

Stringer Topo

For AutoCAD® Civil 3D®



Getting Started

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A Complete AutoCAD® for Surveyors

As well as doing everything you ever wanted to do in AutoCAD®, AutoCAD® Civil 3D® manages COGO points, surface data, point tables, point and surface labels and reports.

With synchronisation between your points, breaklines and surface outputs, you can quickly generate your site survey. Robust and comprehensive point and breakline editing tools help to readily tidy your survey for immediate plotting and sharing.

Dynamic point and surface labelling and synchronised point tables are generated from the data to suit your plan requirements. You can explode any of the data back to AutoCAD® entities as desired, or export directly to a simple AutoCAD® drawing file.

AutoCAD® Civil 3D®, incorporating Stringer, can benefit you in the following processes:

Reduction of Survey Data and Importing COGO Points

- ✓ Intuitive survey reduction environment accepting extensive Survey equipment formats
- ✓ Add, delete or edit observations directly
- ✓ Multiple methods to adjust control points before and after import of COGO points
- ✓ Support for traverse adjustments including Bowditch and Least Squares
- ✓ Button click import of co-ordinated points into the drawing with assigned display based on raw descriptions
- ✓ Point grouping tools automatically include and exclude points from the surface

Surface Creation with Breaklines

- ✓ Automatic surface creation from the points and button-click creation of all breaklines, including updating of surface display
- ✓ Complete user control over breakline creation based on alpha/numeric codes, as well as simultaneous creation of 2D polylines for drafting output
- ✓ Advanced point/breakline editing tools to improve your survey output, including
 - ✓ Fitting 3 point arcs to the breaklines and closing strings/breaklines
 - ✓ Automatically reordering points surveyed out of sequence
 - ✓ Supporting multiple point codes for breakline/stringing creation
- ✓ Dynamic surface updates during editing
- ✓ Switch surface display as desired – show triangles, slope arrows and contours at user defined intervals with your preferred layers, linetypes and colours

One Change. Multiple Updates. All Automatic

Labels, Tables and Plans

- ✓ Save time with dynamic surface contour and point labels
- ✓ Quickly create point tables for presentation plans
- ✓ Export points to file for upload and setout, as required
- ✓ Point/surface comparison tools ensure survey quality is maintained

Plotting, Publishing and Data Share

- ✓ AutoCAD® Civil 3D® includes comprehensive tools to share your data with your end customers via a variety of digital formats for data collaboration, plotting and publishing.

Data In

Topographical Survey and Documentation

Data Share

Survey Data



Drawing File:

- dwg
- dxf
- dgn



Geospatial Data



- **Reduce Raw Observations**
- **Import COGO Points**
- **Review and edit points**
- **Create & display Surface**
- **Auto Add breaklines**
- **Edit breaklines/points**
- **Point Tables**
- **Export options**
- **Dynamic contour surface labeling**

AutoCAD®

Plot & Publish Outputs



Survey Data
- points
- surfaces
- LandXML



Drawing File
Design Review
Other formats



Geospatial Data



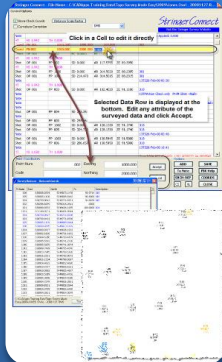
AutoCAD® Civil 3D® Benefits – Topographical Survey

AutoCAD® Civil 3D® provides a dynamic modelling environment for all your surveying processes, including survey reduction, COGO point output, dynamic surface creation and advanced breakline creation/editing tools.

Since AutoCAD® Civil 3D® supports your land survey data it is presented and published directly from AutoCAD® - you save time exporting data from other design packages and avoid all the hazards of revision control and drafting updates as your survey develops.

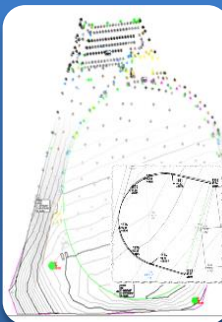
A summary of the benefits of topographical survey inside AutoCAD® Civil 3D® are listed below. A more detailed listing of features and benefits is shown overleaf.

Survey Reduction



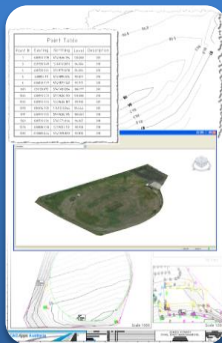
- Supports cadastral and field surveys including survey download from a myriad of data recorders
- Graphical and intuitive editing environment of your observations
- Adjust control points using a variety of graphical and numeric techniques
- Export COGO points directly to AutoCAD Civil 3D
- Grip edit and numeric control over points via the AutoCAD Properties window, making it easy to edit and manage points
- Point Groups enable immediate filtering of points for surface modelling, point tables and display
- Supports multiple day surveys and appending of multiple site surveys

Surface Creation and Editing



- Automatic and dynamic surface creation and display, synchronised with the COGO points and all breaklines
- Surface creation directly references the input data so is always synchronised - changing the data inputs immediately updates the surface.
- All surface display, including triangulation and contours, dynamically react to changes in the surface data. Direct surface edits enable flipping of triangle edges and triangle removal
- Button click surface merging facilitates connection of multiple surveys, as required
- Continuously reports the elevation at any location of interest across the surface
- Complete user control over all display outputs including layer, colour, linetype and linewidth

Documentation and Output

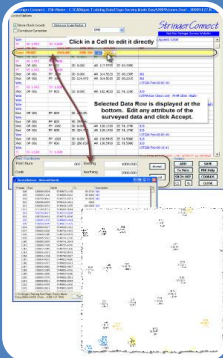


- Contour and other surface labels continuously update as surfaces change
- Grip edit controls of contour and other labels makes label relocation painless
- Labels display completely configurable by the end user
- Save time making duplicate text for different layout scales - labels automatically rescale
- Visualisation inside Civil 3D including Aerial Photo draping
- Graphical alignments and long sections for display
- Button click production of your survey on multiple sheets with your title block/s
- Multiple options to export your survey data for upload and setout as required
- Ready to print or publish directly from AutoCAD®

Deliverables

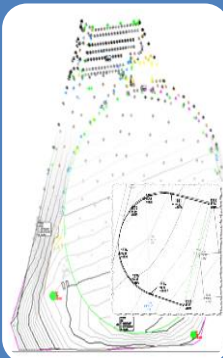
Your site survey will include:

Survey Reduction



- Edit and convert observations into COGO Points
- Import, view and edit the COGO points inside AutoCAD Civil 3D
- Create the surround lot from AutoCAD lines, arcs and polylines

Create and edit the Surface



- Automatically generate a surface from the COGO Points
- Automatically add breaklines based on the point descriptions assigned in the field
- Make surface breakline edits including:
 - Fitting arcs in the breaklines
 - Reordering points taken out of sequence to fix breakline generation
- Apply a surface boundary from a 2D polyline (not covered)

What Civil 3D Can Deliver - Labelling and Outputs



- Generate and display 2D drafting of all strings on user definable layers
- Dynamically label surface contours across the site
- Add spot elevations as required to the surface
- Display point markers and labels to suit
- Create point tables of the setout points and all surveyed points
- Generate a plan layout of the survey ready for plotting

Starting Point

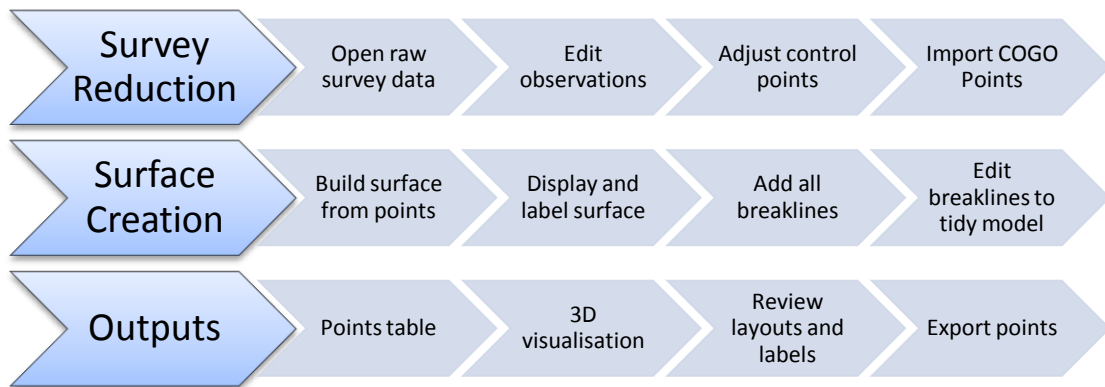
It is required to pick up a topographical survey of the site describing all the features with 2D polylines, points and a surface contoured and labelled and including all breaklines.

The site includes the following features, amongst others:

- a football oval with fences and viewing areas
- paths between oval and car park
- cricket nets
- building and car park areas

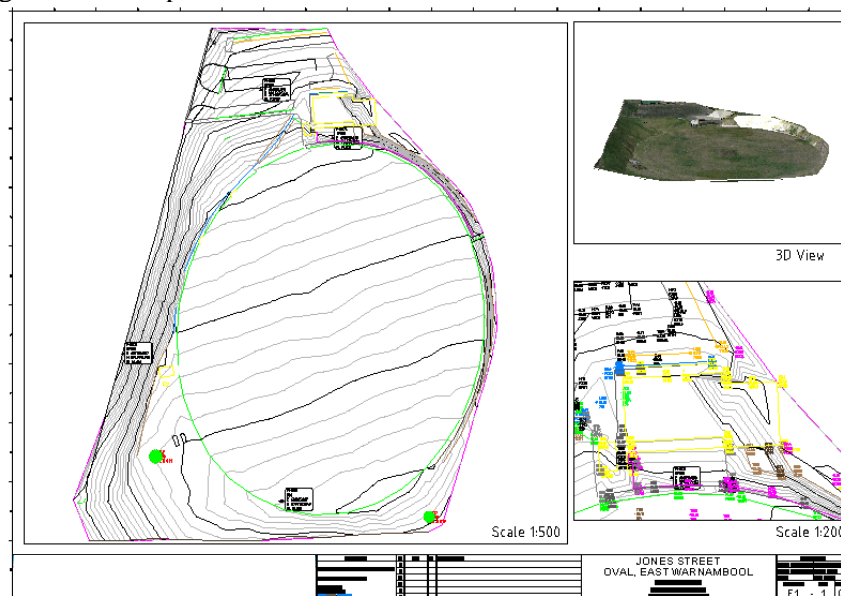
We will be starting with a raw Sokkia .sdr file (picked up using Sokkia equipment) describing an oval and surrounds in Warnambool, Victoria. The surveyor has picked up the survey using arbitrary points and an arbitrary bearing. It will be required to shift and rotate the survey onto the required co-ordinates. A file of corrected control points exists for the job, prepared after the original survey was undertaken.

The output is to consist of a series of layouts of the surface and features with different scales and including a 3D view. A general overview of the process is as follows:



Expected Outputs

We will be focusing on the functionality of Stringer Topo to automate survey reduction, import into the drawing and creation of a final surveyed surface. Using Civil 3D you can generate final plan documentation.



Importing Field Survey Data

In this example, we will be starting from:

- a raw observation file from a Sokkia data recorder (.sdr format), and
- a comma delimited (.csv) file containing a list of known control points with co-ordinates. This file will be used to shift, rotate and scale the survey

Transferring from your Total Station/Data Recorder to File

Survey reduction occurs from a raw observation file that has been transferred from the Total Station/Data Recorder to the computer or to file.

You have access to a wide range of tools to obtain this file, including the use of – Leica Geo Office Tools (for Leica instruments), Prolink (for Sokkia Instruments), Topcon Link (for Topcon instruments) and others. Trimble include a variety of services, including a product known as Trimble Link which resides directly inside AutoCAD® Civil 3D®, to download from data recorders. Software often comes with your data recorder to assist in this part of the process.

From inside AutoCAD® Civil 3D® you can click on the Survey menu and select **Survey Data Collection** to access additional resources to transfer data directly from your Total Station straight to file.

Working with Raw Observation Files

Civi Survey Solutions and AME Surveys include functionality to read raw observation data from a wide variety of data recorders and typical data file formats for Australian surveyors, and are committed to adding to this list as required. Currently the following file formats are directly supported:

- | | |
|-----------------------------------|------------------------------|
| ✓ RW5 (Native format for editing) | ✓ RAW C&G |
| ✓ NEU (CivilCAD) | ✓ GRE Code Before/After |
| ✓ FBK (Autodesk) | ✓ DN (Nikon) |
| ✓ GSI Code Before/After (Leica) | ✓ FC?/DATA/GT7 (Topcon) |
| ✓ SDR/RAW (Sokkia) | ✓ JOB/.ARD/AGA/DC? (Trimble) |
| | ✓ CSV file (Comma Delimited) |

Once a file is selected the software creates a matching copy of the file and opens for immediate editing and adjustment of the observations.


Points can be exported from this process and imported directly into AutoCAD® Civil 3D®

Getting Started

In the following exercise we will be:

- Converting a raw Sokkia observation file into an intermediary editing format
- Editing observations and using a file of control points
- Creating co-ordinated points and importing them directly into Civil 3D


Start AutoCAD® Civil 3D® by double-clicking on the Civil 3D® desktop icon .

From the Civil 3D Icon  (top left corner) click once, then select **New**.

In the **Select Template** dialogue box, browse the list of Templates and open **_Topo Survey Made Easy.dwt**.

Note: This template is installed for the current user as part of the latest Stringer Builds.

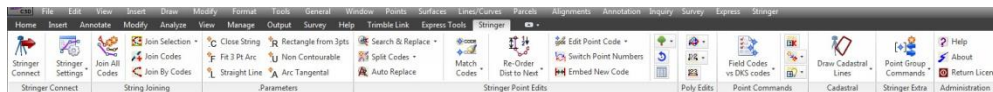
A new drawing is opened, with layers, styles and point groups inherited from the drawing template.

From the Civil 3D Icon  (top left corner) click once, select **Save As** and save the drawing. Pick a location for the drawing and a name (eg: Topo Survey Made Easy.dwg)

Editing Field Survey Data



In the following steps you will open the raw observation file and create a copy for editing.

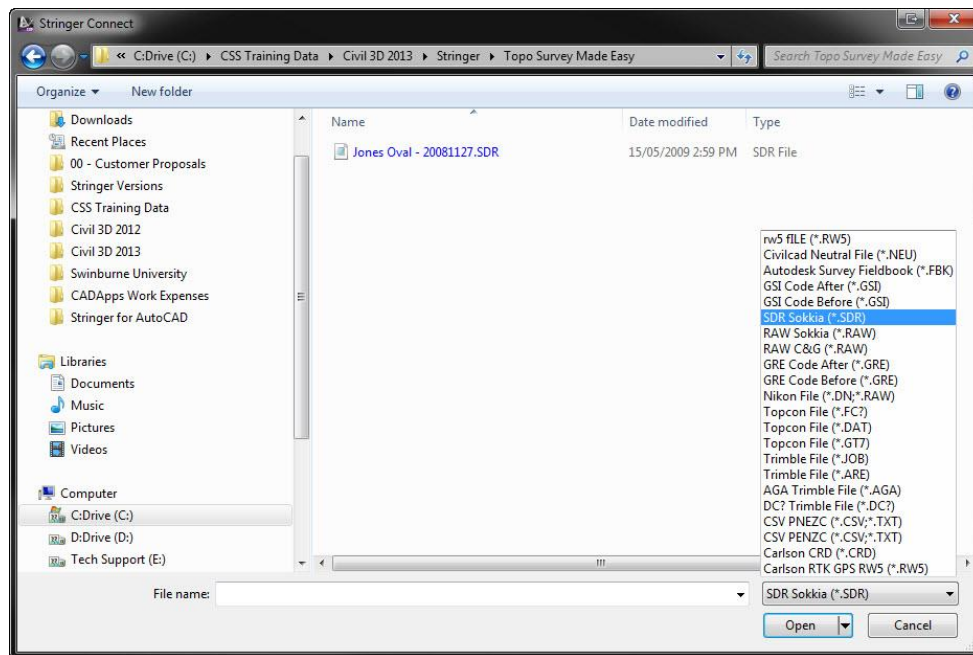
You should have a collection of **Stringer** utilities displayed in the ribbon. The Stringer Ribbon in AutoCAD Civil3D looks like the Picture below:



This Ribbon contains the majority of commands used to execute a standard Topographical Survey.

Open the Raw Field Survey File

Step 1. From the Ribbon select the  **Stringer Connect** icon (or from the **Stringer** menu select **Stringer-Regular Icons Toolbar** and then  **Stringer Connect**. Stringer Connect allows you to select from a variety of raw survey files, edit the observations and generate co-ordinated points directly inside AutoCAD® Civil 3D®.



You now use the interface to select the original survey data file:

Step 2. Use the pick list on the right hand side to select the file format of **SDR Sokkia**.

Now to locate and select the file:

Step 3. Using the normal Windows Search display navigate to the folder location below
C:\CSS Training Data\Civil 3D 20XX\Stringer\Topo Survey Made Easy

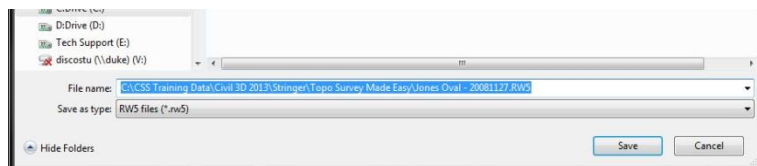
All files of format .sdr are now displayed

Step 4. Click on the file **Jones Oval 20081127.sdr**

Step 5. To accept the file for editing click on the Open button

The software now prompts you to create an intermediary file for editing

Step 6. Simply click on **Save** to create a **COPY** of the original data for editing



Edit the Observations

The **Stringer Connect** observations editor immediately opens and includes all your survey data.

Stringer Connect - File Name : C:\CSS TRAINING DATA\CIVIL 3D 2013\STRINGER\TOPO SURVEY MADE EASY\JONES O...

Control Options

Raw Data Miscloses Reduced Coords Preview

☒ Store Check Coords Scale Factor

☐ Curvature Correction DMS BC<=>BS

StringerConnect

Visit the Stringer Survey Website

Click in a Cell to edit it directly

HT	HI 1.942	TH 0.000				
Coord	PN 001	1000.000	1000.000	100.000		001
Coord	PN 002	1000.000	2000.000	0.000		
Orient	OP 001	BP 002	BC 0.0000	BS 117.5755		
HT	HI 1.942	TH 0.000				
Shot	OP 001	FP 002	SD 0.000	AR 117.5755	ZE 89.3950	
HT	HI 1.942	TH 1.800				
Shot	OP 001	FP 1000	SD 0.000	AR 314.5020	ZE 88.2305	001
Shot	OP 001	FP 1001	SD 214.470	AR 314.5015	ZE 88.2315	001
Note						13TS26-Feb-00 00:30
HT	HI 1.942	TH 1.800				
Shot	OP 001	FP 003	SD 0.000	AR 102.4020	ZE 91.1100	018
Note						13TPAction Check only Pt-Pt SDist <Null>
Note						13TPCheck only From 001 To pt 003
Note						13TPeNorth <Null> eEast <Null> eElev <N...
Note						13TPCheck only 018
Shot	OP 001					018
Note						13TPAction Store Obs Pt-Pt SDist <Null>
Shot	OP 001	FP 003	SD 293.360	AR 102.4015	ZE 91.1100	018

or the Selected Data row is displayed at the bottom. Edit any Attribute of the Surveyed data and click Accept.

Point Coordinates

Point Num 001 Easting 1000.000

Code 001 Northing 1000.000

Level 100.000

Attributes <empty> <empty> <empty> <empty>

Accept Cancel

Options

ADD SAVE

To Note FBK Help

SRCH-RE COORDS

CSV CLOSE

Each type of survey data recorded is colour coded for quick and easy identification. You can click on any cell to make direct edits within the cell, or use the dynamic data editing window at the bottom to make any changes to the data row and click Accept.

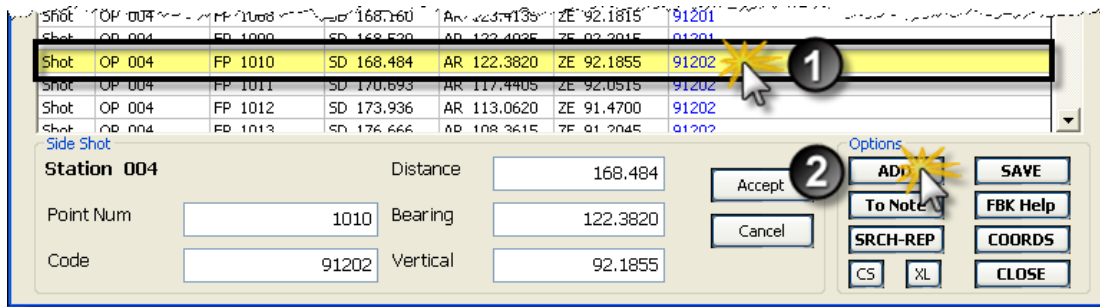
Step 7. Use the scroll on the right to review the recorded data or click in the display and use the roller on the mouse.

You can readily move data that has been taken out of sequence and also Add extra data.

Search and Replace tools are available for you to make bulk edits to (usually) the point descriptions (Codes).

Adding Observations

Let's assume that we have forgotten to add a target height adjustment in the survey. This is easily rectified within the editor:

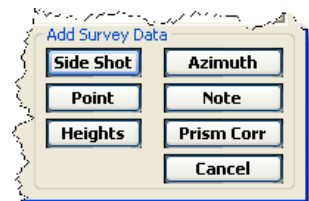


Step 8. Scroll to FP1010 and click on this Shot. This will highlight the entry.

You can Click on **Add** to add a new survey entry below the highlighted row

The options include:

- Side shot: Adds and Observed Shot (**Shot**)
- Point: Adds a Control Point (**Co-ord**)
- Heights: Adds an Instrument Target Height (**HT**)
- Azimuth: Adds an Orientation (**Orient**)
- Note: Adds a Note line
- Prism Corr: Adds a Prism Correction



Removing Observations

Some of the data picked up in the field may be incorrect or no longer needed for inclusion in the output. You can remove it from the co-ordinated points by turning any data row into a

Re-Ordering Observations

Point co-ordinates are calculated by reading and applying the edited observation data working from the top down. You may have taken some shots 'out of sequence' or need to otherwise reorder the survey entries – this can easily happen when an Instrument/Target Height adjustment is missed in the field and added later during the field survey.

Adjusting Control Points – Shift, Rotate and/or Scale

It is not uncommon to setup on known control points in the field and to apply assumed co-ordinates and bearings during the field survey. The exact co-ordinates may not be known at the time of the survey or you may wish to adjust these when you are back in the office.

- Inside Stringer Connect:
 - o By typing in the corrected co-ordinates directly in the cells during the reduction process, or
 - o Importing a file of points (this takes the form of a comma delimited file with extension .csv) with point numbers matching and adjusted co-ordinates – the software will read in the file and update all the point co-ordinates
 - o Scaling the co-ordinate points based on imported control points
- Using AutoCAD® Civil 3D®:
 - o Graphically move and rotate your control points inside AutoCAD® Civil 3D® and update the co-ordinates inside Stringer Connect by reading the updated point co-ordinates from the drawing
 - o Undertake a traverse adjustment (Bowditch or Least Squares) and update the co-ordinates inside Stringer Connect by reading the point co-ordinates from the drawing

In this example we will import a file of known co-ordinates to update the control point co-ordinates inside the editable Field Survey file.

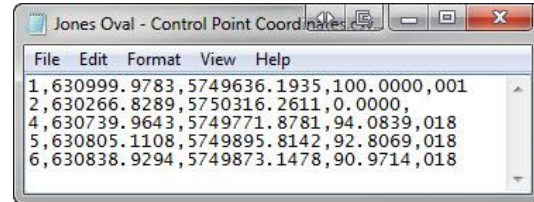
Adjusting the Control Points – From File

A file has been created with adjusted control points. The format of the file is as follows (viewed in Notepad):

The file contains the following information (comma delimited):

Pt No, Easting, Northing, Elevation, Description

Since this is a .csv file format it can be created, editing and viewed in Excel.

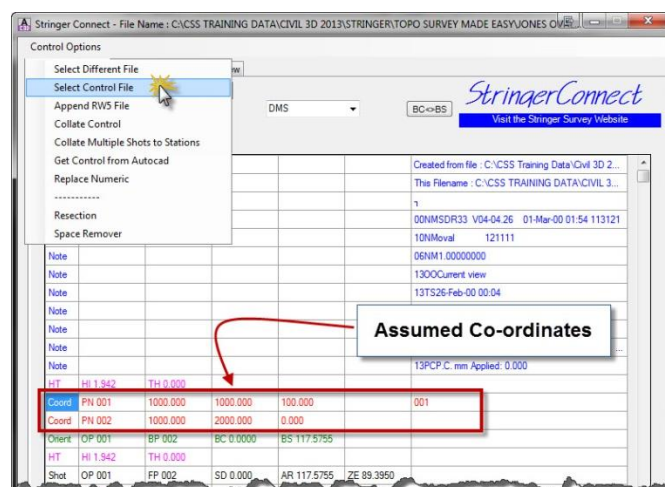


Pt No	Easting	Northing	Elevation	Description
1	630999.9783	5749636.1935	100.0000	001
2	630266.8289	5750316.2611	0.0000	
4	630739.9643	5749771.8781	94.0839	018
5	630805.1108	5749895.8142	92.8069	018
6	630838.9294	5749873.1478	90.9714	018

Stringer Connect will match up the Point Numbers and replace the control point data from this file.

Step 9. From the menu **Control Options** select the command **Select Control File**.

You will be prompted to locate and open a control file



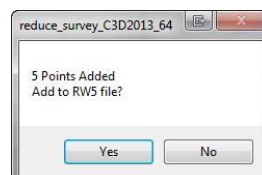
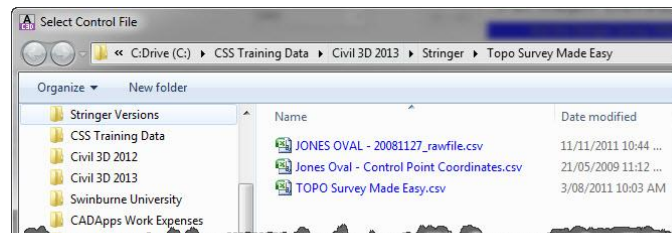
Step 10. Navigate to the file **Jones Oval – Control Point Coordinates.csv**.

The file is located in:

C:\CADApps Training Data\Topo Survey Made Easy\2010\

Step 11. Click on **Save** to include the file

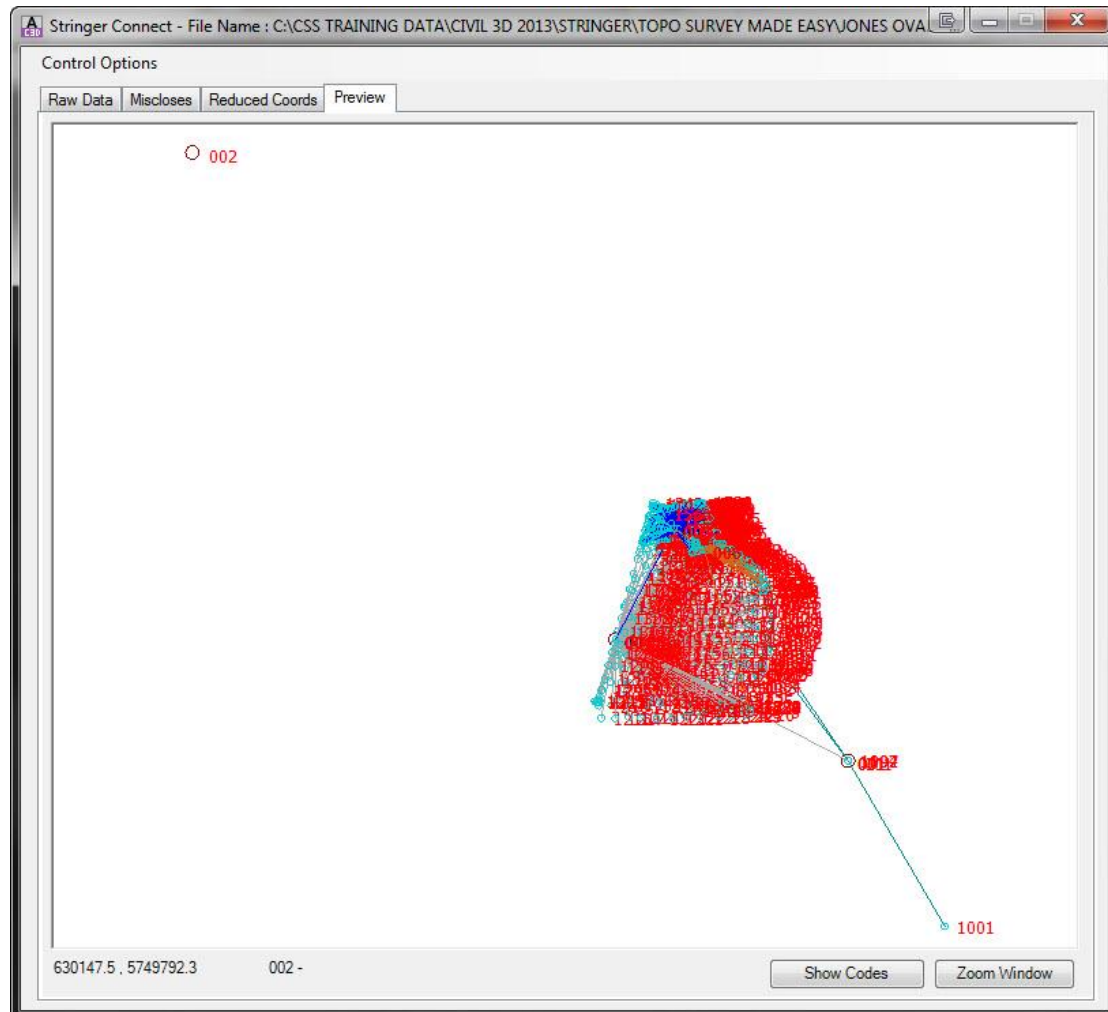
Step 12. At the prompt to add the points to the RW5 file, click on **Yes**



The corresponding Points in the RW5 are updated from the file.

Preview Tab

Now that you have the Adjusted Co-ordinates for the Instrument Stations in the raw data you can now look at a preview of the data before adding it to the drawing so you know that the data you have edited will reduce as specified. Below is a screen grab of the Preview Tab in Stringer Connect:



In the Preview Tab you can zoom in and out with you wheel on your mouse, you can also zoom into an area and when you want to zoom extents again you can double click on the wheel again just like in AutoCAD. It also has the co-ordinates in the bottom left corner of anywhere where the mouse is at the time. You can change it from the Pt Numbers to show Codes, so it's up to you with what you want to see while in this display.

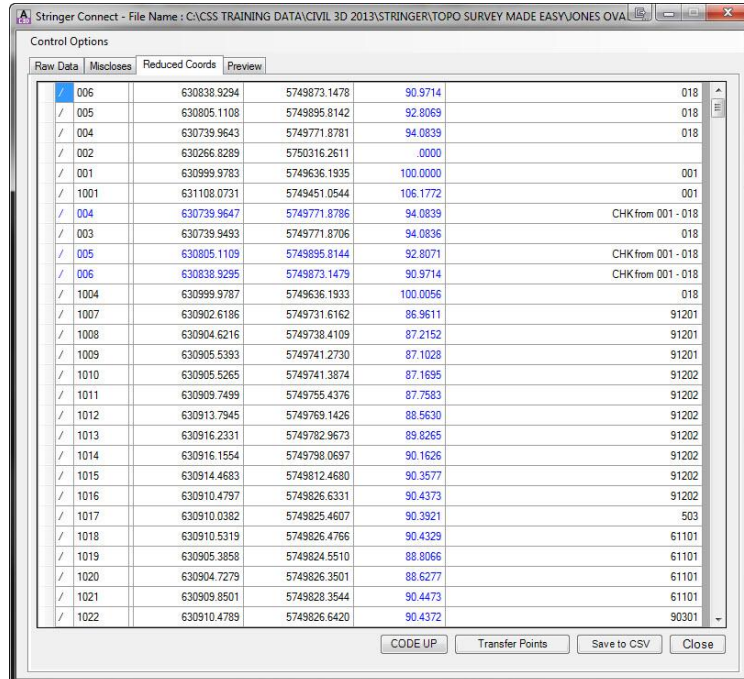
Importing Coordinated Points into AutoCAD® Civil 3D®

After you have reviewed and edited the field data, the next step is to reduce these to co-ordinated points and import them into AutoCAD® Civil 3D®.

Step 13. From the **Tabs** up the top click on the **Reduced Coords** Tab. The points will immediately be converted into co-ordinates and displayed for review and importing into AutoCAD® Civil 3D®.

If you want to save a CSV file of the original points from the field click on the **Save as CSV** button down the bottom.

Some Alpha codes that have been typed into the jigger can be in lower case so we have a button **Code Up** that will change all lower case letters to upper case letters.



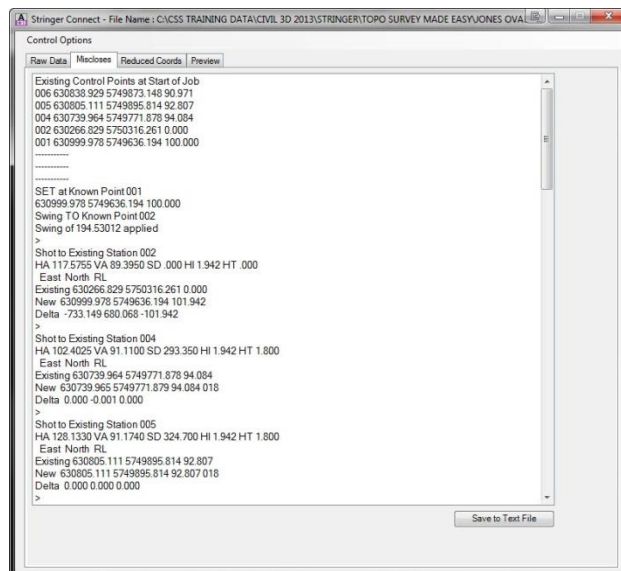
Raw Data	Miscloses	Reduced Coords	Preview
006	630838.9294	5749873.1478	90.9714
/ 005	630805.1108	5749895.8142	92.8069
/ 004	630739.9643	5749771.8781	94.0839
/ 002	630266.8289	5750316.2611	0000
/ 001	630999.9783	5749636.1935	100.0000
/ 1001	631108.0731	5749451.0544	106.1772
/ 004	630739.9647	5749771.8786	94.0839
/ 003	630739.9493	5749771.8706	94.0836
/ 005	630805.1109	5749895.8144	92.8071
/ 006	630838.9295	5749873.1479	90.9714
/ 1004	630999.9787	5749636.1933	100.0056
/ 1007	630902.6186	5749731.6162	86.9611
/ 1008	630904.6216	5749738.4109	87.2152
/ 1009	630905.5393	5749741.2730	87.1028
/ 1010	630905.5265	5749741.3874	87.1695
/ 1011	630909.7499	5749755.4376	87.7583
/ 1012	630913.7945	5749769.1426	88.5630
/ 1013	630916.2331	5749782.9673	89.8265
/ 1014	630916.1554	5749798.0697	90.1626
/ 1015	630914.4683	5749812.4680	90.3577
/ 1016	630910.4797	5749826.6331	90.4373
/ 1017	630910.0382	5749825.4607	90.3921
/ 1018	630910.5319	5749826.4766	90.4329
/ 1019	630905.3858	5749824.5510	88.8066
/ 1020	630904.7279	5749826.3501	88.6277
/ 1021	630909.8501	5749828.3544	90.4473
/ 1022	630910.4789	5749826.6420	90.4372

Step 14. Click on the **Miscloses** Tab to display information regarding the survey accuracy

The report confirms the accuracy of your shots taken in the field by comparing the Existing Control Points to the raw observed data shot.

The report can be readily exported to a .csv format or moved directly to Excel.

Step 15. Click back on the **Reduced Co-ords** Tab to transfer the points into the drawing



Raw Data	Miscloses	Reduced Coords	Preview
Existing Control Points at Start of Job			
006	630838.929	5749873.148	90.971
005	630805.111	5749895.814	92.807
004	630739.964	5749771.878	94.084
002	630266.829	5750316.261	0.000
001	630999.978	5749636.194	100.000

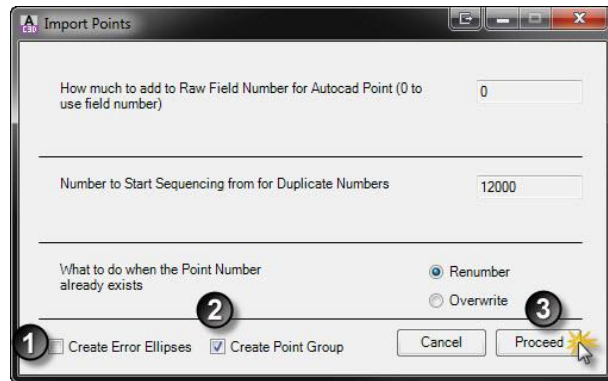
SET at Known Point 001			
630999.978 5749636.194 100.000			
Swing TO Known Point 002			
Swing of 194.53012 applied			
>			
Shot to Existing Station 002			
HA 117.5755 VA 89.3950 SD .000 HI 1.942 HT .000			
East North RL			
Existing 630266.829 5750316.261 0.000			
New 630999.978 5749636.194 101.942			
Delta -733.149 680.068 -101.942			
>			
Shot to Existing Station 004			
HA 102.4025 VA 91.1100 SD 293.350 HI 1.942 HT 1.800			
East North RL			
Existing 630739.964 5749771.878 94.084			
New 630739.965 5749771.879 94.084 018			
Delta 0.000 -0.001 0.000			
>			
Shot to Existing Station 005			
HA 128.1330 VA 91.1740 SD 324.700 HI 1.942 HT 1.800			
East North RL			
Existing 630805.111 5749895.814 92.807			
New 630805.111 5749895.814 92.807 018			
Delta 0.000 0.000 0.000			
>			

The final step is to transfer the points into Civil 3D

Step 16. Click on the **Transfer Points** button down the bottom right of the **Reduced Co-ords** **Tab** as shown from Step 18.

AutoCAD® Civil 3D® protects surveyors from creating duplicate points. This form allows you to determine how to deal with duplicate points.

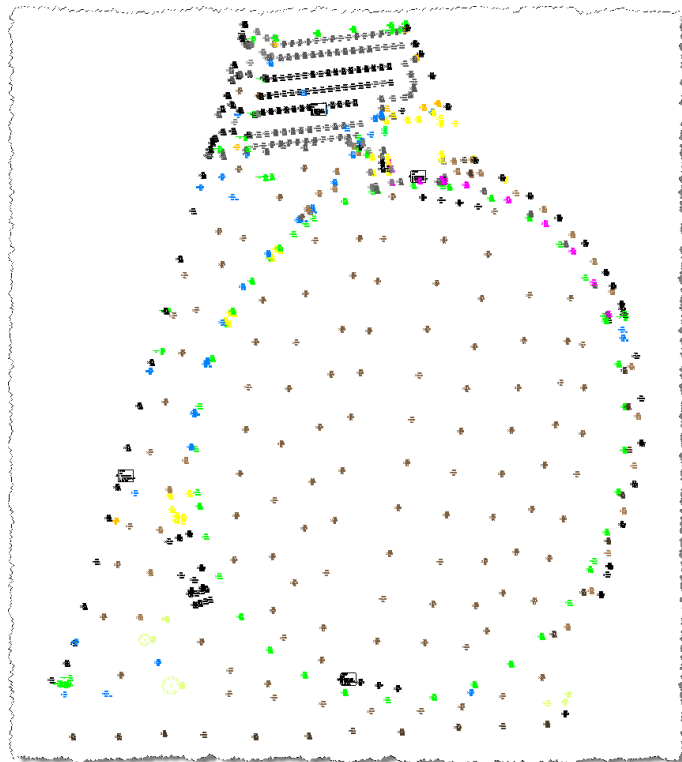
Step 17. Untick the option to **Create Error Ellipse** and click on **Create Point Group** and then click on **Proceed**.



If required double click the middle mouse button to zoom to the extents:

All points are now included in the drawing.

Each point has been assigned an object (marker) style and text (label) style based on its description.



Reviewing your Point Codes

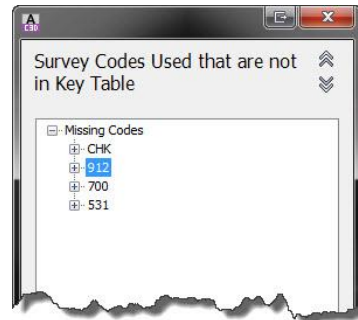
In a medium to large surveying firm it is important to ensure consistency in the point codes used in the field.

When survey points are imported into AutoCAD® Civil 3D® it is important to check that the survey includes all the expected field codes – this can be done by checking all point codes in the drawing to ensure that they match the list of codes specified in the Description Key Set.

Step 18. From the Stringer Ribbon select the  **Field Codes vs DKS Codes** command

After a few moments a validation check is made between the points in the drawing and the Description Key Set.



Point Codes CHK, 700, 531 and 912 have been used in the field survey but do not have a corresponding code in the Description Key Set



It is usual to either include these point codes in the Description Key Set (so the points are put on the correct layer and have the expected display) or else change the Point Code to match one in the Description Key Set that's already there.

Point Search and Replace

Point code search and replace tools exist in the drawing.

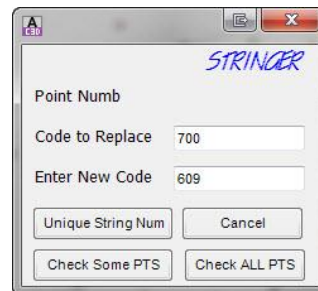
Step 19. To replace all points with description 700 with description 609 (retaining wall) select the  **Search and Replace Dialog** command from the Stringer Ribbon (or from the **Stringer** menu select **Stringer Point Edit Toolbar** and then  **Search and Replace Dialog**)

At the command prompt, press [Enter].

At the Replace Codes form, set the following:

- Code to Replace: **700**
- Enter New Code: **609**

Click **Check ALL PTS.**



Click **OK** when prompted to select points to replace, and then press [Enter] to select all points in the drawing.


All points with description 700 are changed to 609. Any stringing associated with the points will stay the same, just the code is changed. e.g. 70001 - 60901

Surface Creation and Editing

Stringer - Automating Breakline Creation


Via Stringer, users are able to automatically create surface breaklines and linework based on point descriptions. The software will automatically add both a 2D polyline and a 3d breakline from point descriptions containing user definable (alpha or numeric) codes and a String number. Polylines and Breaklines are added in sequence of the points taken in the field (for each unique code and string number combination).

Getting Started

If required, start AutoCAD® Civil 3D® by double-clicking on the Civil 3D® desktop icon .

You can either continue with our previous drawing or open another drawing.

- Open a New Drawing

From the Civil 3D Icon  (top left corner) click once, select **Open**, then select the file C:\CSS Training Data\Civil 3D 20XX\Stringer\Topo Survey Made Easy\Topo Survey Made Easy-Surface.dwg.

Click **Open**.

- Continue existing design
Save As the drawing with the name of your choice.

Adding Points to a Surface


It is time to generate the surface model from the surveyed points.

In AutoCAD® Civil 3D® points are arranged into **Point Groups** – this provides the ability to filter points into a group to use for building a surface model and also enables grouping of like points to manage display and for quick point table creation.

Point Groups can be used directly as a data input to building a surface.

In our drawing, the point group 'Contourable' already existing and has been assigned as a data input for the 'Existing Survey' surface – all we need to do is **Update** the point group to receive the new points into the Group.

To update the Point Groups:

- Step 1.* From the Civil 3D® Toolspace click on the  sign next to **Point Groups** to view the list of Point Groups in the drawing
- Step 2.* Right click on **Point Groups** and select **Update** from the shortcut menu.

The drawing will immediately update and include a new Surface:

Adding Surface Breaklines

In order to control grade breaks across the surface for features such as kerbs, top/bottom of banks and retaining walls breaklines need to be added to the surface.

To improve efficiency in creating breaklines, surveyors normally assign points a code (describing the feature being picked up) and a string number. This enables ready identification of where breaklines are required, and with Stringer you can automate this breakline creation.

Breakline Control

Users are able to control which point codes are connected with a 2D polyline 3D polyline and a 3d breakline, as well as which layers these features are created on. To review the point codes that will be 'strung' with 2D polylines/3D Polyline & 3D breaklines:



Step 3. Select the **Stringer Settings** button from the Ribbon

Code	Type	2d Layer	2d Profile	3d Layer	3d Profile
001	3d Breakline	001_Permanent_Survey_Mark		SURFACE_3D_BREAKLINES	
010	3d Breakline	010_Pin		SURFACE_3D_BREAKLINES	
100	3d Breakline	100_Contour-Edge		SURFACE_3D_BREAKLINES	
101	3d Breakline	101_Contour-Standard		SURFACE_3D_BREAKLINES	
102	3d Breakline	102_Bank-Top		SURFACE_3D_BREAKLINES	
103	3d Breakline	103_Bank-Toe		SURFACE_3D_BREAKLINES	
104	3d Breakline	104_Spot_Height_(Natural_Surfa...		SURFACE_3D_BREAKLINES	
105	3d Breakline	105_Spot_Height_(Existing_Surfa...		SURFACE_3D_BREAKLINES	
106	3d Breakline	106_Change_of_Grade		SURFACE_3D_BREAKLINES	
107	3d Breakline	107_Floor_Level		SURFACE_3D_BREAKLINES	
108	3d Breakline	108_Roof_Level		SURFACE_3D_BREAKLINES	
109	3d Breakline	109_Ground_String-Profile		SURFACE_3D_BREAKLINES	
11	3d Breakline	011_Check_Measurement		SURFACE_3D_BREAKLINES	
110	3d Breakline	110_Ground_String-Breakline		SURFACE_3D_BREAKLINES	
111	3d Breakline	111_Relief-Unclassified		SURFACE_3D_BREAKLINES	
12	3d Breakline	012_General_Reference_Mark		SURFACE_3D_BREAKLINES	

Here you get to set all the codes that should be 'strung' and also if the code represents a 2D feature (such as linemarking) or 3D feature (such as kerbing).

Users are able to set the layers for the strings that are created, based on the point codes.

Given that you may work with alpha and numeric codes, you are able to create and use multiple 'profiles assignment' files.

*Note: the file in use is shown at the top of the form. If it does not read **Topo Survey Made Easy.csv** at the end, click on the **Select Correlation File** and select this .csv file.*

Click on **Ok**.

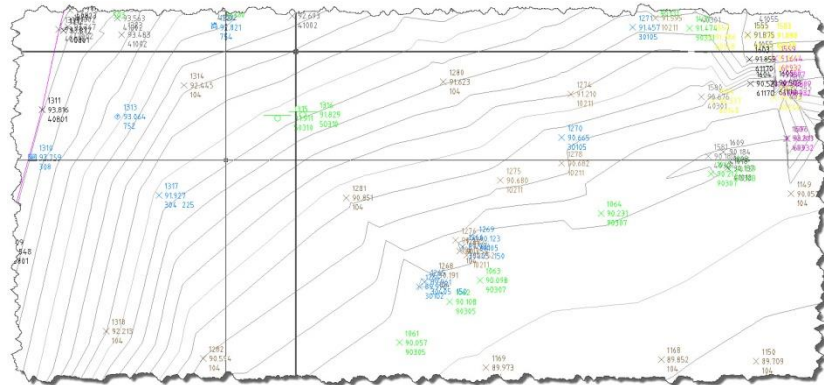
Add all Breaklines



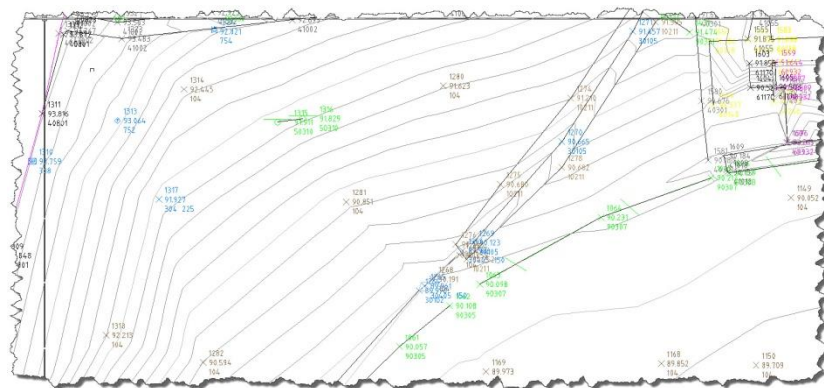
Step 4. Select the **Join All Codes** command from the Stringer Ribbon

The software will scan the all points in the drawing and add breaklines to the surface.
Expected outputs are as follows:

Before



After



It is not unusual for crossing breaklines to result when breaklines are first added to the surface. Each breakline is named in the surface definition and can be reviewed/edited in the Civil 3D toolspace.

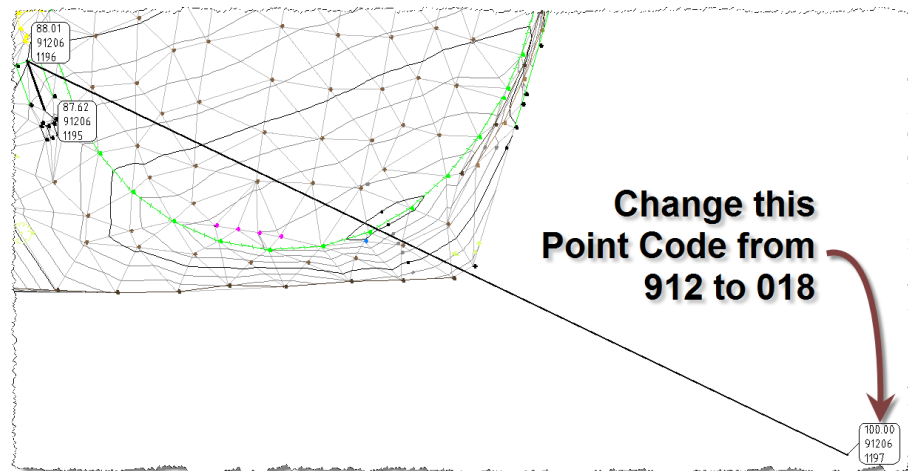
Now it is time to review the breaklines and start making changes to point codes and/or breaklines to make an accurate surface model representation.

Editing Points and Breaklines

Let's start reviewing the surface triangulation and breaklines. Where issues are identified, we will explore a wide range of tools to quickly make corrections.

Changing Point Descriptions

An obvious problem exists with a breakline extending to one of the Station points. The breakline represents a fence.

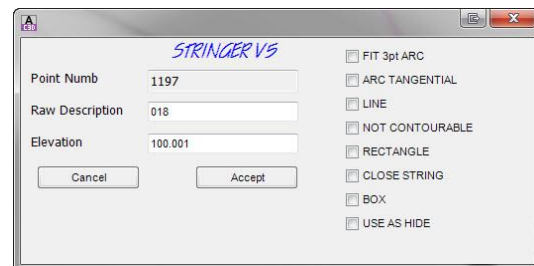


The Point code 91206 has been assigned and is connecting to the fence of the cricket nets and crossing other breaklines. To change this code to, say, 018 (a spike) let's edit the point code:

Step 5. Select the  **Edit Point Level or Code** command from the Stringer Ribbon

At the prompt, click on Point number **1197** in the drawing (southeast corner).

The Point Edit form will display for you to change the description and/or elevation of the point.



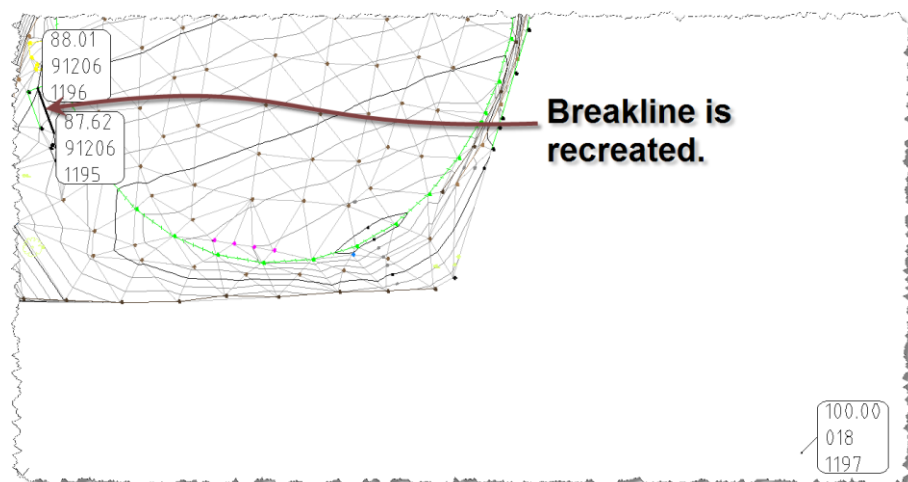
Step 6. For the **Raw Description** type in **018**.

Step 7. Click **Accept** to replace the point and re-string the breakline.

Note: You can fit curved breaklines and close strings/breaklines by adding a suffix to the point code Typical code suffixes will be explored, below.

The breakline is recreated and no longer crosses outside the survey area.

The adjusted point is redisplayed with a marker and label suitable for the point description.



Fixing Out-Of-Sequence Points

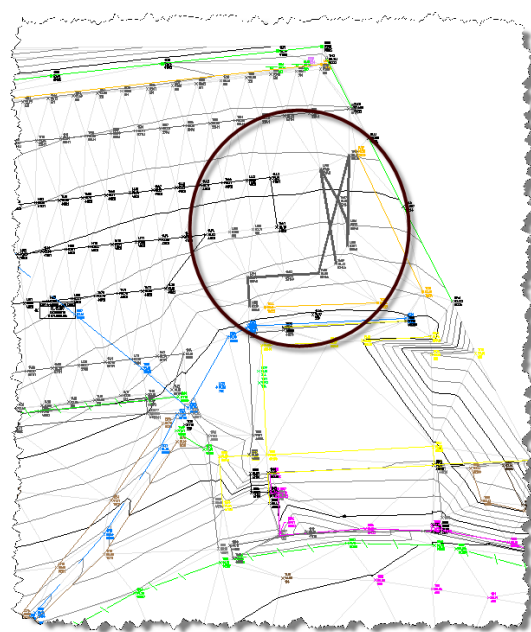
Breaklines and linework is formed by connecting unique point code/strings working from the lowest to highest point number.

It is easy to pick up points out of sequence – these results in overlapping breaklines and incorrect model triangulation (in the case of a breakline being added).

In the example, right, the point numbers 1490-1499 (description **53140**) represent a kerb edge and have been recorded out of sequence.

Zoom to the points in the drawing and note the overlapping breakline.

Location in Plan



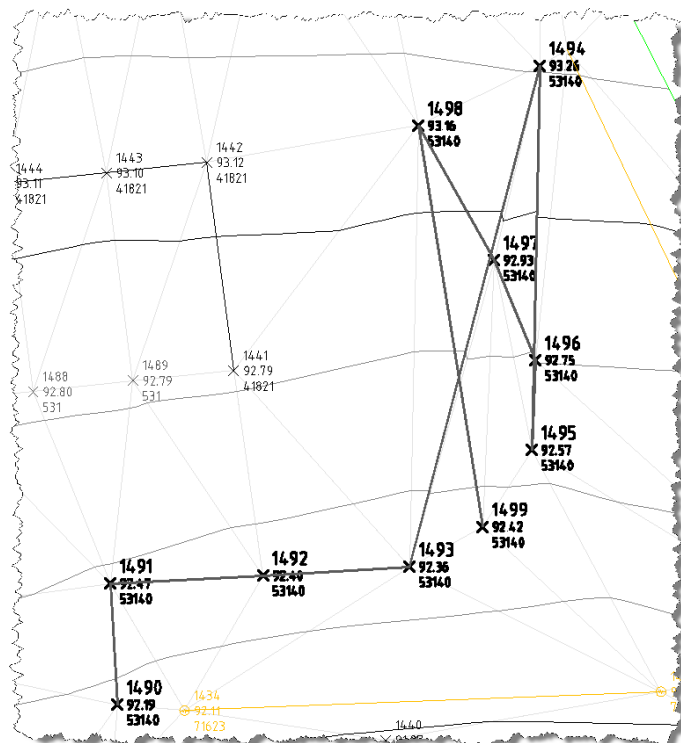
There are a number of tools to fix up points that have been picked up out of sequence. One



very effective tool is **Re-order Distance to Next** – this takes all the points of a selected description and re-orders them working from the lowest Pt Number and finding the closest next point, repeating to the end, with the highest Pt Number last just as if you picked it up in that order out in the field.



Step 8. Select the **Re-order Distance to Next** command from the Stringer Ribbon



The next step may be to fillet a curve in the breakline to better represent this feature.

Adding Curves to Breaklines and Linework

Many features picked up in the field, particularly kerbing, includes horizontal curves.

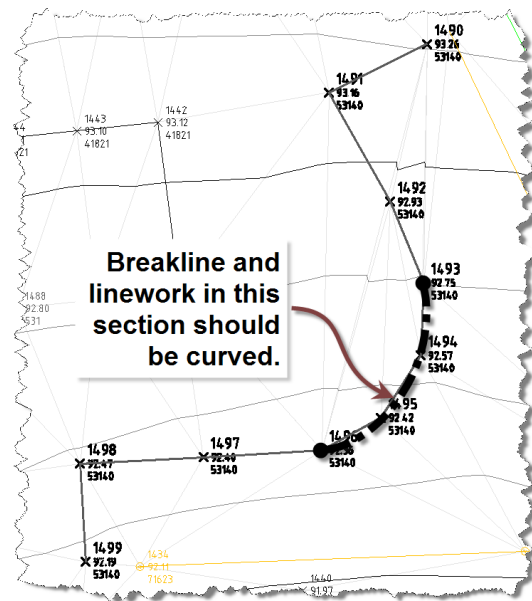
It is easy to add Stringer parameters to your point codes to result in curves being added automatically to the linework/breakline that is formed.

In the example, right, the kerb shown (description **53140**) require a filleted curve section to be added.

You can 'fit' a 3 point curve from any point, with curves being applied forward until you restore the linework back to straight lines.

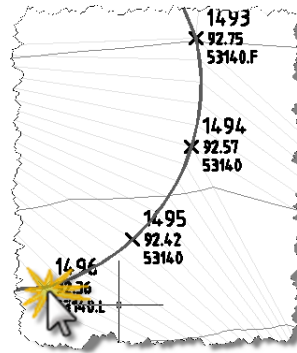
Let's explore this functionality

Location in Plan



Step 2. Select the  Straight Line **Add L** command from the Stringer Ribbon

At the command prompt, click on point number **1496**, as shown.

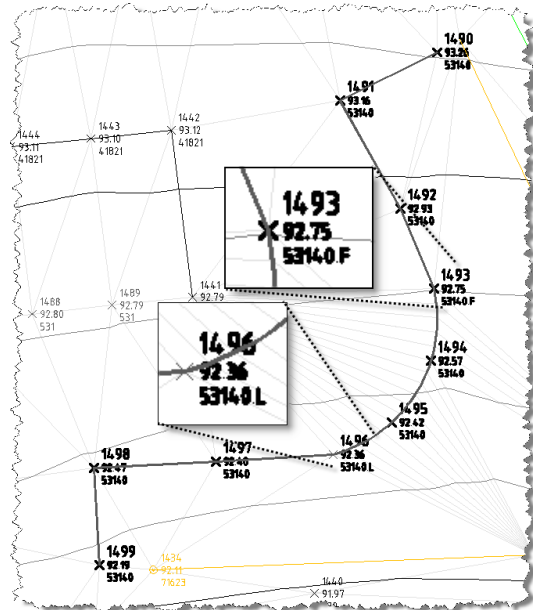


The breakline and linework has been restored to line segments from this number forward to the end of the linework/breakline.

Curved linework/breaklines are created from points that have a **.F** parameter applied to the point description.

Line segment linework/breaklines are created from points that have a **.L** parameter applied to the point description.

Note: If you add a .Parameter to a point but in the wrong spot, just click on it again and it will take it off the point you just added it to




*Special Note: During the editing process, the Surface may appear to keep a 'ghost' of the previous triangulation. You can fix this by selecting the **Existing Survey** surface in the Civil 3D® Toolspace, pressing the right mouse button and selecting **Rebuild** from the shortcut menu.*

Surveying Trees with independent trunk and canopy scaling.

In AutoCAD® Civil 3D® each point surveyed in the field can have a single symbol assigned to it based on a scaling parameter. Using these tools, surveyors need to make two shots to a tree in order to independently scale the tree trunk and canopy

For many surveyors, it would be preferred to take one shot to a tree and specify the trunk diameter, canopy diameter and height all at once. Stringer facilitates this process by applying multiple AutoCAD® blocks to a point based on its description and the sizing parameters.

The  Tree Block Definition command allows you to set the codes that should be used for creation of tree symbols.

You need to have all your tree codes added to this form. This form will then allow you to add the tree block that you want associated with that code to be added as a block in the drawing .

How do we do this, lets run through the steps:

A point exists at the bottom right corner of the survey with the following parameters:

Location in Plan

Point Description **TR .3 5 10**

.3 Trunk diameter

10 Tree height

Step 11. If you haven't already done so, save your drawing

Civil 3D - Labels, Tables and Plans

AutoCAD® Civil 3D® includes comprehensive tools for labelling your points and surface/s, creating point tables, generating plans (sheets) of your survey and visualising your outputs.

