*SoundPLAN Nord ApS, Bakkevej 26A, DK-5210 Odense NV, Denmark*
*phone: +45 2946 1030*
*www.soundplan.dk*
*support@soundplan.dk*
*CVR no.: 27 92 34 88*

**Import of elevation data from laser scanning**

**SP Net info 97**

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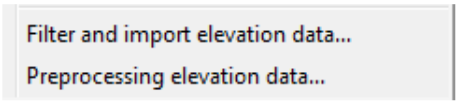


Point data (xyz; txt; asc) from laser scanning are widely used to map the terrain and surface elevation. The density of points can be high, down to 0,4 m between points if organized in grid. Files covering a big area therefore get big, sometimes very big and consequently heavy to handle in the GeoDatabase. If you need the terrain data only in order to calculate a DGM (no need for post processing in the GeoDatabase like creating embankments or defining mean building height from surface data), SoundPLAN 7.2 and younger has a tool to skip the import in the GeoDatabase and instead prepare files for the DGM calculation in Calculation directly. This feature is very time-saving in projects covering a huge area; it is hosted by the module Noise Mapping Toolbox and is found under File > Import > '**Preprocessing elevation data'**. Licenses without Noise Mapping Toolbox still must import the data in the GeoDatabase via File > Import > '**Filter and import elevation data'**.

## Filter and import elevation data

This tool offers more or less the same as File > Import > 'Elevation data' in former versions. Call the tool and browse to the location where you have saved the external data. Data are often tiled in 1 km x 1 km so even for small areas you might need up to 4 files to cover your project area. However, multiple files can be imported in a single operation. Double clicking on one of the files will display all files with the same extension in the import window, see Fig 1.

Hint: If special national characters appear in the file name, then rename the files so only English letters are used.

Important: Remember to select all the files you want to process, see Fig 1 with all 4 files marked.

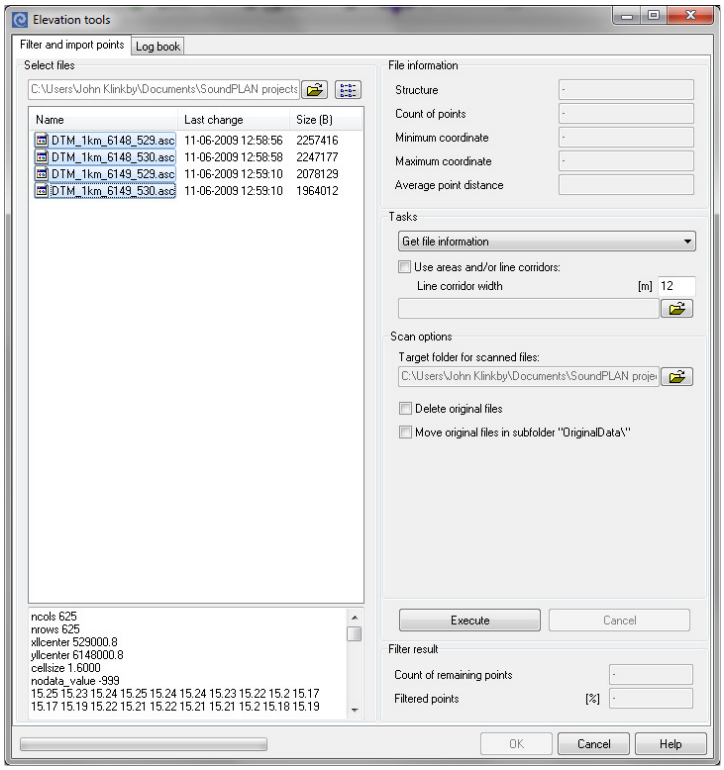


*Fig 1 'Elevation tools' displaying all files with the same extension*

If your external data are *.xyz or *.txt data you can now define column number if for example the first column hosts the y coordinate and the second the x coordinate, see Fig 2. This must be done **before** you go on.

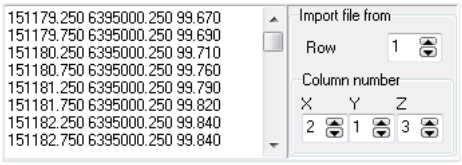


*Fig 2 Define column numbers*

The program needs some basic info about the data before you can filter and do the import. To get this info click Execute. This will scan/check the data. Since the tool offers to handle multiple files with the same extension in the same operation, it can be recommended to keep terrain and surface data saved in different folders from now on.

During the scan the data are stored binary which considerably reduces the time needed for the filtering. The files get extension *.elg if the data are organized in grid, otherwise *.elv (for point clouds). These files are default saved together with the raw original data, but you can define a separate folder to host the binary data ('Target folder for scanned files') which for example is necessary if the external data come from a CD. Further under 'Scan options' you can choose to delete the original data (not possible if data come from a CD) or move them to an automatically generated folder 'OriginalData'.

After scanning the 'Elevation tools' window might look like in Fig 3. Please be aware that if the external data are a mix of grid and cloud points, only the *.elv files are shown; however, the *.elg files are present in the destination folder also.

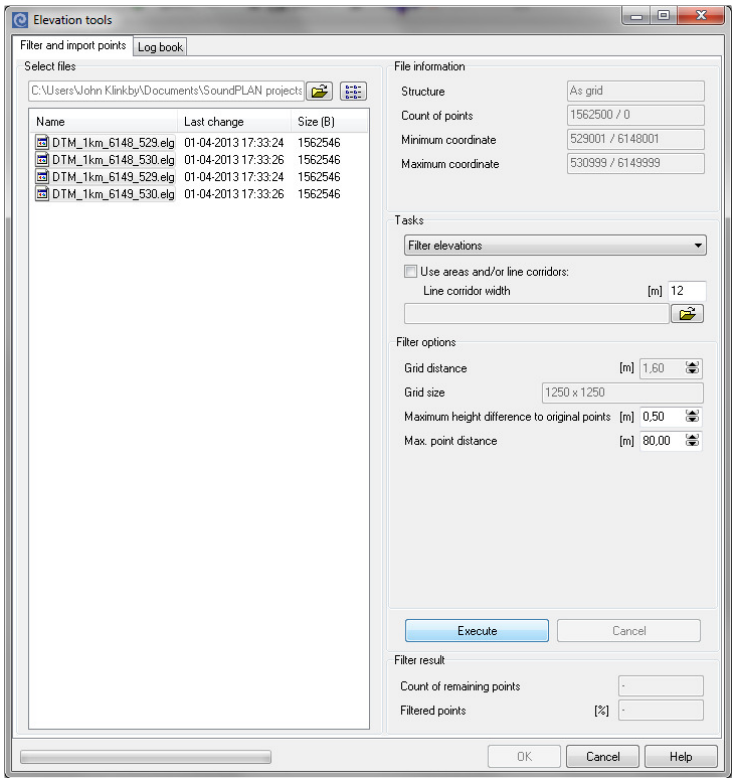


*Fig 3 After scanning, ready for filtering*

As soon as the scan is done and reliable data are shown under 'File information' the option in the selection list changes to 'Filter elevations'. Now the selection list looks like in Fig 4.

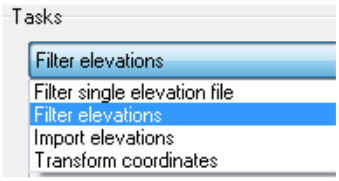


*Fig 4 Selection list after the scan*

You can choose to filter and import to the GeoDatabase a single file or all marked files. If you import only a single file (Tasks: Filter single elevation file) an extra index card appears giving you the chance to see 'statistics and preview'.

The filtering is done according to settings shown in Fig 5.

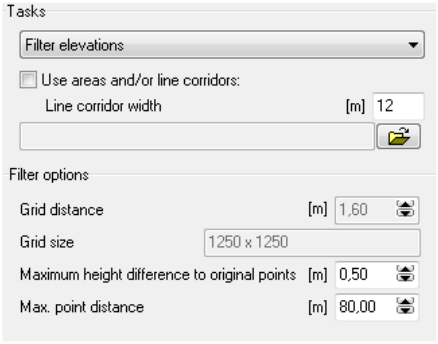


*Fig 5 Settings for the filtering*

You can insert a geofile hosting an area or line object which will cause the program to only import points inside the area or a corridor along the line. This is a replacement for the options 'Import points within buildings without filtering' and 'Import points within road or rail bands w/o filtering' in former versions.

The 'Maximum height difference to original points' is a crucial parameter for the filtering. It defines the max distance between a DGM done from the raw original data and a DGM done from the points remaining after the filtering. In detailed projects it is recommended to decrease this difference below the default 0,50 m, maybe down to 0,20 m, whereas 0,5 m or eventually more can be used in 'overview' projects. The smaller this max difference is set, the more points are left, and the more triangles are generated during the DGM calculation which in the end means slower calculation speed.

'Max point distance': Even in flat areas some points should be left since experiences show it will speed up the filtering and furthermore make it easier for the program later on during the calculation to perform linear regressions in order to find the reflection plane. It is recommended to use the default value of 80 m.

For point clouds the 'Grid distance' can be adjusted. This parameter defines the spacing in a base grid which is needed during the following filter process. It is default 4 times the average distance between points in the raw original data. The finer base grid the fewer iterations are needed to complete the filtering, but the more points will be left and the longer time it will take for the program to evaluate the reflection plane later on during the noise calculation. The default value is the most sensible choice in most projects.

When the filtering is done the selection list will show 'Import elevations' and at the bottom of the window you can read the percentage of the raw data is weeded out, see Fig 6. Click OK to import the remaining points; the import will default be save in the active geofile.

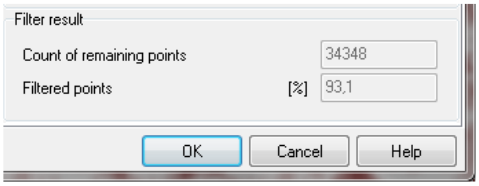


*Fig 6 Filter result*

If your raw external data are a mix of grid and cloud data you must launch the function again and this time filter/import the grid data.

The filtered data are additionally saved in binary form in an automatically generated folder 'ResElev'. If you for some reason need to redo the import you can skip the scan and point to the file(s) in this folder. Here the data are stored in 10 x 10 km$^2$ tiles named according to the coordinates in km, e. g. <elev_X700Y6200.elv>.

If you don't want to filter the data at all but just to import them as they are you can select 'Import elevations' from the select list (see Fig 4).

Finally the 'Filter and import elevation data'-menu can be used to transform coordinates in case the external data are generated in another coordinate system than the project coordinate system. You should define the systems the external data are generated in (the 'source' system), see Fig 7. After the transformation the window stays open and you can get back to the filtering menu (the transformation can also be done after the import with the tool Geo-Tools > Transform coordinates (System) > Transform to project coordinate system).

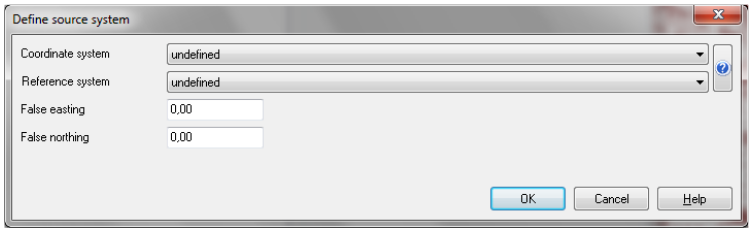


*Fig 7 Transform coordinates*

## Preprocessing elevation points

Licenses with the Noise Mapping Toolbox have the possibility to skip the import of the point data into the GeoDatabase and instead generate files for calculating a DGM directly in Calculation. The scanning part of the process is the same as described above.

For the next step you have multiple possibilities, see Fig 8.

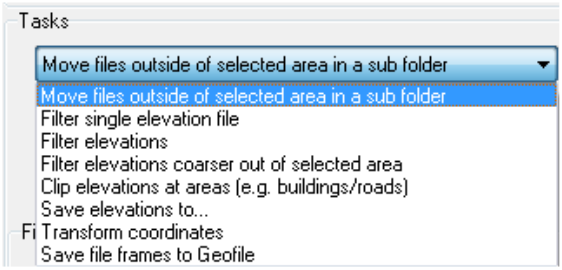


*Fig 8 Selection list if Noise Mapping Toolbox is licensed*

'Move files outside of selected area in a sub folder': Suppose you have received point data for a much bigger area than really needed. In that case you can move the scanned data (format *.elg/elv) outside the relevant area to a subfolder, see Fig 9. Files with no points at all inside the relevant area will be removed. With the option 'Clip elevations at areas', see later, a real cut along the edge of the area(s) is introduced.

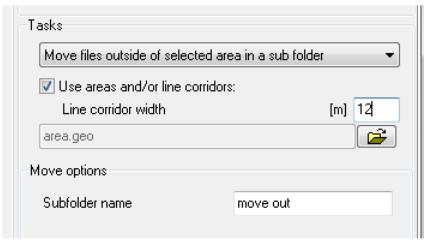


*Fig 9 Moving entire files irrelevant for the project*

'Filter single elevation file' and 'Filter elevations': The first steps are just like with the menu File > Import > 'Filter and import elevation data', see page 3. After the filtering however you must decide where to save the remaining points, see Fig 10. If you don't need the data in the GeoDatabase but only in Calculation, you can save them in the subfolder 'ElevData' from where the files can be loaded with the file selection manager in Calculation. But you can also import them into the GeoDatabase and save them in a geofile. Finally the remaining points can be saved in a 'general' format, (ASCII), if needed in another system.

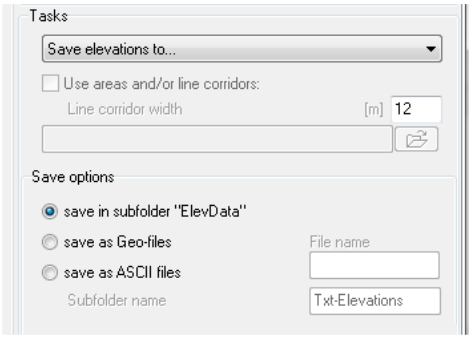


*Fig 10 Saving the remaining points*

Filter elevation coarser out of selected area. In case you go for a detailed DGM in some parts of your project area, but are ready to accept a coarser model elsewhere, this menu can be used to vary the density of remaining points. Fig 11 shows the settings and Fig 12 the result with two areas of high density of points.

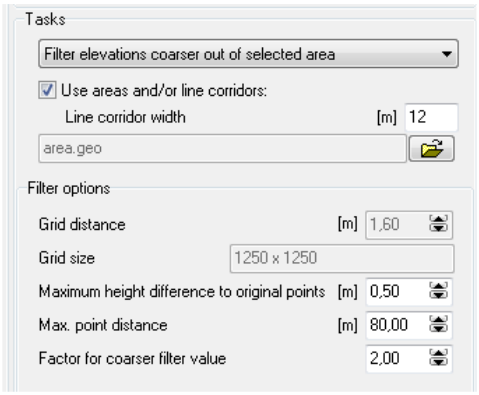


*Fig 11 Preparing different density of points*

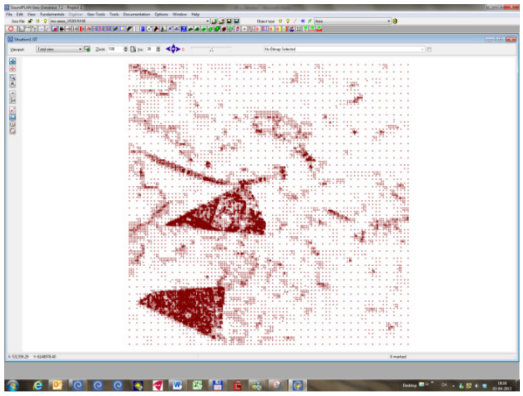

*Fig 12 Two areas with detailed terrain info*

Clip elevations at areas (e. g. buildings, roads). With this tool you can get rid of all points outside areas. This is typically relevant if you want to calculate the mean building height from roof points (with Geo-Tool > Evaluate points for building height) or only need the points inside a corridor along a road or rail track.

As always you should first scan the external data. Click Execute. Next you pick 'Clip elevations at areas' from the selection list. This will automatically tick for 'Use areas and/or line corridors' and call the 'Open file' window from where you can pick the situation or geofile with the relevant area/line. Fig 13

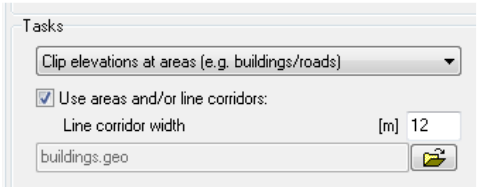


*Fig 13 Preparing for clipping*

Next perform the clipping by pressing Execute.

Finally you can import the relevant data to the GeoDatabase, see Fig 14 and Fig 15.

The geofile that hosts the import will not automatically be loaded into the current situation, you have to call it with the green + (Load/create additional geofiles).

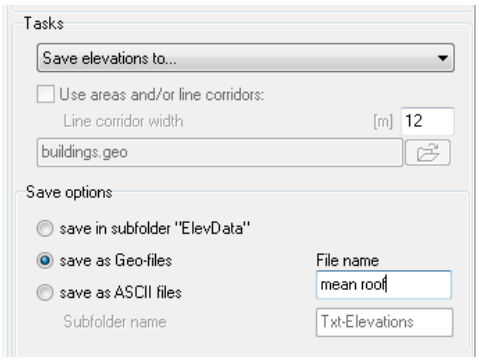


*Fig 14 Import the data to the GeoDatabase*

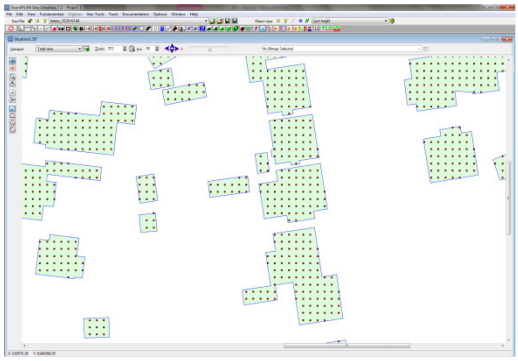

*Fig 15 Imported roof points*

Save file frames to geofile. Frames enclosing the raw original data can be stored back to a geofile which is very informative for an overview of the area in question, maybe presented together with an aerial photo, see Fig 16 and Fig 17.

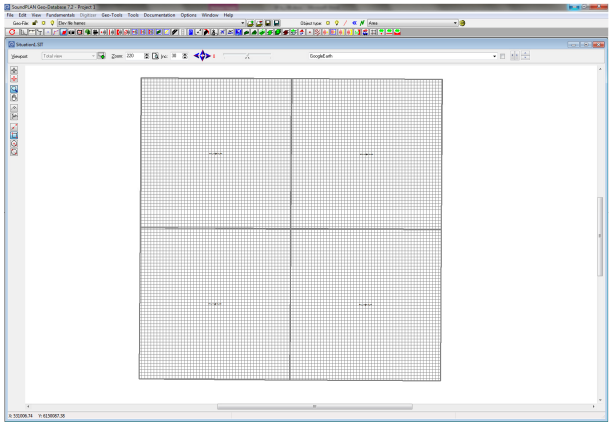

*Fig 16 File frames in GeoDatabase*

*Fig 17 … and presented on top of an aerial* photo

If your external data are a mix of grid and cloud data, the import window, see Fig 3, will only show the *.elv data. In a second step you must then import the grid data *.elg. In case you have received data from different suppliers (maybe data with different accuracy) it might also be relevant to perform multiple import operations: Launch the function 'Preprocessing elevation data' again and this time point to the remaining file(s) in the program folder.

When the filtering has been done and the program is ready to save the remaining points in the ElevData folder, the program finds out that the folder is not empty. The filtered data are stored in tiles of 10 x 10 km$^2$, therefore there might be multiple files in the ElevData folder. You must decide which data to keep in eventually overlapping area, see Fig 18

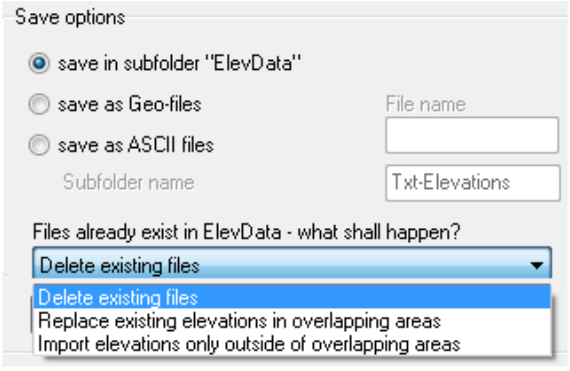


*Fig 18 Which data to keep in overlapping areas?*

Once the filtered data have been stored in the ElevData folder you can go to Calculation and load them for a DGM calculation, see Fig 19.


*Fig 19 Loading elevation data in Calculation*