

Export an inkscape line drawing to a survex file

Current version:

v3.0 - export plans and elevations

Previous versions:

v2.1 - minor improvements

v2.0 - completely rewritten for Inkscape 1.0

v1.1 - for Inkscape 0.92

Summary

This plugin provides a mechanism to export inkscape line drawings as survex (.svx) input files. Use-cases include:

- producing a length or depth estimate for a drawn-up survey;
- generating a skeleton to hang data off in a resurvey project;
- georeferencing a drawn-up survey (see below);
- giving ‘armchair cavers’ something useful to do.

Some example surveys (Inkscape traced drawings) are included.

Note that whilst plans and elevations can be digitised separately, merging them into a single survex file still has to be done by hand. Automating this would clearly be highly desirable but the work flow is quite complicated to design and implement and there are many edge cases to consider. If you have ideas and/or proposals for how to do this please feel free to get in touch!

This documentation (README) is also available in PDF and HTML.

Installation

Copy the files `svx_export.py`, `svx_plan_export.inx` and `svx_elev_export.inx` into your local Inkscape extension folder, namely:

- `~/.config/inkscape/extensions/` on unix / linux,
- `%APPDATA%\inkscape\extensions\` on Windows.

Usage

The extensions appear under “Extensions → Export” as “Export elevation to .svx file...” and “Export plan to .svx file...”.

The following conventions are observed:

- all (poly)lines of a given color (default *red*) are converted to traverses in the survex file;
- a line of a second color (default *blue*) sets the scale (eg from the scale bar);
- for plan views, a line of a third color (default *green*) determines the orientation (default S to N).

Lines of any other color are ignored, as are other drawing objects. The default colors can be changed in the color tabs in the dialog box.

Exported (poly)lines are converted to traverses. If there is more than one traverse, each one is captured in a separate ***begin** and ***end** block in the survey file using Inkscape path name so that individual traverses can be matched up to the drawn paths. The survey as a whole is wrapped in a top level ***begin** and ***end** block with a name corresponding to the **.svx** file name following standard conventions.

Exported (poly)lines that are also *dashed* (or *dotted*) in any way can be optionally flagged as 'splays' by selecting this option in the export dialog box. This results in the corresponding traverse or traverses being wrapped in pairs of ***flags splay** and ***flags not splay** survey commands.

Survey stations that are closer than a given specification are assumed to be the same and given as an ***equate** at the start of the **.svx** file. The tolerance to select these (eg 0.2m) can be adjusted in the Parameters tab in the export dialogue box. Stations which feature in this ***equate** are automatically exported out of the underlying ***begin** and ***end** block by the appropriate ***export** commands.

Plan views Within each traverse survey legs are generated in the format

***data normal from to tape compass clino**

where:

- The **from** and **to** stations are integers generated automatically.
- The **tape** length is generated using the scale line as reference, which will usually be traced over a scale bar in the survey. The true length that the scale line represents is specified in the Parameters tab in the export dialogue box.
- The **compass** bearing is generated using the orientation line as reference, which for example will be traced over a North arrow in the survey (in the direction S to N; corresponding to bearing = 0.0 in the dialog box). If a North arrow is not used the true bearing represented by the orientation line should of course be specified in the Parameters tab in the export dialogue box.
- The **clino** reading is set to zero.

Elevations Within each traverse survey legs are generated in the format

***data diving from to tape compass depthchange**

where:

- The **from** and **to** stations are integers generated automatically.

- The **tape** length is generated using the scale line as reference, as described for plan views above.
- The **compass** bearing is generated from the ‘facing’ direction set in the export dialog.
- The **depthchange** is calculated also using the scale line as reference.

Workflow

Usually the drawing will be made by tracing over a scanned image of a drawn-up survey. A typical workflow might be as follows:

- start a new Inkscape document;
- import (link or embed) a scanned survey as an image;
- optionally, lock the layer containing the image and create a new layer to work in;
- then do the following (the default *colors* here can be changed in the export dialog):
 - trace the desired survey traverse lines in *red*, adjusting the positions of nodes which are supposed to represent the same survey station until they are coincident (within the tolerance);
 - trace the scale bar in *blue* making a note of the distance this represents;
 - for a *plan* view, trace an orientation feature in *green* (eg a North arrow, from S to N);
- optionally save the Inkscape file to preserve metadata;
- then do “Extensions → Export” and export the drawing as a plan or elevation as desired.

In the subsequent dialog box, under the Parameters tab:

- an existing directory should be selected;
- the output **.svx** file should be selected from one of the options;
- then :
 - specify the length of scale bar line (in m);
 - for a *plan* view specify the bearing of orientation line (in degrees);
 - OR for an *elevation* specify the ‘facing’ direction (in degrees);
 - finally specify the tolerance to equate stations (in m), eg 0.2;
- optionally restrict export to a named layer;
- also optionally, interpret dashed exported lines as splays;
- click on Apply.

A box should appear reporting that the **.svx** file has been generated successfully, and indicating the number of (poly)lines exported. If the conversion encounters errors, they are similarly reported. A successfully generated **.svx** file is immediately ready for processing by *survex*.

Notes:

1. The scale bar and (for plan views) orientation lines are picked up irrespective of the layer selection. Be careful not to get the colors of the orientation and scale bar lines mixed up! There's no other way to tell them apart: the conversion step cannot know the difference, and no warning or error will be raised.
2. Be careful in setting the colors of the exported lines: they have to match exactly the export dialog, for example 'nearly' red lines will not get exported. As a check, for example, select all the lines that you *expect* should be exported and compare the count of these with the number of actually exported (poly)lines reported by the export dialog: the numbers should be the same.
3. Path names in Inkscape can be set by Object → Object properties...
4. If subsequently processing with `survex` generates the error 'Survey not all connected to fixed stations', then it is most likely a pair of supposedly coincident survey stations are not close enough together. To diagnose this:
 - increase the tolerance until `Survex` no longer complains and the `.svx` file processes properly;
 - open the `.svx` file in a text editor and examine the list of `*equate` commands to see which stations were too far apart;
 - return to Inkscape and fix the problem.
5. It is suggested that magnetic N *not* be corrected for using the 'bearing' or 'facing direction' settings in the Parameters tab. Instead one can add a `*calibrate declination` line by hand to the top of the `survex` file, where the angle is positive for declination W. The NOAA website can be consulted to obtain declination data for a given location and year. Alternatively (and better) the declination can be corrected automatically using `*cs` commands and a `*declination auto` command (with a `*date`). The design choice to export legs as `tape` and `compass` readings, rather than as cartesian changes in easting and northing, was made precisely to accommodate this.
6. Depth information can be added to a plan view by hand editing the `.svx` file. A convenient way to do this is to change the survey data type to `*data cypolar from to tape compass depthchange`. Note that the `cypolar` style is very similar to a diving survey, used for the elevation export, except that in a `cypolar` survey the tape is *always measured horizontally* rather than along the slope of the leg, so it is the `cypolar` style we want here. The final column (which originally contained zero `clino` entries) can be edited to reflect the depth change between survey stations, whilst preserving the `tape` and `compass` entries which are presumably correct if taken from a drawn-up survey in plan view.
7. A large survey can be dealt with by partitioning the (poly)lines into different, named layers, keeping the same scale bar and orientation line,

but generating a different survey files for each named layer. These survey files can be stitched together using a master file as illustrated below. Some hand editing has to be done to match up the corresponding stations in the different survey data files and it may be necessary to export these stations through the ***begin** and ***end** blocks in each file.

8. To make it clear what distance the line used for the scale bar represents, perhaps after a units conversion, I often find it convenient to add a note in the form of a text block to the Inkscape **.svg** file as in the examples below. In a similar vein one can add an arrow to the *end* of the orientation line to affirm the direction, also done in the examples below. This doesn't affect the conversion.

Examples

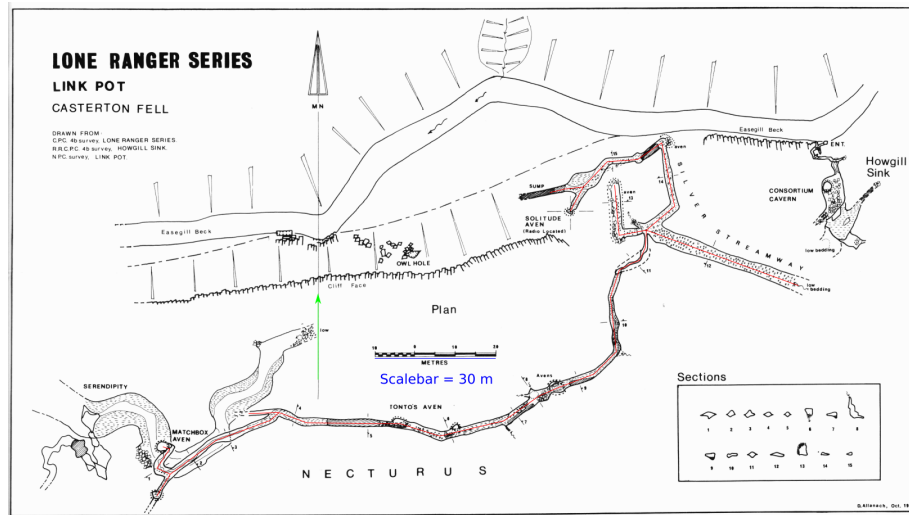


Figure 1: Inkscape: `loneranger_cpcj6-2.png` plus traced survey lines.

The file `loneranger_cpcj6-2.svg` traces over a plan view survey of the Lone Ranger series in Link Pot (Easegill) where the PNG image (`loneranger_cpcj6-2.png`) – originally published in CPC Journal 6(2) – is taken from CaveMaps. The scale line end-end distance is 30 m, so 'Length of scale line (in m)' in the Parameters tab should be set to 30.0.

Similarly, `farcountry_ulsaj89.svg` traces over a plan view survey of Far Country in Gaping Gill where the PNG image (`farcountry_ulsaj89.png`) – originally published in the ULSA '89 Journal – is likewise taken from CaveMaps. In this case the scale line end-end distance is 200 ft, so the 'Length of scale line (in m)' in the Parameters tab would be set to 60.96. To get an idea of the work involved here, the generated Survox file contains 176 survey stations, joined by

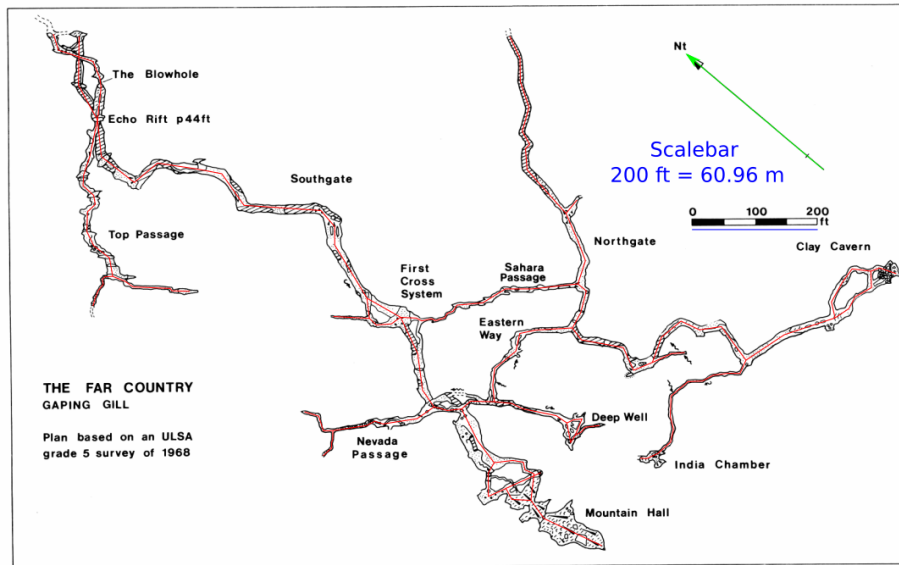


Figure 2: Inkscape: far_country_ulsaj89.png plus traced survey lines.

180 legs, with a total length of around 1.5km of passage: it took less than 30 mins of drawing in Inkscape to do.

Finally, 0189-2444-elev.svg traces over a French elevation of site 0189 in Matienzo. Here the ‘facing’ direction is set to 20° to correspond to the ‘Coupe suivant un axe N 110°’ and the (magnetic) north arrow shown on the survey. Note also the use of dotted lines here, which can be exported as splays.

Multiple layers The `loneranger.svg` tracing can also be used to illustrate the use of named Inkscape layers to break a survey into smaller pieces. The section from Matchbox aven to Tonto aven has been placed in a layer named `matchbox`, and the remaining passage beyond Tonto aven in a layer named `silverstream`. Thus the survex files `matchbox.svx` and `silverstream.svx` can be generated by exporting *twice*, using the option in the Parameters tab in the export dialogue to restrict export to each of these named layers in turn, taking the `.svx` file names from the selected layer name. These survex files can each be processed to a `.3d` file individually but to stitch them together we note that station `path4288.8` in `matchbox.svx` should equate to station `path4290.0` in `silverstream.svx`. Hence the following short survex file will do the job:

```
*include matchbox
*include silverstream
*equat matchbox.path4288.8 silverstream.path4290.0
```

As it stands this doesn’t quite work because we have not yet exported these

Torca MCE 189

n° 2444

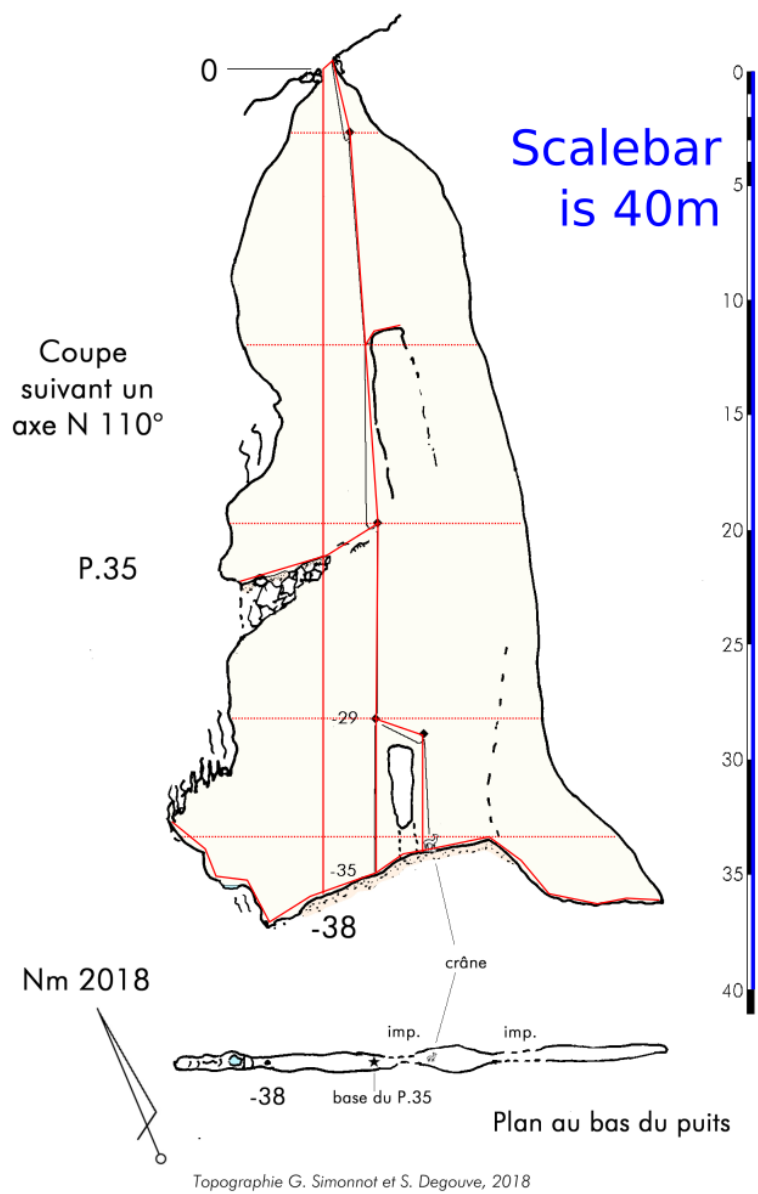


Figure 3: Inkscape: 0189-2444-elev.jpg plus traced survey lines.

Georeferencing

MOSSDALE CAVERNS
 ULSA SURVEY 1989 BCRA GRADE 4
 NGR SO 96597 ALT 1400 LENGTH 34,300 DEPTH 240

Scalebar 500 ft = 152.4 m

For example suppose one wanted to georeference the ULSA 1989 Mossdale

survey, which is included here as `mosssdale_ulsaj89.png`. The original of this was downloaded from CaveMaps. This version has some material cropped out and has been reduced to a binary (2-color) image. The image is imported into inkscape and the scale bar (500ft = 152.4m) and North arrow traced (conveniently, the survey uses true North, so magnetic declination need not be corrected). To georeference, the simplest approach is to add a single line connecting the entrance to a distant identifiable feature in the cave, for example the small chamber shown at the end of the Stream End Cave passage. This line will be exported as the survex centerline and the two stations will be our GCPs. The resulting inkscape drawing is included here as `mosssdale_ulsaj89.svg`. The exported survex file, modified as described below, is `mosssdale_ulsaj89.svx`.

We now need to establish the co-ordinates of the entrance, as the first GCP. To do this one can of course make a site visit with a GPS, or perhaps more conveniently make a virtual site visit using MagicMap website and use the ‘Where am I?’ option to find the entrance is at (E, N) = (401667, 469779). This is the full 12-figure National Grid Reference (NGR). The 6-figure NGR SE 016697 given on the survey is correct of course, but as it locates the entrance only to within a 100m square it’s not really accurate enough.

These entrance co-ordinates are added to the survex file together with a couple of `*cs` commands to georeference the same: choosing here to `*fix` the entrance using a 10-figure NGR in the Ordnance Survey SE square, and specifying the output co-ordinate reference system (CRS) to be EPSG:7405 (British National Grid with ODN altitude) for the fully numeric NGR. This may seem overkill but it gets the CRS meta-data into the `.3d` file in a form suitable for onward processing. Also I have adopted the convention of equating the entrance to a new station named `entrance` and fixing that. Finally, the entrance altitude (1400ft = 425m) has been added, although irrelevant for present purposes.

Thus the final file (`mosssdale_ulsaj89.svx`) contains

```
*cs OSGB:SE
*cs out EPSG:7405

*fix entrance 01667 69779 425
*entrance entrance
*equate entrance mosssdale_ulsaj89.0

*begin mosssdale_ulsaj89

*data normal from to tape compass clino

0 1 1383.460 112.7 0

*end mosssdale_ulsaj89
```

Note there is no inner `*begin` and `*end` for the path as only one path is exported.

Also it doesn't seem necessary to export the station out of the `*begin / *end` block.

On processing by `cavern` and `3dtopos` the result is

```
( Easting, Northing, Altitude )
(401667.00, 469779.00, 425.00 ) entrance
(401667.00, 469779.00, 425.00 ) mosssdale_ulsaj89.0
(402943.29, 469245.11, 425.00 ) mosssdale_ulsaj89.1
```

(saved as `mosssdale_ulsaj89.pos`). The two entries give the co-ordinates of the GCPs in the EPSG:7405 CRS and we can now proceed to georeference the image file, using for example QGIS. The final result, here provided as `mosssdale_ulsaj89.tiff` in GeoTIFF format, can be directly imported into a GIS platform such as QGIS, and superimposed on other mapping data, Google satellite imagery, or the Environment Agency LIDAR data where available, for example.

Since it is also georeferenced (by the `*cs` commands) the survex centreline data can also be imported into QGIS using a plugin to import survex `.3d` files. The combined result, superimposed on an Open Street Map background, is here:

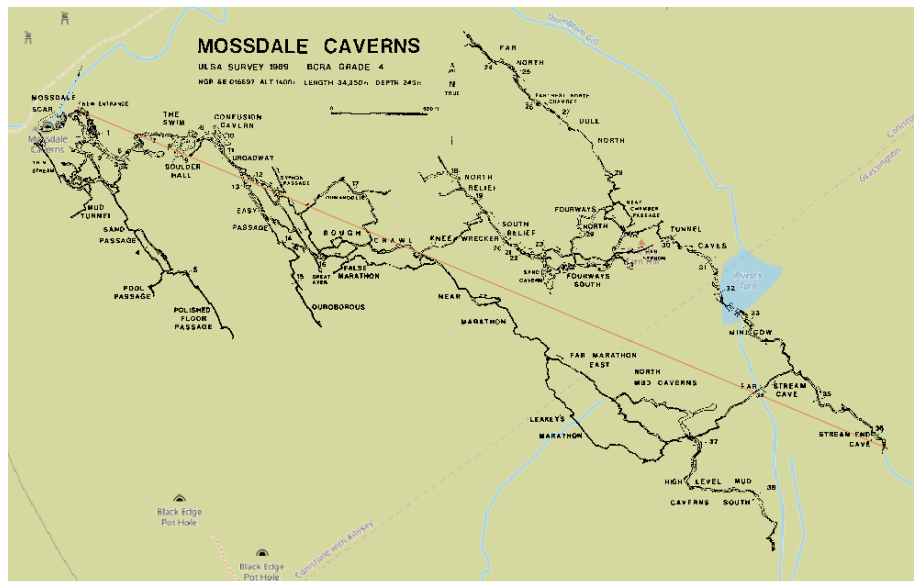


Figure 5: QGIS3: `mosssdale_ulsaj89.tiff` plus artificial survey line and Open Street Map data

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