

# Instrument Manual

Interface to Topcon 3DMC Machine Control

**LSS<sup>TM</sup>**



3DMC

Machine Control

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# Introduction

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In our experience software options are often only used in their simplest forms particularly when combined with data transfer. This document aims to uncover the more powerful aspects of the use of LSS combined with the Topcon machine control using 3DMC.

This document assumes the use of LSSv10.01.10 or later and the information is based on default installation/configuration settings and shows the principles and intricacies of the system from any perspective or knowledge base.

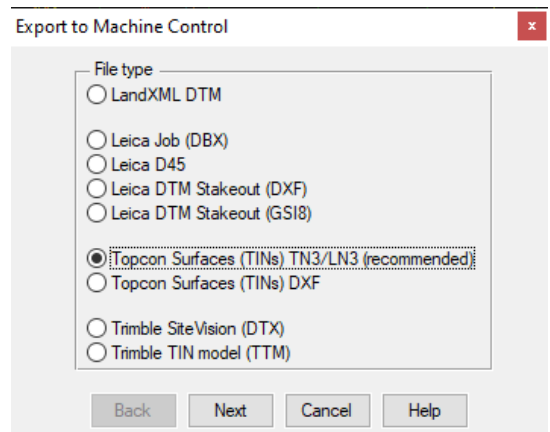
We hope that this document meets all your expectations, but if you feel that it has fallen short in any way please let us know so that we may improve its structure and content.

# Chapter 1

## 1.1 DTM and Linework - Export to Machine Control

This option exports the LSS model as proprietary Topcon TN3 and LN3 files which are the native file formats for '3D Office' or '3DMC'.

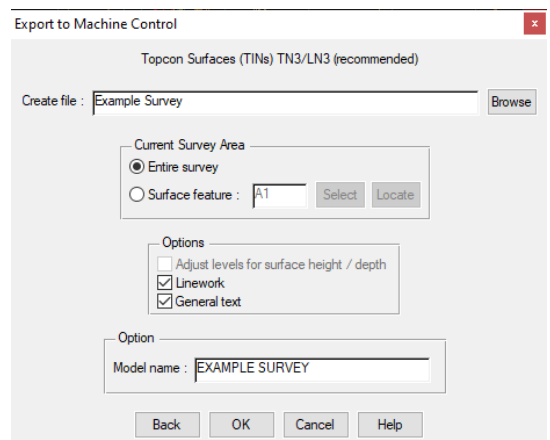
Select 'Topcon Surfaces (TINs) TN3/LN3'



The triangles can be exported to the TN3 as either **Entire survey** or an individual **Surface feature**.

'Adjust levels for surface height / depth' - will be available when heighted surface codes are present in the model and is **best used with a single heighted surface only** where the base / top of the triangles are exported based on their height / depth values.

**Note:** for multiple surface heights/depths within a model please refer to the "Creating a Formation model" section below to see how an LSS formation model can be created avoiding the vertical sides that normally form between adjacent surfaces of varying depths.



'Linework' and 'General text' are the options, for the LN3 file and are on by default

### 1.1.1 3D Office

For a New project select 'File / New'

TIN / Options' – set Show Boundaries in the Plan view tab

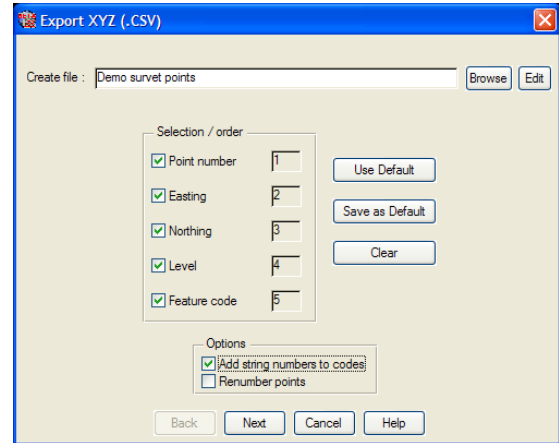
#### Import data

'TIN / Import TIN / From 3D TIN file (\*.TN3) – this will import the DTM into a new surface in 3D Office.

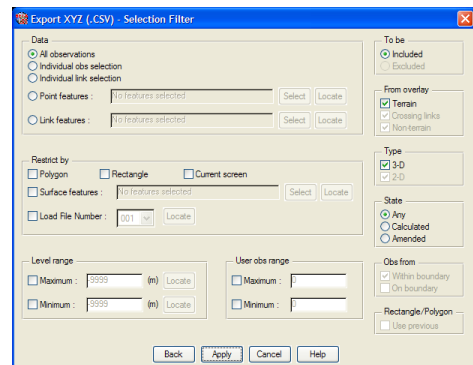
## 1.2 Points – Export/XYZ (.CSV)

From the main menu, select 'Export/XYZ(.CSV)'.

Enter a filename (CSV) and select the dialog options as shown with the 'order' sequential.



Select the observations using the selection filter



### 1.2.1 3D Office

To add the Points data to the model

Points / Import points – from text file (CSV)

Here we need to set up a format of the conversion to match the exported data i.e. Point name / Easting / Northing / Elevation / Description.

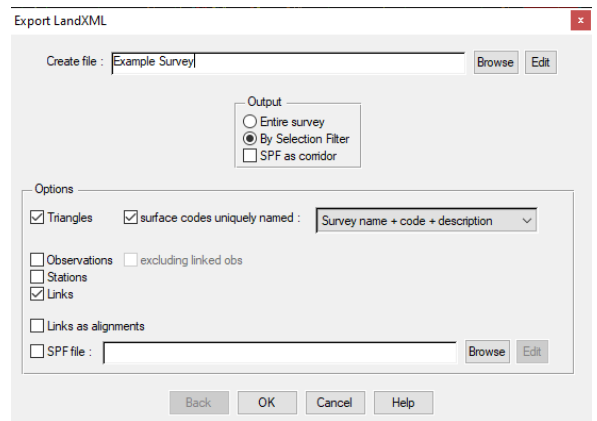
Export data to machine control as PT3

Points / Export selected points – to 3D point file (\*.PT3)

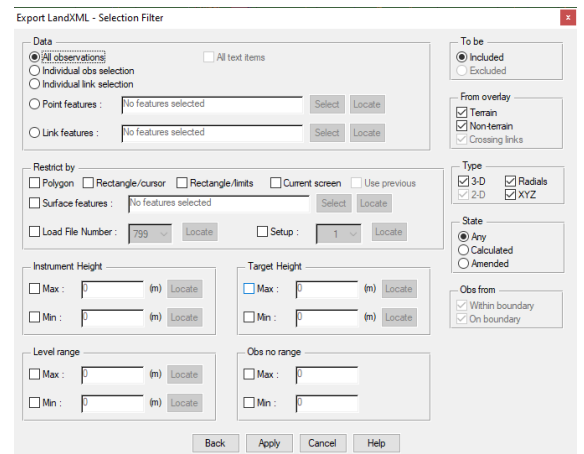
## 1.3 Points – Export/LandXML

From the main menu, select 'Export / LandXML'

Enter a filename and select the required options



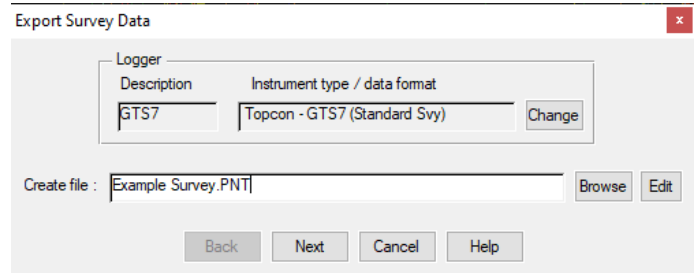
Choose Entire Survey or select the observations using the selection filter dialog shown opposite



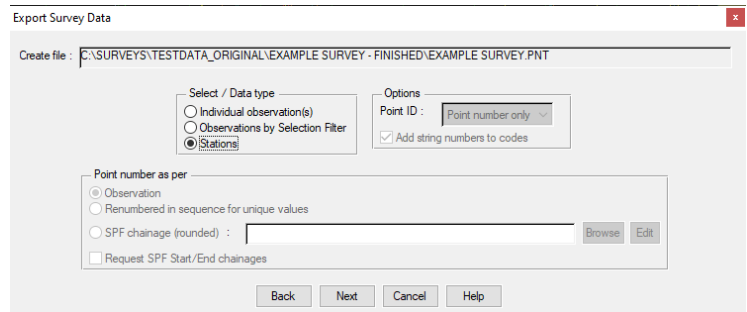
## 1.4 Control - Export/Survey Instruments – Survey Data – Stations

From the main menu, select 'Export/Upload data to survey instruments'.

Select an existing configured logger set to 'Topcon – GTS7' (or configure a new one) and provide a file name for the exported data.



Select Stations - which has no other options.



### 1.4.1 3D Office

To add the Stations to the model

Project / Import control points – from text file

Here use the same format as used previously with points (i.e. Point name / Easting / Northing / Elevation / Description)

**Export data**

Project / Export control points – to 3D control file (\*.GC3)

### 1.4.2 3DMC

All the above files need to be copied to the data card for input to 3DMC

The TIN is used in 3DMC as the Working model.

If the TIN file has surface depths then the original design DTM could also be exported and used as the Reference model.

# Chapter 2

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## 2.1 Creating a Formation Model

This topic describes the combined use of Output / Surface Boundaries and Output / Survey to build a 'formation model' i.e. one that describes the shape along the top or underside of each surface feature height/depths of the current model.

The resultant formation model includes a user defined step between adjacent surface features of different height/depths which avoids anomalies (vertical sides) in the DTM and can therefore be used for machine control work and setting-out etc.

The following steps are needed to complete the process

Use File / SaveAs to create a copy of your current model

Repeat the use of Output / Surface Boundaries twice

On the first pass use a zero Internal offset distance to tidy the model i.e. this will make sure that all surface boundaries are linked i.e. are breaklines in the DTM (this load file can also be used to supply Hatching boundaries for Autocad)

On the second pass use a small Internal offset distance e.g. 10mm, to create parallel offsets to all the selected boundary lines. This is what the Output / Survey option uses to avoid the vertical steps in the resultant formation model where the adjacent surface height/depths have different values.

Finally use the Output / Survey command as described below. See particularly the option 'Adjust levels for surface height/depth' and the related setting 'Perpendicular to surface'

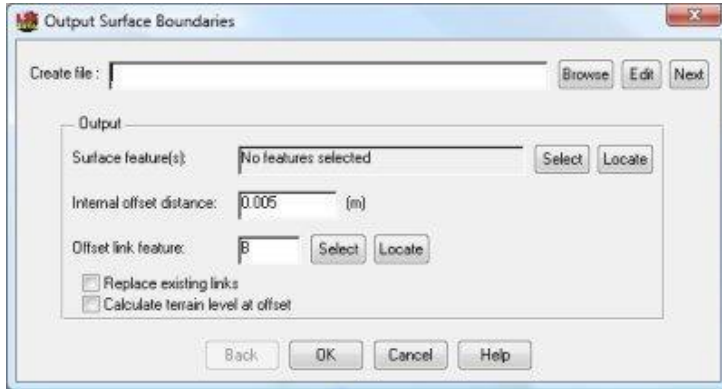
The rest of this topic describes this process in detail.



## 2.2 Output Surface Boundaries

This command creates parallel offsets to the selected surface feature boundaries.

It generates a series of links either on or just inside the outer edge of each nominated surface feature. These points can be given a level at either a horizontal offset or interpolated from the Terrain i.e. they are NOT assigned the surface feature height/depth at this point. The height/depth is only applied to the surface at the Output / Survey stage.



**Create file** - The name of the load file to create. Selecting "Next" will generate the next available number to load into the current survey. The file produced may be used to create a separate survey by specifying an alternative name. By specifying a "+" or a "-" symbol after the load file number e.g. 200- it is possible to force LSS to generate the next available load file equal to or below (-) or above (+) this number. For example the user may want to create load files in a number range. e.g. 001-050 for survey data and 100-200 for design data etc.

### Output

**Surface feature(s)** - The name of the surface feature code(s) to output the boundaries of. The feature code can be selected or located.

**Internal offset distance** - The offset distance from the boundary of each Surface code.

**Offset link feature** - The link feature to apply to the offset points. The feature may be selected or located.

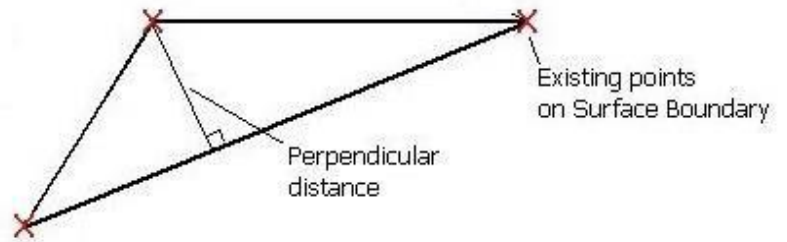
**Replace existing links** - This option will replace any existing links along the offset line if the offset has been set to zero.

**Calculate terrain level at offset** - This option will calculate the level for the new boundary points by interpolating from the Terrain.

## Notes

### Ignored triangles.

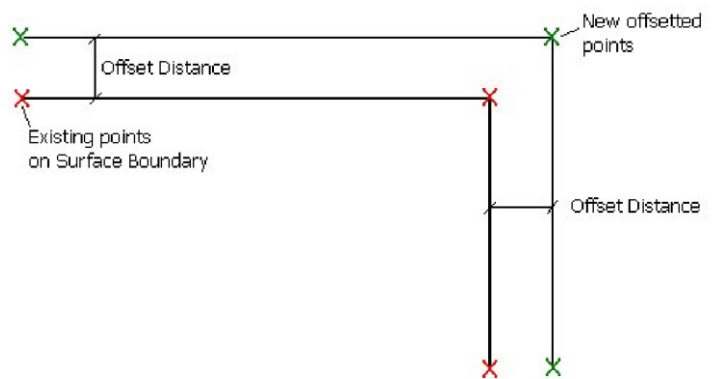
LSS will initially check the survey to see if there are any thin triangles on the boundaries of the surface codes. The tolerance for a thin triangle is 2x offset value. If a triangle is found to be "thinner" than this, then LSS will ignore it.



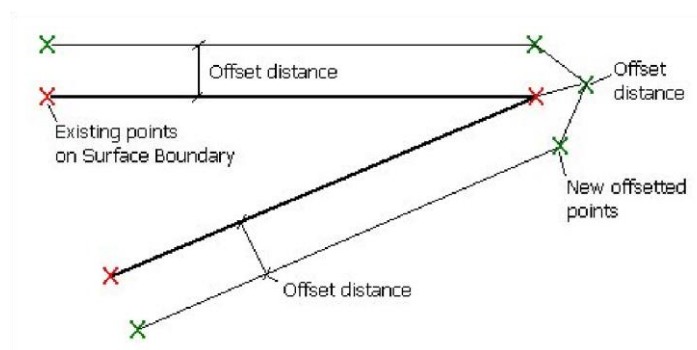
If LSS were to include this type of triangle, then seemingly rogue points could be generated. This test is not carried out when the offset value is zero.

### Mitred external corners.

LSS will always mitre around the boundaries...



... except when the external angle is greater than 275 degrees. In which case 3 radius points will be created.



At the end of the output, LSS will generate a report window if...

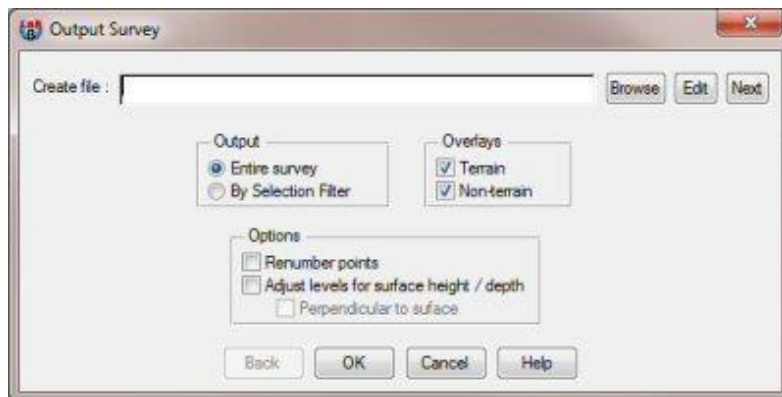
A number of surface boundaries do not have links.

A number of thin triangles have been ignored when generating the surface boundaries.

A number of points have landed in a surface feature other than that of the surface boundary being output.

## 2.3 Output Survey

This command produces a file of co-ordinate information in LSS load format. The only parts of a survey which are not able to be output are the surface features as these are applied manually once the DTM has been formed. If surface features are required it is recommended that 'Input / Merge / Survey' is used to import one survey into another.



**Create file** - The name of the load file to create. Selecting "Next" will generate the next available number to load into the current survey. The file produced may be used to create a separate survey by specifying an alternative name. By specifying a "+" or a "-" symbol after the load file number e.g. 200- it is possible to force LSS to generate the next available load file equal to or below (-) or above (+) this number. For example the user may want to create load files in a number range. e.g. 001-050 for survey data and 100-200 for design data etc.

### Output

**Entire survey** - This option will take into consideration the entire current survey area.

**By Selection filter** - This option will use the LSS observation selection filter to output groups of observations.

### Overlays

**Terrain** - Whether to include any terrain data.

**Non-terrain** - Whether to include any non-terrain data.

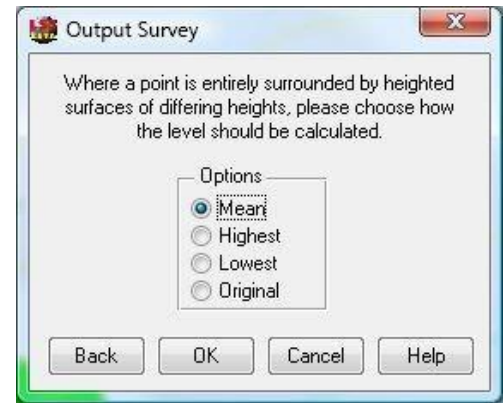
### Options

**Renumber points** - This option will renumber the points sequentially as the data is output.

**Adjust levels for surface height / depth** - This option will move any points in the outputted file, to the top or bottom of the surface code they lie within, if that surface code has a height or depth.

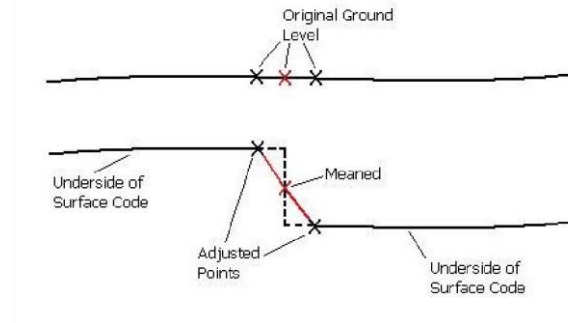
**Note:** Surface boundary points are always left at the same position and level as the original points in order to maintain the volumes and areas of each surface code. This includes points on the edge of; the model itself, a "none" surface coded area, a 0m heighted surface, or a heighted surface. The use of Output / Surface Boundaries with a small Internal offset distance will maintain the shape of the formation model apart from the narrow band specified here.

When the **Adjust levels for surface height/depth** option is selected the adjacent dialog will be offered if LSS finds any points that are both entirely surrounded by heightened surface codes and where differing surface height/depths occur. LSS prompts for how this level is to be calculated. This will generally apply only to the surface boundary points themselves.

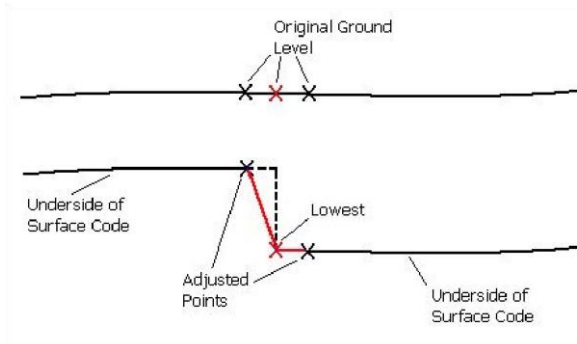
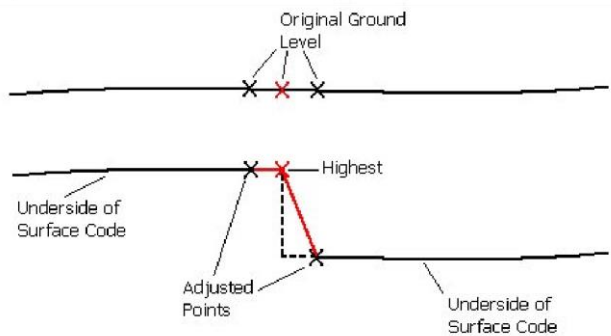


## Options

**Mean** - This option will calculate the mean of the highest and lowest levels.

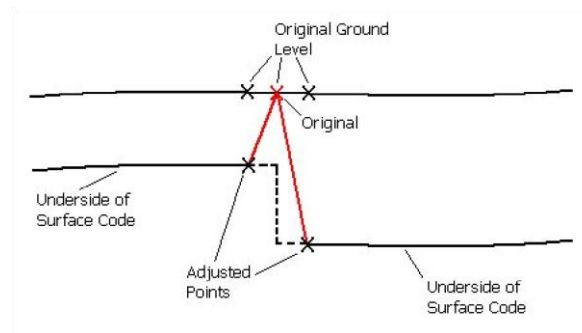


**Highest** - This option will assign the highest level of the boundary points to the new points.



**Lowest** - This option will assign the lowest level of the boundary points to the new points.

**Original** - This option will keep the point at its original level.



**Perpendicular to surface** - This option will move any points in the outputted file, to be perpendicular to the relevant surface.

When dealing with relatively horizontal surfaces the difference between a vertical depth and one which is measured perpendicular to the slope will be negligible. However, the steeper the slope, the greater will be the discrepancy and it is because of this fact that this additional option has been offered.

Here are a few rules:-

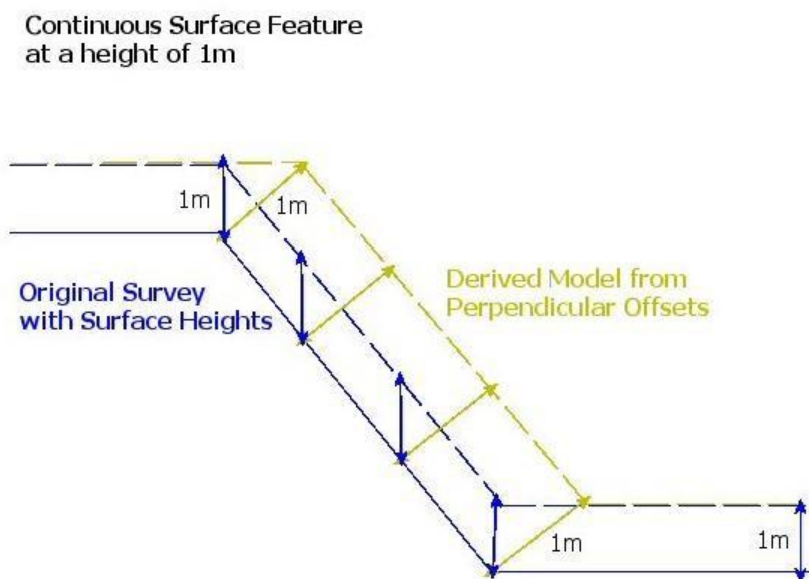
Observations within surfaces will be offset perpendicular to the slope

Any points on the edge of the survey, or a "none" area, or a 0m heighted surface is always at the same position and level as original, to maintain volumes in adjacent surfaces.

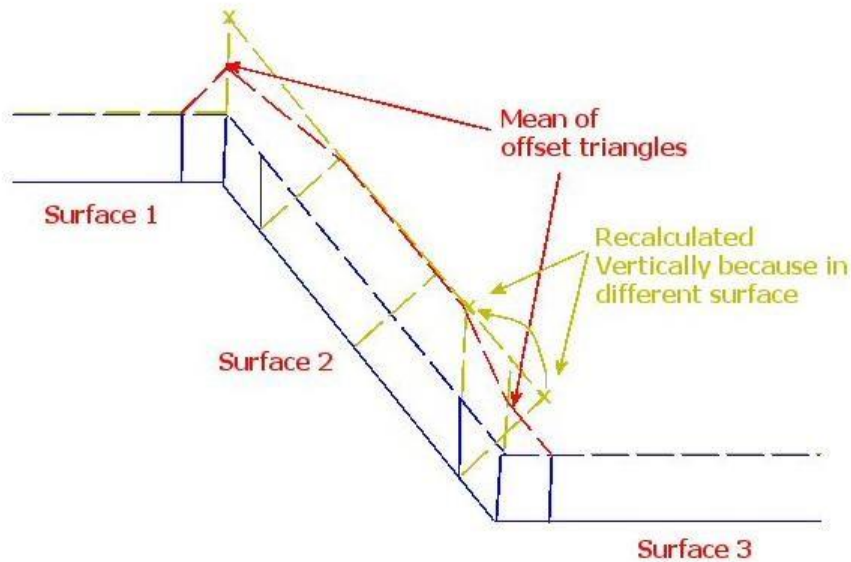
Any points on a surface boundary, but surrounded by surface depths, are extended vertically, and all surrounding triangles are offset, then the mean level of intersections with this line is calculated

If all surrounding triangles to the point intersect the line from original to new at more than 0.1m apart (the mean is taken), then a PIN1 feature is created.

If the new point is further away in plan than twice the surface height, then a PIN2 feature code is created.



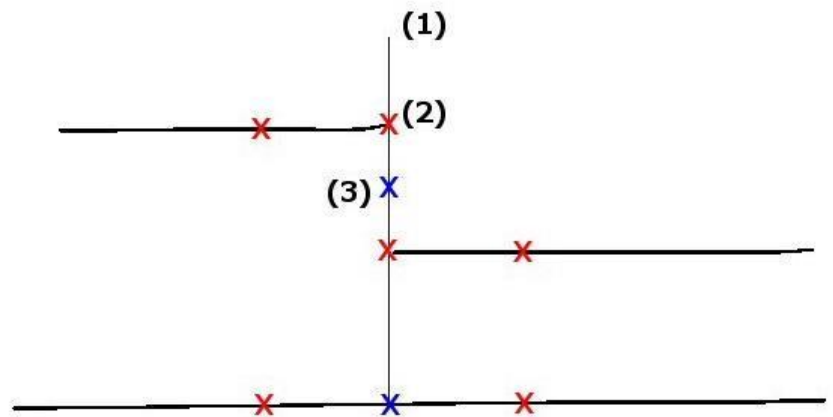
Change in surface  
But all at 1m height



This line is vertical because it is on a surface boundary. This is to maintain the plan areas.

The offset triangles (by surface height/depth) in this case are calculated to intersect with the vertical line (Normally the new point is calculated to where the offset triangles intersect).

The Mean / Highest / Lowest is then taken.



### Quality Assurance

When the data is outputted, some points may include a point feature such as PIN1, PIN2 or PIN3.

**PIN1** – The new point is calculated based on the surrounding triangles. LSS will check between the original point to the new one and then if any surrounding triangles cross this line. A PIN1 feature is generated if any of these intersections are 0.1m away from the new point coordinates. The new point is not adjusted.

**PIN2** - where the new point is further away in plan than twice the surface height.

**PIN3** - where the point ends up in a different surface and is made vertical to original.

# Conclusion

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Using this manual, we hope that you will be in a position to start making the most of the survey instrument.

We strive to cover and support as much of the capabilities as possible but there are always new methods and developments, so do keep in contact by visiting the LSS Help and other on-line resources or call our support line.

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