to form the corridor surface.<br>Forming a corridor from surface meshes has this advantage:<br>▪ The clipping problem between corridors is resolved<br>And these disadvantages:<br>▪ They are not suitable for densification<br>▪ Sub-alignment names are not available<br>▪ Surface formation over non-planar mesh faces may not be what was intended<br>**Note:** See the ***Corridor's Top Surface Formation*** table (two below) for the effect of these options on top surface formation.<br>**Tip:** You may find that the ***Surface Mesh*** option creates a better corridor top surface for GCS900, but that the ***Linestrings*** option creates a better surface for SCS900. Depending on the road geometry, the triangulation you get from linestrings may be unexpected, although not necessarily incorrect. Experiment with the options to see which provides the optimal results for your needs. |

### *Imported Non-corridor Alignments*

Here are the effects of the ***Import non-corridor alignments as*** option on linear objects:

| **Object in the File** | **Resulting Object in Business Center - HCE** | |
|---|---|---|
| | When Imported as an Alignment | When Imported as a Linestring |
| **Alignment** | | |
| Line | Line | Line |
| Arc | Arc | Arc |
| Spiral | Spiral | Chords* |
| BSpline | Chords | Chords** |
| **Profile** | | |
| Line | Line | Line |
| Arc | Arc | Line |
| Parabola | Parabola | Parabola |

*The chording setting (determining the amount of deviation) is specified in ***Project Settings*** > ***Computations*** > ***Surface*** > ***Breakline Approximation Parameters*** > ***Horizontal Tolerance***.

**When imported as linestrings, alignment Bsplines are chorded because the importer first interprets the alignment as a Business Center - HCE alignment and then converts the alignment into a linestring.

## Top Surface Formation for a Corridor

An i-model (.icm.dgn) may contain multiple representations of a corridor, including:

- Sub-alignments of the corridor stored as alignments (with profiles) and/or linestrings (Linear Entity 3D)
- A surface mesh of the entire top surface (Surface Mesh)
- Individual meshes that can be merged to form the corridor surface; these may or may not correspond to the top surface

Two factors determine how the corridor's surface is formed:

- The contents of the i-model (.icm.dgn) file
- The ***Create the corridor's top surface from*** import setting:
  - ***Linestrings*** - The importer's default is to use the ***Linestrings*** option if alignments and/or linear entities 3D are present in the file. If the preferred surface formation data is not present, the importer will revert to the next best option and trigger import report warnings to advise you that your preferred option was not available (see ***Import Report Warnings*** below). If the corridor's top surface is created from linestrings, the top surface mesh and individual corridor meshes for that corridor (if present) are not imported. If the top and/or bottom corridor surfaces have been constructed from linestrings, the names will be: ***<Corridor name> - Top Surface*** and ***<Corridor name> - Bottom Surface*** for the top surface and bottom surface, respectively.
  - ***Surface Mesh*** - If the corridor's top surface is created from the top surface mesh, then the individual corridor meshes for that corridor (if present) are not imported. If the corridor's top surface is created from a top mesh, the name will be ***<corridor name>.default*** or ***<corridor name>.Top Mesh***, depending on the Top Mesh Feature Definition defined in the selected design stage.

Regardless of how the corridor's top surface is formed, a corridor's linestrings are imported. Corridor surface meshes are not imported if the corridor linework is present.

In the absence of top surface information, it is better to have a corridor surface than no surface, so an ***Individual Corridor Surface Meshes*** option (fourth column) is used as the last choice used in forming the corridor surface. While the surface that the individual surfaces represent is valid, there is no indication as to which corridor surface they reflect. To prevent many small surfaces being created in your project, the importer collates the individual corridor surface meshes into one surface on import.

Here are the possible effects of the ***Create the corridor's top surface from*** option on the imported top surface (with the defaults in green):

| Import Option for Top Corridor Surface Formation | Contents of the i-model (.icm.dgn) | | | Warning in the Import Report |
|---|---|---|---|---|
| | Top Surface from Linestrings | Top Surface from Surface Mesh | Top Surface from Individual Corridor Surface Meshes | |
| Linestrings | — | — | — | None |
| Linestrings | | — | — | 1 |
| Linestrings | | | — | 1,3 |
| Linestrings | | | | 1,3 |
| Surface Mesh | — | — | — | None |
| Surface Mesh | — | | — | 2 |
| Surface Mesh | | | — | 2,3 |
| Surface Mesh | | | | 2,3 |

Import Report warnings:

1. Corridor '{0}' doesn't have top surface linework
2. Corridor '{0}' doesn't have a top mesh surface
3. Corridor '{0}' doesn't have a top surface definition

### Bottom Corridor Surface Representation

An i-model (.icm.dgn) can also contain a mesh representing the entire bottom corridor surface. This mesh encompasses the extents of the corridor, which generally means that it joins the top corridor surface. However, the routine that forms the bottom surface selects the next offset out from the edge bottom subgrade point to connect to; this may or may not reflect the intention of the original design. For example, the subgrade may connect to the top surface with a vertical, or even over-vertical, face. When this occurs, the importer takes a conservative approach and forms an alignment surface from the bottom only sub-alignment strings; no connection to the top surface is made.

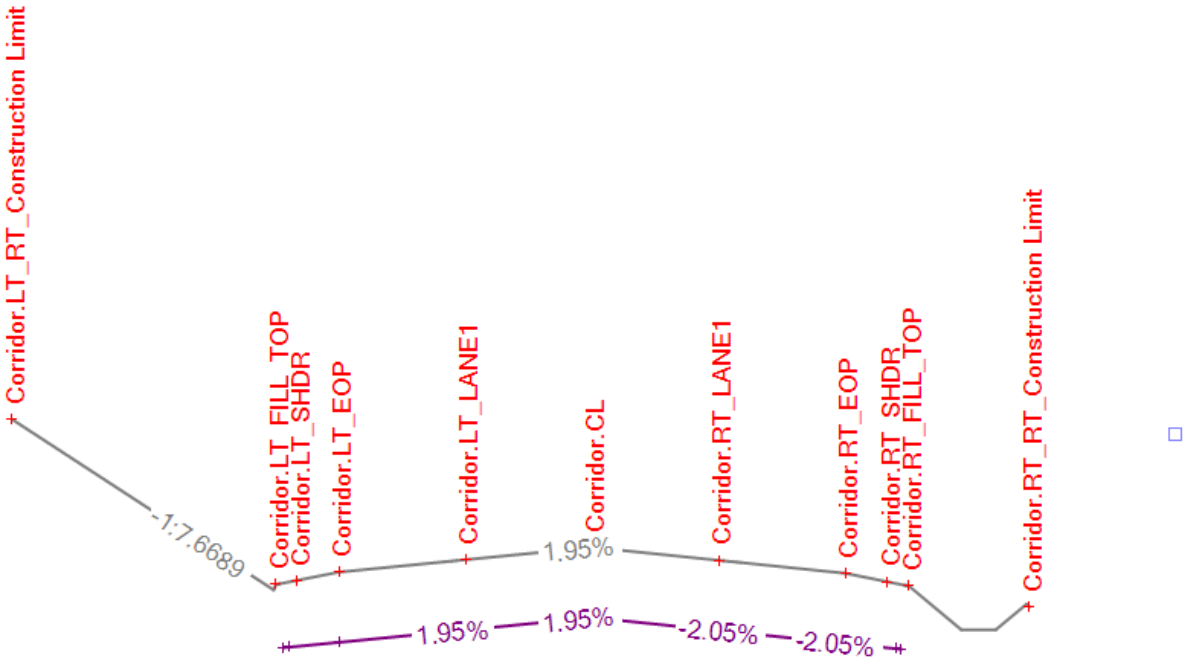



**Figure:** Cross-section (using Surface Slicer View) of imported corridor top and bottom surfaces (to simplify the view, labels have been hidden for the bottom surface)

### Layer Creation and Entity Values

The i-model (.icm.dgn) importer creates layers in Business Center - HCE that correspond to the Bentley levels used by the objects in the i-model. When importing terrain models, the importer creates two layers for each surface:

- ***<surface name>_Breaklines*** - This contains the associated breaklines, contours, and soft breaklines for the surface. These are automatically associated with and used in the surface formation.
- ***<surface name>_Boundaries*** - This contains the boundary, holes, islands, and voids associated with the surface. These objects are automatically added to the surface as closed breaklines, as they are in Bentley products.

### Holes, Islands, and Voids in Surfaces

Both Bentley civil products and Business Center - HCE handle holes and islands in the same way. An island must be enclosed by a hole. Holes and islands cannot overlap. Void boundaries in Bentley products are treated as holes in Business Center - HCE.

### Component Mesh Handling

Component meshes are not natively supported in Business Center - HCE. Component meshes can, however, be imported using a ***Data to import*** option:

- Separately, by selecting ***Component Meshes Only***
- Along with the rest of the civil data, by selecting ***All***.

Component meshes are not imported when the ***Civil Objects Only*** is selected.The i-model (.icm.dgn) importer creates a closed linework polygon to represent each face of the component mesh. These faces are then shaded according to the imported mesh's color.

Scenarios:

- If you import the same i-model (.icm.dgn) file more than once, the first imported model does not get updated by changes in the second; you simply have both models in your project. All the data is imported from i-model (.icm.dgn) model into the Business Center - HCE project. The i-model (.icm.dgn) importer does not provide options to update or overwrite existing data in the project; so you may end up with duplicates of data in the project, depending on the import settings when you reimport data from an i-model (.icm.dgn) into the same project. Each import, however, does create a separate selection set (and thereby view filter) which enables you to hide either set of data.

Dependencies:

- None

### Related topics

- Open and Save Files from/to Bentley ProjectWise (on page 6)

## Export Data

Export data from your project in a variety of formats. See the individual file format topics for details. You can also save your project or data files to an external service (on page 7) using the ***Save File Remotely*** (on page 20) command.

To export data:

1. Do one of the following:
   - Select ***Export.***
   - Select one or more points, right-click, and select ***Export*** from the context menu.

   The *Export* command pane displays.
2. Click an export type (*Custom*, *Survey*, ***GIS***, *CAD*, or *Construction*) in the *File Format* group. A list of available exporters displays.
3. Select an export format (on page 20) in the list. If one with the desired format is not listed, create a custom exporter.

**Caution:** If you have a field device connected, only file types compatible with the device appear.

4. If needed, use the ***View Filter Manager*** command to filter the selectable data in the plan view.
5. Select the data to export using one of the Selection Options.
6. Choose where to save the exported file:
   - Select a local or network folder in the *File Name* list, or click the  icon to browse for a folder.
   - Click the  icon to save the file remotely to an external service. For information on setting up an external service, see External Service Options (on page 7).

   When you click the  icon, the *Save As* dialog displays with the export folder specified in ***Options*** > *File Location* selected. However, you can browse to and select a different folder.
7. Type a new file name in the *File Name* box if you do not want to overwrite an existing file.
8. If export settings appear in the *Settings* group, specify them as needed.
9. Click **OK** to export the data.

**Tip:** You can select data before you begin the *Export* command.
**Tip:** To customize the format of the exported data, select ***Export Format Editor***.

### Related topics

- Export Data Formats (on page 20)
  Save a File Remotely (on page 20)

## Save a File Remotely

Make projects available to your colleagues by saving them to a shared folder hosted by an external service, such as the ***Connected Community*** (TCC) or ***Bentley ProjectWise*** (on page 21). When you save a file remotely, you are essentially making a copy of the file that is saved locally. Before you can save a file to an external service, you should set up a user profile (on page 7) for your external service.

**Note:** When you save a project remotely to an external service, only the .vce file is saved; supporting files that are usually stored in the project's subfolder are not saved with the project.
**Note:** You can also launch the ***Save File Remotely*** command from within the ***Export*** command. Exporters that write multiple files cannot be used to export to external services; external services only support exporters that save a single file.

For additional details, see ***Maintain Project Files Remotely.***

To save a file remotely:

1. Save your file so that it will be copied in its current state when you save it remotely.
2. Select ***Save File Remotely.***
3. In the ***External service profile*** list, select your user profile.
4. Double-click folders to navigate to the location in which you want to save the file.

5. Click **Save**. The file is saved remotely with the same name as the local file.

### Related topics

- External Service Options (on page 7)
- Open a Remote File (on page 9)
- Open a Remote File (on page 9)

## Bentley ProjectWise

ProjectWise is a Bentley system of project collaboration servers and services for AECO information management for the design and construction of architecture, engineering, construction, and operations (AECO) of infrastructure projects. ProjectWise provides an environment for work-sharing, content re-use, and dynamic feedback.

# Glossary items

## alignment

A line used to denote the path of a corridor (roadway, trench, channel).
See also Horizontal Alignment (HAL) and Vertical Alignment (VAL).

**Note:** In some Bentley civil products (such as InRoads) an alignment can be a linear object that has no association with a corridor.

## civil feature definition

Feature definitions, like the former legacy style files are fundamental to Bentley civil users for the display of objects and standardization of designs.

Feature definitions:

- Include properties used to define how a feature is to be displayed, annotated, computed, etc.
- Can be applied to these three object types:
  - Point feature
  - Linear feature
  - Surface feature
- Are typically customized by each organization/company
- Expected to be created in advance and used to drive standardisation of designs across an organisation
- Replace legacy Bentley style files of these types:
  - XIN (InRoads)
  - DDB, XML (GEOPAK)
  - PSS (MXROAD)

## civil model

In Bentley civil software, an infrastructure model composed of civil objects (on page 22).

## civil object

In Bentley civil software, civil objects are points, lines, alignments, surfaces, meshes, corridors, etc. that were created by Civil Tools in Bentley software or they have been promoted into the civil model by applying a civil feature definition. Native MicroStation objects can be 'promoted' to a civil model by assigning civil features to them. Feature definitions, like the former legacy style files, are fundamental to Bentley civil users for the display of objects and standardization of designs.

## component mesh

In Bentley civil products, a shaded, 'closed' 3D shape (mesh) that encompasses a volume. Typically, component meshes, which represent objects such as guardrails, subgrade materials, bridge components, piles, etc. are imported from i-model or IFC files.

## corridor top mesh

In Bentley civil software, a surface mesh of objects tagged in a corridor template as being part of the top surface of the corridor. A corridor top mesh is used to form the corridor top surface in Business Center - HCE when an i-model (.icm.dgn) file is imported.

## corridor bottom mesh

In Bentley civil software, a surface mesh of objects tagged in a corridor template as being part of the bottom surface of the corridor. A corridor bottom mesh is used to form the corridor bottom surface in Business Center - HCE when an i-model (.icm.dgn) file is imported.

## design stage

In Bentley civil products, corridor design stages have a significant impact on the type and accuracy of data exported in an i-model (.icm.dgn) from Bentley civil products. Design stages and associated settings are typically part of a company's libraries, and vary depending on the standards the company wishes to use. Individual DGN files will only contain the stages (and feature definitions) used in their particular project. Each corridor in a DGN file may have an independent design stage setting. You should confirm that the design stage setting reflects your data requirements in the i-model (.icm.dgn) and in Business Center - HCE.

The aspects that a design stage impacts include:

- The template drop interval multiplier - When templates have a drop interval defined, this property determines whether the interval or some multiple of the interval is used.
- Which critical cross-sections are used
- What data is outut:
  - Corridor top mesh (on page 23)
  - Corridor bottom mesh (on page 23)
  - Linear features
    - Corridor sub-alignments (on page 26)
  - Component meshes (on page 23)

The template drops, template drop interval, template drop interval multiplier, and which critical points are used drive the density of the meshes, stroking (on page 25) of some chorded sub-alignments, and chorded linework representations of horizontal alignments. In the later case, where there is a horizontal alignment with geometry and a chorded approximation of it, the i-model (.icm.dgn) importer will ignore the chorded approximation.

Default Design Stages and Some of their Default Properties

| | 0 - Functional | 1 - Preliminary | 2 - Design | 3 - Final | 4 – Final w/ Meshes | 5 – Final Top Mesh | 6 – Final Bottom Mesh | 7 – Final Linear Features | 8 – Final Components |
|---|---|---|---|---|---|---|---|---|---|
| Template Drop Interval Multiplier | 10 | 5 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| Hz. Cardinal Points | False | True | True | True | True | True | True | True | True |
| Vt. Cardinal Points | False | True | True | True | True | True | True | True | True |
| Ext. Cardinal Points | False | True | True | True | True | True | True | True | True |
| Densify Hz. Curves | False | True | True | True | True | True | True | True | True |
| Densify Vt. Curves | False | True | True | True | True | True | True | True | True |
| Create Top Mesh | False | False | False | False | True | True | False | False | False |
| Create Linear Feature | True | True | True | True | True | False | False | True | False |
| Create Comp. Mesh | True | True | True | True | True | False | False | False | True |

Design stages properties can be edited and new design stages can be created. This is set on the individual components that are used to build up the templates. Their properties contain an Exclude From Top/Bottom Mesh check box. Once all the components are used to form the corridor model, Bentley will determine the top most points and the bottom most points to create the top and bottom meshes from.

## hull

In Bentley civil software, a surface boundary.

## i-model (i.dgn)

A container (file format) for the open exchange of infrastructure information.

## i-model (.icm.dgn)

A container (file format) for the open exchange of infrastructure information (like Bentley i-model (.i.dgn) before it). Bentley's i-model technology is used to write an i-model (.icm.dgn) (Infrastructure Consensus Model) file that contains civil engineering objects (points, lines, alignments, surface and component meshes, corridors, terrain models, and attribute information). The i-model (.icm.dgn) functionality is available in these Bentley civil design products with OpenRoads SELECTSeries 3 technology (SS3): InRoads, MXROAD, GEOPAK (SS3; Maintenance Release 2 (MR2)).

## level

See layer or material layer.

(Bentley MicroStation uses "level" for layer.)

## linework

Data with various types of lines (polylines, linestrings, arcs, circles etc.).

## sample rate/interval/sampling distance

Generically, the interval in time or distance at which samples are taken. Specifically, sample intervals in this software are used to:

- Generate cross-section templates (at a distance interval) along a horizontal alignment during the creation of a corridor.
- Download GNSS raw data from a CORS station or a base station (using a time interval equal to or shorter than the interval in your project). If the station has used a collection interval higher than the occupations in your project, the download process will decimate (reduce the station data) down to the level you set.

**Note:** In Bentley civil products, the sampling interval is called the "template drop interval".

## surface mesh

In Bentley civil products, an 'open' mesh that does not encompass a volume, which equates to a surface in this software. Unlike in Business Center - HCE, this imported surface type supports vertical and over-vertical faces. The surface mesh components are typically comprised of straight, four-sided quads. They may, however, contain three-sided triangles or faces that are comprised of five or more straight sides. The faces are typically planar, but non-planar mesh faces are also permitted.

## stroking and densifying

Concepts/terms used in Bentley civil software that control how often to generate points or template drops along various linear objects, such as alignments.

### corridor sub-alignment

In Bentley civil software, secondary linework (may or may not be an alignment) that does not denote a corridor's centerline alignment.

### terrain model

A surface; a conventional TIN model that does not contain vertical nor over-vertical faces.