# Technical Reference Document – TBC v5.0

## Exporting Data from TBC to AutoCAD DWG Files

This document captures information about how to Export data from TBC v5.0 to AutoCAD DWG and what does / doesn’t work in the v5.0 Release. The document has been generated in line with customer requests for assistance in this subject area.

### Layers and Layer Groups

Layers and Layer Properties (excluding Layer Group) are passed as follows to AutoCAD using DWG files.

1. Layer Name – Maps directly to AutoCAD
2. Layer Color – Maps directly to AutoCAD Layer Color
3. Layer Line Style – Maps directly to AutoCAD Line Style
4. Layer Line Weight – Maps directly to AutoCAD lineweight
5. Layer Protection – In TBC this has a different meaning to either Lock Layer or Freeze Layer in AutoCAD. While we could map a TBC Protection Status to AutoCAD it would not have entirely the same meaning. A Locked Layer in AutoCAD stops data from being deleted
6. Layer Group – Does Not Map as AutoCAD doesn’t have a similar capability
7. Display Priority – Does Not Map as AutoCAD doesn’t have a similar capability at Layer Level
8. Layer Print – Does not currently map to an AutoCAD Layer Property – It should however do this
9. ByLayer Property – Maps directly to AutoCAD ByLayer property
10. ByBlock Property – Maps directly to AutoCAD ByBlock property

### The following will be added tomorrow

### Points

## Text

## Smart Text

## Point Labels

## Line Labels

## Polygon Labels

## Point Tables

## Line Tables

## Polygon Tables

## Blocks

## Symbols

### Lines of Different Types

2D and 3D Lines in Trimble Business Center will behave differently when exported to DWG format files, because AutoCAD line types do not map 1:1 to TBC line types. TBC has the following Line Types

1. Linestring - a Linestring in TBC has both vertical and horizontal control points, it also has the ability to contain vertical arcs and vertical curves that AutoCAD does not support. As a result a 3D linestring has to be chorded based on a tolerance to provide a line in AutoCAD that closely represents the source data in TBC.
	1. A Linestring with no elevation nodes or VPIs comes through as a Polyline in the DWG. Color By Layer works. Layer Name works. Linetype and Linetype Scale works. Open / Closed status works. Lineweight Works.
	2. A 3D Linestring with Elevations comes through to AutoCAD as a 3D Polyline in the DWG. All of the above functions work the same way.
	3. Where the Linestring is Closed – it will have the Closed Property in the AutoCAD DWG
	4. Where the Linestring has a Fill, the Fill will only come through to the DWG if the Linestring is 2D or Fixed Height along its path. Where Fill passes to the DWG the Transparency of the Fill is also carried through the DWG.
2. Polyline – A CAD Polyline / Polyline in TBC comes through to AutoCAD as a Polyline. The same applies in terms of the properties of the Polyline (as for the linestring above)
3. Rectangle – A rectangle created in TBC using the Create Rectangle or Create 3Pt Rectangle comes through to AutoCAD as a Polyline. If the rectangle has Height in TBC then it will have Height in AutoCAD.
4. Circle – A Circle created in TBC using the Create Circle or Create 3Pt Circle comes through to AutoCAD as a Circle Object. Where the Circle had elevation in TBC it will also have Elevation in AutoCAD.
5. Boundary – A Boundary Object in TBC becomes a Polyline with Closed Property in AutoCAD DWG. Note that these objects do not carry any XDATA currently. I suggest that we add XDATA to all line objects to carry the following properties
	1. Name (TrimbleName, Code 1000, Name)
	2. Usage (Boundary) (TrimbleBndyType Code 1070) and then an Integer e.g. 0 = Generic, Avoidance Zone = 3, Borrow Pit = 1, Dump Zone =2)
	3. Area (Plan Area (True TBC Area pre chording)
	4. Perimeter (True Perimeter before Chording)
6. Polygon – A Polygon object in TBC becomes a Polyline or 3D Polyline in the AutoCAD DWG depending on whether or not the source data in TBC was 2D/Fixed Height or 3D.
7. Arc – An Arc in TBC becomes an Arc object in an AutoCAD DWG. When we have a 3D Arc in TBC (it is a Linestring), it comes through to the DWG as a chorded 3D Polyline.

On output to a DWG, TBC provides the options to Export Linework as 2D Polylines which totally ignore the vertical component of the lines and suppresses chording on all but alignment objects with Spiral Segments. If No is selected here then lines will be output as 3D, however they will be chorded approximations if any of the above elements exist in the source linework. Once lines are 3D the thing that is most affected is Fills.

Line Properties in TBC include

1. Name – Line Names are passed to AutoCAD as XDATA. To see the Name of objects, use the command XDLIST and you will see a Code 1000 followed by the Object Name. The Application is called TrimbleName.

How does this match up with Civil 3D object data that have names Mike?

1. Elevations of Nodes and VPIs – a 3D Linestring becomes a 3D Polyline. The Nodes and VPI locations of the Linestring become 3D Nodes on the 3D Polyline. If the linestring is 3D and includes arcs then the arcs are chorded creating additional 3D
2. Length Property in TBC is the Plan Length. In AutoCAD it is the 3D Length.
3. Fill Color – Fills only work on 2D or Fixed height closed polygon areas. Any 3D Linestring that is closed, a 3D Polygon or a 3D boundary will not pass the fill to AutoCAD DWG unless it is sent out as a 2D Drawing.
	1. Linestring – For a closed Filled 3D Linestring the fill color does not come through in the DWG file. (AutoCAD doesn’t support this)
	2. Linestring – For a closed filled 2D or fixed height linestring the Fill does come through into the DWG file
	3. A 3D Polyline in TBC doesn’t have a Fill Property – only a Material property once it gets to AutoCAD that can be changed. However, in testing, even when the Closed 3D Polyline is given a Material – and even when it is Coplanar it does not get filled in 3D (when you set the view to Shaded or other setting than Wireframe). Fills in TBC can be applied to 3D Linestrings and Polygons but in AutoCAD
	4. A 2D Boundary or a Boundary with Fixed Height that is filled will pass the 3D Fill to AutoCAD DWG.
	5. A 3D Boundary will not pass the Fill to AutoCAD DWG. (AutoCAD does not support this)
	6. A 2D Polygon or a Polygon with fixed height will pass the fill to AutoCAD DWG
	7. A 3D Polygon will not pass the fill to AutoCAD DWG (AutoCAD does not support this)
	8. All fills are passed to AutoCAD DWG as an additional Hatch Object. TBC should consider outputting Filled polygonal areas as 2D lines with Hatch Object as well as the 3D Polygon. While the user can elect to output the TBC data as 2D and thereby keep the Fills created in TBC, they will then lose the 3D capabilities of the TBC Model in AutoCAD.
4. Fill Transparency – Where fills transfer to AutoCAD DWG, the Transparency of the Fill is also passed to the DWG. This is an area where I think we should give the user the opportunity to additionally export Filled Objects as 2D Filled Polygons so that an AutoCAD drawing can be sent to an Engineer that replicates the TBC Drawing to a large extent. If the surveyor is finishing the drawings in AutoCAD they have to make the compromise also because of the limits of AutoCAD. The alternative is that we “3D Face” the polygon Areas and then fill the 3D Faces with a Material Color.
5. Border Color – This is the Line Color in the AutoCAD DWG
6. Border Line Style – This is the Linestyle in the AutoCAD DWG
7. Border Linestyle Scale – This is the Linestyle Scale in the AutoCAD DWG
8. Line Weight – Works correctly through DWG
9. Surface Sharpness – No Surface Model in AutoCAD so fails to come through in DWG
10. Extend Vertical – no equivalent in AutoCAD so fails to come through in DWG
11. Include in Surface - No Surface Model in AutoCAD so fails to come through in DWG
12. AutoClose – Comes through as Closed Property on the line
13. Smooth – Where a Polyline (Closed or Open) is tagged with the Smooth Property in TBC, the output DWG file uses a chorded approximation. In AutoCAD 2019 there is a Smoothed Function that allows the user to specify None, Cubic, Quadratic or Curve Fit which I think we should be supporting.
14. Override Segment Length (Linestring) – no surface modeling in AutoCAD so fails to come through in DWG (See Note Below in red)
15. Where the line in TBC includes arc elements in 3D the arc is chorded in AutoCAD as expected. The chording is based on the Project Settings – Computation – Surface – Breakline Approximation Parameters. We use the Horizontal and Vertical Tolerance Parameters only. We currently do not use the Maximum Sampling Distance (which adds nodes into straight sections of lines) nor do we use the Override Segment Length property of a Linestring which allows a user to change the Maximum Sampling Distance for a specific line). These would be useful changes to the DWG Exporter.

### Alignments

Alignment – Does Not map fully to a DWG (use LandXML or a different format that supports Geometry Data). Alignments will only be the same if they are 2D and contain Arc and Straight segments only. Where the source alignment contains Spiral elements or vertical Arcs or Vertical Symmetrical or Asymmetrical Curves, the DWG will contain a chorded approximation of the source data. While Civil 3D has a full alignment object that has similar capabilities to an alignment in TBC, AutoCAD does not. A DWG file, without extended Civil Object capabilities (as would be found with a Civil 3D DWG file), can only contain a 2D Alignment where the alignment in TBC contained Arcs and Straight segments.

1. A 2D Alignment (HAL Only) will map Straight and Arc Segments correctly to the DWG. Spiral Segments will be chorded.
2. A 3D Alignment (HAL + VAL) will map Straight and Arc Segments where there is no vertical curvature or elevation changes correctly. Where there are Spiral Segments or Vertical Elevation Changes or Vertical Curvature the output DWG file will be a chorded 3D Polyline.
3. Note that Polylines and 3D Polylines do not have the concept of Stationing so that will always be lost in the Export to a DWG file.
4. For the best exchange of Alignment Geometry, use a LandXML file or other supported Geometry based format.

### Surfaces and Corridor Surfaces

Surface models in TBC are exported to AutoCAD DWG as 3D Faces. They are placed on an AutoCAD Layer of the same name as the surface in TBC. The color of the 3D Faces is created from the Surface Color in TBC.

If the Surface is output as Solid Color, By Elevation or By Material (where Materials have been applied), it makes no difference to the result in AutoCAD today. The Surface if displayed as anything other than Wireframe will take the Surface Color Only in v5 Export to DWG.

This is an area that could for sure be improved in TBC to leverage the ability to color 3D Faces using Material for example.

### Corridors

AutoCAD DWG does not support the transfer of Corridor Models. While Civil 3D has its own definition of a corridor model, there is no mapping of a TBC Corridor Model made up of Template(s) to a Civil 3D Corridor Model. The best way to transfer Corridor Model data to AutoCAD is to export as a DWG. The best way to transfer Corridor Model data to Civil 3D is to use a LandXML file which can carry Alignment Geometry, Station Equations, Surfaces, Points and Linework.

### Inserted / Placed Images

Images created in Business Center can be created in two ways

1. Insert the Image
2. Georeference the Image

Images that have been placed in Plan or Sheet View using the Insert Image command are currently not supported by the DWG Export. Inserted Images are placed at a location with a scale and are not Georeferenced.

Images that have been imported and Georeferenced in the Plan View are carried by the DWG Export in both the Plan View and in the Dynaviews (images are cropped to the Viewport in Paper space). Images in AutoCAD can be turned On / Off in the image Properties.

Note when you place a PDF Page using Known Distance and Bearing etc., it is converted to a georeferenced image and as a result is passed to AutoCAD Model Space and by relation to the Viewport in Paper Space.

Multiple Images can be passed to a DWG File. Note the path to the images is sent with the DWG file, so the DWG File receiver will need access to that path for the images to show up in AutoCAD. For this reason, we recommend storing the images in the same folder as the DWG file, such that when the DWG file is used by a third party that the images are available to them also.

If a Georeferenced Image has Image Boundaries Applied to it in TBC, the image that is passed to AutoCAD is the complete unclipped image. If you pass the Image Boundary Objects to the DWG then you will have to re clip the images in AutoCAD.

Note: Because the DWG file just carries a path to the File / Filename, you can substitute an Old Image for a New Image in the same location, provided the new image has exactly the same name as the old image, the next time the DWG file is opened, the New Image will be rendered to replace the old image.

This is another area that it would appear we should be able to improve on Export to DWG Files

### Dynaviews

A TBC Dynaview is the equivalent of an AutoCAD Viewport. A Viewport requires the Model Space data in order to populate the Viewport.

Dynaviews created in the Plan View containing Plan View Data (Note Dynaviews can also be used to capture Cross Section, Profile and Sheet data etc.) do not export to AutoCAD DWG Files today. Dynaviews created in the Sheet View for Plan or Custom Sheet Types will export to AutoCAD DWG provided that you do it in the following way

1. Select the Plan View data (this is equivalent to selecting the Model Space data for AutoCAD) that is captured in the Dynaview – the Dynaview only doesn’t provide its content, it requires the model space data in order to populate the Viewport
2. Also select the Sheets that you want to export from the Project Explorer tree. The Sheet in TBC will become a Paper Space Layout in AutoCAD. The Dynaview(s) placed on the sheet will become Viewports on the layout in AutoCAD. You can have multiple Dynaviews on a single sheet at different scales. Each Dynaview will create a separate Viewport in the Paper Space Layout of AutoCAD.

When you import the exported DWG file into AutoCAD you will get a Paper Space Layout tab with the same name as the Sheet in TBC.

If you click on one of the Dynaview frames in AutoCAD it will select a Polyline and if you select it again it will select the Viewport. In the AutoCAD Properties pane, it will show that you have 2 objects selected. You can select the Viewport from that list and it will show you the Viewport Properties which includes the Standard Scale (the scale used on the Dynaview in TBC). All Viewports created from Dynaviews will have a UCS (User Defined Coordinate System) that picks up the rotation of the view etc. The Height and Width of the Viewport is the Height and Width of the Frame used to create the Dynaview in TBC.

Circular Dynaviews do not work in TBC v5.0

Polygonal Dynaviews that do not have arc elements can be used, however they are converted to a rectangular Viewport in AutoCAD. While AutoCAD 2018.1 and higher support a Polygonal Viewport in the Paper Space (Use MVIEW Command), Business Center – HCE does not yet support that.

Polygonal Dynaviews that do have arc elements can also be used, however they are also converted to a rectangular Viewport in AutoCAD. The AutoCAD MVIEW command also supports the creation of a Polygonal Viewport that contains Arc elements.

Note the Viewport Properties capture the Center X and Y location (in sheet units) of the Model View that is captured by the Viewport.

If you create a Dynaview around e.g. a Cut Fill Map Legend or an Elevation Map Legend the Legend is currently not a supported export to DWG and as a result the Dynaview that is created around the Legend is left empty. This is something that we should improve in TBC DWG Output.

## Sheet Data – Plans

Entire Sheets can be selected from the Project Explorer and Exported to DWG. Note that if the Sheets include Dynaviews that represent content from the Plan View the Plan View Data must also be selected. Any Linework or Text drawn in the Sheet View will be carried automatically through selection of the Sheet in the project Explorer.

## Sheet Data – Cross Sections

Cross Section data created on a Sheet can be exported to DWG by selecting the Sheet from the project Explorer or through selection of the data in the Sheet View. Since the Cross Sections are drawn as native CAD Objects in the Sheet View, they can be selected like any other linework. Note if the Cross Sections are then “Dynaviewed” onto another Sheet, the Cross Section Sheet Source Data would also need to be selected in order to carry the Dynaview Content to the DWG File.

## Sheet Data - Profiles

Profile data created on a Sheet can be exported to DWG by selecting the Sheet from the project Explorer or through selection of the data in the Sheet View. Since the Profiles are drawn as native CAD Objects in the Sheet View, they can be selected like any other linework. Note if the Profiles are then “Dynaviewed” onto another Sheet, the Profile Sheet Source Data would also need to be selected in order to carry the Dynaview Content to the DWG File.

Note Profiles can also be created by drawing a Frame(s) in the Profile View and then creating a Dynaview from the Profile View in the Sheet View. In this case, the source Profile Data would need to be selected as well as the Sheets in order to carry the Dynaview based data.

## Sheet Data - Station and Offset View

The Station and Offset View can be created as a Drawing Sheet output using a Dynaview. In this case on output of the Sheet data to a DWG file, the Source Station and Offset View Data would also have to be selected.