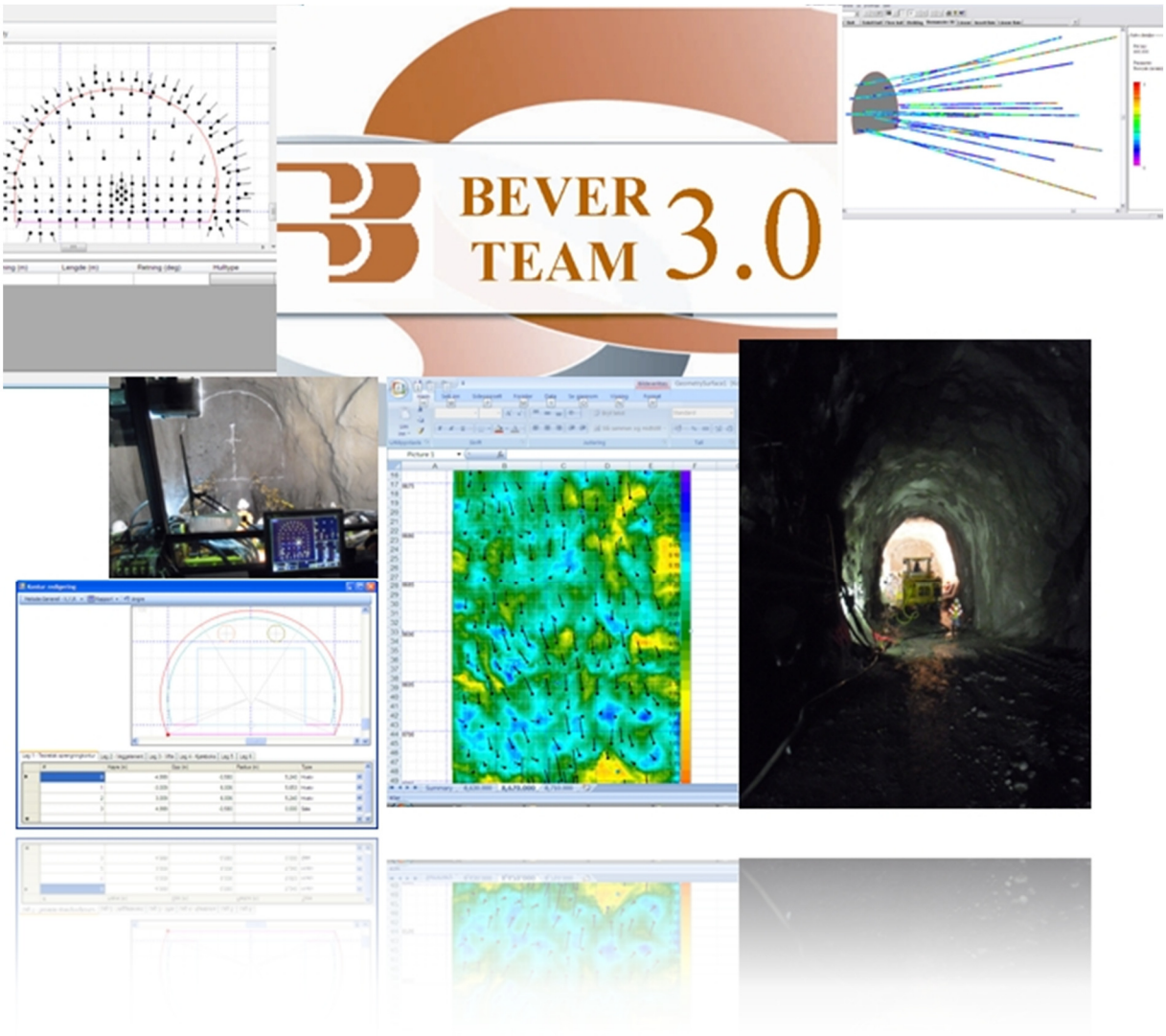
Bever Team 3

User Manual



Bever Control as

Bever Team 3

Operators Manual

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Content

Bever Team 3 Main

1 What is Bever Team

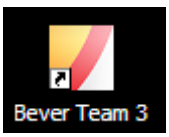
Bever Team is a program that is used for planning and documentation in tunneling.
The program is used by contractors, consultants and clients that need access to project data and as built data. The database is based on standard SQL.

2 Definitions

- **Tunnel line** Center line or Aligment. The line witch the tunnel is built around. Defines the horizontal curve of the tunnel.
- **Contour** Cross section. Describes the cross section on a given chainage number on the tunnel line.
- **Road model** A digital model from client/consultant that can be read directly into the program.
- **Drill plan** A planned drill pattern which can be transferred to a jumbo.
- **Drill log** A log from a jumbo. Gives data on as built drilling. Placing on the face, MWD, water flow, pressure and so on…
- **Profiler log** Points measured with Bever Profiler 3D, scanner or a total station.
- **Fixed points** Reference points in the tunnel. Used to navigate a jumbo or a profiler.
- **Memory stick** Movable media (USB). It is used to import/export data on a jumbo.
- **XML** Normal file format on the import/export data. Can also be a contour definition file from Novapoint tunnel.
- **SQL** Standardized database solution. Here defined as the name of the database, like; XXX.mdf (SQL server Master Database Fil).

3 Installation

Bever Team is installed by inserting the CD. If it is not, use explorer and double click on the setup.exe file. After the installation is done start the program by opening the "Bever Control" folder on the desktop. Double click on the Bever Team 3 icon:



3.1 *Installation with XP OS and service pack 3*

There could be an issue with Microsoft`s sevice pack 3 for XP. If the installation is not completed, contact Bever Control AS for help.

3.2 *Licensing*

After startup the program will ask for a valid license file. The following dialogue box will appear:

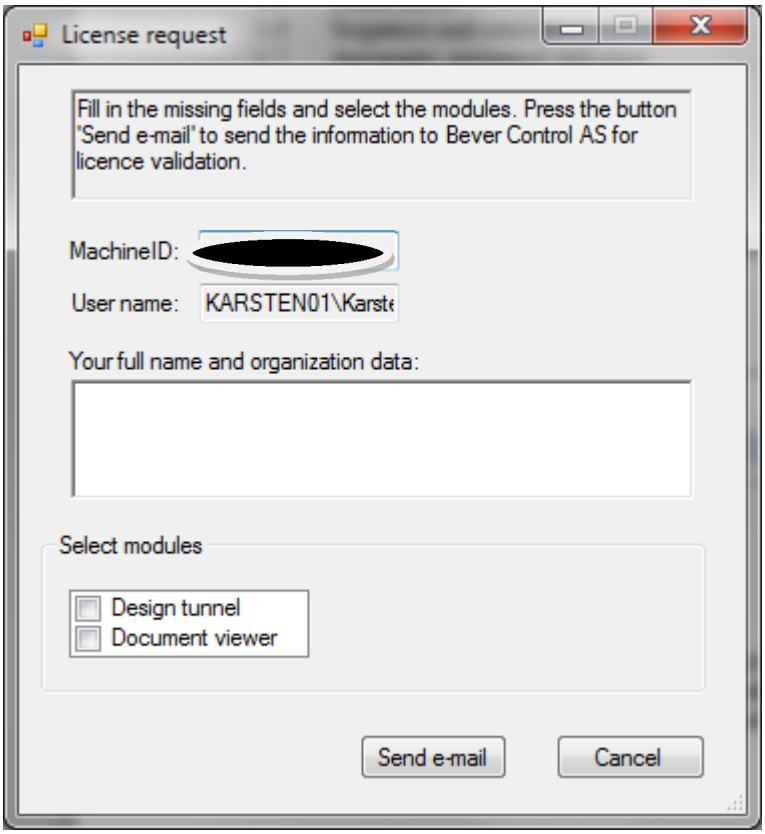


Fig. 1

Add your name and organization data. Select modules and push the “send e-mail” button. The program will then open up MS Outlook where the information will be added.
If the license is valid a confirmation will arrive in the e-mail after a short while.
Then the program can be started as normal.

4 Main screen

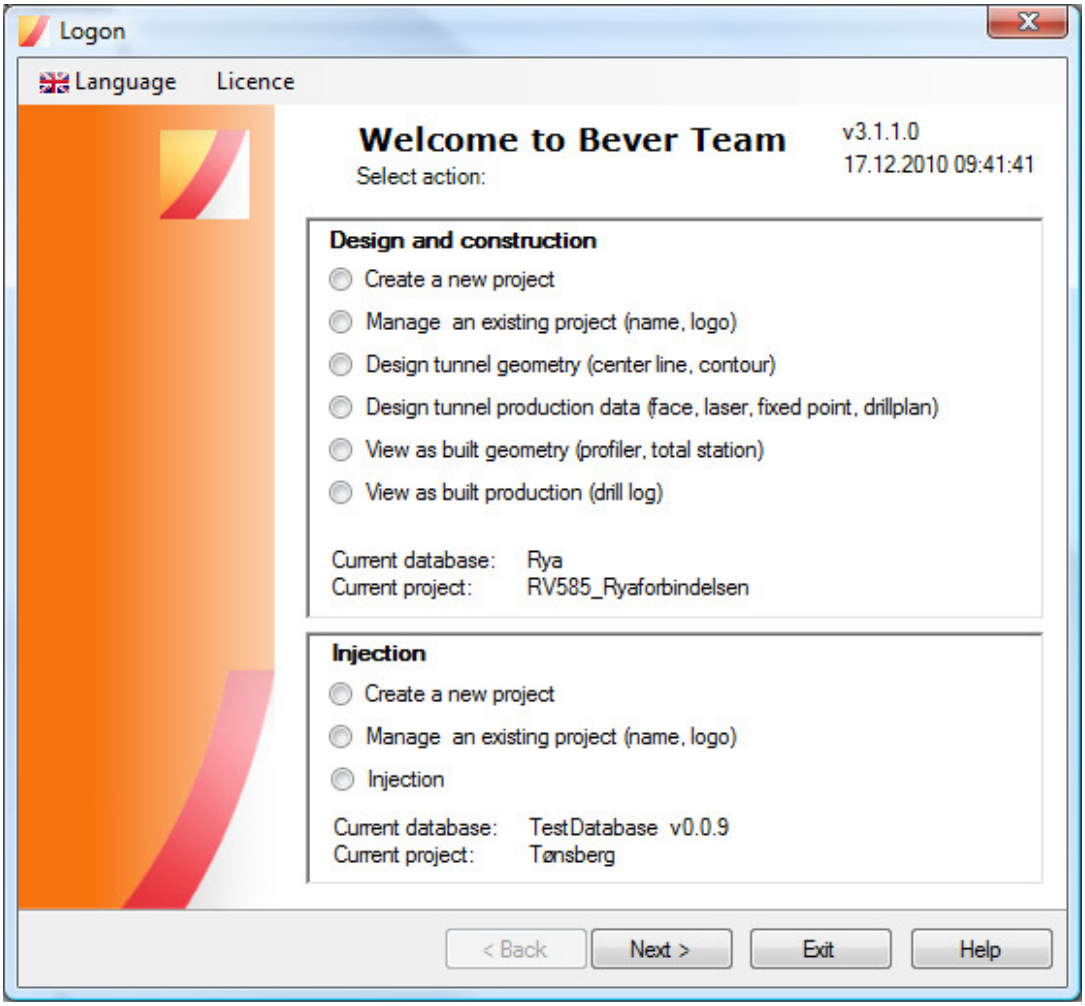


Fig. 2

Main screen. First time starters will notice that it is only the two first choices in the menu that are active.

Change language and ask for a valid license is located in the upper left corner.

5 Make a new project

A project in Bever Team is a collection of planned data and as built data. It is not defined just how much data the project contain. It can be a total project with many tunnels or just a small niche inside a tunnel. It is up to each user to define the complexity and size of each project.

Click on “Create a new project” and on “Next”. The box below will appear:

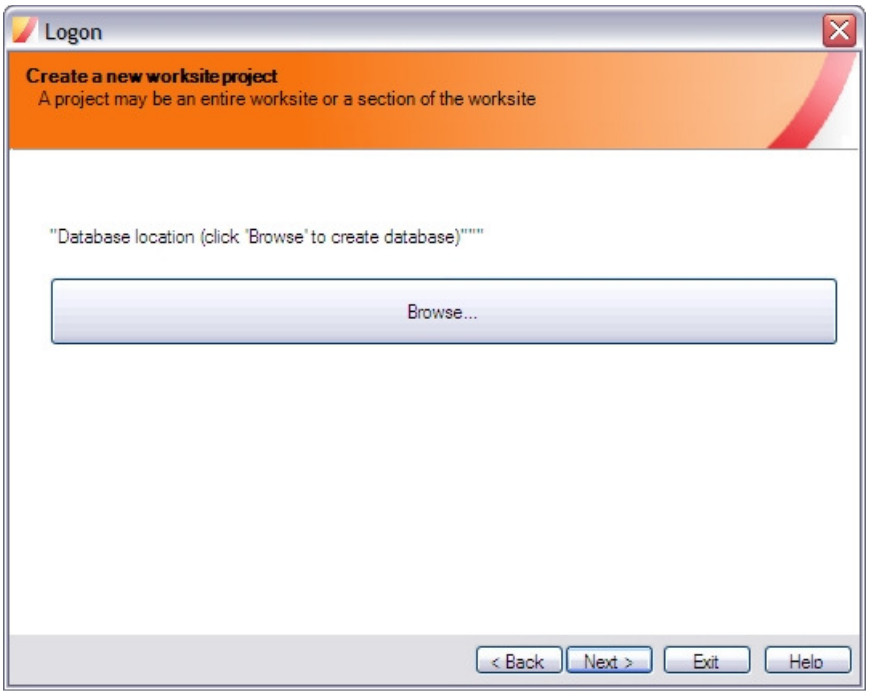


Fig. 3

Click on “Browse” to define where to save the project file and to give the project a name. The box below will appear:

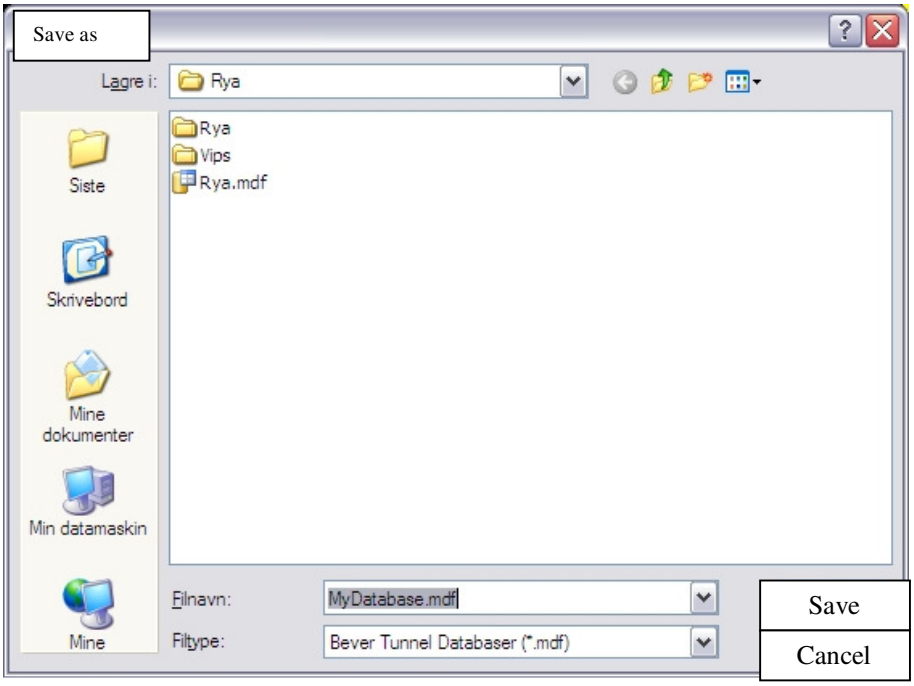


Fig. 4

Click on ”Save” to approve and go to the next dialogue box:

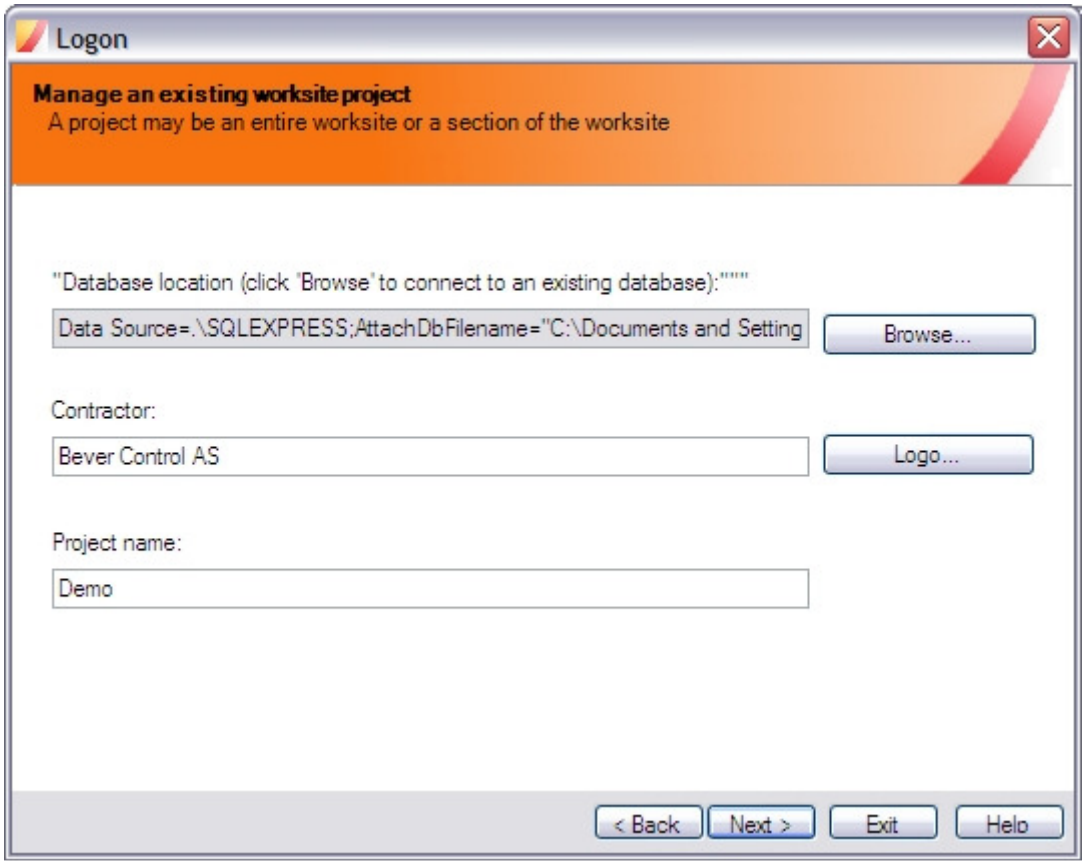


Fig. 5

Data base connection

On the fig. 5 box, click on the "Browse" button to address the database correctly. The following box will appear:

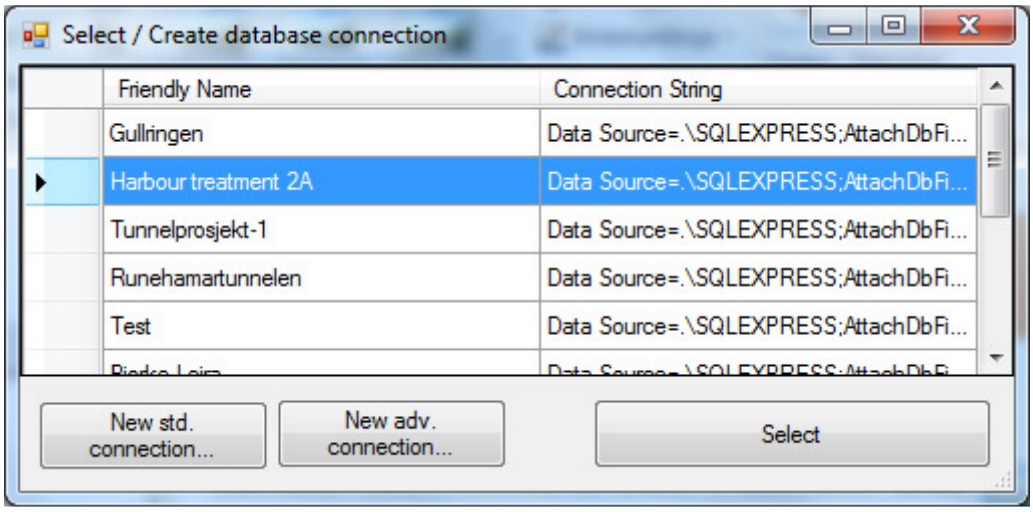


Fig. 6

If it is the first time the program is being used the list will be empty. Each database will however be on the list after creation.

A database can be deleted by graying out the row and push the delete button.

Normally the user chooses “New std. connection…” then a new window will open and here the user must find the database file made in a previous step. (Database.MDF). Click on “Open” and the program will return to Fig. 5, database connection.
Now the user can type in company name and a project name. By clicking on the “Logo” button can a company logo be referred to. This logo will then appear in all the reports made in the program. The logo picture should be about 1,5 cm high and 4,2 cm in width to fit ok in the reports. Recommended format is .bmp.

5.1 *Advanced connection*

If ”New adv. Connection…” is chosen every connection to the database needs to be configured manually. The first dialogue box to appear is this:

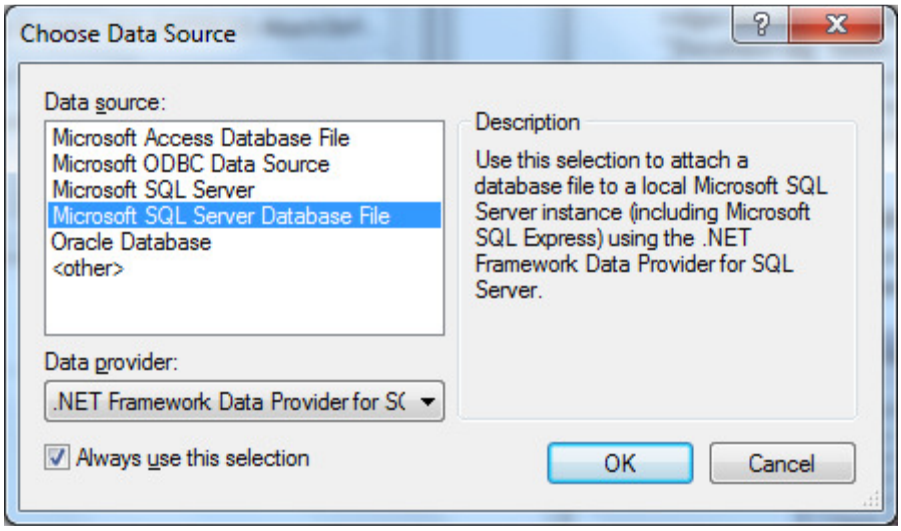


Fig. 7

Here the user must choose which SQL server that is to be used with the program and data base management. With the Bever Team 3 installation is the MS SQL Express. This is used in the following instructions.
Choose ”Microsoft SQL Server Database File”. Click ”OK” and the next box will be:

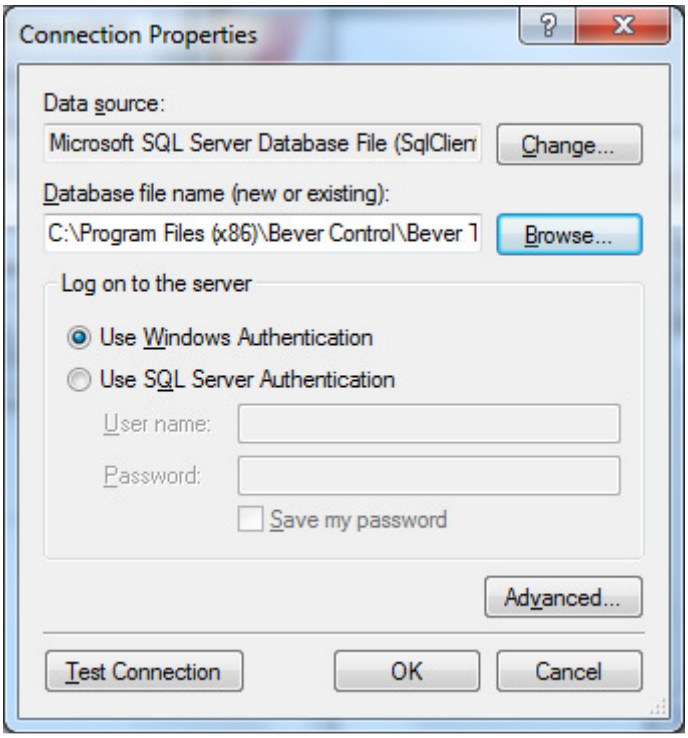


Fig. 8

Find the project .mdf file made in a previous step by clicking on ”Browse”. Then click on ”Advanced…”. This box will appear:

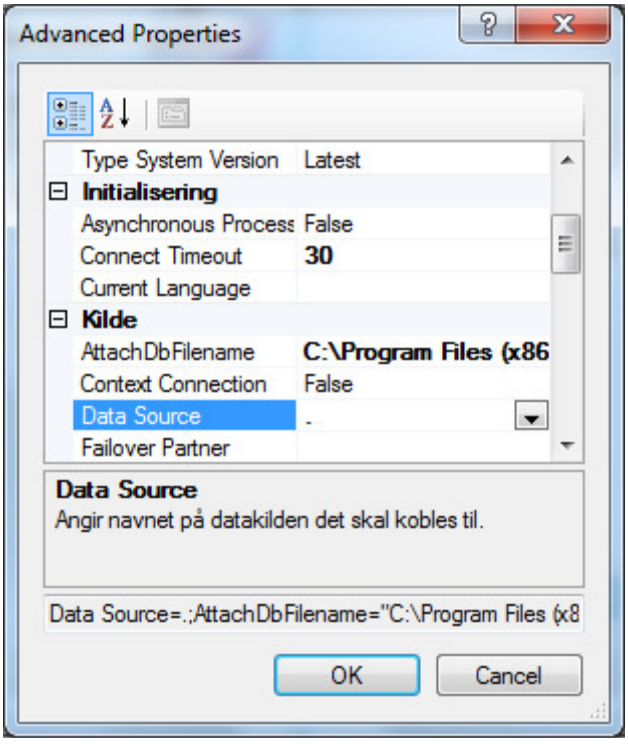


Fig. 9

”Data Source” must be set to SQLEXPRESS. Click on ”OK”. The ”Connection Properties” box (Fig. 8) will appear and the next step is to test the connection. This is done by clicking on the ”Test Connection” button. The following box should appear:

Fig. 10

Click on “OK” twice and the main screen will appear:

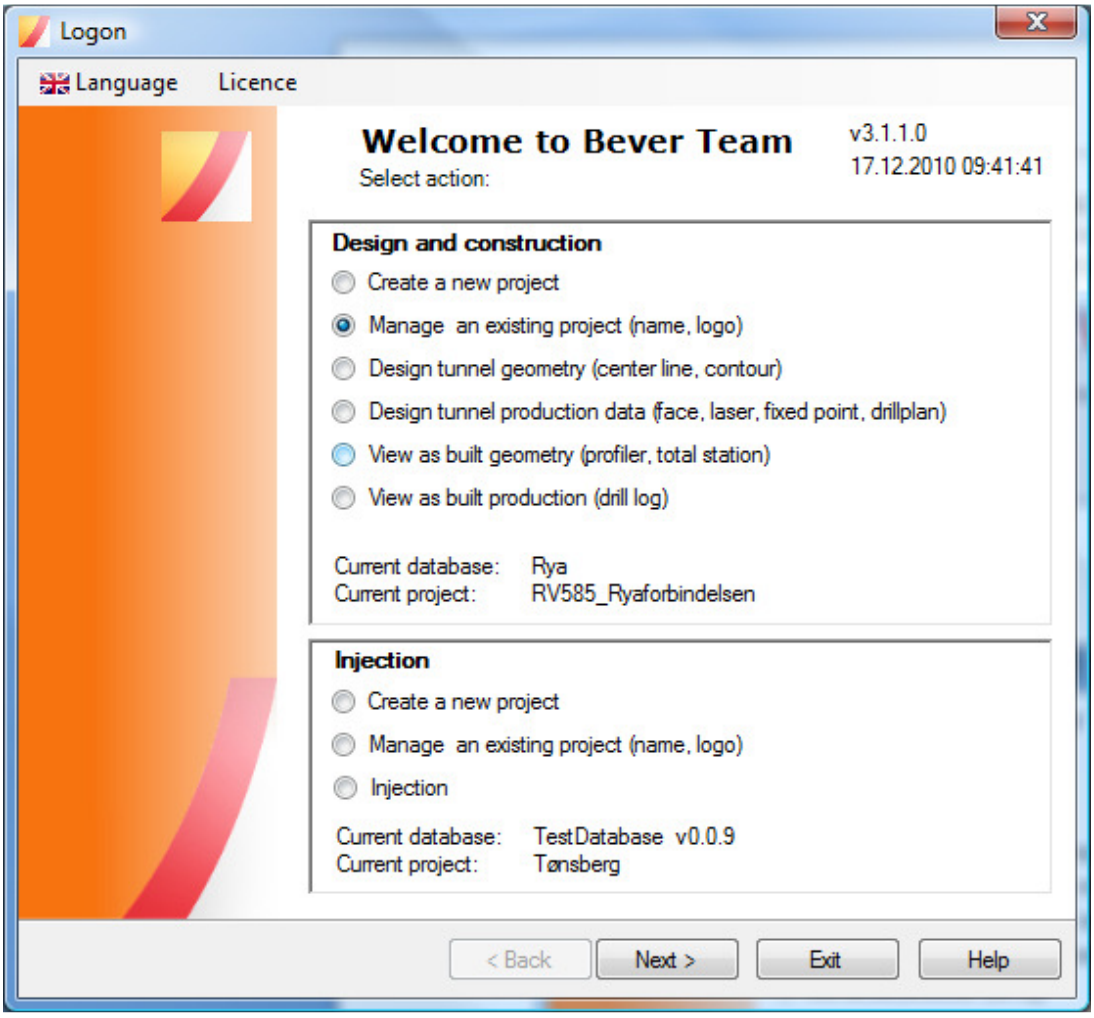


Fig. 11

Main screen. The whole menu should now be active.

To open an existing database file (.MDF) the user must mark ”Manage an existing project” in the main menu. Then the steps from Fig. 5 must be done.

When an already existing project is opened it is necessary to load all the log files into the database again. If it is a project with a digital road model this must be referred to again as well.

Note! If the database is on a network it is necessary to do a change in the registry. The procedure to do this is described in a text file on the installation CD.
Note! Only highly trained IT personnel should do this!

Design Tunnel Geometry

Designing the tunnel geometry is where one or more tunnels are defined. Both with a horizontal and a vertical alignment. And onto the alignment there has to be contours connected to it.
A tunnel must always be defined with an alignment and one or more contours.
Main screen in Design Tunnel Geometry:

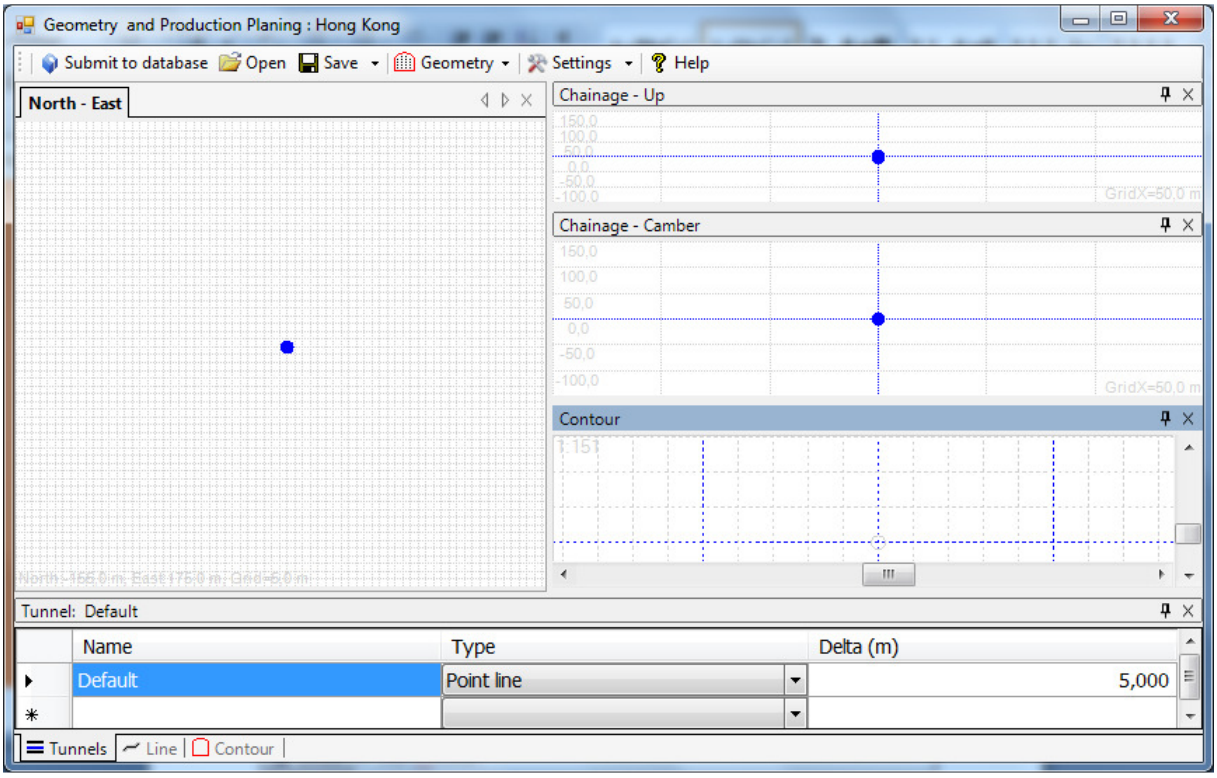


Fig. 12

1 The Menu

The menu is the same in Design Geometry and Design Tunnel Production Data. Here the user can find settings for export to jumbo, name of layers in the contour, import of XML files and etc.

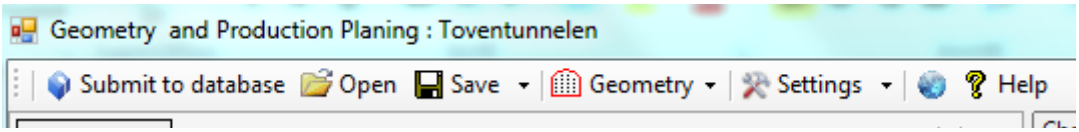


Fig. 13

1.1 *Submit to database*

This button will save all the changes done in the database.

1.2 *Open*

This is used for opening an already existing Bever Team 2 project or an XML file.
The Bever Team 2 project and the XML file can both contain an alignment and contours.

1.3 *Save*

This is used for export of the database. Export to Jumbos, IREDES XML, LandXML, Trimble survey controller, Leica Road Runner or the database can be converted into a .ZIP file. The Jumbos are defined under the Settings button.

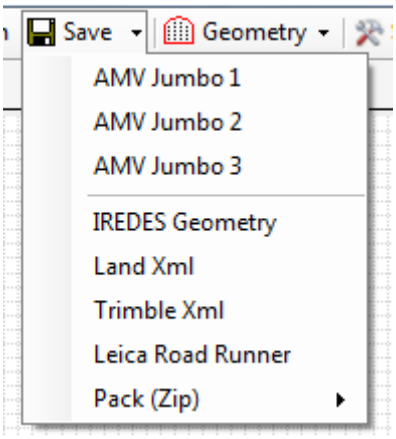


Fig. 14

1.4 *Geometry*

This button is a short cut between Design Tunnel Geometry and Design Tunnel Production Data.

1.5 *Settings*

Here the user can define various settings. See Fig. 15.

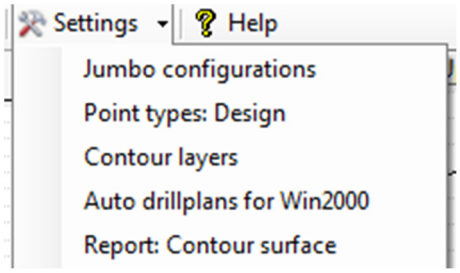


Fig. 15

1.5.1 Jumbo Configurations

Is used for setting up export parameters to the jumbos.

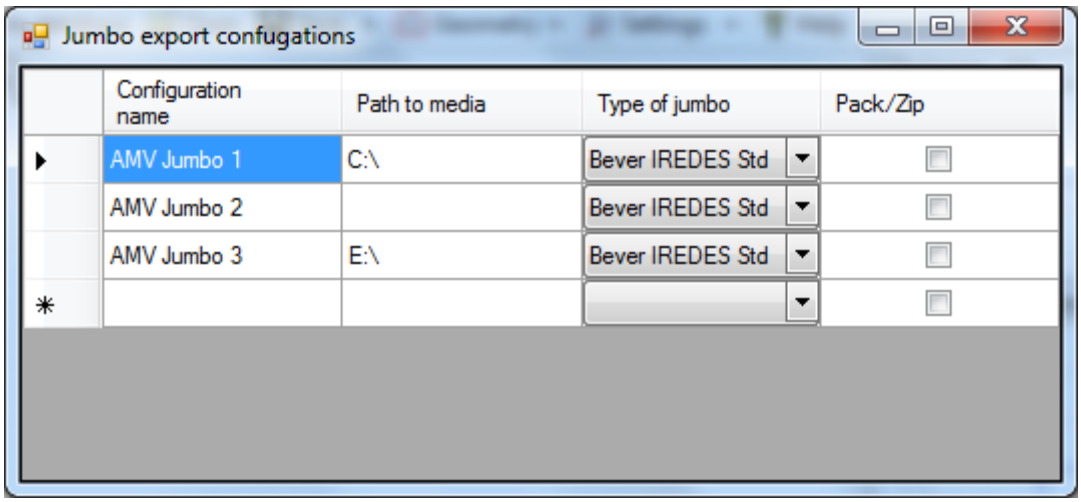


Fig. 16

Configuration name: Name of the Jumbo/configuration.
Path to media: Choose the path to the memory stick to use.
Type of jumbo: Defines the data format to the jumbo.
Pack/Zip: Used to Zip the project for wireless transfer of data.

1.5.2 Point types: Design

This is used to define different point types that can be used on the jumbo. These values are used in the Design Tunnel Production Data module.

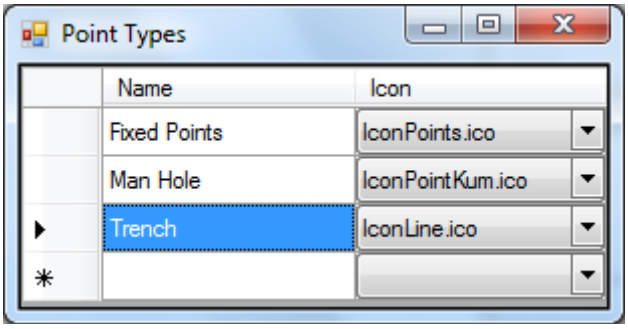


Fig. 17

1.5.3 Contour Layers

Here the different layers in the contour can be defined. Layer number, name, visibility, if camber is to be used and color on the layers.

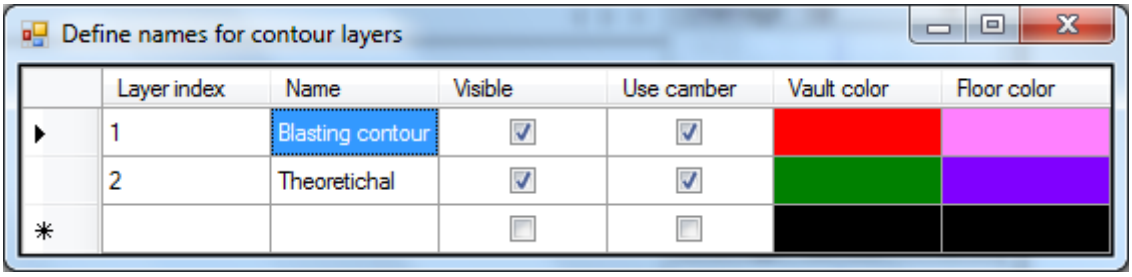


Fig. 18

1.5.4 Auto drill plans for Win2000 jumbos

Is used to create an automatically generated drill plans for old versions of the Bever Control system on the jumbo. There is a user guide from Bever Control which can be purchased for this feature.

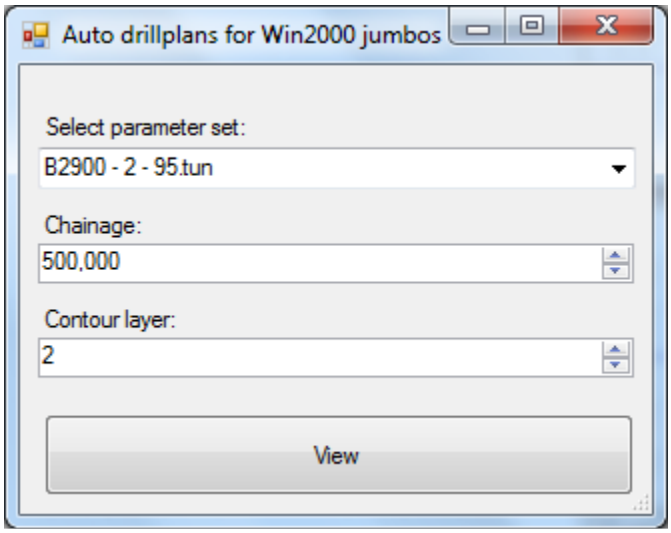


Fig. 19

1.5.5 Report: Contour surface

Used to create a report from the theoretical contour surface. This report is only possible with MS Visio.

A typical report can be as shown in Fig.20.

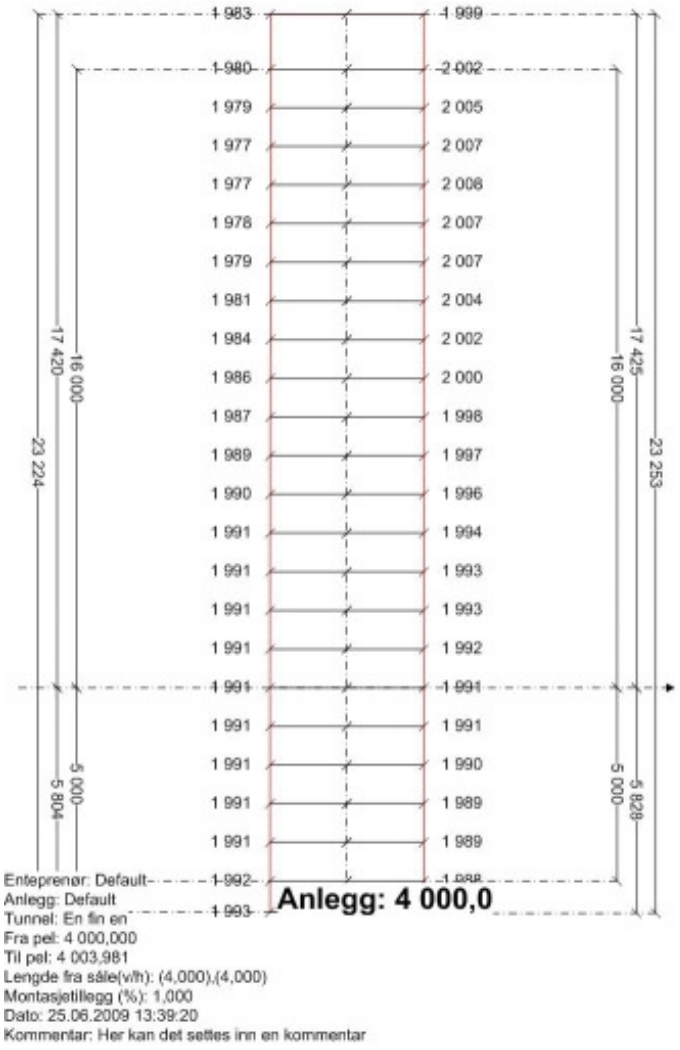


Fig. 20

1.6 *Virtual Earth*

Virtual Earth, depended on datum, has to be WGS-84/UTM

1.7 *Help*

Opens the user guide

2 The Screen

The screen is divided in five separate parts. See Fig. 21 for an overview.

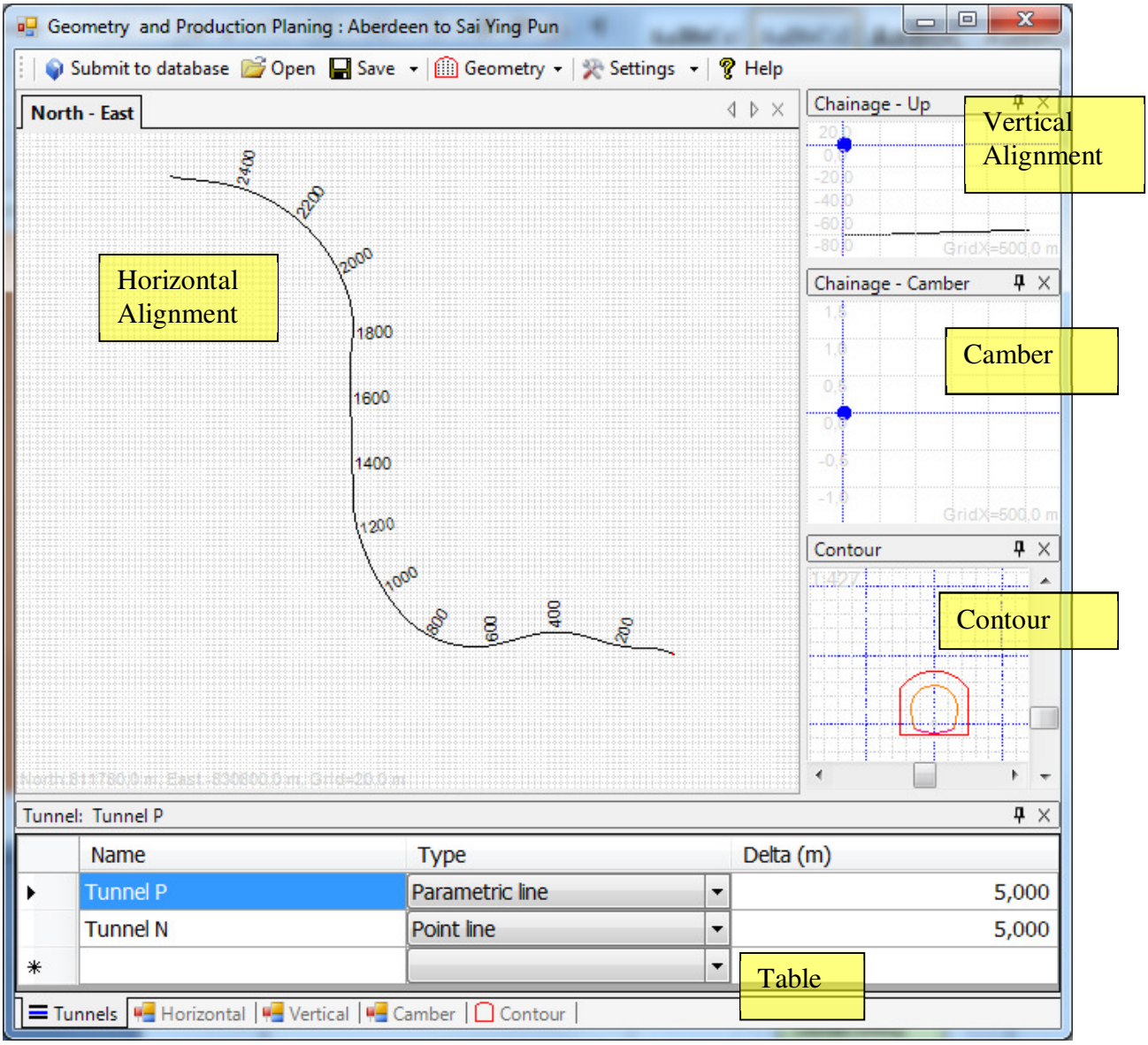


Fig. 21

By using the scroll wheel on the mouse it is possible to zoom in and out on the horizontal alignment.

Click and press down the left mouse button to pan on the horizontal alignment.

By clicking on the pin in the upper right corner can the box be minimized. Maximize with the same function. See Fig. 22.

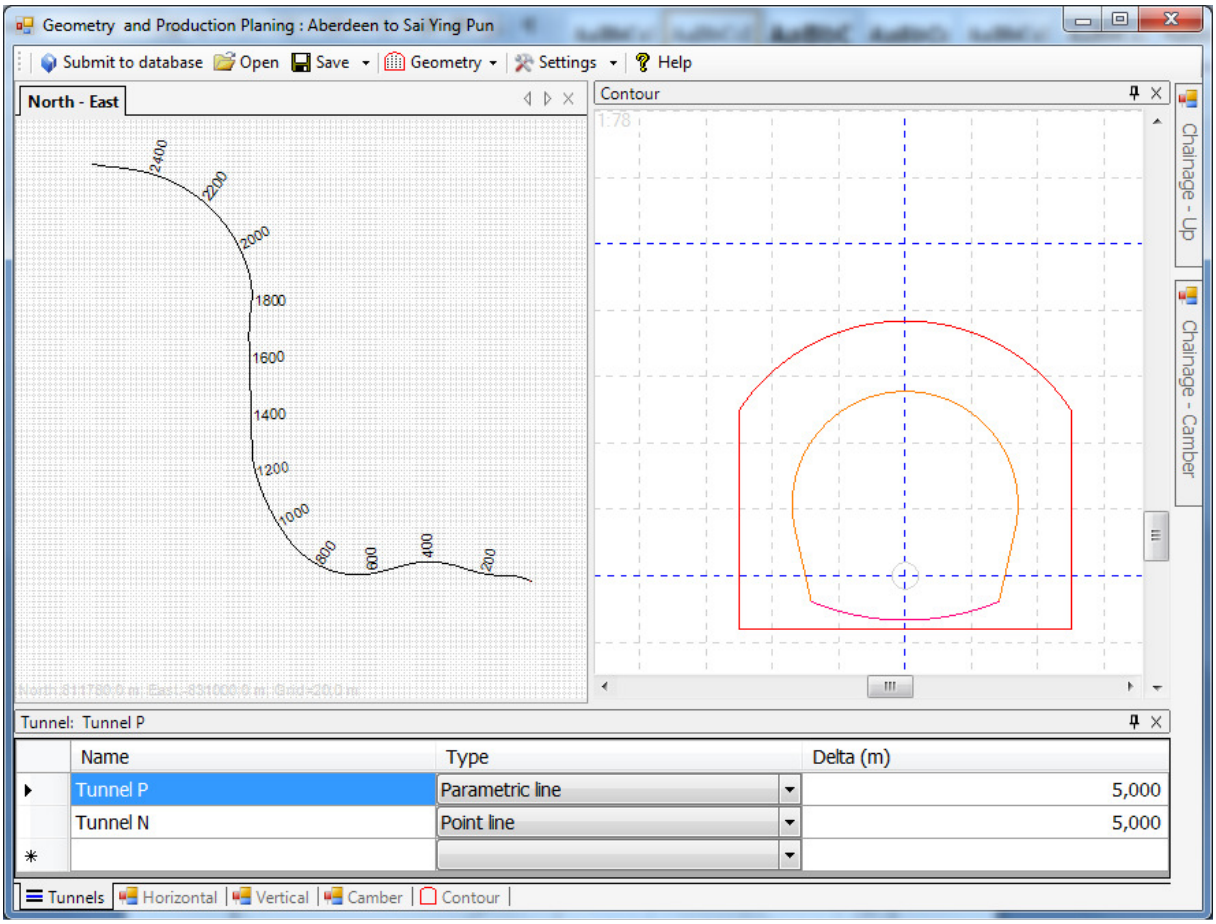


Fig. 22

3 A geometric minimum – how to create a quick tunnel

To make a quick test project it is enough to have a line and a contour. The easiest way to do this is first to define a tunnel. This is done by giving the tunnel a name, for type, choose point line.
After this is done click on the Line sheet.

The picture in Fig. 23 will appear. Punch in some easy values on the northing and easting and the simple alignment are all done.

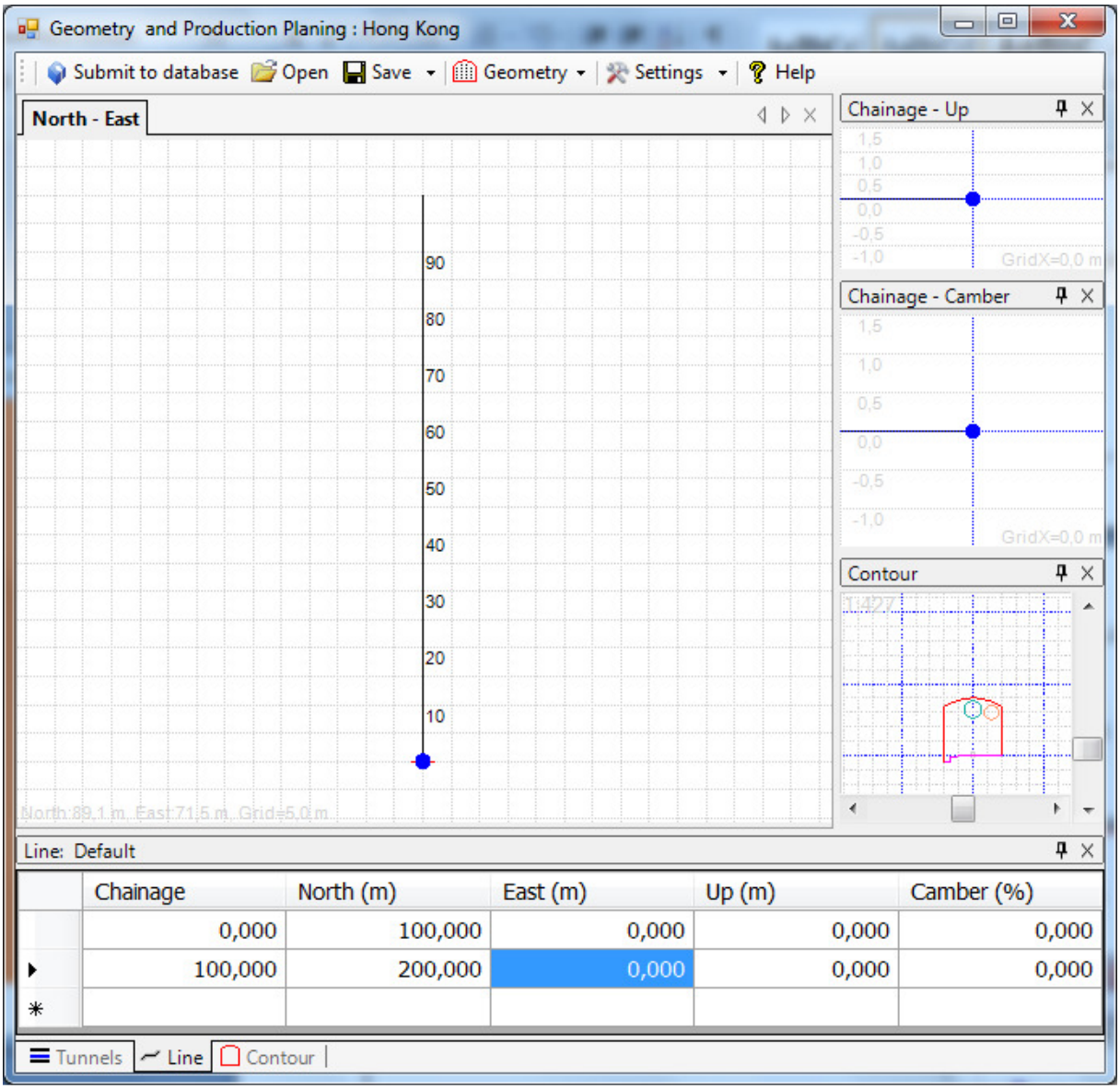
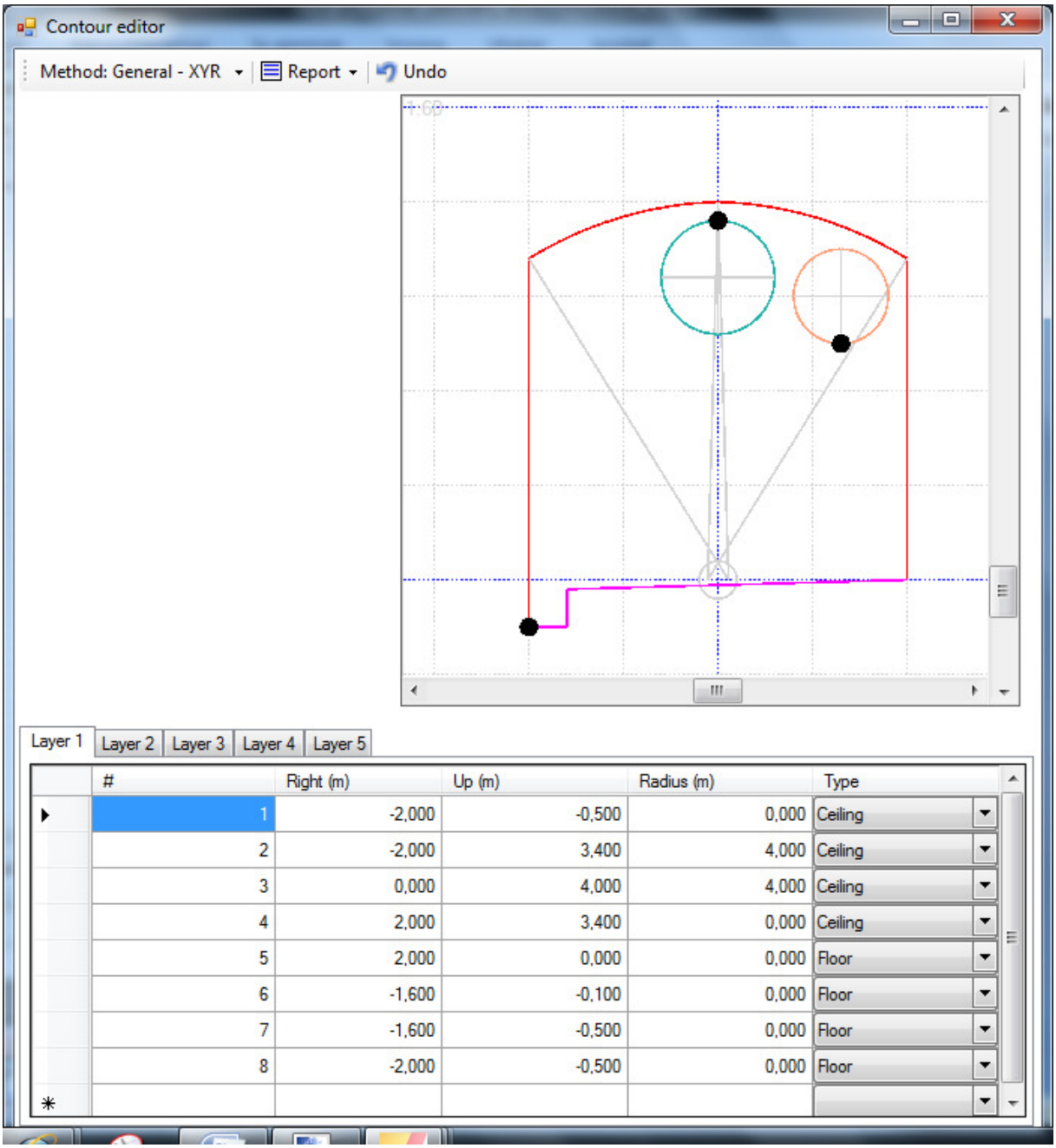


Fig. 23

The next step will then be to create a contour.. Click on the Contour sheet. Type in a Chainage, should be on the alignment somewhere. Then type in a description. After that, click on the Edit button. Then the contour editor will come up.
In the contour editor there are several ways to enter a contour. In this case we choose the General – XYR. Then type in some values. Fig. 24 gives an example on values.



#	Right (m)	Up (m)	Radius (m)	Type
1	-2,000	-0,500	0,000	Ceiling
2	-2,000	3,400	4,000	Ceiling
3	0,000	4,000	4,000	Ceiling
4	2,000	3,400	0,000	Ceiling
5	2,000	0,000	0,000	Floor
6	-1,600	-0,100	0,000	Floor
7	-1,600	-0,500	0,000	Floor
8	-2,000	-0,500	0,000	Floor

Fig. 24

Go out of the contour editor and push the Submit to database button.

4 Sheets - overview

The different elements in the design are available in the sheets in the lower left corner. They can vary if it is different type of alignments that are in use. Point line, Parametric or VIPS. In Fig. 22 it`s shown with a Parametric line.

5 Sheet - Tunnels

A tunnel can be one of many in a project. On each tunnel there can be contours, points, lasers and as built data.
To get up a menu in the tunnel table, just right click with the mouse.

Save: Saves the tunnel line into Atlas tunnel line (tl8), Bever Win 2000 line (tli) or Bever Org line (tli).
Control: To control northing, easting, height and camber on the alignment.

5.1 *The columns*

Name – The name of the tunnel or alignment
Type – Here the user can choose between Point Line, Parametric or VIPS.
Delta – Gives the length between each point created on the alignment for the jumbo export. With steep curves it can be useful to put this to maybe 1 or 2 meter. Default value is 5 meters.

If the tunnel consists of a point line then the next sheet will be Line.
If it consist of a parametric line then there will be three new sheets, Horizontal, Vertical and Camber.
If the tunnel is defined as VIPS then there will also be in addition to the ones mentioned above a sheet named Changes and a sheet named VIPS.

6 Sheet - Line

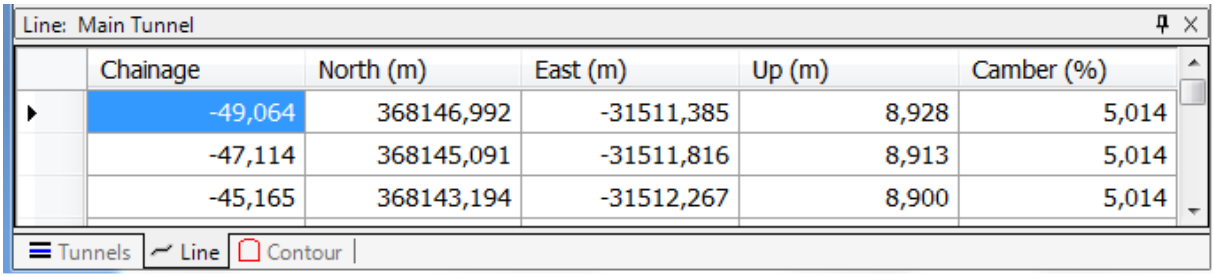


Fig. 25

A point line is defined with a series of points containing chainage, northing, easting, up (elevation) and camber at each point. These values can either be typed directly in the table or be imported on .TLI (Bever Control), .TL8 (Atlas Copco) or Iredes.XML formats.

When right clicking in the table a menu will appear. Fig 26.

Open will bring the user to the import dialog box.
It`s also possible to extend a line or find a point on the line by typing in a new chainage value in the bottom of the table. Right click and choose Suggest coordinates and the program will interpolate or extend.
Check delta pel will control if there are any differences between the chainage values and the coordinates.

It is also possible to right click on the header over each column.

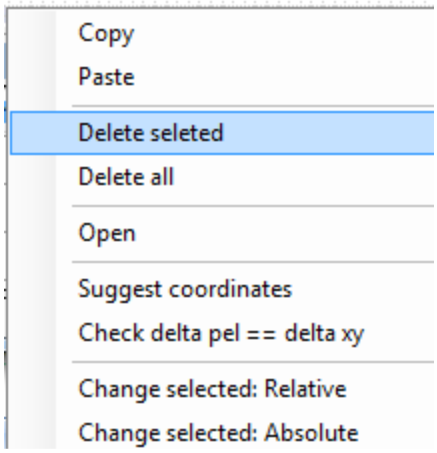


Fig. 26

7 Sheet - Horizontal

When having a parametric line as alignment the Line sheet will be switched with three new ones. The first is the Horizontal.

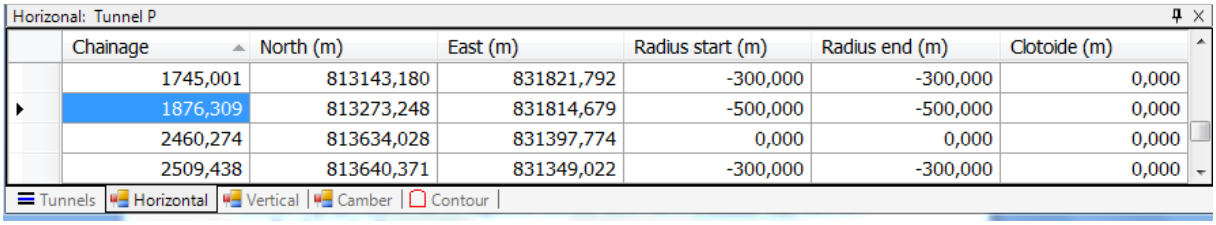


Fig. 27

It shows the Horizontal alignment in the tunnel with chainage, northing, easting, radius start, radius end and clotoides. Right click in the table and the menu in Fig. 28 will appear.

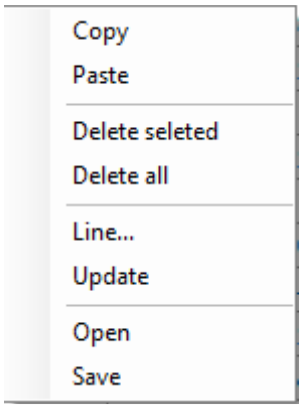


Fig. 28

8 Sheet - Vertical

The vertical sheet will show the vertical alignment in the tunnel

.

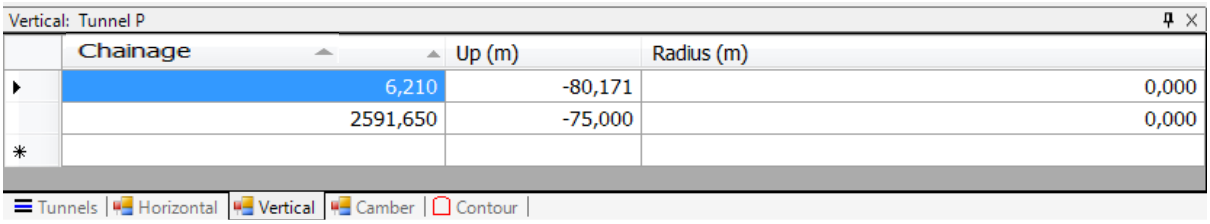


Fig. 29

Right click and the same menu as on the horizontal sheet will appear. Fig.28.

9 Sheet - Camber

The Camber sheet will show the "tilt" of the tunnel around the alignment. It`s even here possible to right click and get up a small menu with copy, paste and so on.

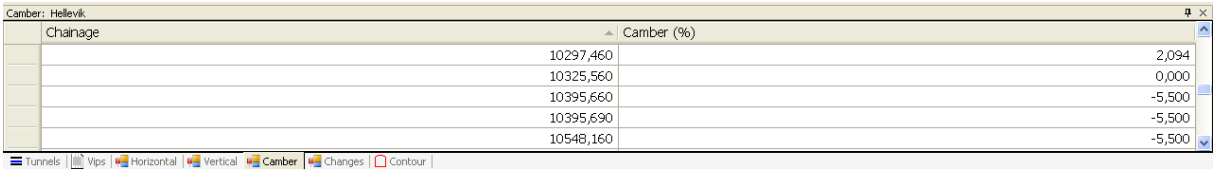


Fig. 30

10 Sheet - VIPS

Vips is a total road model that can be imported directly into the Bever Team 3. Together with a digital tunnel model the user can get a total project which contains all the data needed to start making drill plans. To read a Vips project the model files are needed. Including the tunnel geometry file. If the geometry file is not included it is possible to make a dummy structure file. That must be done in order to export survey data.

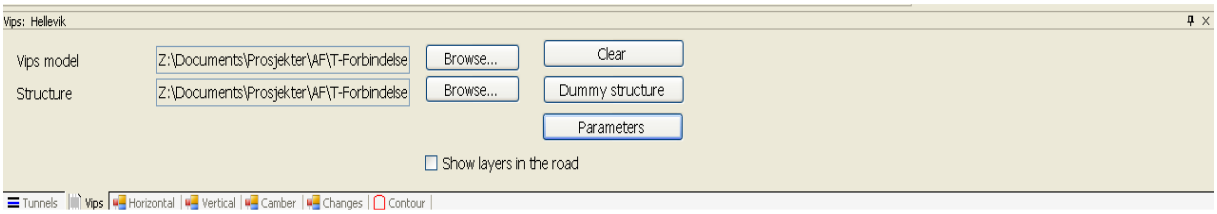


Fig. 31

Load in the Vips and the tunnel structure file by pushing the browse button.
Beware to get the right camber values from the model by choosing the right surface.
Clear will reset. Dummy structure will create a dummy structure a parameter will give an overview of the tunnel length were there are structure, or contours. If marking the show layers the different layers in the road model will be turned on and off in the graphics.

11 Sheet - Changes

This shows the changes in the geometry of both the road model and the tunnel model. This is defined by chainage and a code for what is happening at the actual chainage.

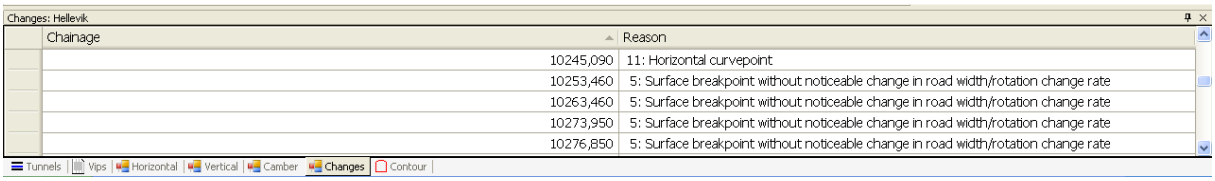


Fig. 32

It`s even here a right click menu. The most used features in that is the update selection.
If a new road model is read in the update feature should be used on all sheets containing one in the menu.

12 Sheet - Contour

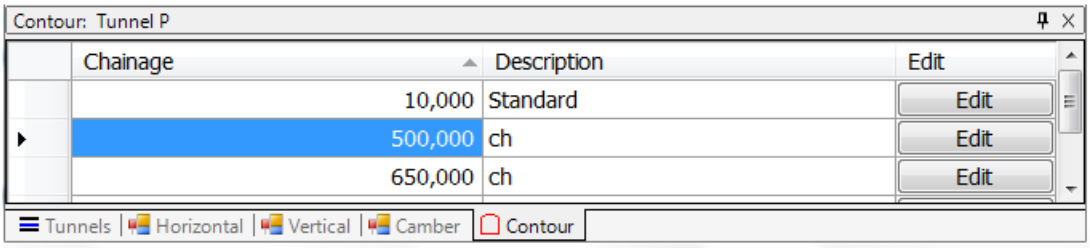


Fig. 33

This is where the contours will be connected to the alignment and where the contours are made. Type in chainage and give the contour a name (description). After this is done, click the Edit button and the contour editor will open.

There is also a right click menu here. Fig. 34.

Here copy and paste can be used as well as deleting contours.
Send To and Get From are basically sending the actual contour to a library and get a contour from the library.
Choose File and an open/save dialogue will appear.
If you are at a chainage between two known contours the program can suggest a new interpolated one with the suggest contour election.
Suggest interpolation will try to find a way to arrange the points in a contour automatically for correct interpolation between the two.
Check interpolation will open up the profiler log viewer so that the user can “walk” through the tunnel and control the interpolation done.

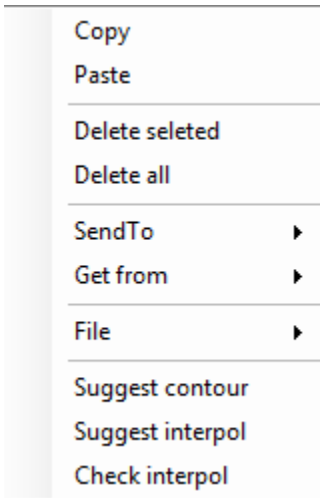


Fig. 34

There are several types of making a contour. In the roll down menu there are:
General – XYR, Input data by typing or cut and paste. X and Y relative to the tunnel alignment, which is shown as a small round marker in the grid. R is the radius.
General – Angle, input as the previous but with angles as well.
Open/Save File, an existing one can be opened or the one in play can be saved. In .tl2 and XML format.
Standard, here a standard from the Norwegian tunneling handbook can be chosen and inserted.
Graphical, Here a contour can be drawn directly into the grid by clicking the mouse.

It is possible to zoom in and out by using the scroll wheel on the mouse.
To add or remove layers. Just right click on the layer sheet and choose add or delete.

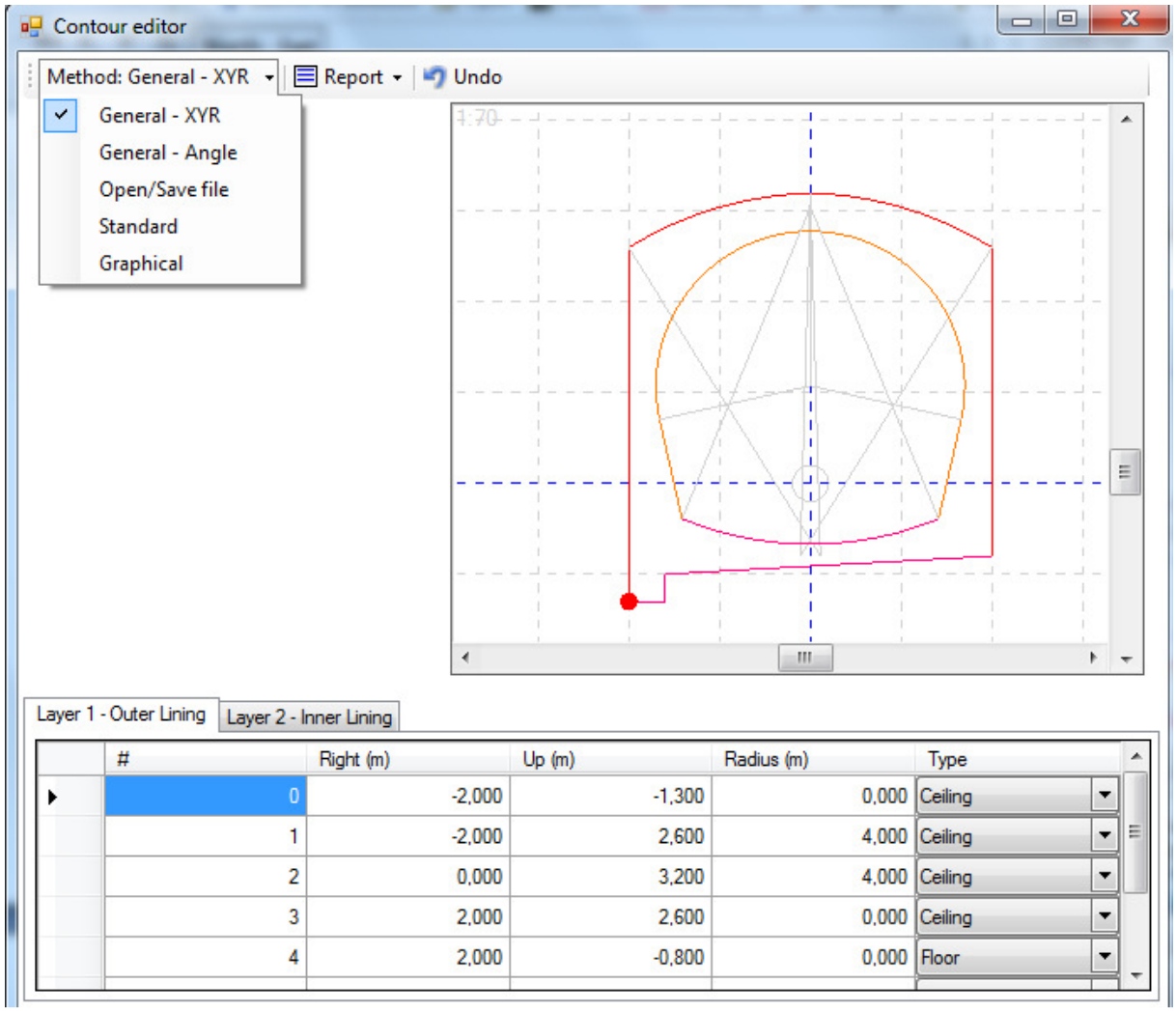


Fig. 35

It is also important to notice that a contour always is defined with the first point in the low left corner and goes clockwise to the end point. The endpoint doesn`t have to be the same as the start point. The program will close the polygon with a straight line.

To make a report it is necessary to keep the graphical contour to the left of the thin grey line in the grid. After this is done click the report button and choose Excel or Visio.

Any regrets? Hit the Undo button.
Right click for a menu like Fig. 36. Here the user can select to copy and paste, add a line, delete lines and scale up or down the whole contour.

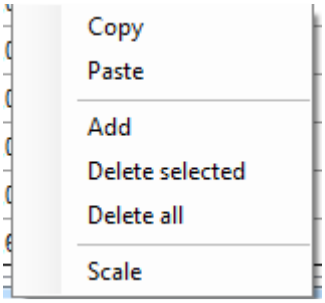


Fig. 36

Production Planning

1 Overview Production Planning

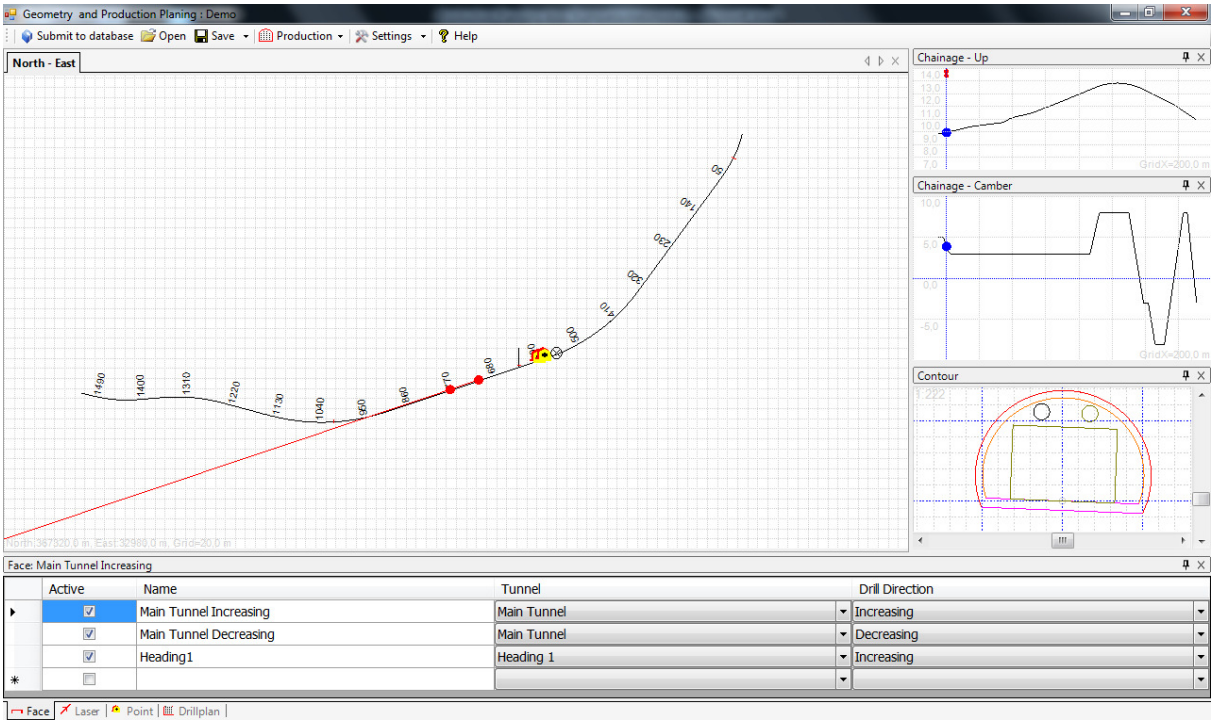


Fig. 37

This part is used to define Faces, Lasers, Points and Drill Plans
The Main menu on top is the same as in the Planning of Geometry part.

1.1 *Face*

The difference is in the sheets at the low left corner.
The first sheet is Face. This is used to define the different faces in a project, connect the face to a tunnel and give the drill direction. The column to the left (Active) indicates if the face are to be exported to a Jumbo or a Total station. Mark the box and it will be exported, leave it unmarked it will not.

1.2 *Laser*

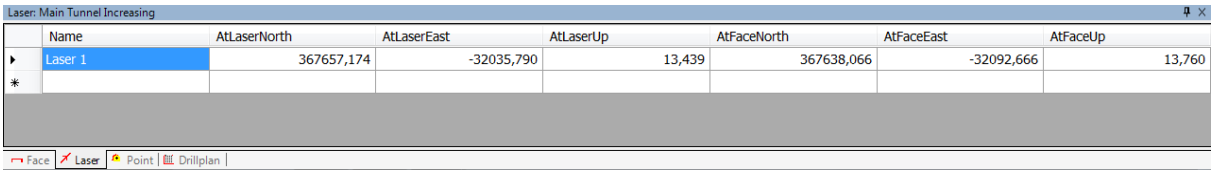


Fig. 38

Here the user can define a laser used for navigating the Jumbo. Give the laser a name and type in Northing, easting and Elevation. Both at the laser and at the face, or as close to the face as possible.
There is also a right click menu in the table.

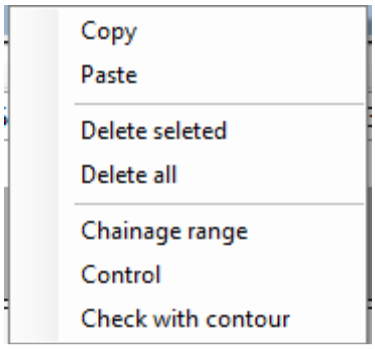


Fig. 39

Chainage range is for limiting the range for where the laser is active, this is given with a start chainage and an end chainage.
Control is for a third point measured on the laser, and then the user can see the deviation on the laser line.
Check with contour will open the contour window and the laser can be checked if it`s inside the contour for the desired range.

1.3 *Point*

Point is used for defining Fixed Points and other installations in the tunnel that could be useful.

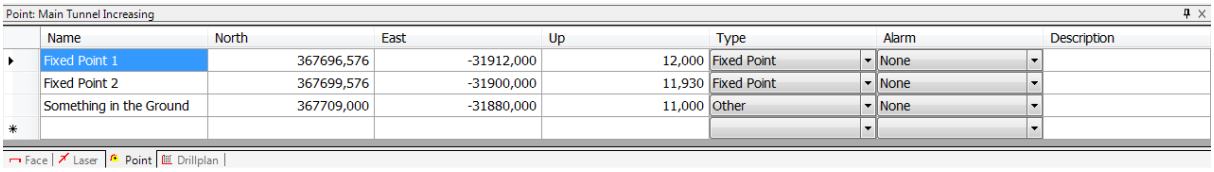


Fig. 40

Give the point a name, type in northing, easting and the elevation.
Type of points can be defined in the main menu at the top, under *Settings* and *Point Types: Design.*

If the Alarm is set, the Jumbo operator can get information of the point on the screen in the Jumbo. This is mainly used for trenches, niches and installations that`s not included in the design. The operator will also get the text from the description field.

Right click in the table and the following menu will appear:

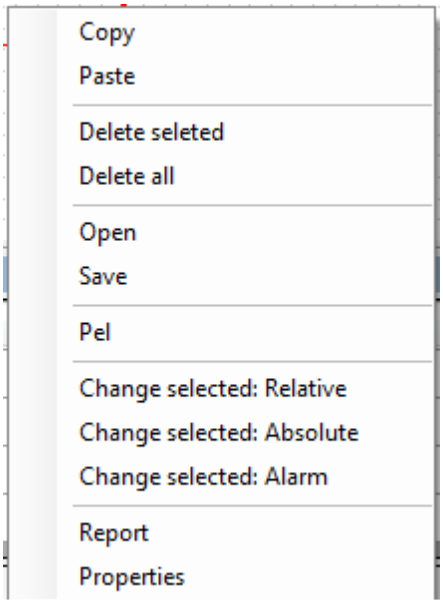


Fig. 41

Open is for importing a file containing points.
Save is for saving the point list to a file.
Pel is for typing in a point with chainage, distance to alignment and elevation.
Report brings up an excel report.
Properties give information on the selected point.

1.4 *Drill Plan*

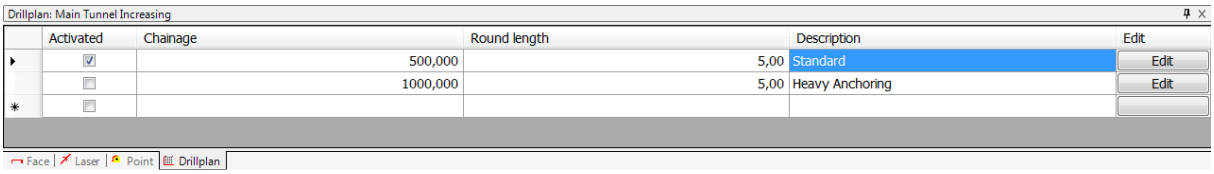


Fig. 42

This is for making drill plans. The activate column to the left defines if the drill plan is to be exported to the Jumbo or not. If active it will be exported.
The chainage typed in will define the actual contour for the drill plan.
Round Length defines the length of the round and will indicate if it is a blast round, grouting, bolt or probe.
The description will be the information the Jumbo operator will see and must be used.
To create the drill plan simply press the *Edit* button.

Right click and the following menu will appear:

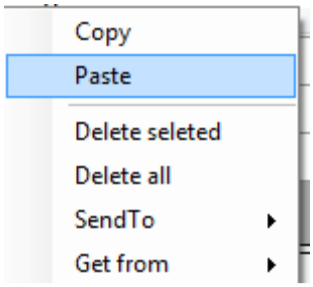


Fig. 43

Send to is used to send the drill plan to a library called favorites.
Get from will open the library so that a drill plan can be inserted.

Drill plan editor

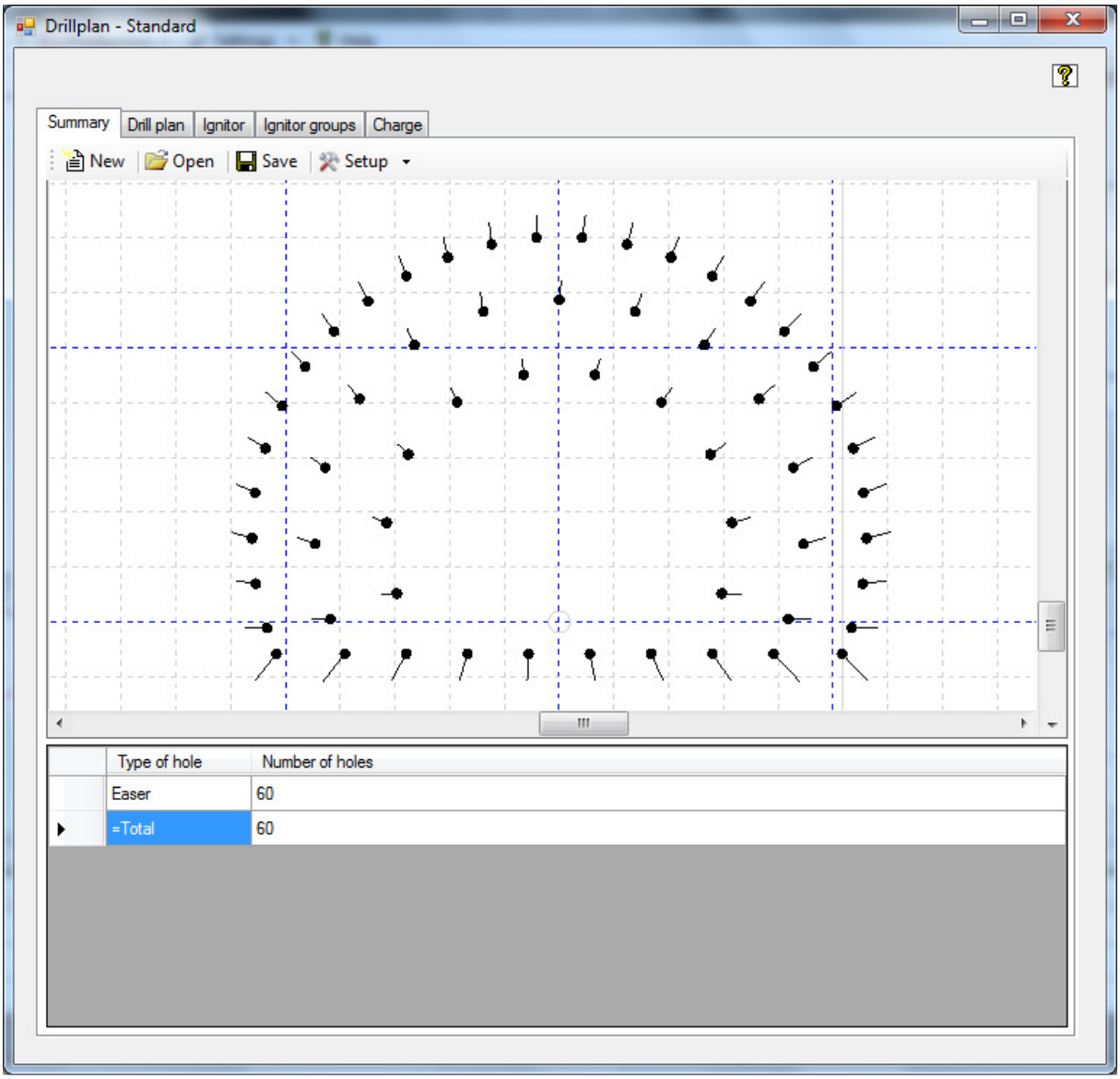


Fig. 44

The drill plan editor will contain two or five sheets at the top of the screen.
The first one gives a summary of the drill plan.
The user can create a new one, open an existing or save the current one.
Setup is mainly used for turning the ignitor and charge sheets on and off and for setting of the hole parameters.

1 Drill plan

The drill pattern is defined on this sheet.

Use the *Selec*t button to create holes, help lines, sequences or an automated drill pattern:

1.1 *Create helper lines*

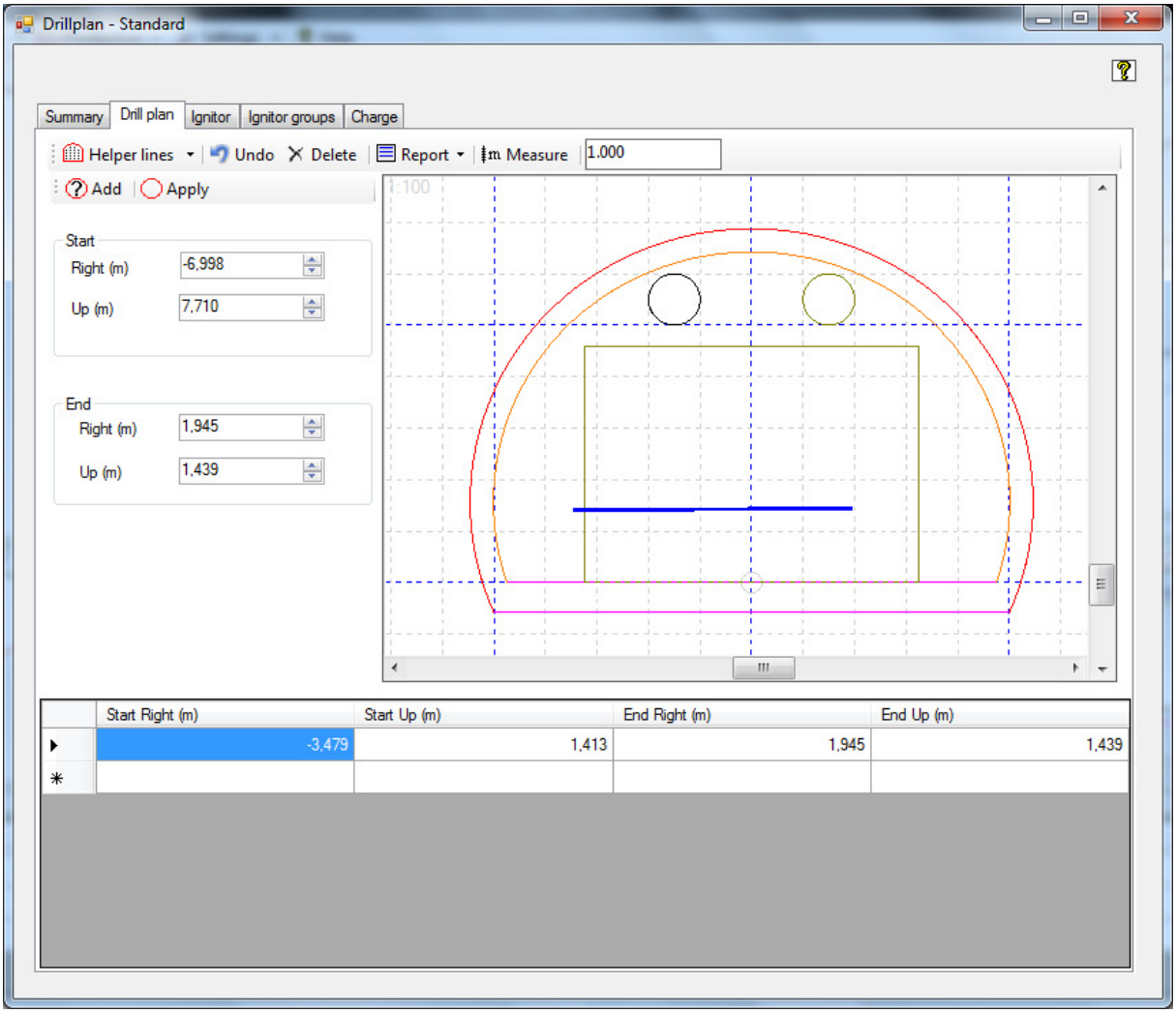


Fig. 45

Helper lines can be used to create holes on a line. To create a line just left click with the mouse and drag the line to where it should be. After the line is created it is easy to edit the line in the table if it is not in the right place.

1.2 *Create holes on a line*

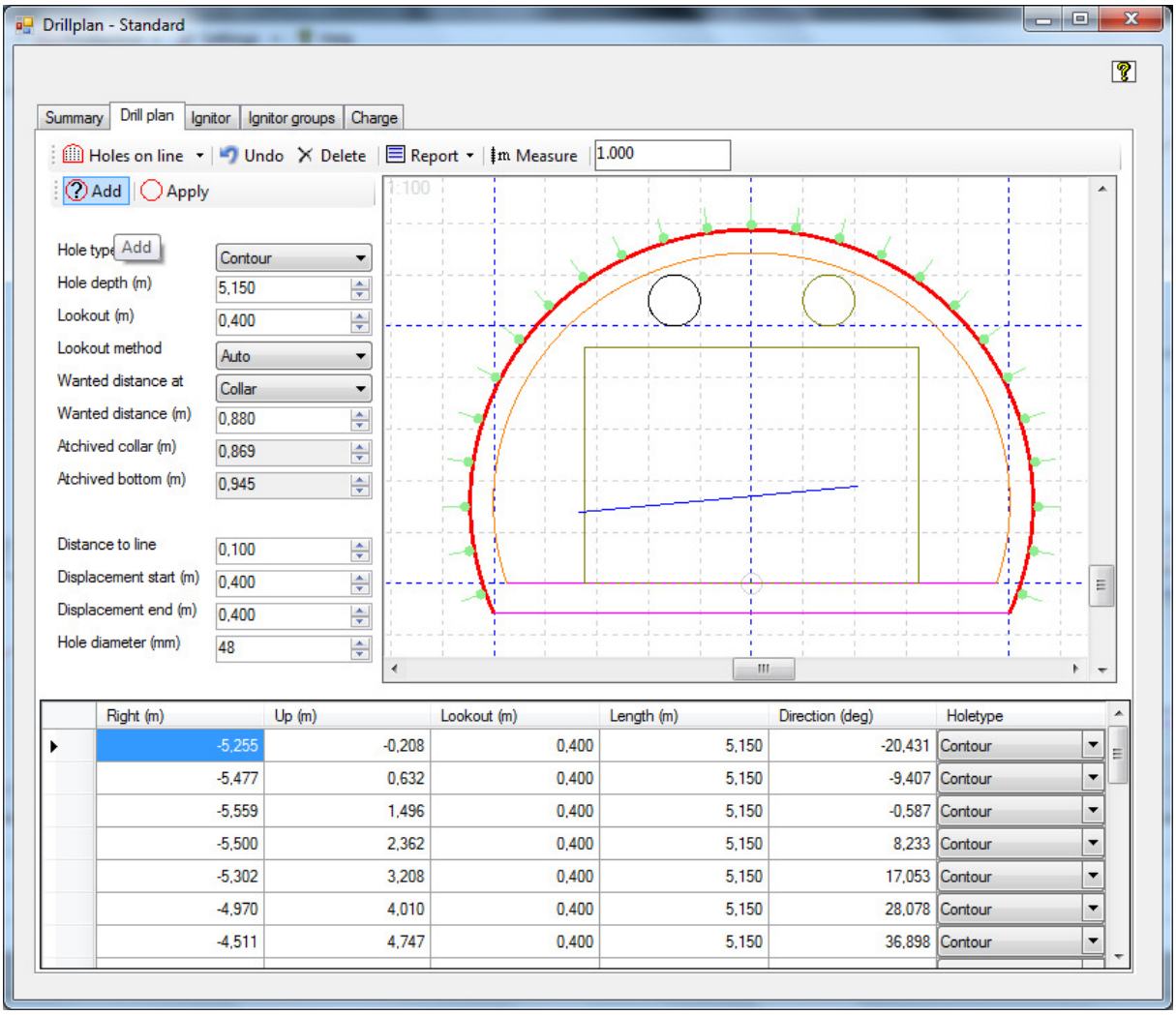


Fig. 46

First must the line to use be marked. Use left click on the mouse. There are two methods of adding holes.

1. Choose the hole type and set the parameters from the table on the left side. Push the *Add* button on if pleased push *Apply*.
2. Right click and choose Add and pick the desired hole type.

1.3 *Single holes*

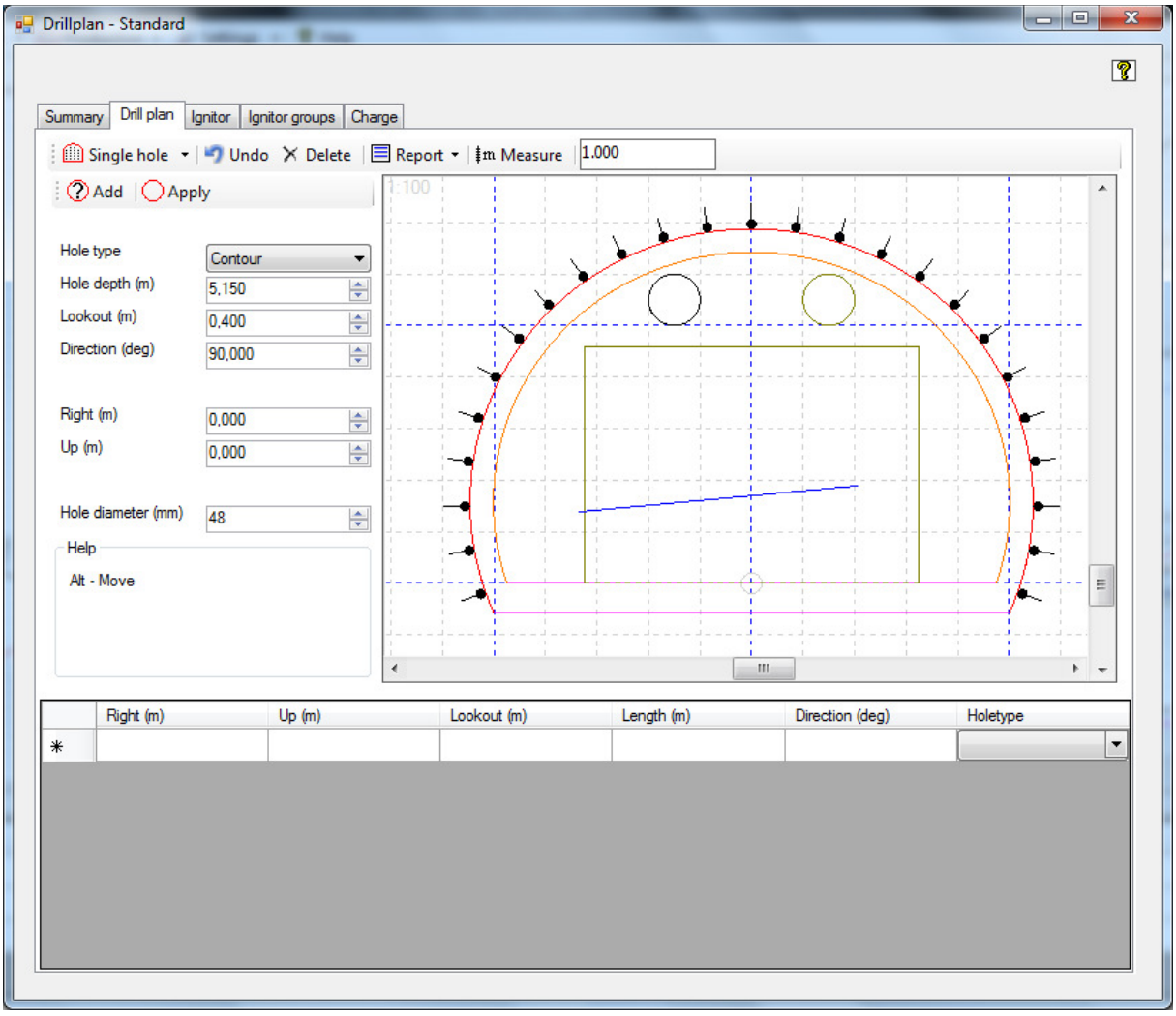


Fig. 47

There are two methods of adding holes.

1. Choose the hole type and set the parameters from the table on the left side. Click inside the contour and the hole will be placed.
2. Right click and choose Add and pick the desired hole type.

1.4 *Read hole group*

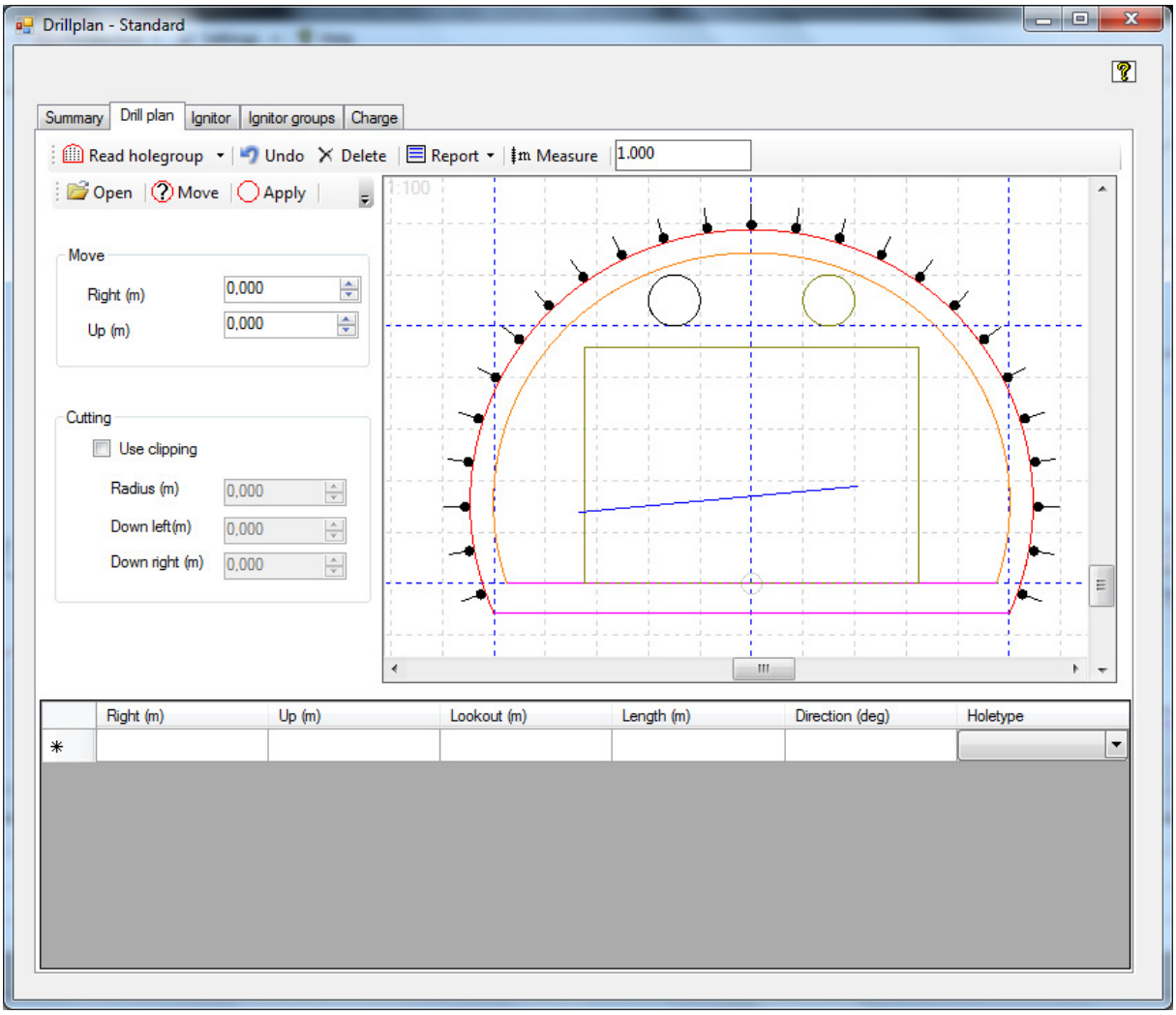


Fig. 48

Choose Open, find the file and it will be opened.

The group of holes can be moved around by typing in coordinates and press the Move button or left clicking with the mouse.

Cutting:

The group of holes can be cut so that only the holes inside the area will be applied. Mark the Use clipping. Adjust the parameters

1.5 *Select holes*

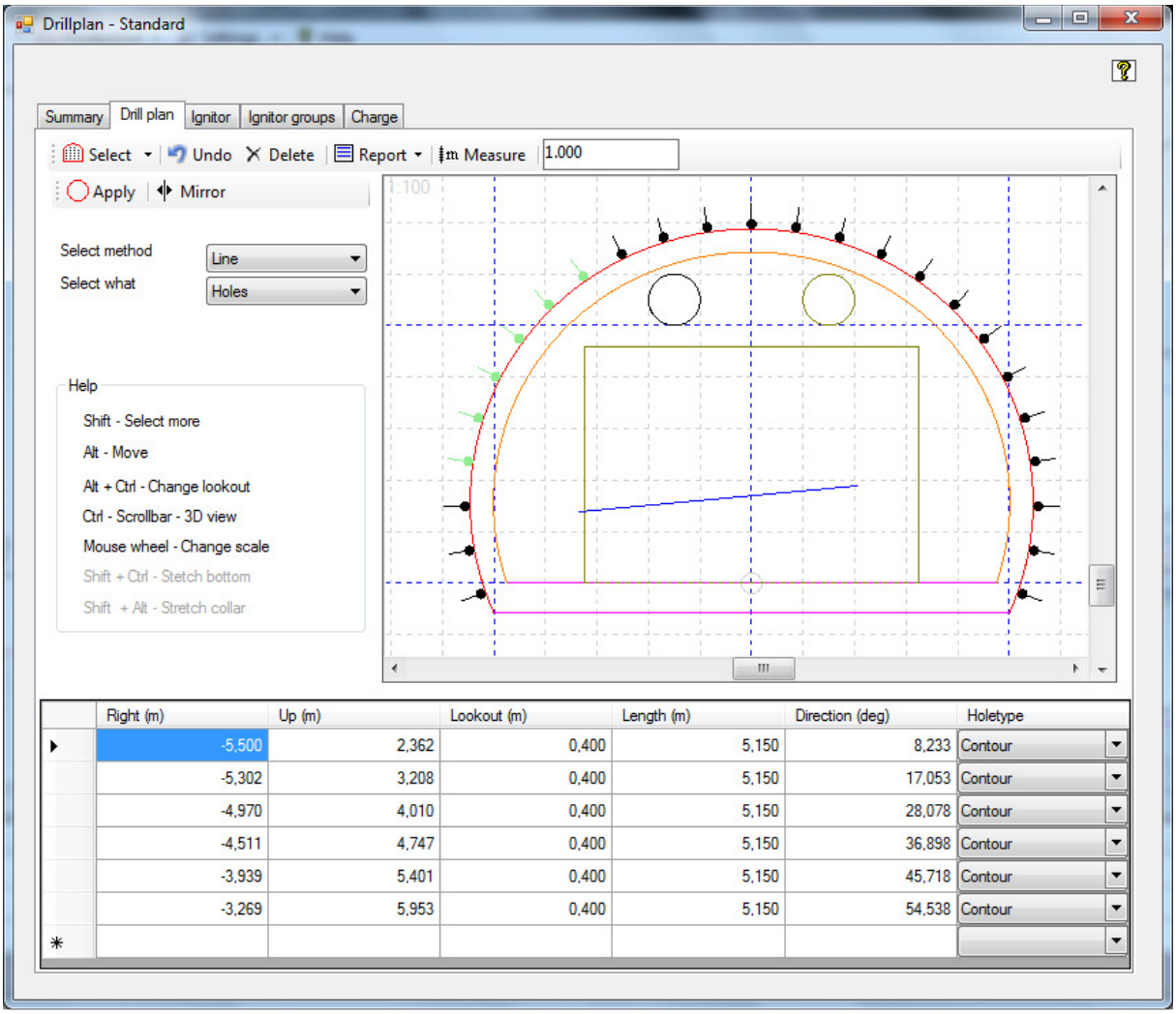


Fig. 49

Choose method and then mark the desired holes. The marked holes will turn up green on the screen and will also appear in the table.

The Help on the left side gives an over view over quick tools.

To use the last two quick tools the method has to be “single”.

1.6 *Sequence and rotation*

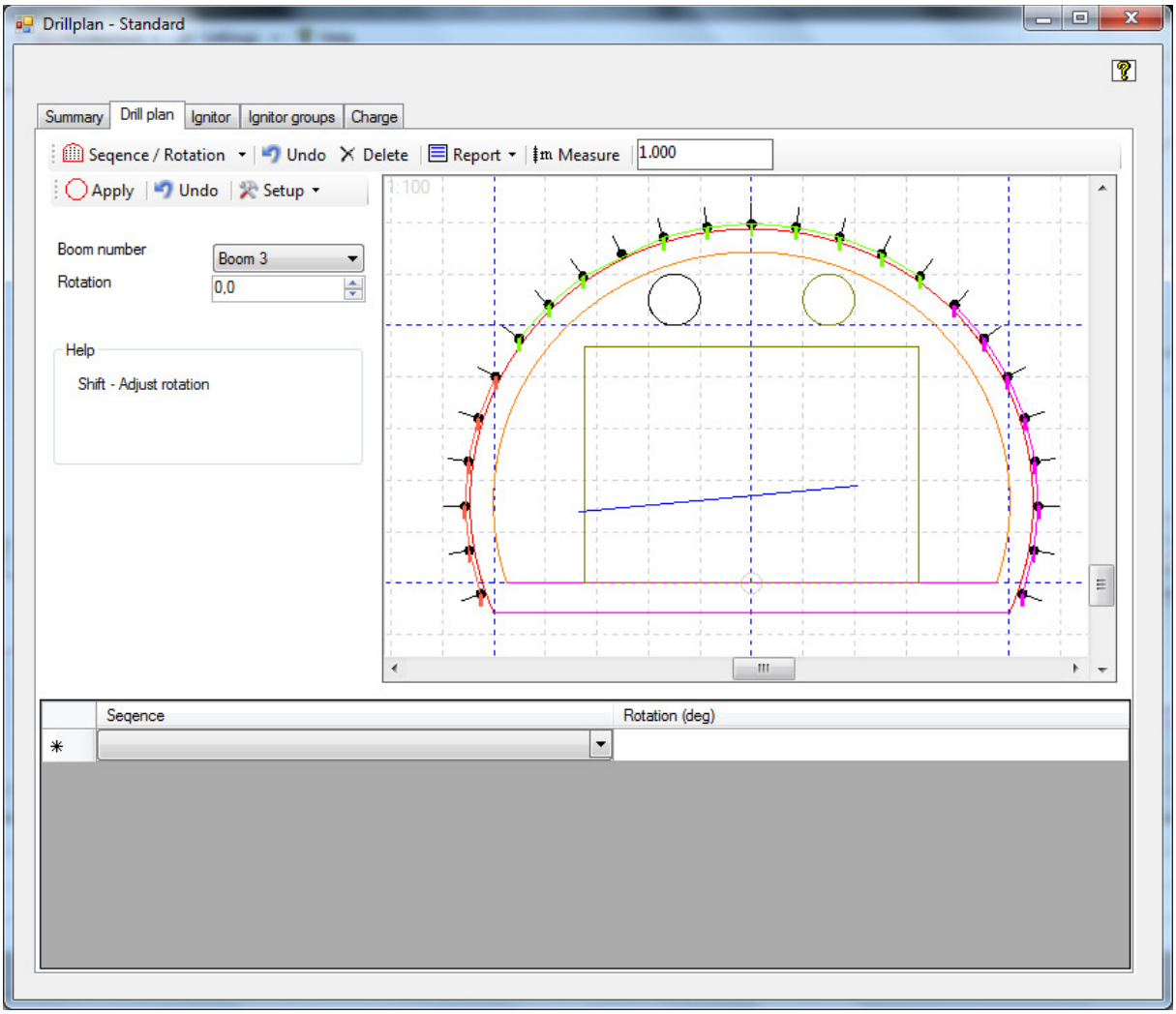


Fig. 50

Choose the boom for the sequence. When a hole is marked: Hold down the Shift button and the left mouse button to change the rotation.

1.7 *Automatic generated drill plan*

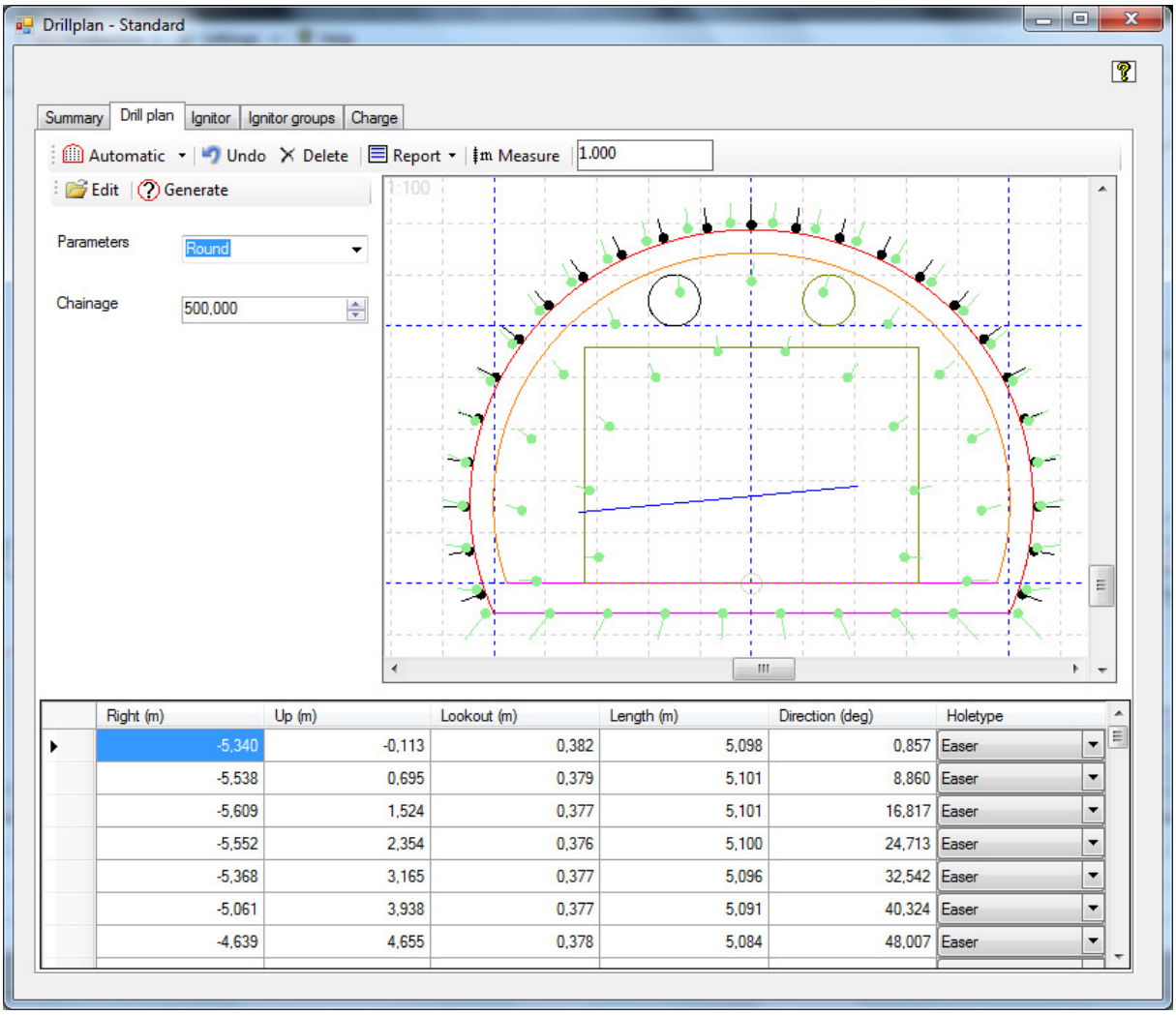


Fig. 51

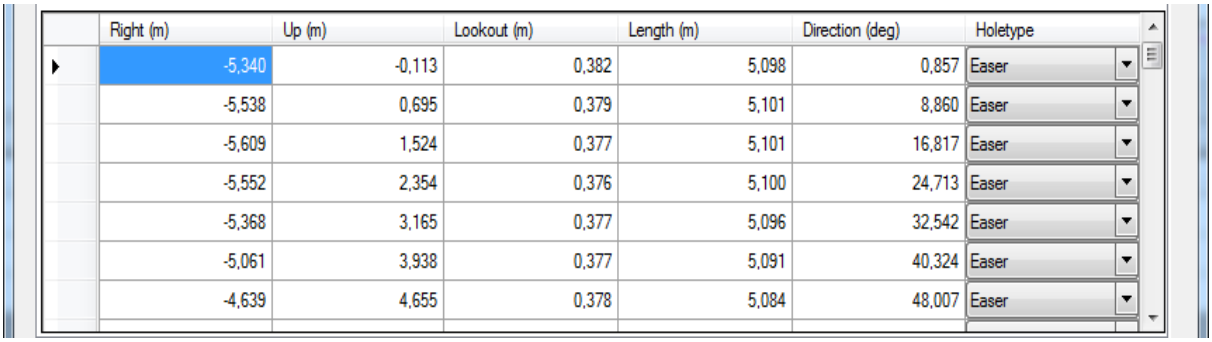
Load the parameters by choosing Generate. Also choose which parameter set to use and the chainage to put it.

The parameters in the excel file can be adjusted to fit the users need:

- Choose Edit
- Excel will start
- Change the desired values
- Save the file.
- Read in the new parameters.

1.8 *Operations in the table*

Table:



Right (m)	Up (m)	Lookout (m)	Length (m)	Direction (deg)	Holetype
-5,340	-0,113	0,382	5,098	0,857	Easer
-5,538	0,695	0,379	5,101	8,860	Easer
-5,609	1,524	0,377	5,101	16,817	Easer
-5,552	2,354	0,376	5,100	24,713	Easer
-5,368	3,165	0,377	5,096	32,542	Easer
-5,061	3,938	0,377	5,091	40,324	Easer
-4,639	4,655	0,378	5,084	48,007	Easer

Fig. 52

There are several ways to change the values in the table:

Directly type values in each cell.

Right click on the column header to change values on the entire column.

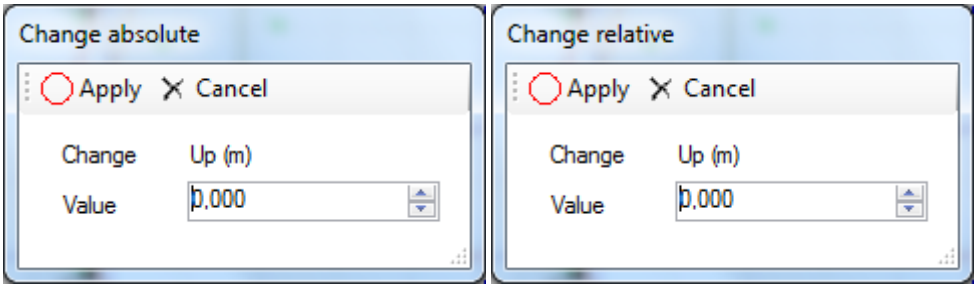


Fig. 53

By right clicking in the table the following menu will appear. Here the user can choose to show more columns, delete and copy / paste in the table.

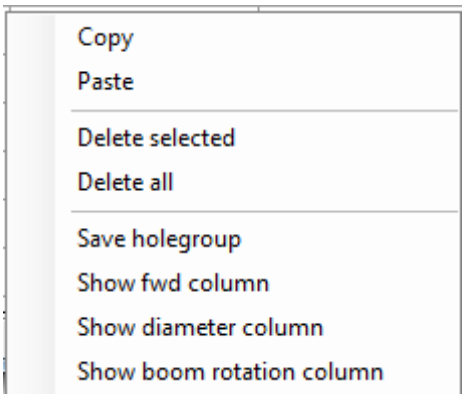


Fig. 54

1.9 *Ignitor*

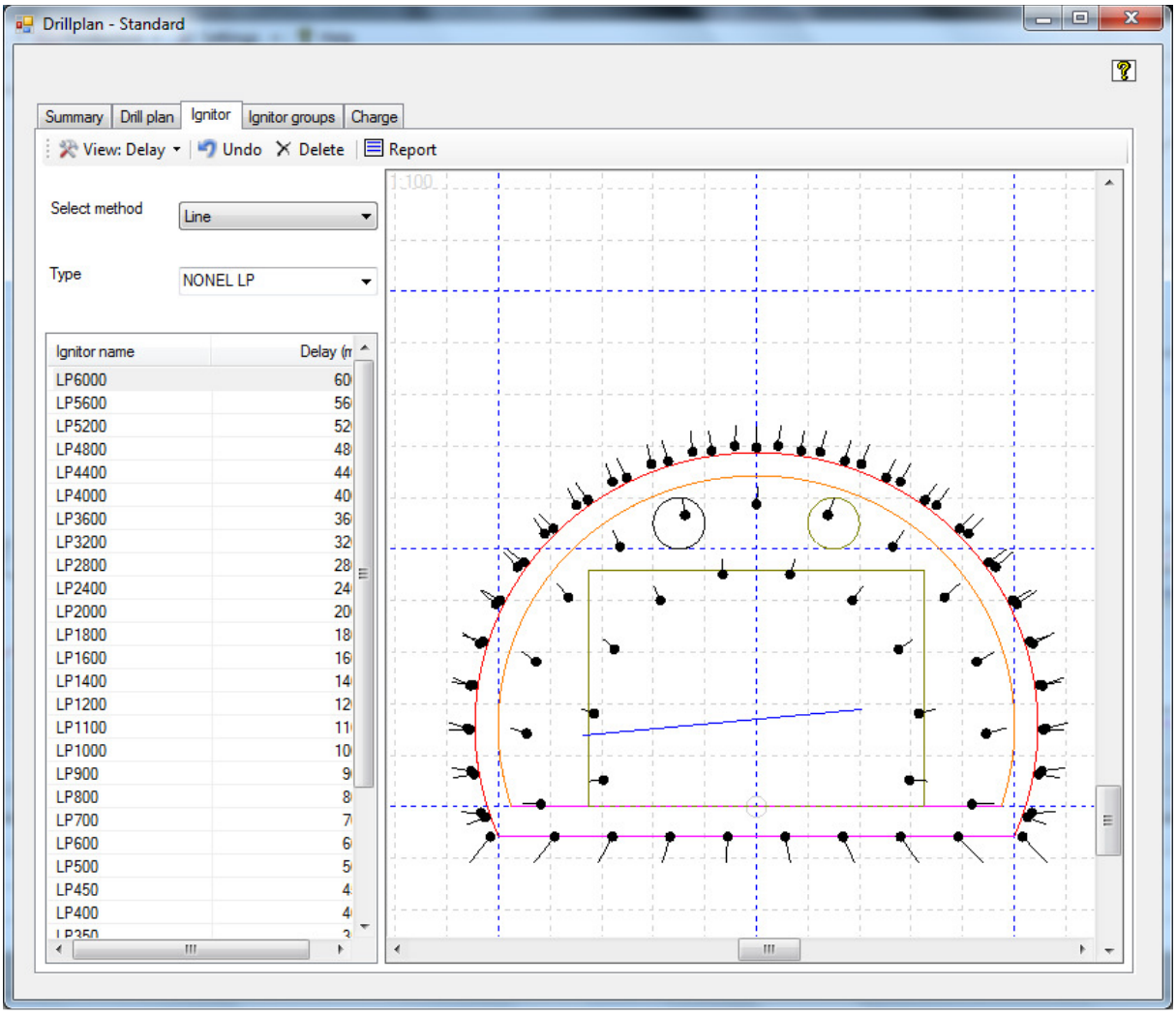


Fig. 55

Choose method to mark the holes for the ignitors.
Type: Ignitor type.
View: Delay or ignitor name in the graphics.
Report: Makes an excel report with ignitors.

1.10 *Ignitor Groups*

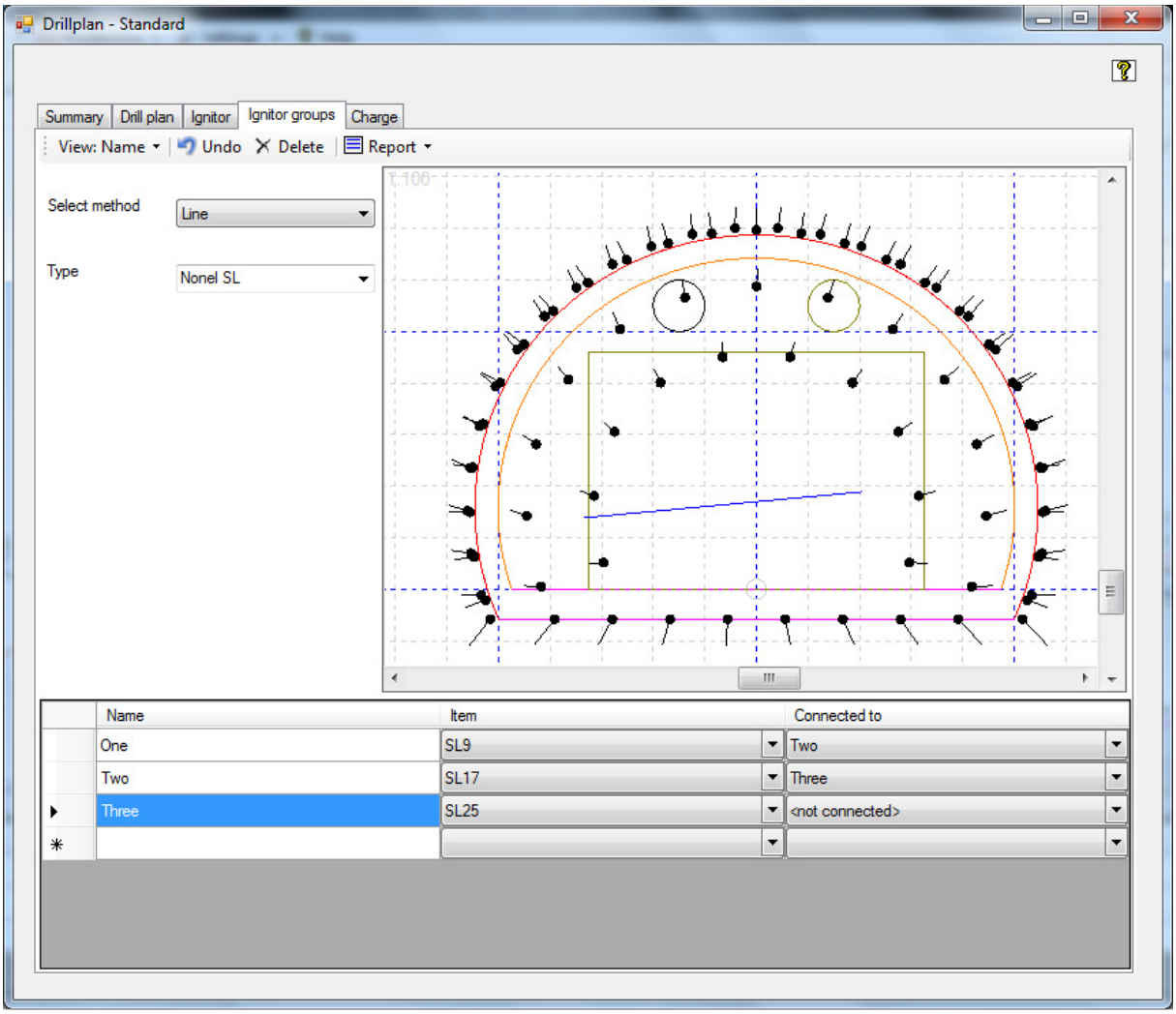


Fig. 56

Choose method to mark the holes for the ignitors.

Type: type of delayer.

Name: A free given name on the group.

Connected to: the connection from this group and to the next. The user must type in several groups in order to get more groups to choose from.

View: Group name or total delay for the hole.

Report: Makes an excel or Visio report with ignitor groups.

1.11 *Charge plan*

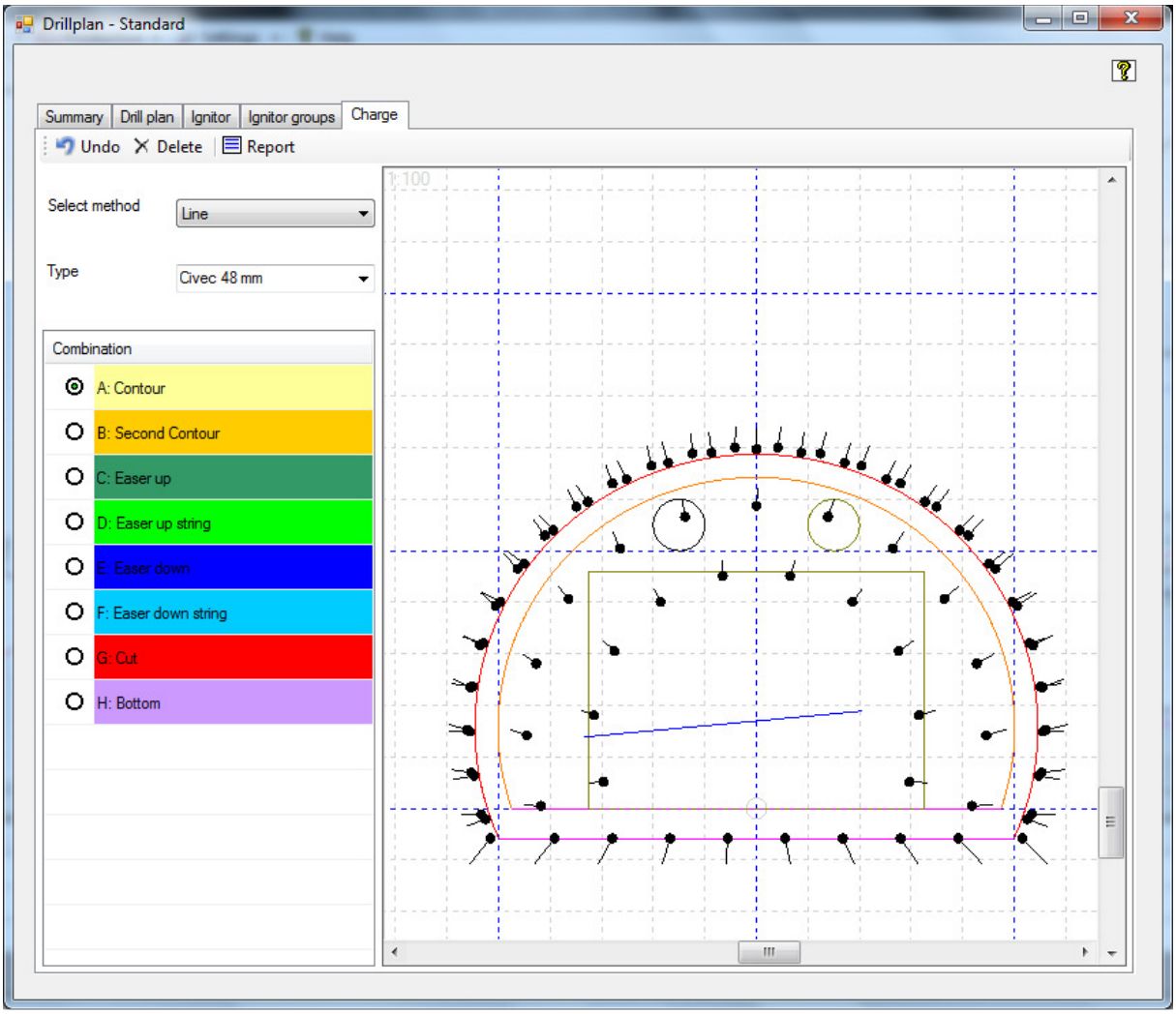


Fig. 57

Choose method to mark the holes for the charge.

Type: Different types of charge.
Report: Makes an excel report with the actual charge in each marked hole.

Standard values used are from Orica.

As built geometry

1 Overview

The as built geometry module is used to control the tunnel geometry and create reports of over and underbreak, including volumes and areas in a tunnel. There are two main screens, the first one gives an overview of log files, both from a Bever Win 3D profiler and other scanner units, such as total stations and scanners. The second one gives a view of the scanning, graphically. All the settings and the different reports are also in the second screen.

2 Tunnel log overview

The tunnel log overview screen:

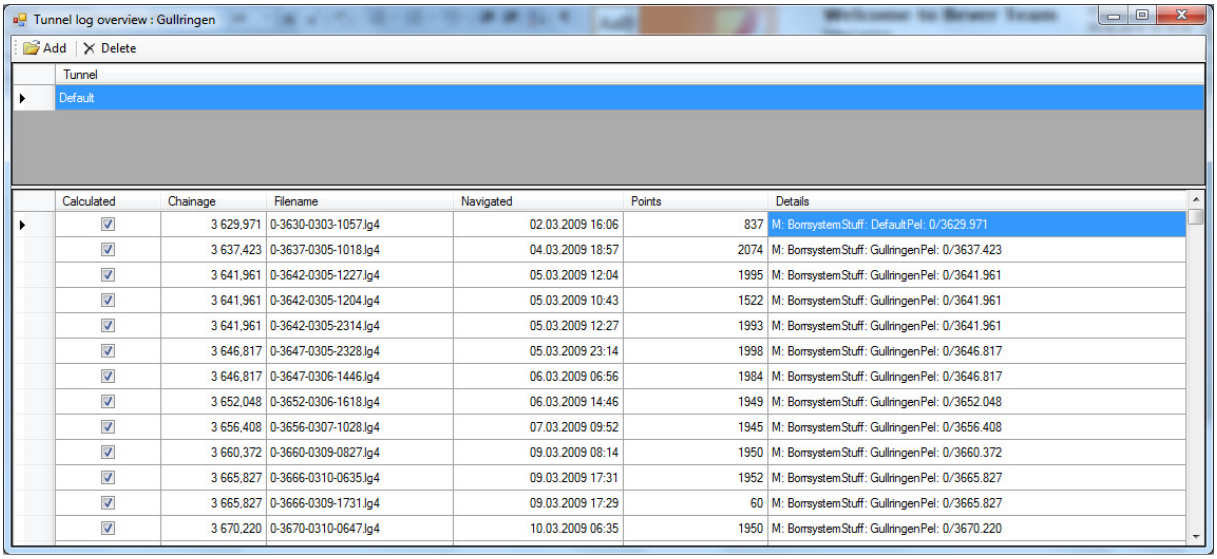


Fig. 58

A list of the different tunnels in the project are displayed in the top window. In Fig. 58 there is only one. Mark the desired tunnel and the log files connected to the selected tunnel will appear in the bottom window.

To add new files just click on the Add button in the upper left corner. An explorer window will then appear. Navigate to where the log files are, mark the ones to import and click Open. In the dialog box the user can also choose different file types.

- .LG4 Bever Win 3D Profiler
- .LG5 Atlas Copco Win 3D Profiler
- .KOF text based file
- .PXY text based file
- .SVY Leica Scanner text based file

The new files will automatically be sorted along the horizontal alignment. It is also possible to click on the header over each column to sort by number of point, date, chainage and so on.

To delete log files, mark the ones that should be deleted and press the Delete button on upper left corner. Only the one or ones that is marked will be deleted.

If right clicking on a log file the following menu will appear Fig.59:

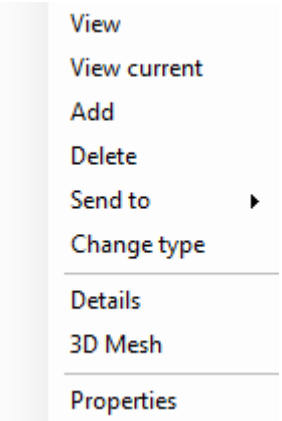


Fig. 59

View – this will open the Profiler log viewer and display all log files.
View current – this will open the profiler log viewer and show the current log.
Add – this will open the add log files dialog window.
Delete – this will delete the marked log file.
Send to – this will allow the user to save the log file in another folder.
Change type – here the point type code can be changed.
Details – this will open the Profiler log viewer.
3D Mesh – this will show the log file in a 3D mesh.
Properties – this will show details about the log file, see Fig. 60. Some values are only valid from the Bever Win 3D profiler.

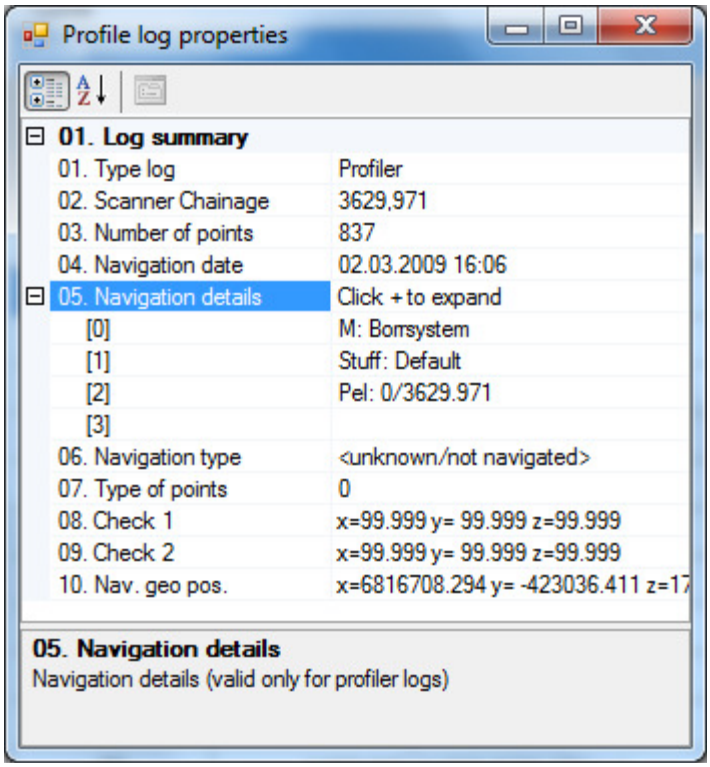


Fig. 60

3 Profile log viewer

The main window shows a picture of the contour together with scanned data. Optional production data can also be shown. The different point types and information about these can be seen on the right side. On the top menu the user can step along the alignment, choose to report and do various settings under the Tools button. The field under the graphical display are for comments and marking in the graphical view. Note that this can only be done with the model mode switch off.

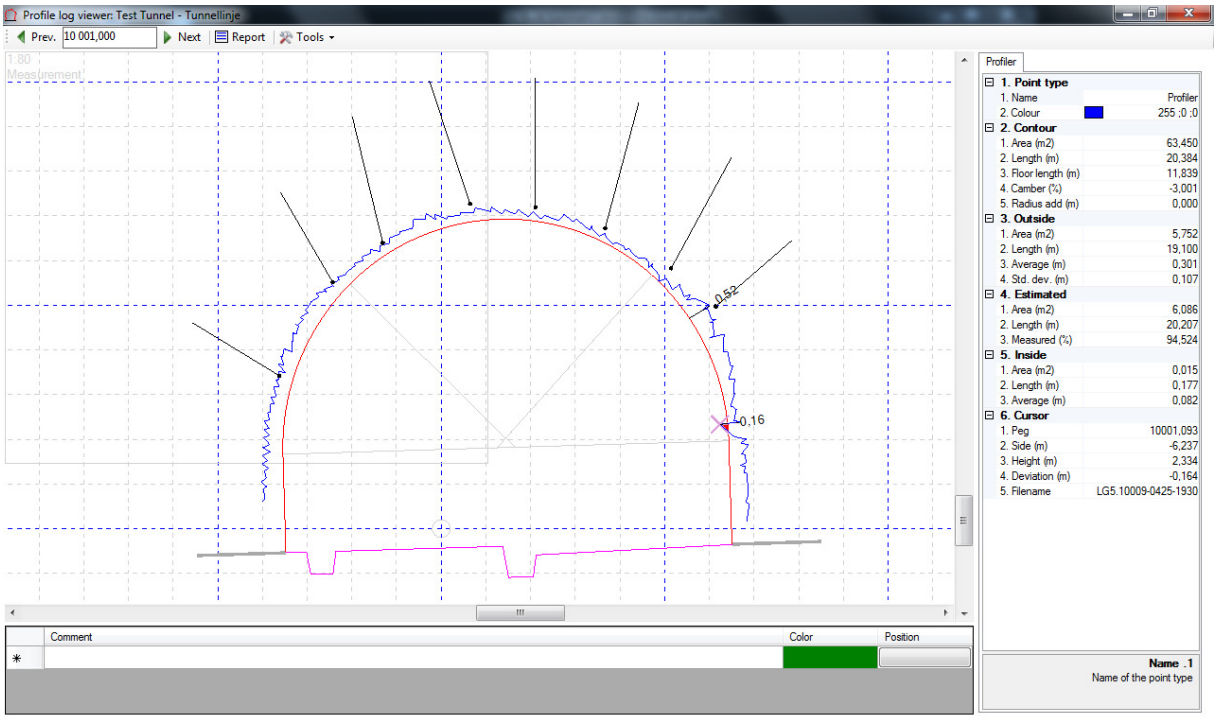


Fig. 61

To zoom in and out, use the scroll wheel on the mouse or the pad.

To walk along the alignment the user can use the Prev. and Next buttons in the upper left corner. It is also possible to type in a chainage number directly in the box. For faster movement, hold down the ALT + arrow down/up buttons.

To choose a scanned point along the contour just click on the desired point or hold down the ALT + arrow left/right buttons. When this is done the values to the right, under the "cursor" header will change.

To comment in the graphical window just type in the desired comment. Click on the color to change this and click on the position and thereafter on the contour to set a circular marker in the graphical window. To delete this, just mark the comment line and push the delete button or right click in the window and choose Restore from the menu.

Right click menu in graphical window, Fig 62:

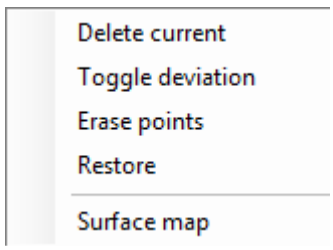


Fig. 62

Delete current: Will delete the current point where the marker are.

Toggle deviation: Will set the deviation on current position in the graphics.

Erase points: Will bring up an eraser. To turn it off, right click and choose Erase points again.

Restore: Will restore any erased points and remove any comments in this session.

Surface map: Will bring up a flattened view of the tunnel with the current production holes on it, e.g. rock support bolts. See Fig 63.

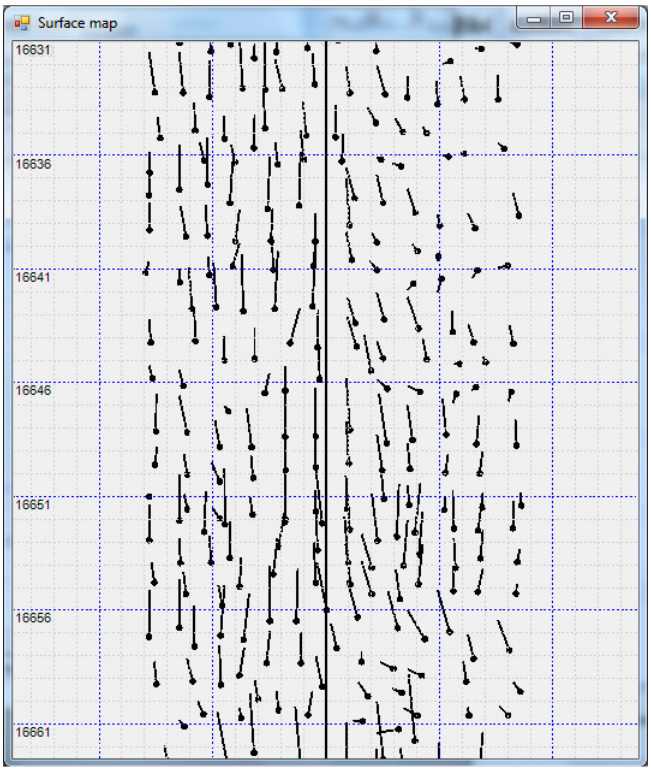


Fig. 63

By right clicking on one of the logs in the surface map the Move production holes dialog box will show. Here the production holes can be moved. The whole log or just within a timeframe. Start values will give the actual desired movement and the End values will give the direction.

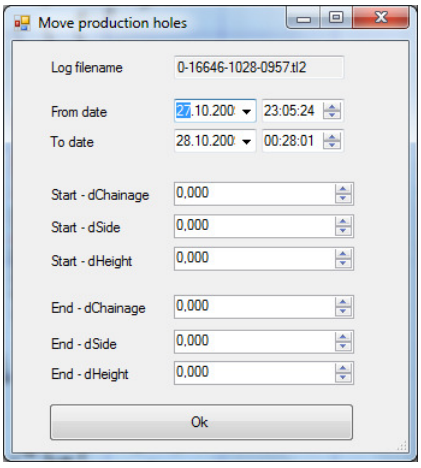


Fig. 64

3.1 *Tools*

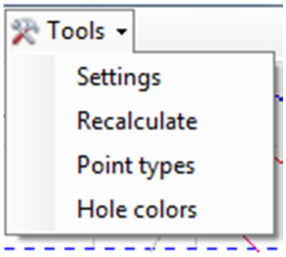


Fig. 65

Settings: Various settings for calculations, views, graphics and filters.
Recalculate: Must be done after adjusting various settings. Choose between the complete tunnel or a specified length.
Point types: Settings for displaying point types. E.g. color.
Hole colors: Settings for displaying production data (Drilled holes).

3.1.1 Settings

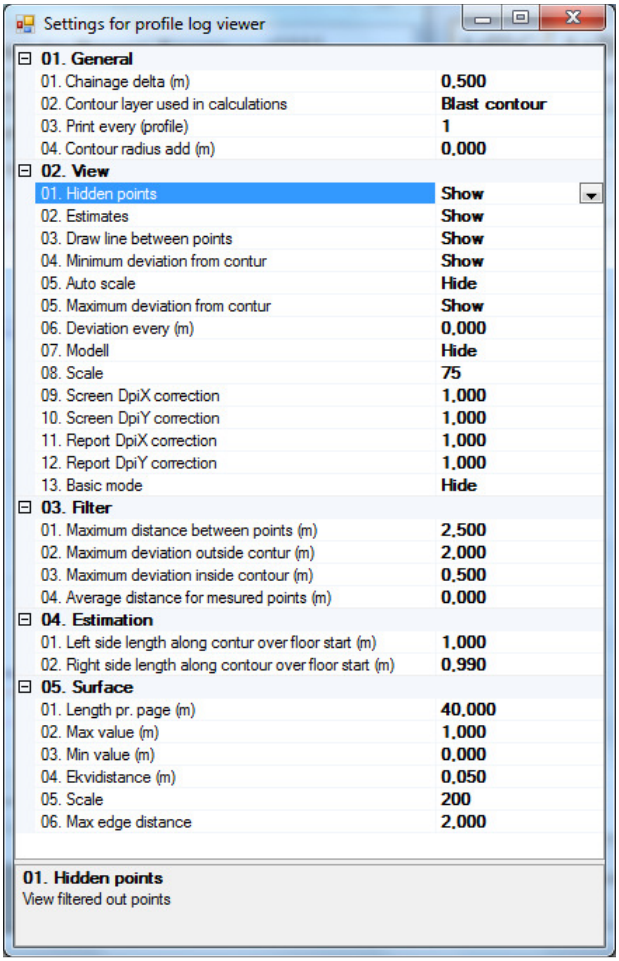


Fig. 66

To change values, type directly in the table. To turn on and off, choose hide or show.

01 General

01 Chainage delta (m) — **The** step length along the alignment. Standard length are 0,5 meters. This will display all the points at the actual chainage ± 0,25 m. If the value is set to 1 meter then all the points ± 0,5 meters will be displayed in the graphics. The program will also use this value when calculating over and underbreak, so it is therefore important to set this as small as possible.

02 Contour layer used… — **Choose** which layer to use in calculations.

03 Print every (profile) — **If** the chainage delta is set to 0,5 meters and a print for every 10 meters is needed this can be set to e.g. 20.

04 Contour radius add (m) — **Can** be used to calculate and display an offset to the current contour layer. Both positive and negative values can be used.

02 View

01 Hidden points — **To** hide or show the points that is outside the values set in the "Filter" dialogue.

02 Estimates — **This** is to turn on/off estimates in calculations. The values is set in the "Estimation" dialogue.

	Calculations are done between where the estimates are set.
03 Draw line between points	**Turn** on/off lines between the scanned points.
04 Minimum deviation from…	**Turn** on/off a graphical value where the scan is closest to the theoretical surface.
05 Auto scale	**For** printing. The contour will automatically be fitted in the print window. (The grey square in the graphically view).
06 Maximum deviation…	**Turn** on/off graphical value where the scan is furthest away from the theoretical surface.
07 Model	**This** can be used to smoothen the surface on the scan. A triangulated model is made. From the model points and lines will be drawn along the contour with a 50 mm distance between them. No changes can be made and saved in this mode.
08 Scale	**The** standard scale when opening the viewer.
09-10 Screen corrections	**Can** be used to set a factor to correct the scale on the graphical view on screen.
11-12 Report corrections	**Can** be used to set a factor to correct the scale on the printout.
13 Basic mode	**Displays** only the basic information in the log file.
03 Filter	
01 Maximum distance…	**If** the distance between two points exceed this value there will not be drawn a line between them.
02 Maximum deviation…	**All** point outside this value will not be used in calculations. They can also be hidden if the "Hidden points" is turned on.
03 Maximum deviation**…**	**All** point outside this value will not be used in calculations. They can also be hidden if the "Hidden points" is turned on.
04 Average distance for..	**A** filter. If a value is given here the program will take all the points within the radius and make one point with an average value. Mostly used for large scanner files. > 500 000 points.
04 Estimation	
01 Left side length…	**Where** to set the start of the estimated values/calculations. If there are no points where the estimate start the program will take the average deviation and use that value where there are missing points.
02 Right side length…	**Where** to set the end of the estimated values/calculations. If there are no points where the estimate ends the program will take the average

	deviation and use that value where there are missing points.
05 Surface	
01 Length per page (m)	**The** length along the alignment that will be printed per page on the report.
02 Max value (m)	**Outside** perimeter. Points outside this value will not be displayed.
03 Min value (m)	**Inside** perimeter. Points outside this value will not be displayed.
04 Equidistance (m)	**Steps** of color within the max and min value.
05 Scale	**Scale** of the surface.
06 Max edge distance	**Defines** the longest length of a leg in the triangles used to create the surface. There will not be created a surface if the lengths are longer than this value.

3.1.2 Recalculate

If major changes are done in the settings menu, the hole types are changed or if some of the log files are deleted then a recalculation must be done. Choose the whole tunnel or a section of the tunnel.

3.1.3 Point types

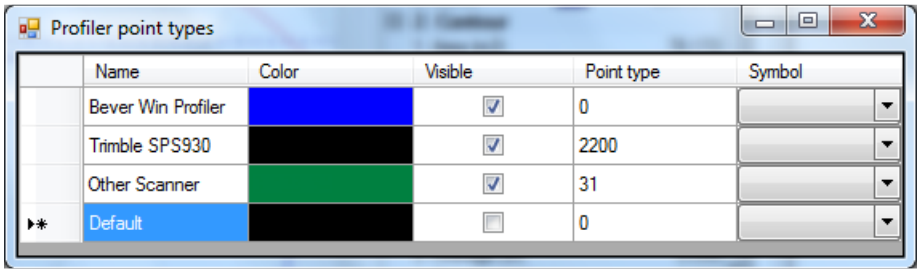


Fig. 67

Name of the different types can be defined. Color can be changed by double clicking on the color.
Visible indicates whether the points are visible or not.
Point type is the actual coding of the scanned points. If the points don`t have any codes attached to them they will automatically get the code 31. The codes can also be changed in the log overview window.
The graphic point symbol is a small dot, if the user want another symbol it can be changed under the Symbol column.

! If there are a number of different point types they all can be displayed as one if the point type in the first field in the Point type column is set to 1000.

3.1.4 Hole colors

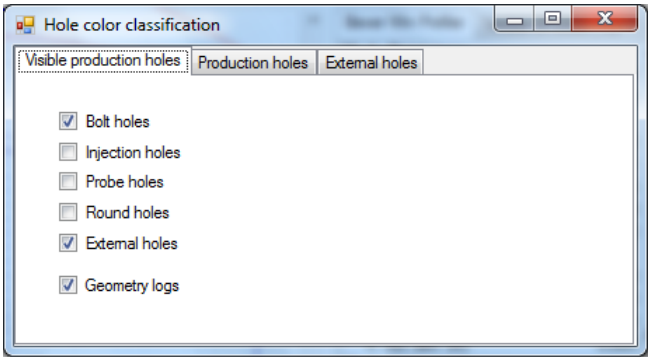


Fig. 68

Here the viewing of different production holes in the graphical overview can be turned on and off.
The first sheet defines the different hole types.
External holes are holes that are measured and imported from a non production file.
The geometry logs must also be turned On in order to view them in the graphical window.

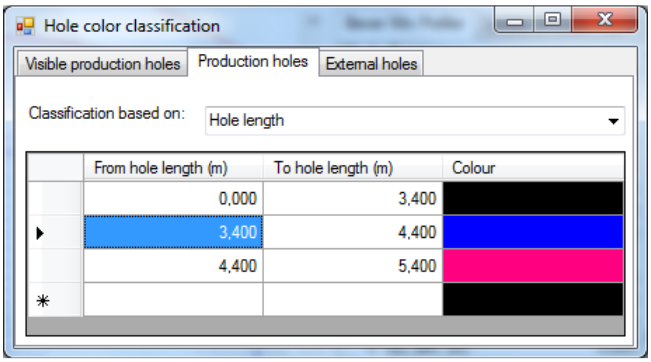


Fig. 69

Fig. 69 shows the sheet where the coloring and viewing of the different production holes can be classified. There are two types of classification; based on hole length or based on hole type.
Type in different lengths and choose the color.

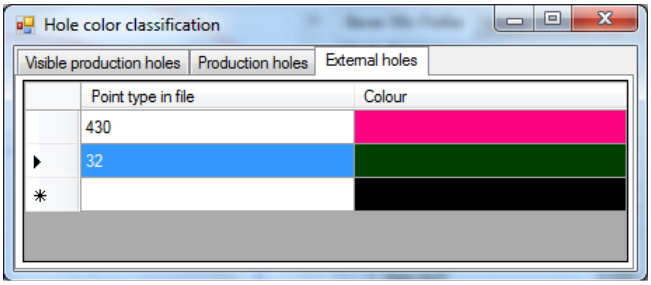


Fig. 70

Fig. 70 shows the last sheet where external hole types can be defined. Type in the code on the points from the file and choose the color.

3.2 *Report*

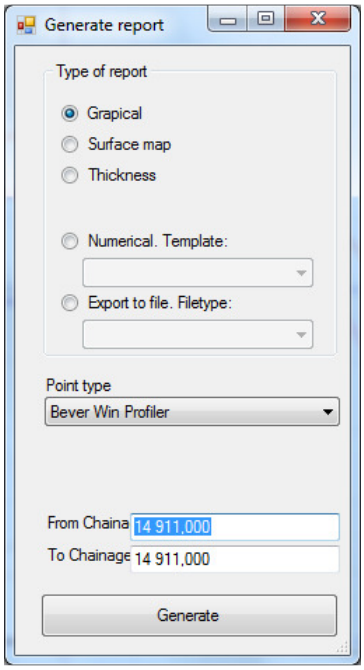


Fig. 71

Here different types of reports can be generated. It is also possible to export points to different text based files (.KOF and .PXY).
From and to chainage must be typed in for all the reports and export.

Graphical report will generate a report of the cross section/contour.

Surface report will generate a surface map/flattened view of the tunnel containing the scanned surface and production holes. These must however be turned on in the hole color table (Fig. 68). The surface map is a function of the distance between the scanned surface and the theoretical contour.

Thickness report will generate a map/flattened view of the tunnel containing the two scanned surfaces. Two types of holes must be chosen. The surface map is a function of the distance between the two scanned surfaces.

Numerical report either a volume report or a estimated bolt length report. Choose template; *extended* or *standard* for volume and *bolt estimates* for the bolt report.
Extended contains more information in the calculations than the standard. Volume are calculated by area x length. See Fig. 72.

Export to file type will export data from and to a specified chainage to a text based file.

All of the reports are Excel based, so it is possible to go in and change the template if necessary. This must however be done by experienced Excel and computer people.

4 Report examples

Excel volume report example. Type Standard:

				Tunnel	From	To
Profiler report				**0**	**16625**	**16725**
Project:	**Sky-Langangen Tunnels**		**Length of tunnel calculatet:**		**100,5**	
Sign:	**The Chief Surveyor!**					
Date:						
Comments:	**none**					
			(1) Measured area			
			(2) Estimated area			
			Overbreak floor is not included!			
Comments:					**Interval (m)**	
Sign:					0,5	
Teoretical values	**Total**	**pr. meter**	**Measured**		**Total**	**pr. meter**
Contour volume (m^3)	7856,263	78,17	**Omit sections without data**			
Trench volume	100,500		Overbreak scan data (1)		830,61	8,26
Volum total (m^3)	7956,763					
Length contour	2279,452	22,68	Measured-Tunnelmeter(1)		96	0,96
			Total overbreak (1)		869,55	8,65
Length floor	1222,565	12,16	Total volume tunnel(m3) (1)		8725,81	86,82
Length total	3502,017	34,85	Overbreak percent (1)			11,07
			Overbreak estimated measured (2)		844,05	8,40
			Measured-Tunnelmeter (2)		96	0,96
OutArea			Total Estimatet overbreak (2)		883,62	8,79
Condition			Total volume tunnel(m^3) (2)		8739,88	86,96
>0						
No of slices			Overbreak percent (2)			11,25
192						
			Underbreak (m^3)		14,1501207	0,140797221
InArea						
Condition						
>0						

Fig. 72

4.1 *HEADING*

Site – Project or site, from the excel sheet; RawData1.
Tunnel – Specific tunnel, from the excel sheet; RawData1.
Date – Date, from the excel sheet; RawData1.
Comment – Comment, from the excel sheet: RawData1.
Calculated length in meter – The calculated length, from the excel sheet; RawData3, plus the last area.

4.2 *LEFT SIDE (theoretical values)*

Comment - Place to type in a comment.
Signature – Place to type in operator
Contour volume – Total volume of calculated tunnel. Area of theoretical contours times steps on tunnel line (Station, Chainage). From the excel sheet RawData3.

Trench volume – The operator must define the size of the trench in the formula. If there are none the volume is zero.
Total volume - Contour volume plus ditch volume.
Contour length – The length along the contour from the defined floor on the left side and to the defined floor on the right side. From the excel sheet RawData3.
Perimeter floor – The length of the floor from left to right side. From the excel sheet RawData3.
Perimeter floor – Total length around the contour, including tunnel profile and floor.
Out Area conditions – The value indicates what should be taken into the calculations of the over break. If the value is set to 0, all area of over break will be used. The value here is used in the formula in "No of slices".
No of Slices – The number of contours with over break data in it. Containing over break larger than the value set in "Out area conditions".
InArea Condition - The value indicates what should be taken into the calculations of the under break. If the value is set to 0, all area of under break will be used. The value here is used in the formula in "Total measured inside" on the right side of the sheet.

4.3 *RIGHT SIDE (Measured values)*

Omit sections without data – Sections without any data.
Overbreak measured – All sections with over break are summoned. From the excel sheet RawData3.
Measured tunnel length – Length of tunnel containing scanned data.
Total overbreak – Estimated value including the sections without measured data. It is an average of the sections with data times the sections without.
Total volume tunnel – Theoretical volume and over break volume summoned.
Overbreak % - The percentage over break compared to the theoretical contour.

All the numbers above are from scanned data. The numbers below are from estimated data. The average deviation is taken and used on the parts along the contour lacking scanned data.

Overbreak total - All sections with over break are summoned. From the excel sheet RawData3.
Measured tunnel length – Length of tunnel containing scanned data.
Total estimated overbreak – Estimated value including the sections without measured data. It is an average of the sections with data times the sections without.
Total volume tunnel – Theoretical volume and over break volume summoned.
Overbreak % - The percentage over break compared to the theoretical contour.
Total measured inside – gives the value of the under break. From the excel sheet RawData3.

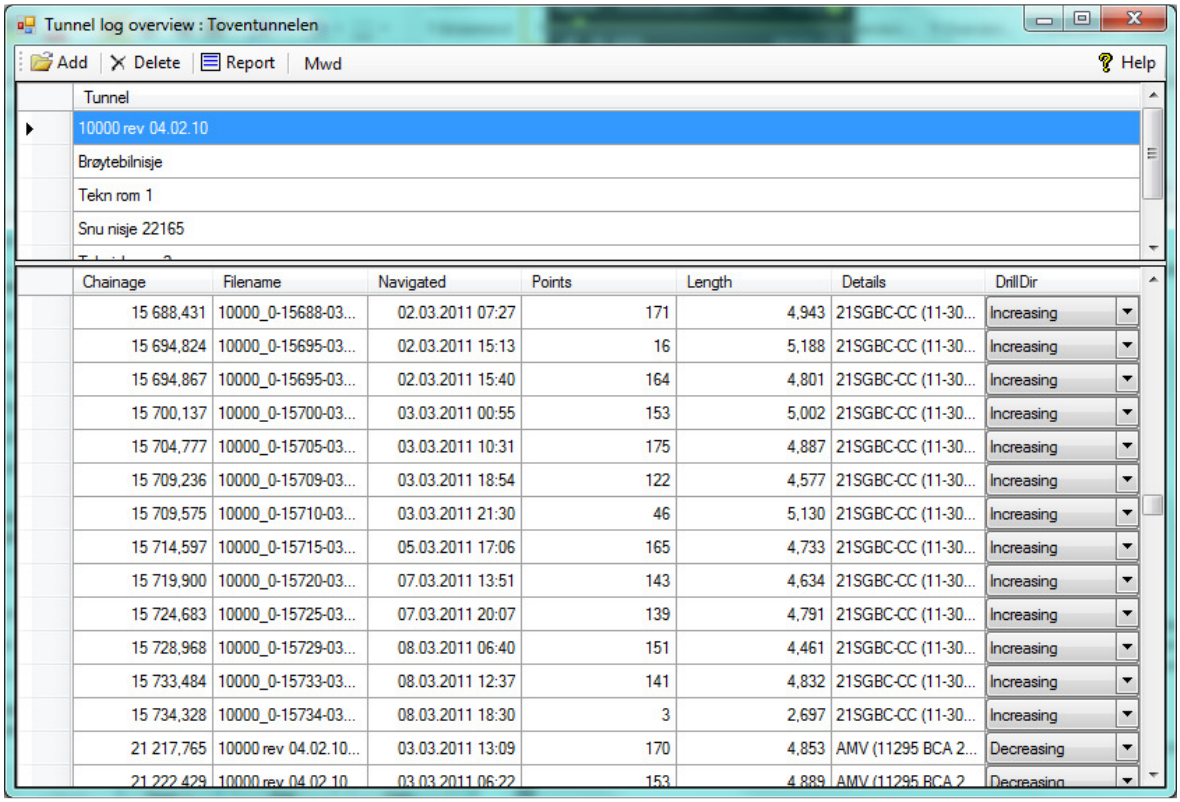
As built production

1 Overview

The as built Production module is used to show log files from data controlled jumbos such as AMV, Atlas Copco, Terex and Sandvik. The log files can be displayed graphical and together with the actual tunnel contour. Important parameters like penetration rate can be displayed from one or several holes. When opening a log file a new program will be launched. The Bever Team Tunnproduction.

2 Tunnel log overview

The tunnel log overview screen:



Chainage	Filename	Navigated	Points	Length	Details	DrillDir
15 688,431	10000_0-15688-03...	02.03.2011 07:27	171	4,943	21SGBC-CC (11-30...	Increasing
15 694,824	10000_0-15695-03...	02.03.2011 15:13	16	5,188	21SGBC-CC (11-30...	Increasing
15 694,867	10000_0-15695-03...	02.03.2011 15:40	164	4,801	21SGBC-CC (11-30...	Increasing
15 700,137	10000_0-15700-03...	03.03.2011 00:55	153	5,002	21SGBC-CC (11-30...	Increasing
15 704,777	10000_0-15705-03...	03.03.2011 10:31	175	4,887	21SGBC-CC (11-30...	Increasing
15 709,236	10000_0-15709-03...	03.03.2011 18:54	122	4,577	21SGBC-CC (11-30...	Increasing
15 709,575	10000_0-15710-03...	03.03.2011 21:30	46	5,130	21SGBC-CC (11-30...	Increasing
15 714,597	10000_0-15715-03...	05.03.2011 17:06	165	4,733	21SGBC-CC (11-30...	Increasing
15 719,900	10000_0-15720-03...	07.03.2011 13:51	143	4,634	21SGBC-CC (11-30...	Increasing
15 724,683	10000_0-15725-03...	07.03.2011 20:07	139	4,791	21SGBC-CC (11-30...	Increasing
15 728,968	10000_0-15729-03...	08.03.2011 06:40	151	4,461	21SGBC-CC (11-30...	Increasing
15 733,484	10000_0-15733-03...	08.03.2011 12:37	141	4,832	21SGBC-CC (11-30...	Increasing
15 734,328	10000_0-15734-03...	08.03.2011 18:30	3	2,697	21SGBC-CC (11-30...	Increasing
21 217,765	10000 rev 04.02.10...	03.03.2011 13:09	170	4,853	AMV (11295 BCA 2...	Decreasing
21 222,429	10000 rev 04.02.10...	03.03.2011 06:22	153	4,889	AMV (11295 BCA 2...	Decreasing

Fig. 73

A list of the different tunnels in the project are displayed in the top window. In Fig. 73 there are several tunnels. Mark the desired tunnel and the log files connected to the selected tunnel will appear in the bottom window.

To add new files just click on the Add button in the upper left corner. An explorer window will then appear. Navigate to where the log files are, mark the ones to import and click Open. In the dialog box the user can also choose different file types.

- .TL2 Bever Production log files
- .TL4 Bever Production log files
- .XML Iredes Production log files
- .LOG Atlas Production log files
- .PXY text based file
- .KOF text based file

The new files will automatically be sorted along the horizontal alignment. It is also possible to click on the header over each column to sort by number of points, navigation date, chainage and so on.

To delete log files, mark the ones that should be deleted and press the Delete button in the upper left corner. Only the one or ones that is marked will be deleted.

If right clicking on a log file the following menu will appear Fig.74:

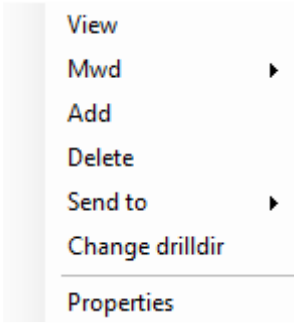


Fig. 74

View – This will open the Tunnproduction app and show the log files. The user will be asked if the tunnel line should be reused. Answer yes or no. If there are no changes in the geometry it is not necessary to reuse the line. This is for quicker response in the application.
Mwd – Opens up the Mwd module.
Add – This will open the add log files dialog window.
Delete – This will delete the marked log file.
Send to – This will allow the user to save the log file in another folder or tunnel.
Properties – Not in use.

2.1 *Report*

Click on the report button to generate a production report. The menu in Fig 75. will appear.

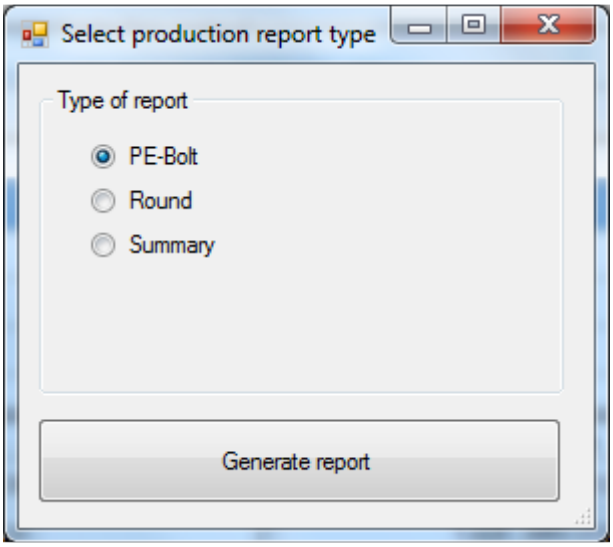


Fig. 75

2.1.1 PE-Bolt Report

This report is used for documenting fixed bolts/anchors. Depending on the inner lining it can be bolts for rock support, membranes, concrete elements, various attachments and other water and frost protection bolting.

PE-Bolt Report — Bever Control AS

Drilled by.
Date: 02.03.2009 12:56:28
Direction: Increasing
Drill plan: Chainage 4200 - 4300

Tunnel: 13011_Dolvik_N_XML-0
Number:
Station: 4207,768

1 — 2 — 3 — 4

	4207,77		4208,97		4210,16		4211,36		4212		4213,75	
1	1,00	0,62	1,00	0,66	1,20	0,54	1,20	0,60	1,40	0,68	1,20	0,56
2	1,20	0,60	1,20	0,59	1,20	0,67	1,20	0,54	1,20	0,53	1,20	0,57
3	1,20	0,61	1,20	0,59	1,20	0,59	1,00	0,51	1,20	0,56	1,20	0,58
4	1,40	0,67	1,40	0,66	1,40	0,65	1,20	0,57	1,40	0,62	1,40	0,69
5	1,40	0,68	1,20	0,64	1,20	0,57	1,20	0,59	1,20	0,67	1,00	0,51
6	1,20	0,68	1,00	0,63	1,20	0,60	1,20	0,56	1,20	0,69	1,00	0,55
7	1,00	0,61	1,00	0,60	1,20	0,56	1,20	0,59	1,00	0,52	1,00	0,54
8	1,00	0,55	1,00	0,60	1,20	0,53	1,40	0,59	1,20	0,58	1,20	0,59
9	1,20	0,56	1,20	0,56	1,20	0,59	1,40	0,71	1,20	0,55	1,20	0,59
10	1,20	0,67	1,20	0,65	1,20	0,53	1,40	0,64	1,20	0,60	1,60	0,65
11	1,20	0,66	1,40	0,57	1,60	0,59	1,40	0,61	1,40	0,60	1,40	0,58

Fig. 76

1. The bolt number along the contour, numbered from the lower left corner.
2. Station number.
3. Length of bolt to be mounted.
4. Actual drilled length.

2.1.2 Round Report

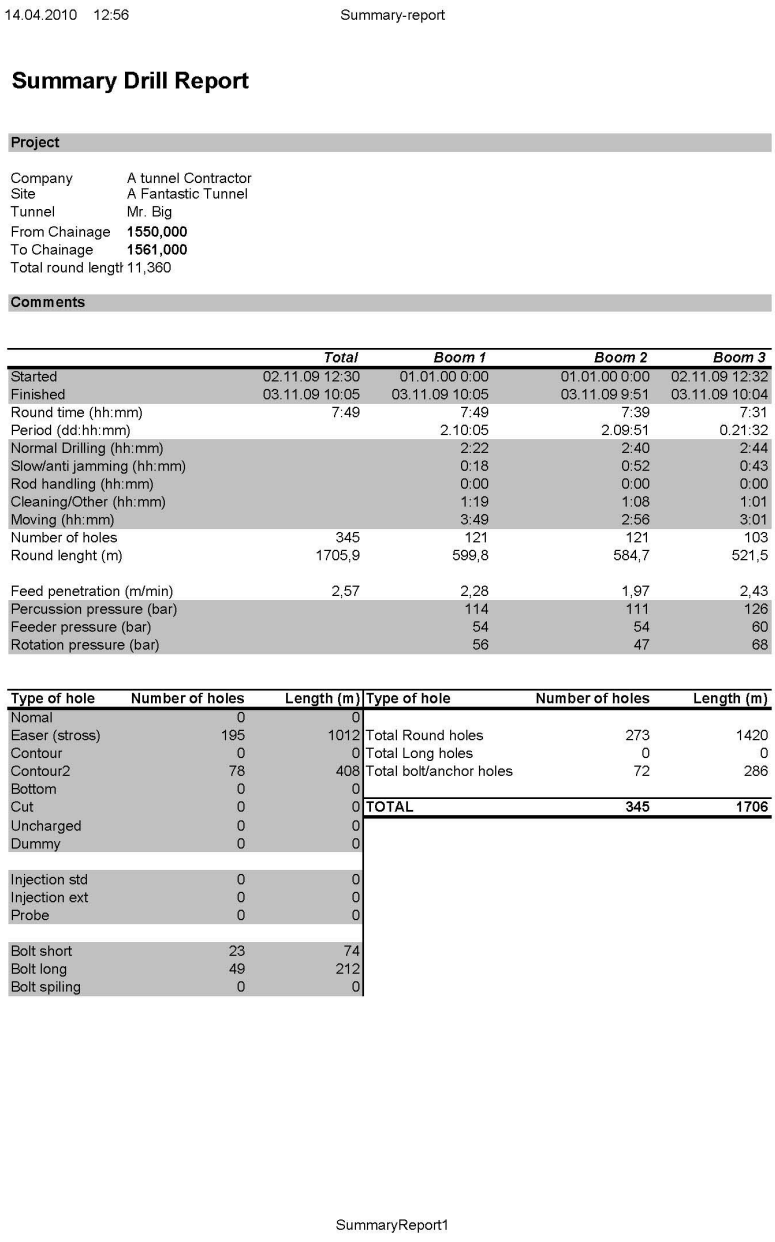
A report where various average values from the jumbo are summoned.

	A	B	C	D	E	F
1	**Round Report**					
2						
3						
4						
5						
6	**Project**					
7						
8	Company	Hæhre Entreprenør				
9	Site	Sky-Langangen Tunnels				
10	Tunnel	Sandbekk South				
11	Chainage	**16622,764**				
12	Round length	5,028				
13	Jumbo ID	AMV (11295 BCA 24.51)				
14						
15	**Comments**					
16						
17						
18						
19						
20						
21	**Round**					
22			***Total***	***Boom 1***	***Boom 2***	***Boom 3***
23	Started		02.11.09 12:30	02.11.09 12:31	02.11.09 12:30	02.11.09 12:32
24	Finished		02.11.09 15:26	02.11.09 15:11	02.11.09 15:26	02.11.09 15:08
25	Time used (hh:mm)		2:56	2:39	2:56	2:36
26						
27	Normal drilling (hh:mm)			1:10	1:22	1:20
28	Slow/anti jamming (hh:mm)			0:08	0:30	0:10
29	Rod handling (hh:mm)			0:00	0:00	0:00
30	Cleaning/Other (hh:mm)			0:28	0:34	0:27
31	Moving (hh:mm)			1:14	0:58	1:04
32						
33	Number of holes		169	58	58	53
34	Round length (m)		849,760	298,265	280,639	270,857
35						
36	Feed penetration (m/min)		3,17	3,53	2,89	3,14
37	Percussion pressure(bar)			170	166	166
38	Feeder pressure (bar)			81	81	83
39	Rotation pressure (bar)			85	71	82
40						

Fig. 77

2.2 *Summary*

A report who also generate more hole details about the drilling. Mark the desired log files in the overview and generate the report.



14.04.2010 12:56 Summary-report

Summary Drill Report

Project

Company	A tunnel Contractor
Site	A Fantastic Tunnel
Tunnel	Mr. Big
From Chainage	**1550,000**
To Chainage	**1561,000**
Total round lengt	11,360

Comments

	Total	Boom 1	Boom 2	Boom 3
Started	02.11.09 12:30	01.01.00 0:00	01.01.00 0:00	02.11.09 12:32
Finished	03.11.09 10:05	03.11.09 10:05	03.11.09 9:51	03.11.09 10:04
Round time (hh:mm)	7:49	7:49	7:39	7:31
Period (dd:hh:mm)		2.10:05	2.09:51	0.21:32
Normal Drilling (hh:mm)		2:22	2:40	2:44
Slow/anti jamming (hh:mm)		0:18	0:52	0:43
Rod handling (hh:mm)		0:00	0:00	0:00
Cleaning/Other (hh:mm)		1:19	1:08	1:01
Moving (hh:mm)		3:49	2:56	3:01
Number of holes	345	121	121	103
Round lenght (m)	1705,9	599,8	584,7	521,5
Feed penetration (m/min)	2,57	2,28	1,97	2,43
Percussion pressure (bar)		114	111	126
Feeder pressure (bar)		54	54	60
Rotation pressure (bar)		56	47	68

Type of hole	Number of holes	Length (m)
Nomal	0	0
Easer (stross)	195	1012
Contour	0	0
Contour2	78	408
Bottom	0	0
Cut	0	0
Uncharged	0	0
Dummy	0	0
Injection std	0	0
Injection ext	0	0
Probe	0	0
Bolt short	23	74
Bolt long	49	212
Bolt spiling	0	0

Type of hole	Number of holes	Length (m)
Total Round holes	273	1420
Total Long holes	0	0
Total bolt/anchor holes	72	286
TOTAL	**345**	**1706**

SummaryReport1

Fig. 78

3 TunnProduction

3.1 *Main Screen*

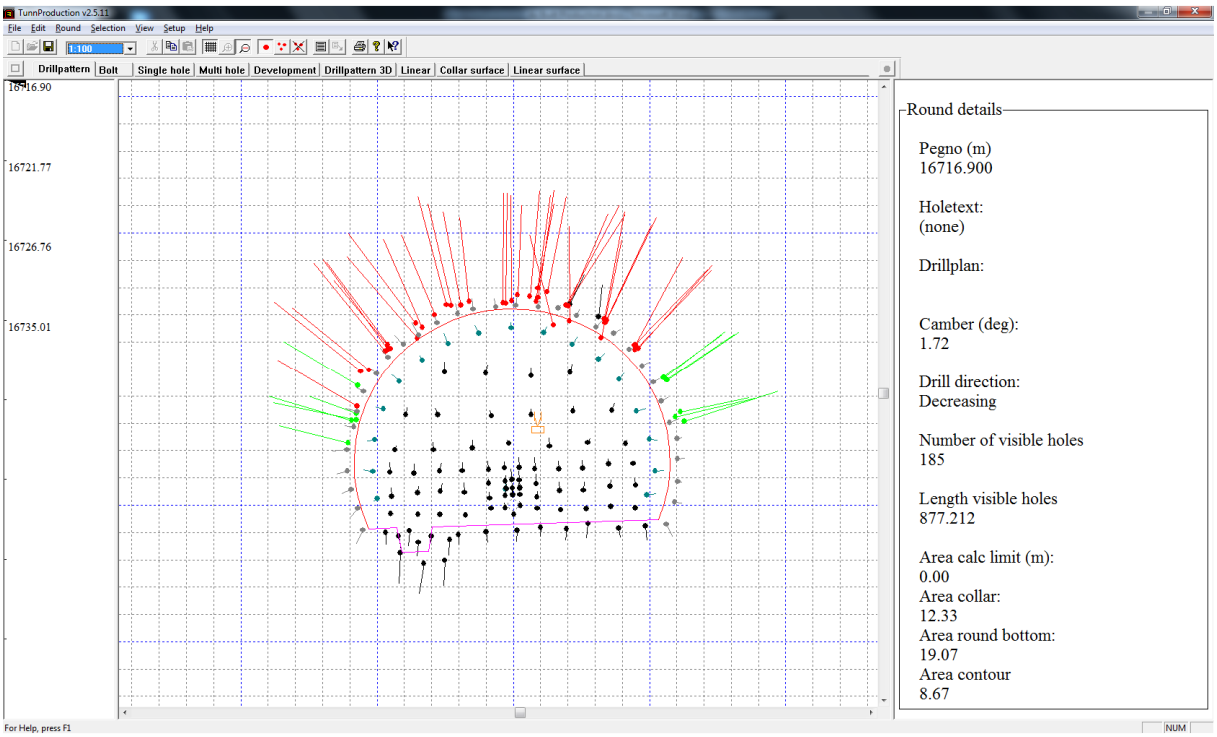


Fig. 79

- To the left are the chainage numbers on all the rounds registered in the project.
- The marker is on the round displayed.
- The middle window shows a graphical display of the drilled round.
- To the right are a list with details and descriptions for the graphical window.

3.2 *Menus*

File

• New	Create a new Tunnlog project.
• Open	Open a TunnProd project.
• Save	Save as a TunnProd project.
• Save as	Save as a TunnProd project.
• Save holetab	Save the current log and holes in a text file with coordinates.
• Open external bolts	Import external bolts from .TXT or .KOF files.
• Graphdata to Excel	Export graphs to Excel
• Print	-
• Print preview	-
• Printer setup	-
• Exit/Back	Exit the program and returns to the log overview.

Edit

• Delete	Selected hole will be set as a Dummy hole.
• Restore	Delete all the changes made in the log.
• Copy	Copies the graphical window. Paste into desired application.
• New textbox	Create a textbox in the graphical window.
• Line textbox	Create a line from the textbox to a desired point.

Round

• Holedata	Shows a detailed report for a chosen hole.
• Diagram	Choose between the different sheets in the graphical window.
• Sequence	Shows the sequence of the drilled holes.
• Area	Shows area of the contour or drilled holes.
• Number	Shows number of drilled holes and type of holes.
• Next round	Go to next drill log increasing chainage.
• Prev round	Go to next drill log decreasing chainage.
• Merge next	Merge the next logfile in increasing chainage.
• Merge next	Merge the next logfile in decreasing chainage.

Selection

• Single	Shows data and graphs from a single hole .
• Multi	Shows data and graphs from several holes.
• Redraw	Refresh the graphical view.

View

- Tool bar — Turn on/off the tool bar.
- Status bar — Turn on/off the status bar at the bottom.
- Page header — Turn on/off the sheets in the graphical window.
- Grid — Turn on/off the grid.
- Zoom in — Zoom in on chosen hole.
- Zoom out — Zoom out to default value.

Setup

- Options — Various control parameter settings.
- Language — Not in use.

Help

- Not in use.

3.3 *Tool bar*

Button functionality:

 Create a new Tunnlog project.
 Open a TunnProd project.
 Save settings for the application.
 Set holetype to dummy
 Copy
 Paste
 Grid on/off.
 Zoom in on a selected hole.
 Default zoom scale.
 Left mouse button to choose a hole.
 Left mouse button to choose many holes.
 Refresh / Remove marking on holes.
 Make a new textbox.
 Create a line from textbox
 Print. One page pr. round.
 Show version number and copyright information.
 Not in use.

3.4 *Sheets*

3.4.1 Drillpattern

Will show the round from the face and in.

Use the scroll bars to move the graphics around. This will also move it on the printout.

Choose a hole in the round by left click and then right click. A menu will appear were different settings can be done:

- Change the hole type.
- Type a text line which can be shown in the graphics and on the reports.
- Show a detailed report on a hole.

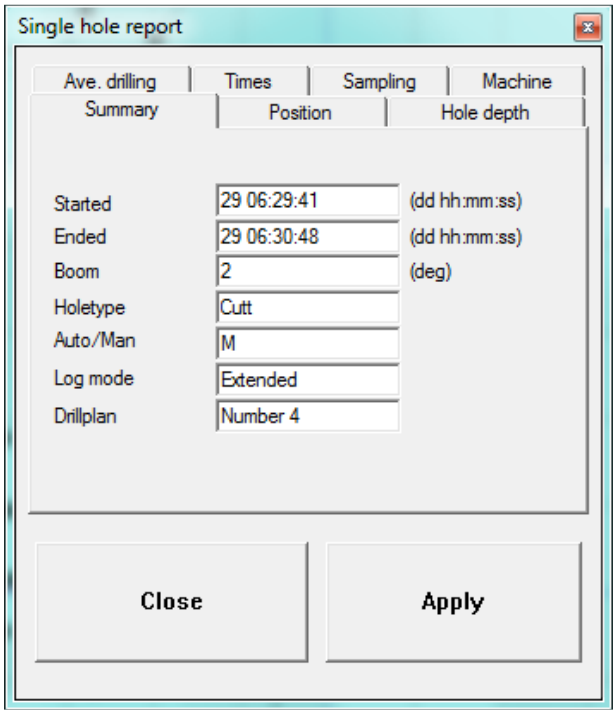


Fig. 80

Summary

- Started: When the hole was started.
- Ended: When the hole was ended.
- Boom: Which boom who drilled the hole.
- Hole type: Registered hole type.
- Auto/man.: Shows whether the hole is drilled in auto or manually mode.
- Log mode: Position, normal or extended.
- Drillplan: Which drillplan is used for this hole.

Position

- Right, Height, Distance: Position for where the hole was started.
- Look out: Look out.
- Direction: The angle of the hole.
- Rotation: Feeder rotation.

Hole depth

- Depth ref: Max, collar or face.
- Number of rods: The number of rods used to drill the hole.
- Start depth: Distance from depth ref before the logging started.
- End depth: Distance from depth ref before the logging ended.
- Drilled in normal: Drilled length in normal modus.

Ave. drilling:

- Penetration rate – Hammer, Feeder, Rotation pressure: Average values for the hole.

Times

- Detailed time view of the different drilling operations.

Sampling

- Number of samples from the drilling.

Machine

- Voltage: Average supply voltage for the drilled hole.
- Motor current: Average electric current for the drilled hole.
- System pressure: Average system pressure for the drilled hole.

3.4.2 Bolts

Show a flattened view of the tunnel with the bolt holes. An external bolt file can be opened and displayed in the graphics by choosing File, Open external bolts.

3.4.3 Single hole

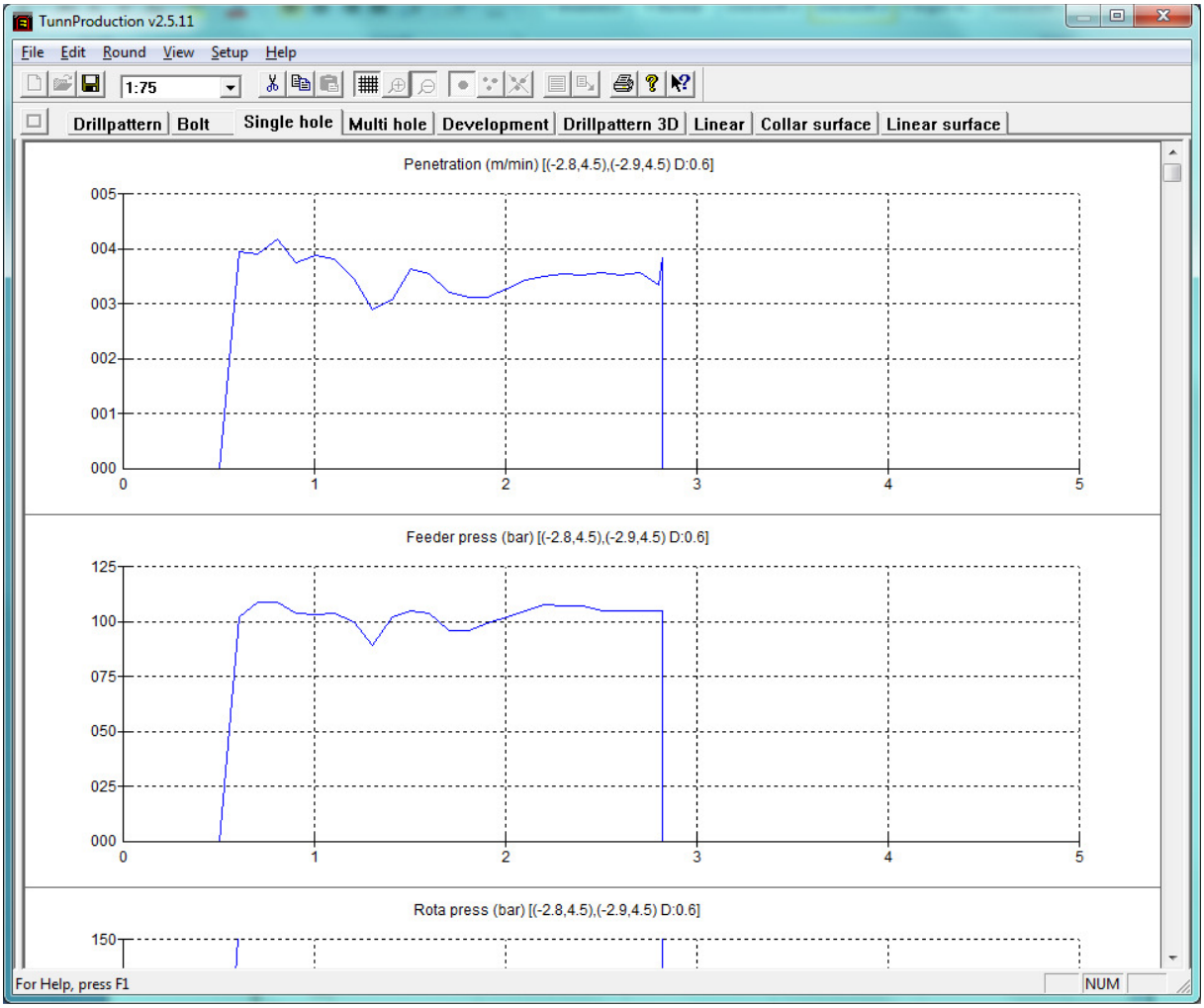


Fig. 81 Single hole

Graphical view of the different hole parameters as a function of the hole depth.

3.4.4 Multi hole

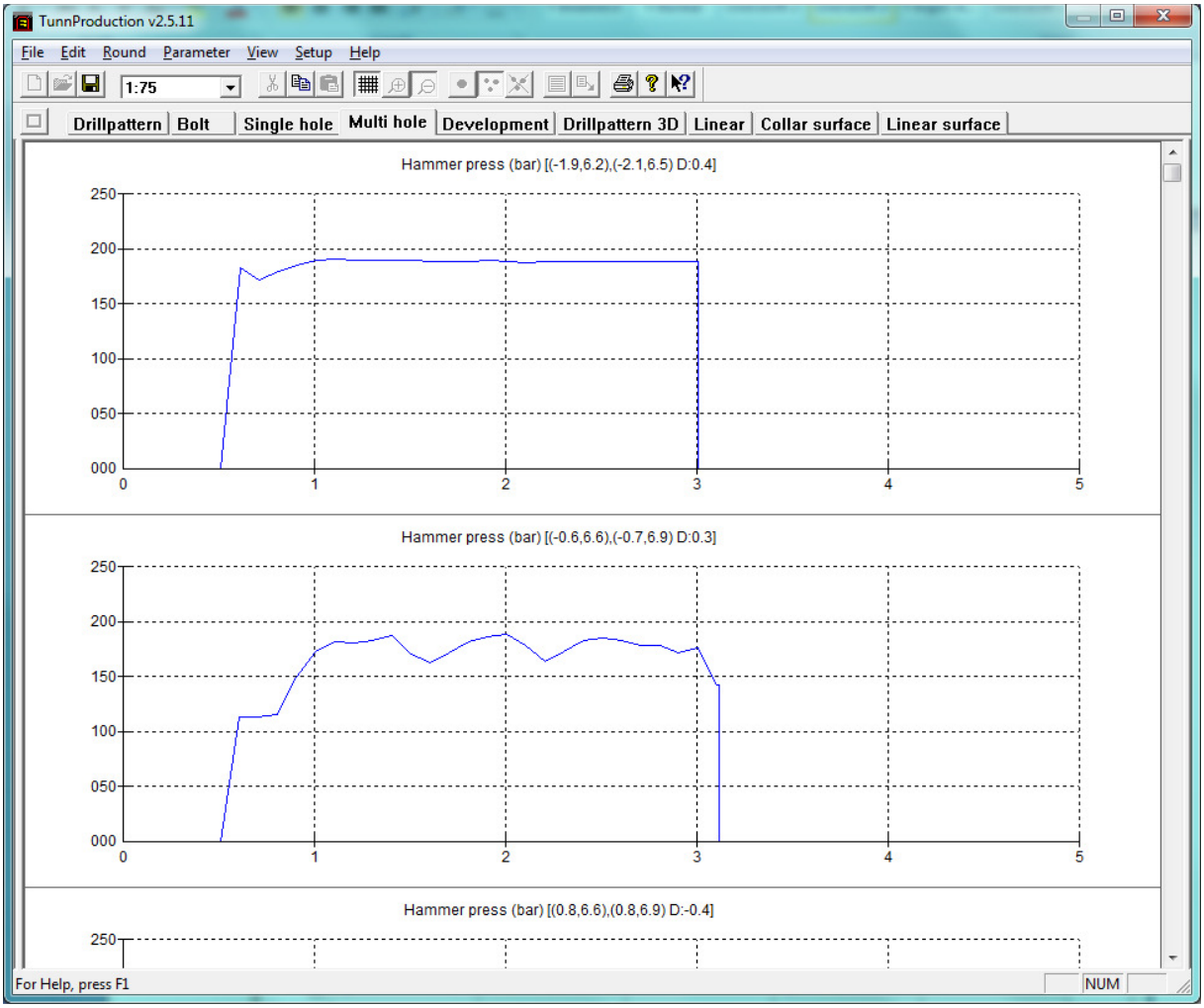


Fig. 82 Multi hole

Graphical view of one hole parameter as a function of the hole depth.
Choose other parameters by clicking on the Parameters button in the menu.

3.4.5 Development

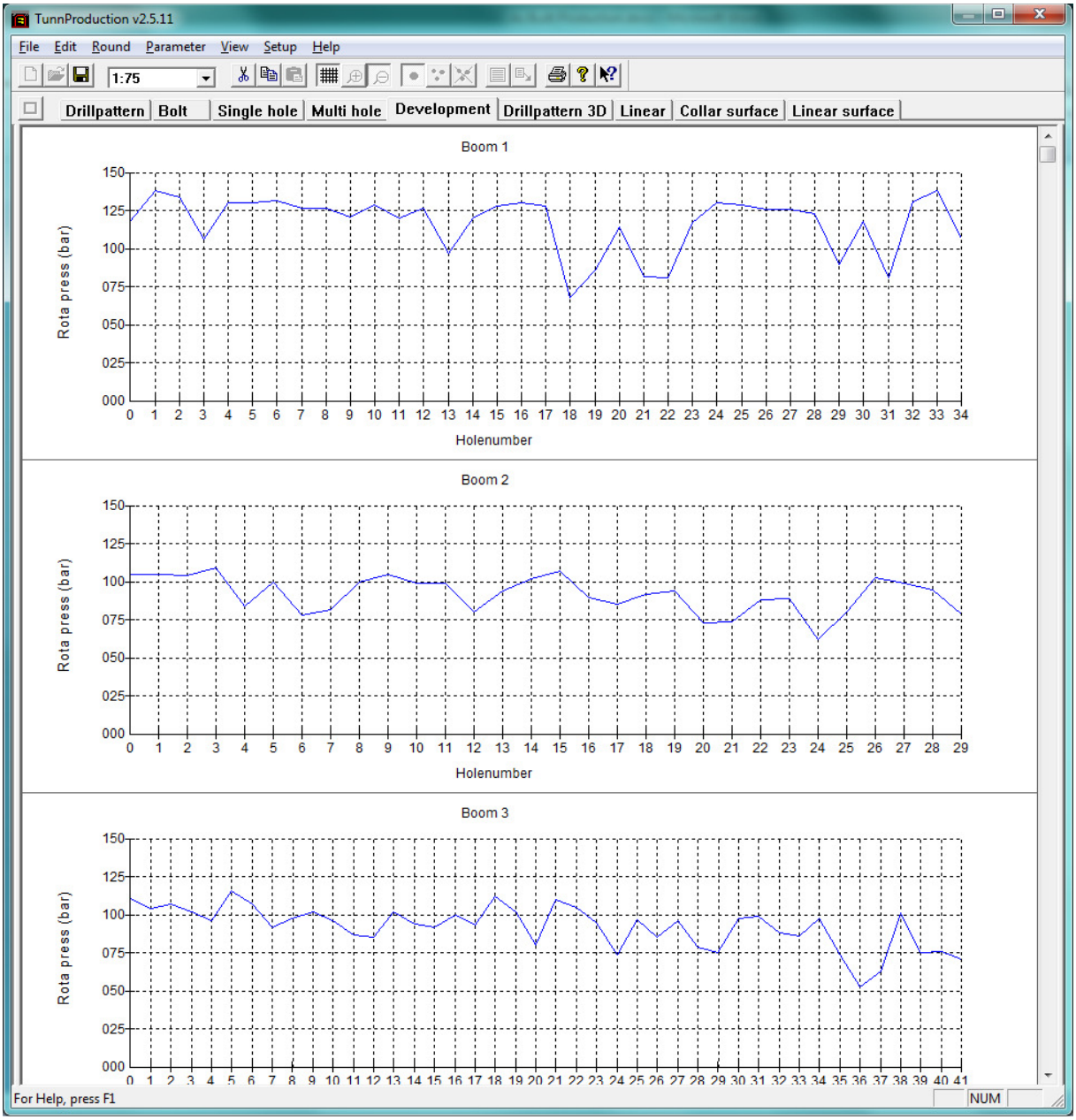


Fig. 83 Development

Graphical view of one hole parameter as a function of the hole number.
Choose other parameters by clicking on the Parameters button in the menu.
Show one graph per boom.

3.4.6 Drillpattern 3D

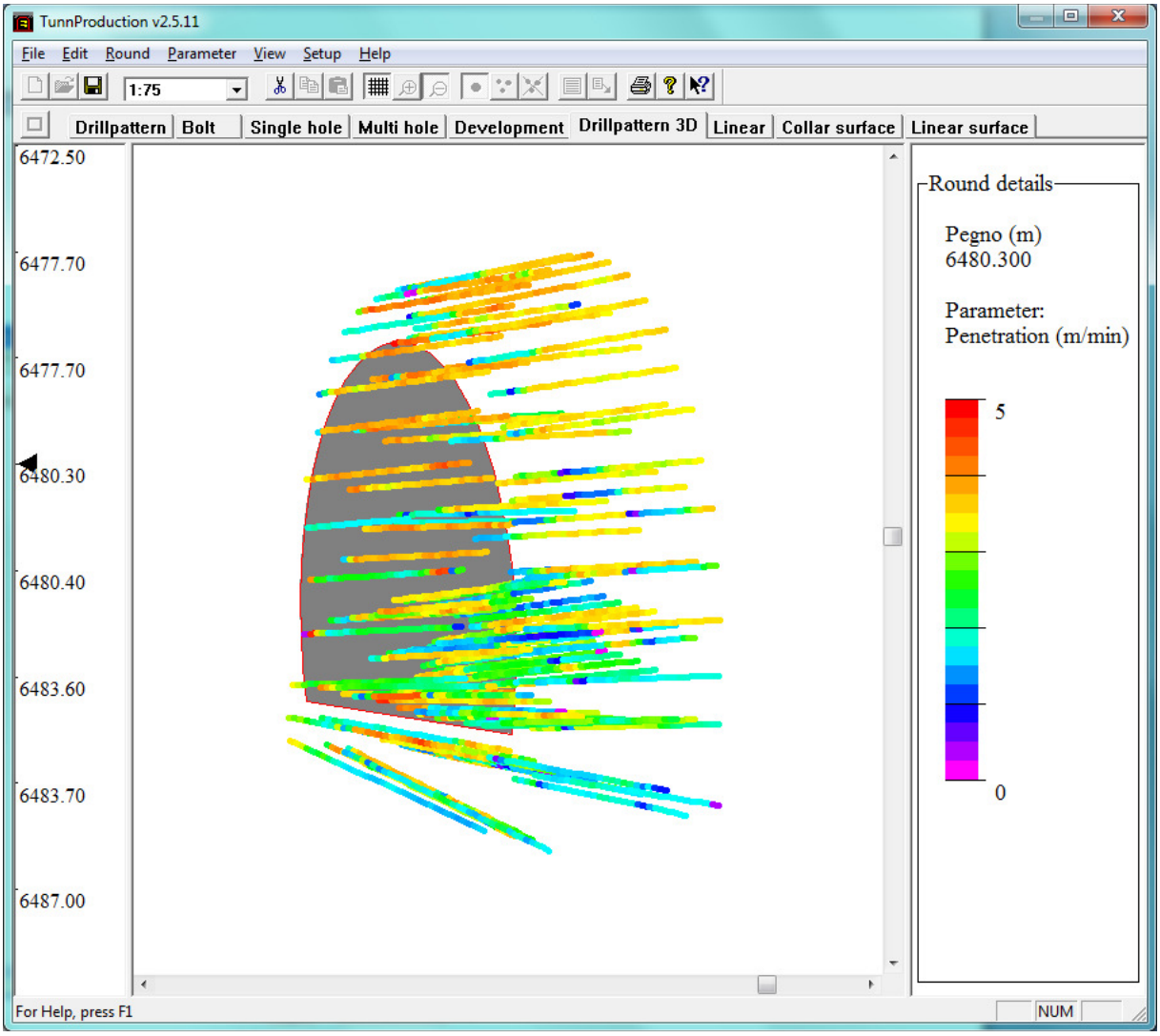


Fig. 84 Drillpattern 3D

A 3D view of the round. The scoll bars decides the angle of the 3D rotation. The length of the graphical axis can be set under Settings in the menu.
Graphical view of one hole parameter as a function of the round.
Choose other parameters by clicking on the Parameters button in the menu.

3.4.7 Linear

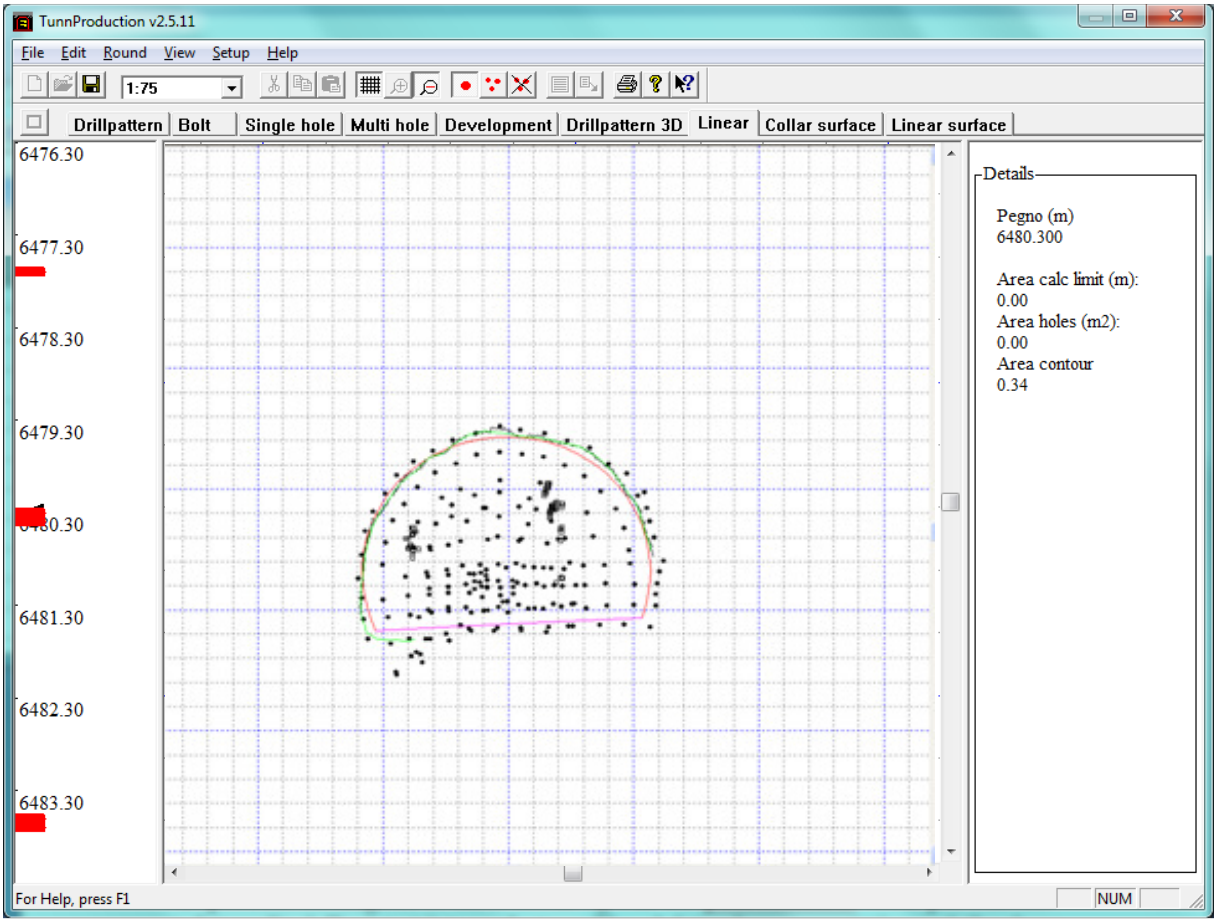


Fig. 85 Linear

A Graphical view of one or more rounds at a specific chainage. It is also possible to view the profiler scan together with the round holes.

3.4.8 Collar surface

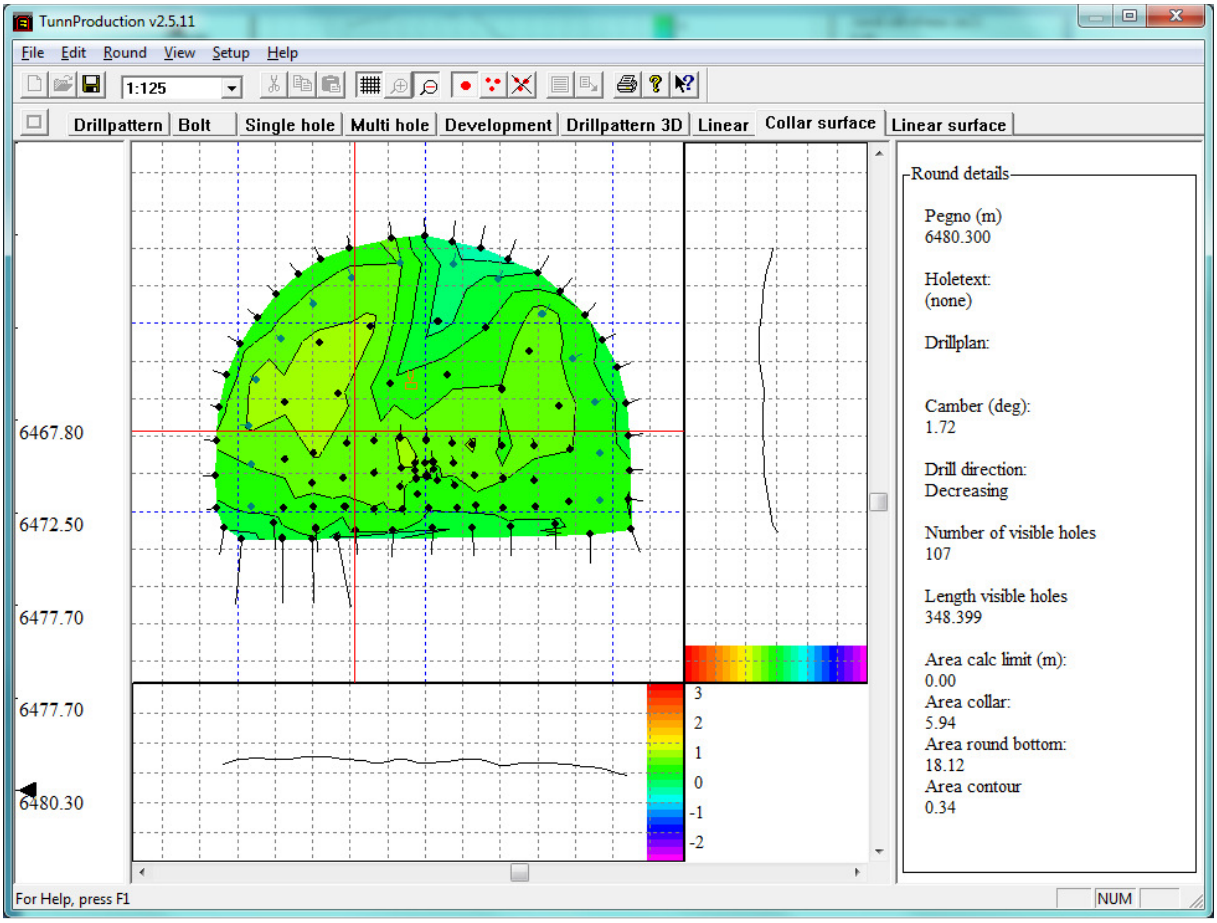


Fig. 86 Collar Surface

Graphical height map of the collar surface. To the right there is a profile of the collar seen from the left towards the right. Under is a profile seen from above and downwards. Choose where to see the profile by left click on the mouse in the map. The red cross will then indicate where the profiles are.

3.4.9 Linear surface

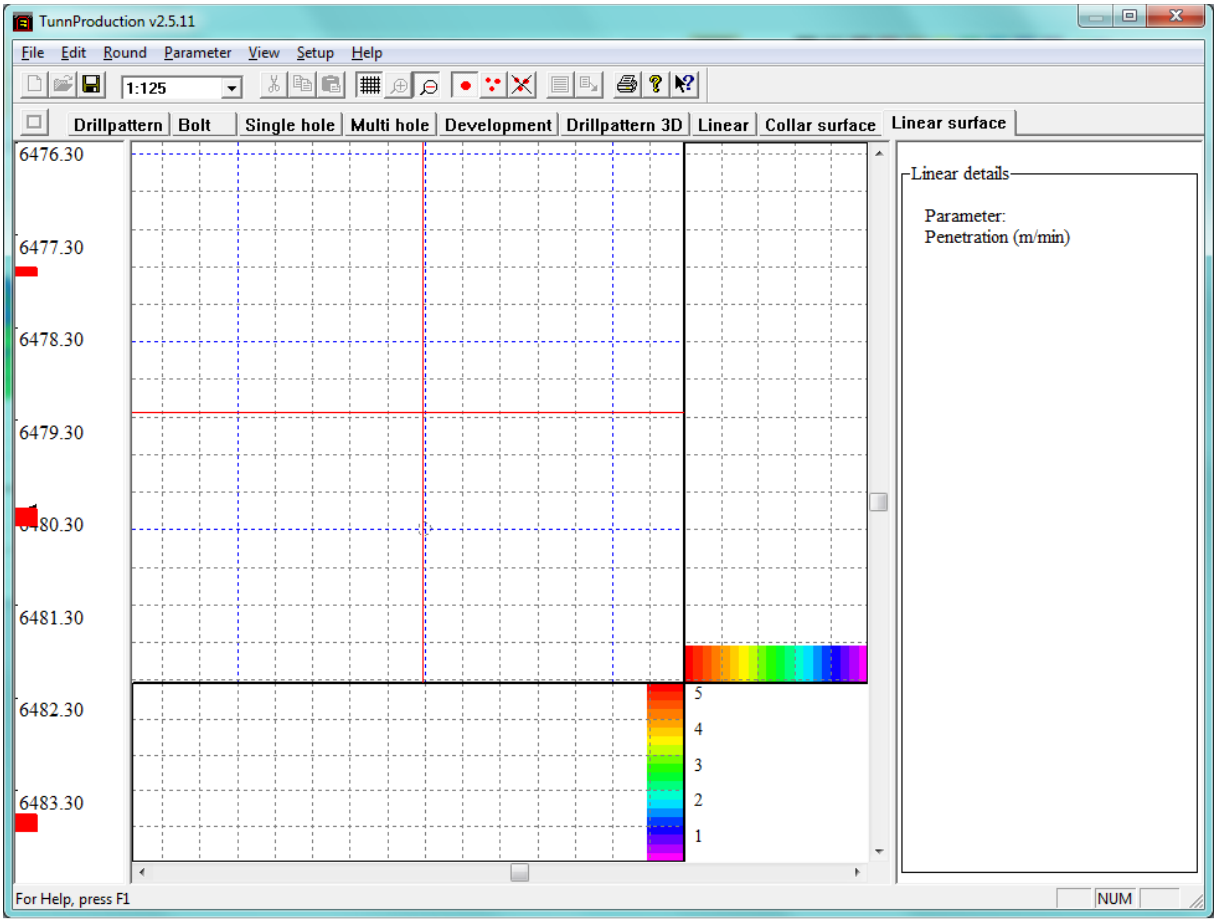


Fig. 87 Linear Surface

Graphical map of one or more rounds shown as a function of penetration rate. Choose other parameters by clicking on the Parameters button in the menu.

3.5 *Settings*

This tool box is found by clicking on setup and options in the top menu.

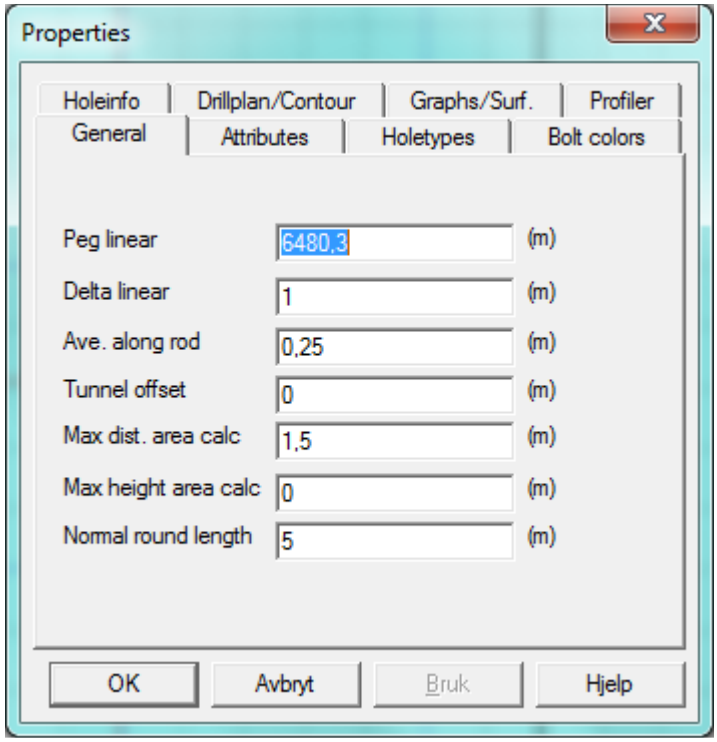


Fig. 88 Properties

General

- Peg linear — Chainage where the drill log and interpolated contour are.
- Delta linear — The chainage distance in linear mode.
- Ave. along rod — Distance where the average values are collected.
- Tunnel offset
- Max dist. Area calc — Max distance between the holes when calculating area.
- Max height area calc — Max height above tunnel line when calculating area.
- Normal round length — Standard round length

Attributes

- Drill hole size — The size of the graphical holes.
- Grid dist. — The distance between the squares in the grid.
- Graphs pr. page — How many graphs per page to be printed.
- Size 3D view — The length of the axis in the 3D view.
- Colored surface map — Turn the colors on/off.
- Print in color — Print in color or black and white.

Holetypes

- Mark the holes to show in the graphics.
- Double click on the color in order to change this.

Bolt Colors

- To show different bolt lengths in different colors. Click add and then double click on the added line to set the length and color.

Hole info

- Feeder rotation Turn on/off the display of feeder rotation on each hole.
- Sequence line Show the sequence line for each boom.
- Look out Turn on/off the look out for each hole.
- Collar point Show the collar as a point in the graphics.
- Hole text Turn on/off different text values for each hole.

Drillplan/Contour

- Drillholes Show drillholes from the drillplan.
- Lines Show the lines from the drillplan.
- Colored Show the drillholes from the drillplan in blue.
- View Show the teorethical contour.

Graphs/Surf.

- Setup for displaying the graphs and surface maps. Normally set to auto.

Profiler

- Max distance between points to draw a line between them.
- Max deviation outside the contour to draw a line to the points.
- Max deviation inside the contour to draw a line to the points.
- Measurement: To show the measurements one step before and one step after the chainage value.
- Interpolated profile: Use a triangulation to draw a interpolated profile at the chainage value.

3.6 *Miscellaneous*

3.6.1 Sequence

Choose Round – Sequence in the menu.

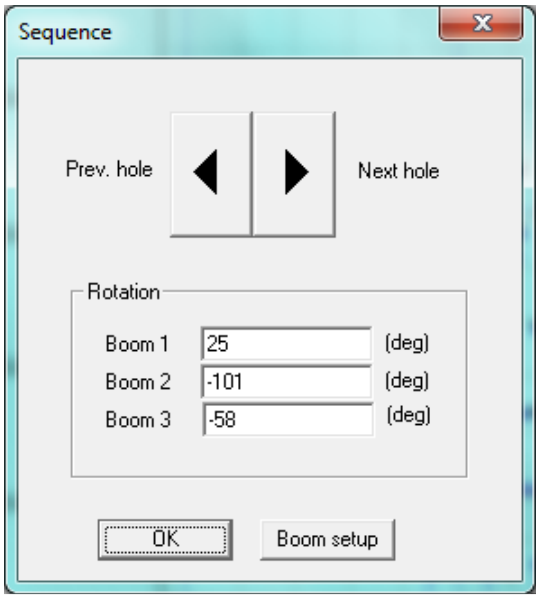


Fig. 89 Sequence

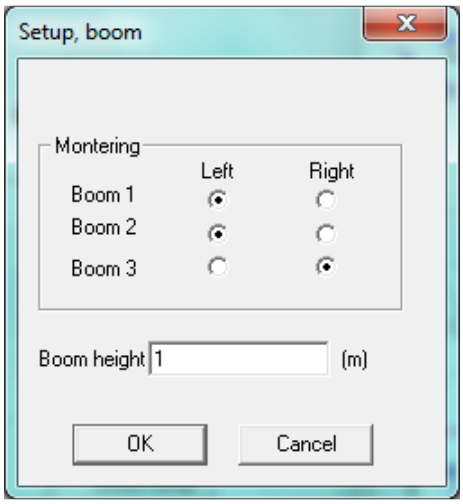


Fig. 90 Setup Boom

In the Drillpattern sheet will the first hole drilled in the round be marked with a boom figure. It is the possible to step trough the actual drilled sequence by clicking on the next/previous buttons.

Determine the boom setup. For a tree boomer it is best to use the default settings. Boom height is the graphical size of the boom figure.

3.6.2 Area calculation

Choose Round – Area in the menu.

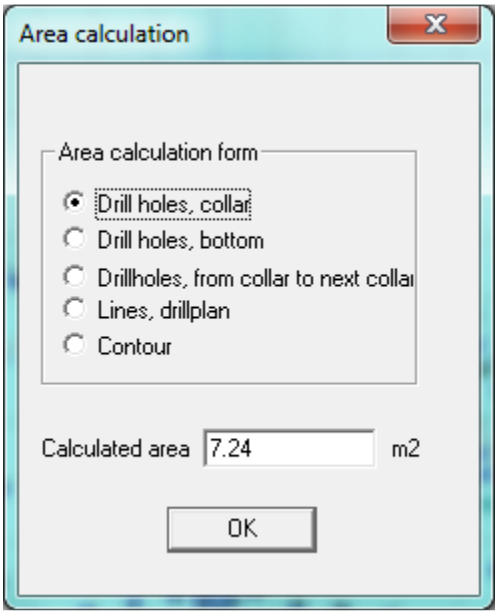


Fig. 91Area calculations

The area can be calculated from:

- Drill holes, collarThe area drawn around the holes on the collar.
- Drill holes, bottom The area drawn around the holes at the bottom of the round.
- Drillholes, from collar to collar will give a volume on the round.
- Lines, drillplan The area drawn around the holes in the drillplan.
- Contour Area of the theoretical contour.

3.6.3 Number of drillholes

Choose Round – Number in the menu.

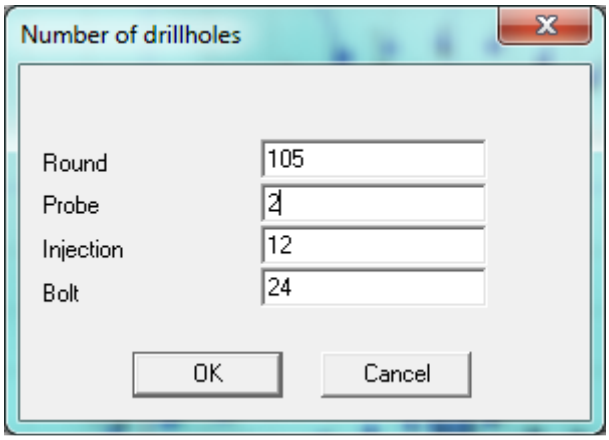


Fig. 92 Number of drillholes

Injection

4 Start Injection

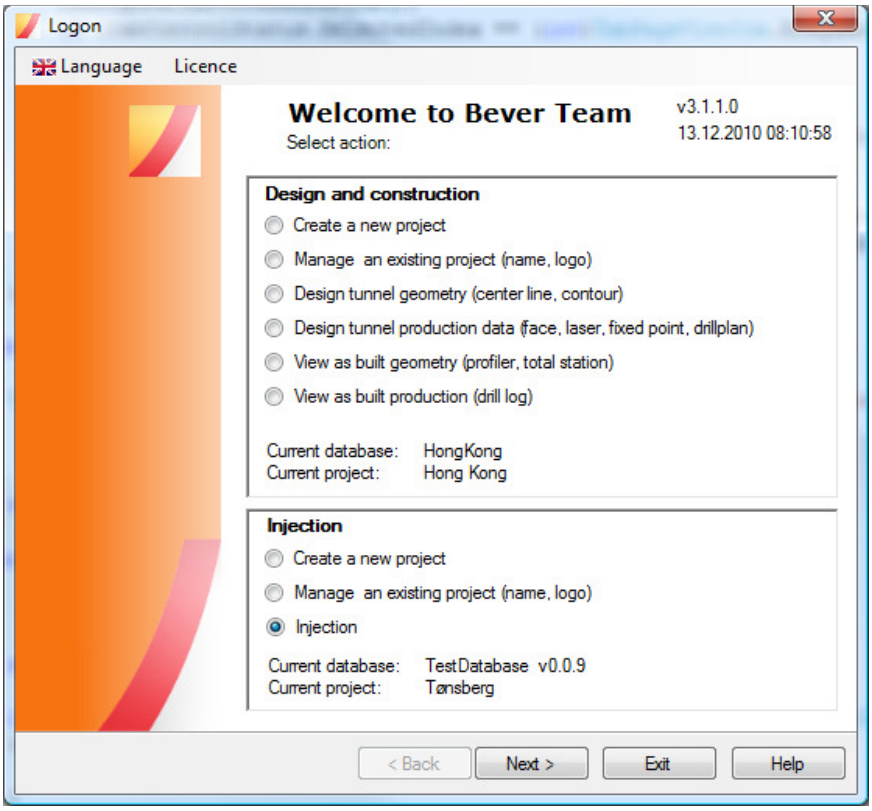


Fig. 93 Start Injection

Select *Injection* and click *Next* to start the Injection program.
At the bottom the current selected database and project name are shown.

4.1 *Import directory*

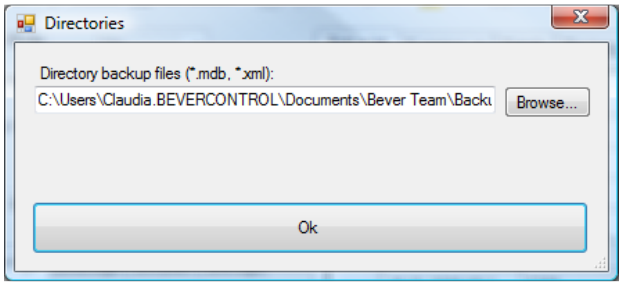


Fig. 94 Directories

The first time the program starts and no backup directory have been selected the dialog for select the backup directory appears. Click Browse beside the *Backup directory:* and select a folder in which the imported files will be stored. Finish the action with *OK*.
To change the directories at runtime select *Settings|Directories* in the toolbar.

4.2 *Overview*

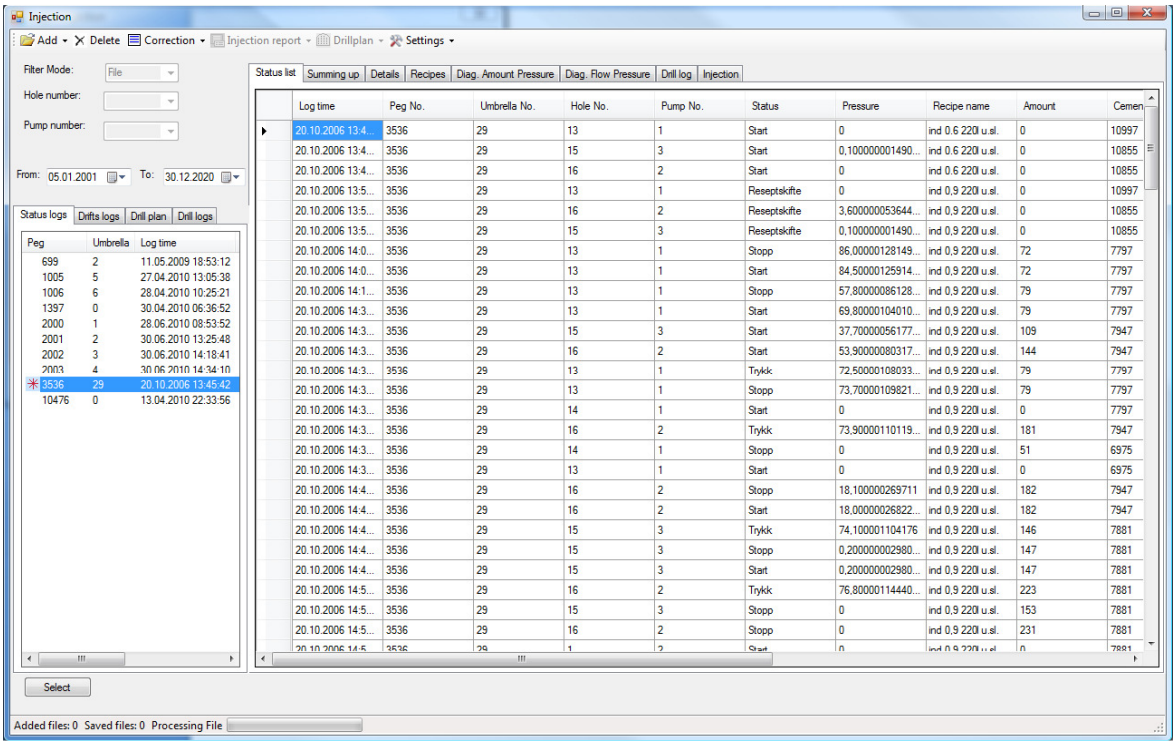


Fig. 95 Status list

On the left side are the tabs with the list of log files and drill files which can be selected. The lists show the Peg number, Umbrella number, start of the log time and the filename. With double click or with the *Select* button on the bottom a new file can be selected which is displayed in the tabs on the right side. The tabs on the right side show the log information, reports and diagrams of the current selected log file.
When the tab (on the right sight) *Status list*, *Summing up*, *Details*, *Recipe*, *Diag. Amount Pressure* or *Injection* is active then a file from the tab list *Status logs* have to be selected and for the tab *Diag. Flow Pressure* a file from the tab list *Drifts logs* have to be selected. For the tab *Drill log* a drill log file from the tab list *Drill logs* and a drill plan from the tab list *Drill plan* have to be chosen.

4.3 *Status list*

The *Status list* shows all log entries of the log file see **Feil! Fant ikke referansekilden.**.

4.4 *Summing up*

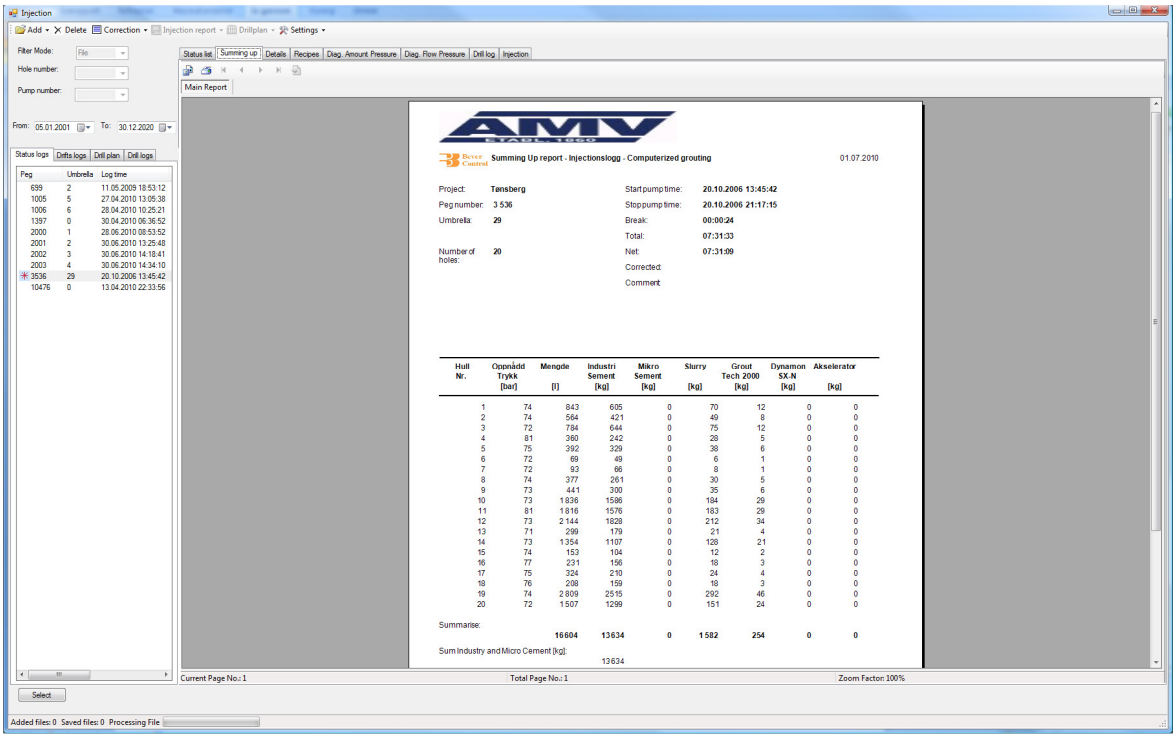


Fig. 96 Summing up report

The Summing up tab shows the report for summing up of cement, supplements, slurry, accelerator and end pressure per hole. For correction of the amount of cement and injection time see chapter 4.12.

In the toolbar of the tab are buttons for export, print and navigate to the next page. The report can be exported to Excel, Word and Pdf.

4.5 *Details*

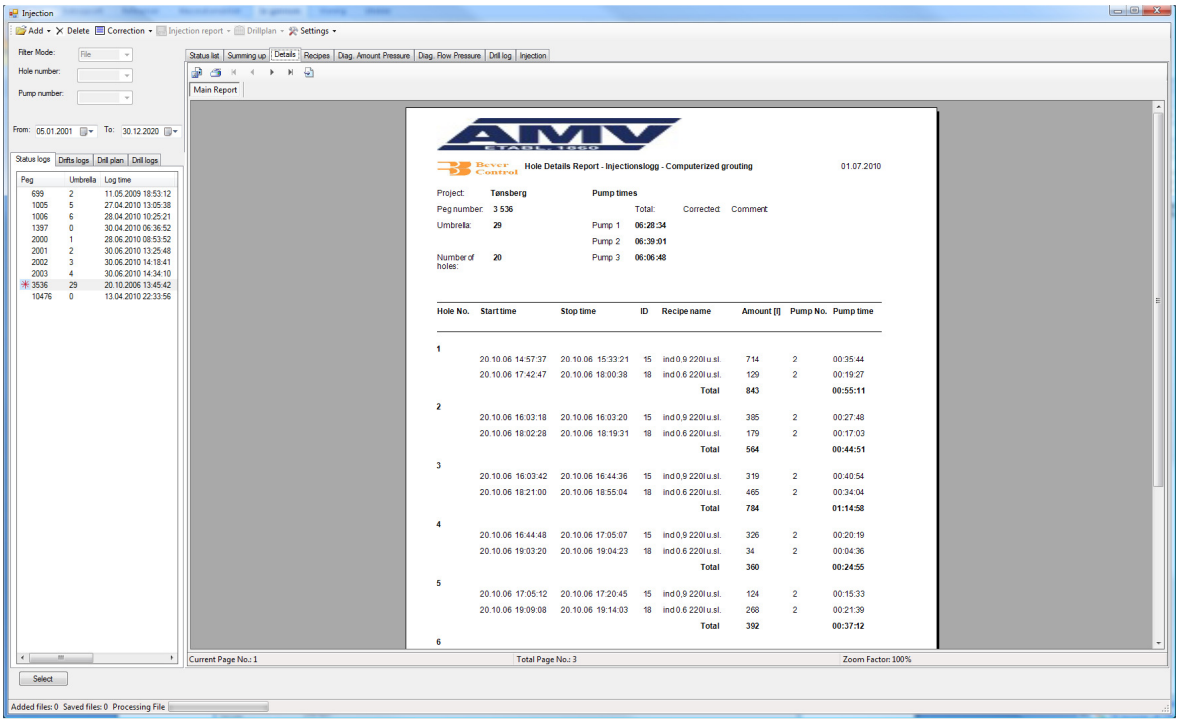


Fig. 97 Details report

The *Details* report shows the pump time and recipe name with the injected amount of each hole. In the header the total pump time of each pump is listed. For correction of the pump times see chapter 4.12.3.

In the toolbar of the tab are buttons for export, print and navigate to the next page. The report can be exported to Excel, Word and Pdf.

4.6 *Recipes*

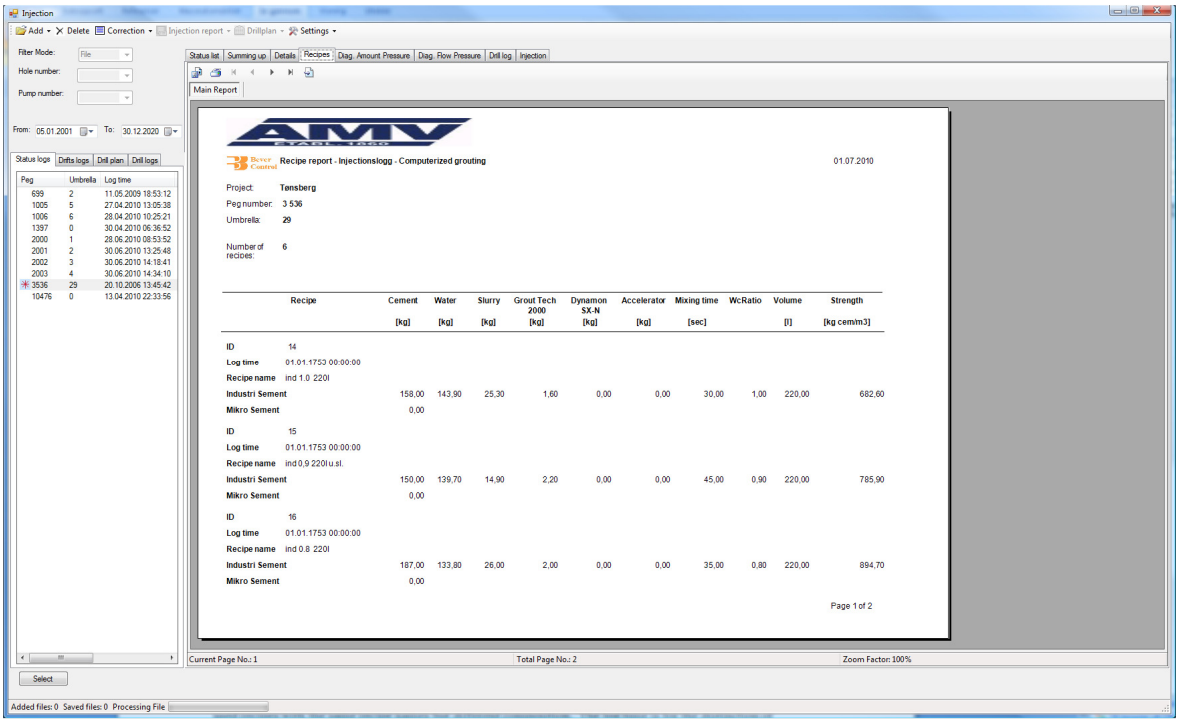


Fig. 98 Recipe report

The recipe report listed the used recipes with the composition of the recipes, mixing time and so on. It can be used recipes with the same recipe names but different composition. The log time is for the distinction of these recipes. It shows at which time the recipe is valid.

In the toolbar of the tab are buttons for export, print and navigate to the next page. The report can be exported to Excel, Word and Pdf.

4.7 *Diagram Amount Pressure*

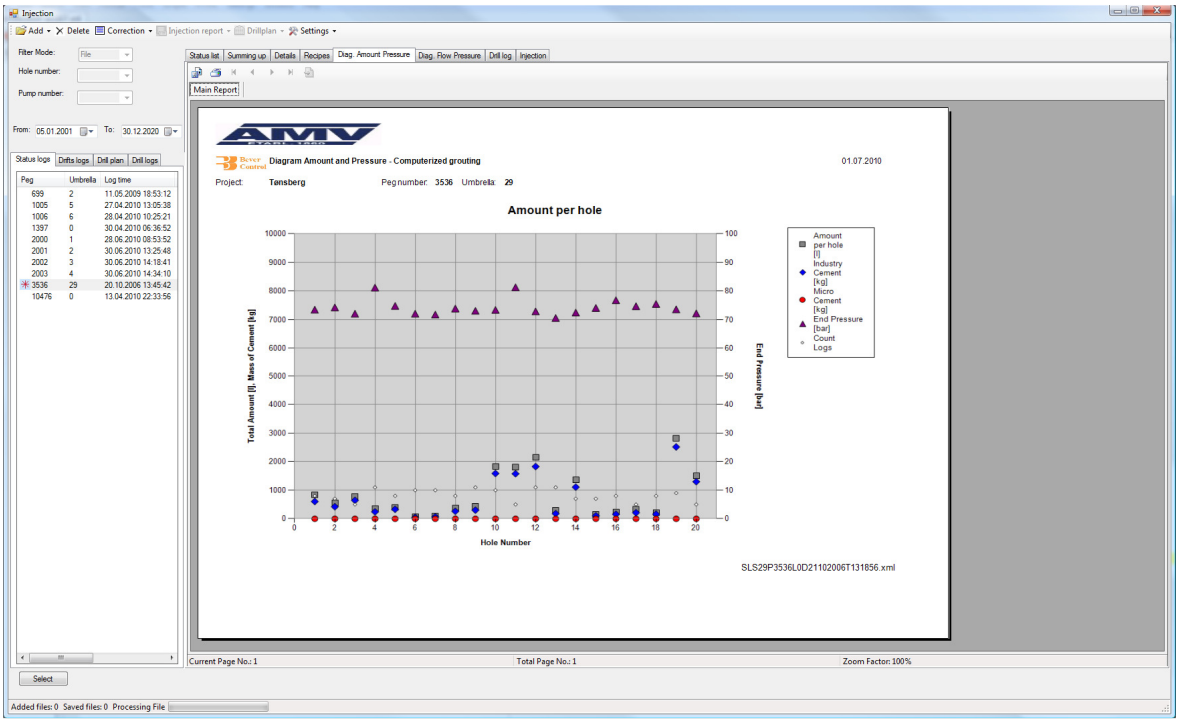


Fig. 99 Diagram Amount and Pressure

The diagram amount pressure shows the summing up per hole of amount, amount industry cement, amount micro cement, end pressure and count of logs.

In the toolbar of the tab are buttons for export, print and navigate to the next page. The diagram can be exported to Excel, Word and Pdf.

4.8 *Diagram Flow Pressure*

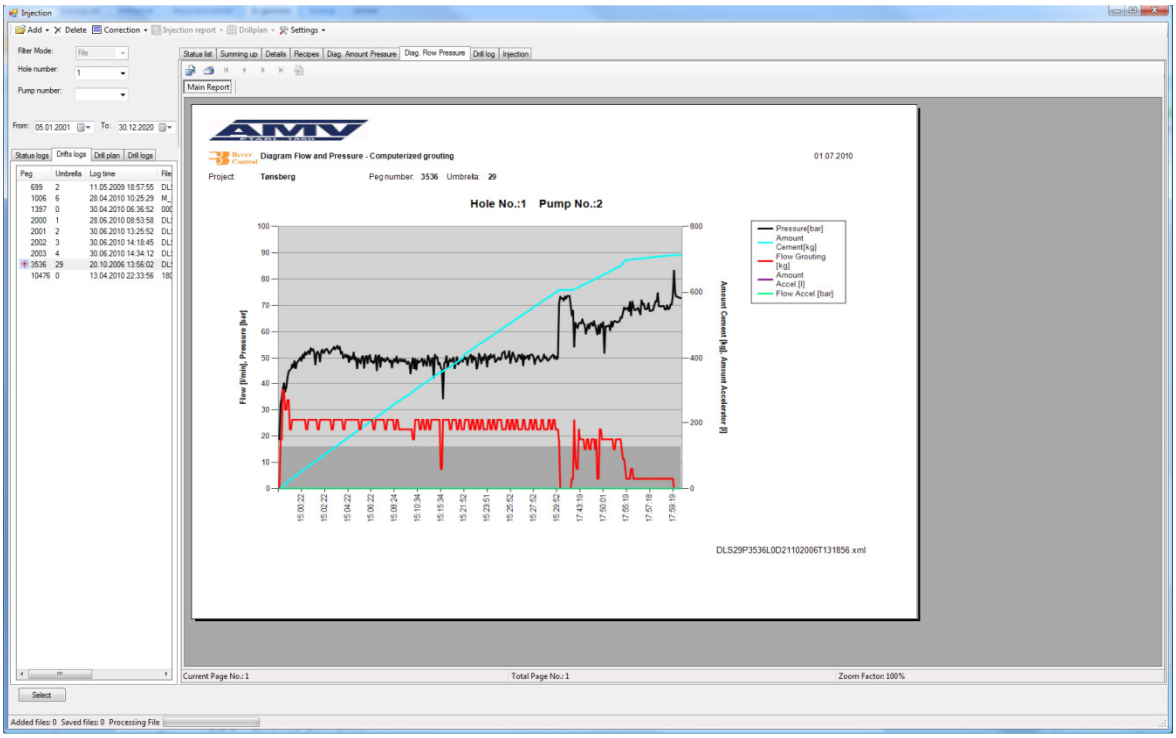


Fig. 100 Diagram Flow and Pressure

The diagram flow pressure shows the pressure, flow of cement, flow of accelerator, amount of cement and amount of accelerator over the pump time.

For displaying a diagram double click the file in the list on the left side and then select the hole number from the *Hole number* combo box and the pump number from the *Pump number* combo box on the top left corner.

In the toolbar of the tab are buttons for export, print and navigate to the next page. The diagram can be exported to Excel, Word and Pdf.

4.9 *Drill log*

The drill log tab shows the drill log file information linked with the injection log file information of a screen. Therefore a drill log file a drill plan file and an injection file have to be selected (see chapter 4.14.1.2).

The drill plan can be displayed in three different views Geometry, Production and Column view. Geometry view shows the constructed holes in the drill plan. Production view shows the drilled holes in the drill plan. If no drill plan exists the column drill plan can be used. From the menu D*rill plan*| *View drill plan* in the toolbar or the context menu in the drill plan graphic the different views can be selected. With mouse wheel the zoom factor of the drill plan can be changed.

4.9.1 Drill log Geometry view

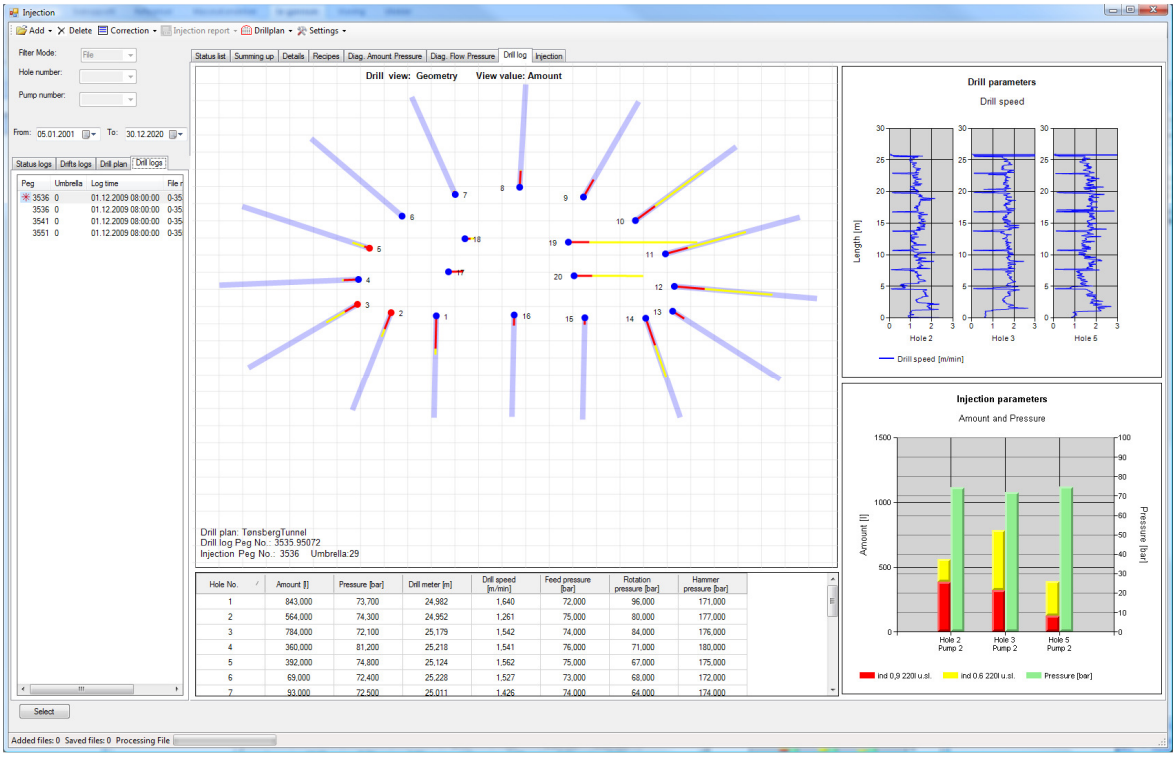


Fig. 101 Drill log

The graphic display is divided in 4 sections, the drill plan, the injection and drill parameters in a list view, the diagram of the drill parameters and the diagram of injection parameters. The diagram drill parameters are only show in the drill plan view Geometry and Production.

The drill plan is shown on the left side with the injected amounts of all holes. The position and length of the holes in the geometric drill plan are extracted from the drill plan. The holes which are marked with a red circle are the selected holes which are displayed in the drill and injection diagram (in **Feil! Fant ikke referansekilden.** hole 2, 3, 5). Up to 3 holes can be chosen at the same time. The holes can be selected with left mouse click on the hole in the drill plan.

In the menu *Drill plan* on the toolbar (see chapter 4.14.2) or with right mouse click a context menu opens and with selection of the menu point *View value* the view can be toggled from amount to pressure. In the pressure view the highest pressure of each hole is displayed. By using the scroll wheel on the mouse it is possible to zoom in and out in the drill plan.

4.9.2 Injection parameters diagram

Injection parameters amount/time and highest pressure of the 3 selected holes are shown on the right side of the drill log tab page. From the context menu or *Drill plan* menu the view can be toggled from injected amount to injected time.

4.9.2.1 Injection Amount and Pressure

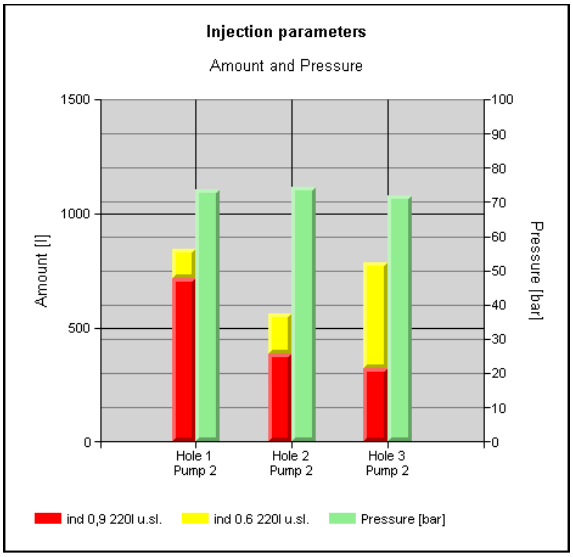


Fig. 102 Injection amount and pressure

The diagram shows the injected amount of each recipe and the highest pressure of the 3 selected holes.

4.9.2.2 Injection Time and Pressure

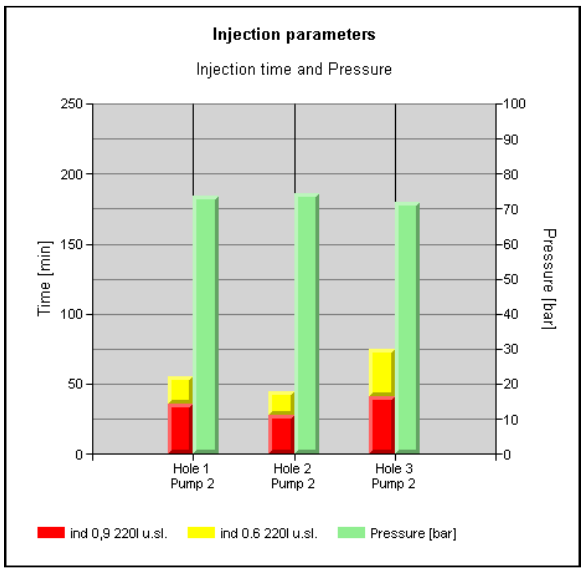


Fig. 103 Injection time and pressure

In this diagram the injected time per recipe and the highest pressure of the holes are displayed.

4.9.3 Diagram drill parameters

Drill parameters of the 3 selected holes are shown on the top of the right side of the drill log tab page. From the context menu or *Drill plan* menu the view can be toggled from drill parameter flow to drill parameters average and the different flow views.

4.9.3.1 Flow drill parameters

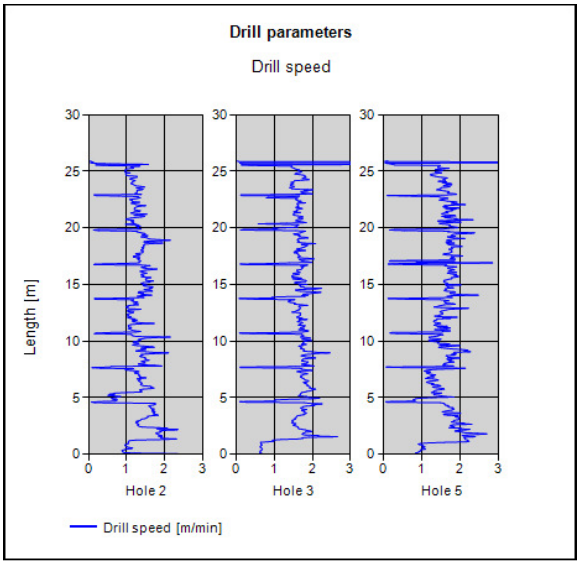


Fig. 104 Drill speed parameters

4.9.3.2 Average drill parameters

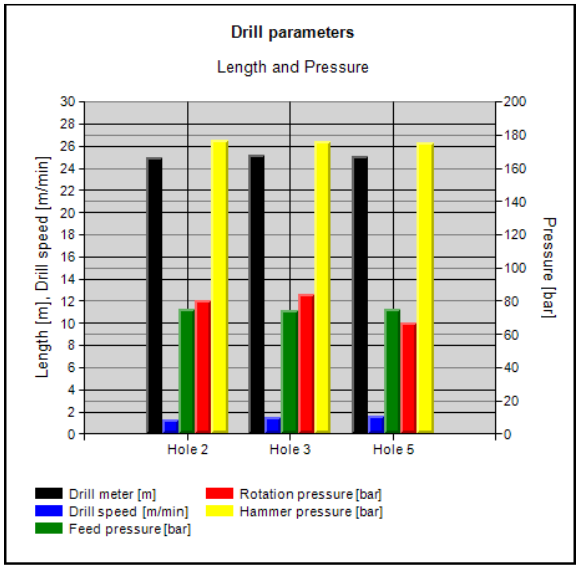


Fig. 105 Average drill parameters

In the average view all average drill parameter of the 3 selected holes are displayed.

4.9.4 Drill plan view Column

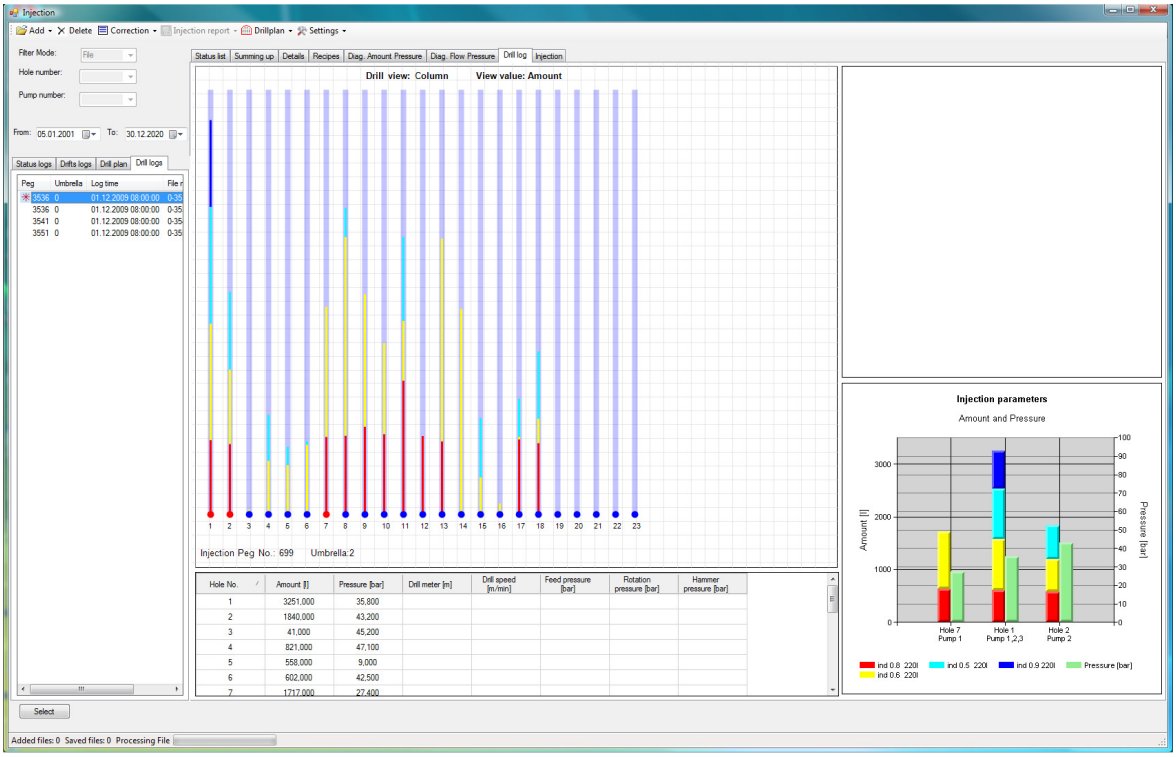


Fig. 106 Column drill plan

If no drill plan exists, the column drill plan can be used. In this view no drill parameters are available.

From the *Drill plan* menu *Drill plan Column parameter* in the toolbar the user has to set the number of holes (max. 100 holes) which should be shown and the injection file (see chapter 4.14.1.1).

4.10 *Injection Report*

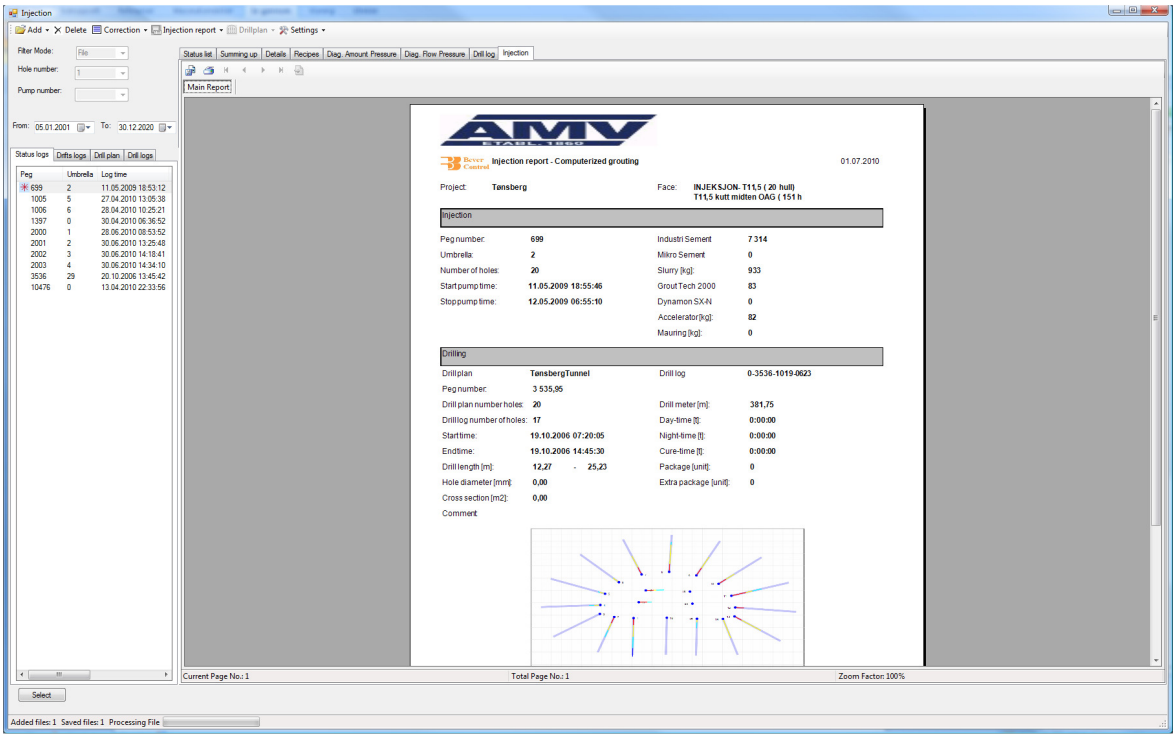


Fig. 107 Injection report

The *Injection* report is the summary of injected amount and time and drilled length and time of all holes.

4.11 *Menu Settings*

The menu settings are for the general configuration of the program.

4.11.1 Import directory

See chapter 4.

4.11.2 Setting cement parameters

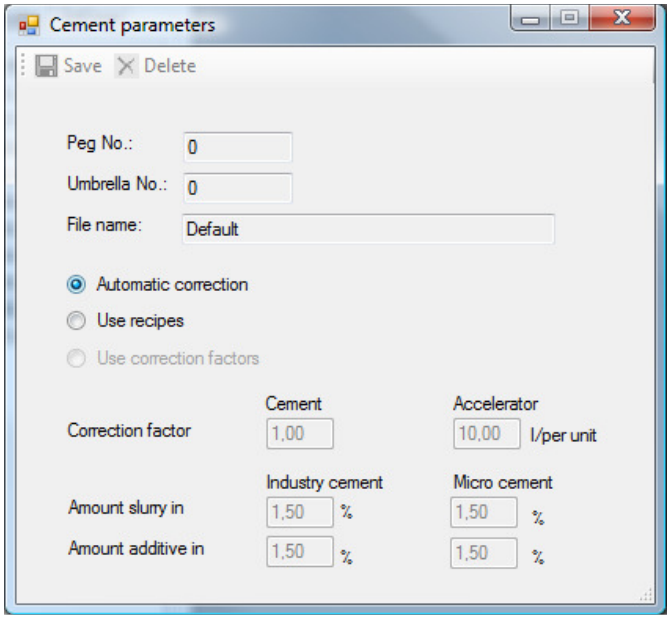


Fig. 108 Cement parameters

General settings of the cement parameters which are used for the calculation of the amount cement, additives and accelerator. These settings are general used for a log file if nothing else is specified for the log file. With *Automatic Correction* the calculation relates on the counter balance. This is the recommended setting.

4.11.3 Setting summing up report

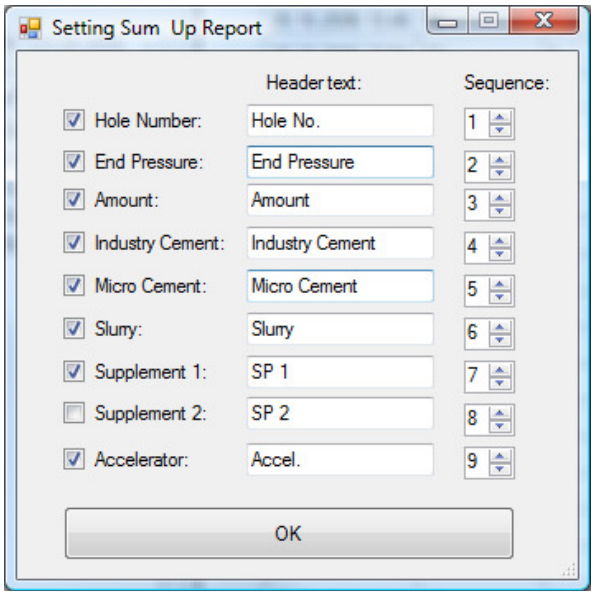


Fig. 109 Setting summing up report

With these settings the appearance of the *Summing up Report* can be changed. It can be selected which columns should be shown, the sequence of the columns and the header text in the report.

4.11.4 Setting diagram

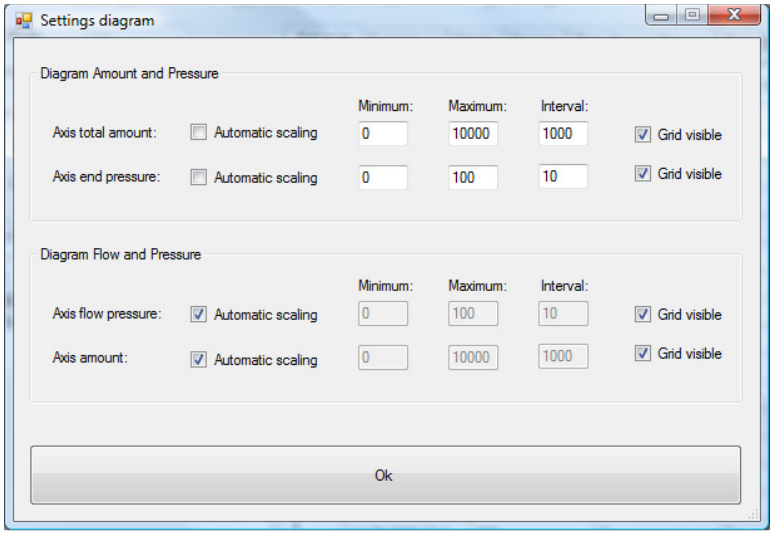


Fig. 110 Settings diagram

In this menu the appearance of the diagrams Amount/Pressure and Flow/Pressure can be configured. The scaling of the axis and if the axis grids should be shown can be set.

4.11.5 Setting drill log

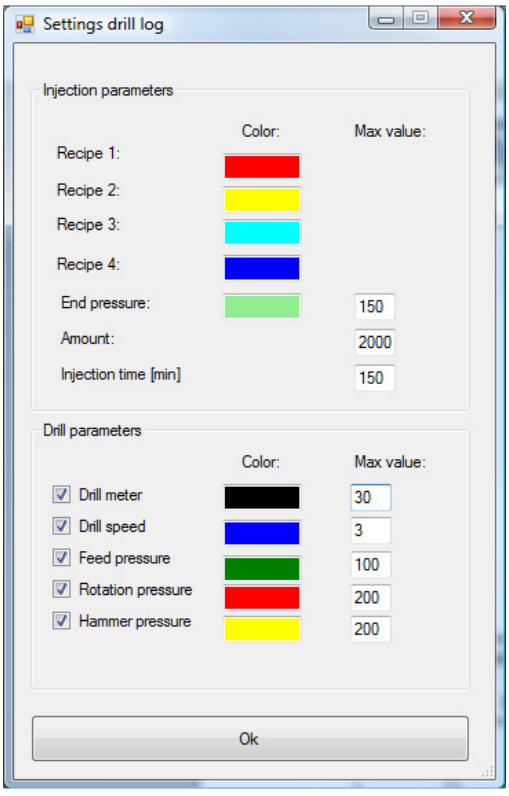


Fig. 111 Settings drill log

In this menu the appearance of the drill log can be configured. The color for the recipes and the drill parameters and scaling of the parameter values can be set.

4.11.6 Setting General

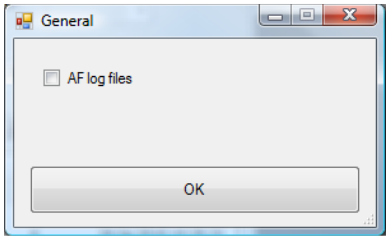


Fig. 112 Settings general

If AF log files are enabled an additional menu which is only for AF log files will be visible.

4.12 *Menu Correction*

Depending on the current selected tab menu items are enabled or disabled.

4.12.1 Cement Parameters

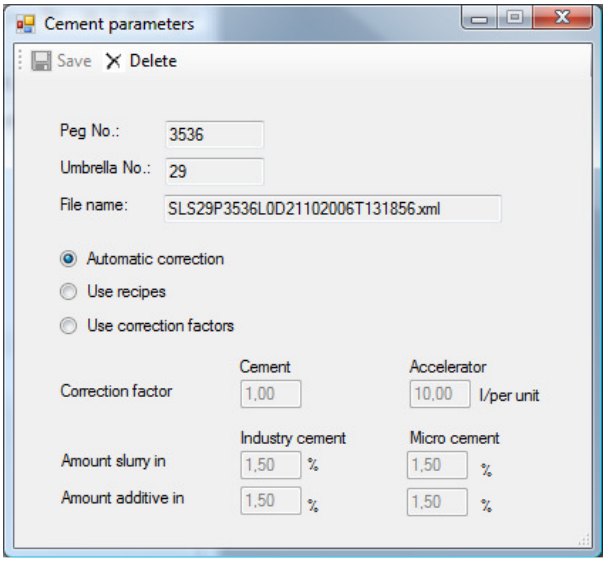


Fig. 113 Cement parameters specific file

File specific settings of the cement parameters which are used for the calculation of the amount cement, supplement and accelerator. With *Automatic Correction* the calculation relates on the counter balance. The *Name:* shows the filename to which the parameter belongs.
When the saved settings are deleted then the default setting of the menu *Settings*|*Cement parameters* are used.
Menu item is enabled when the tab *Summing up* is active.

4.12.2 Injection time

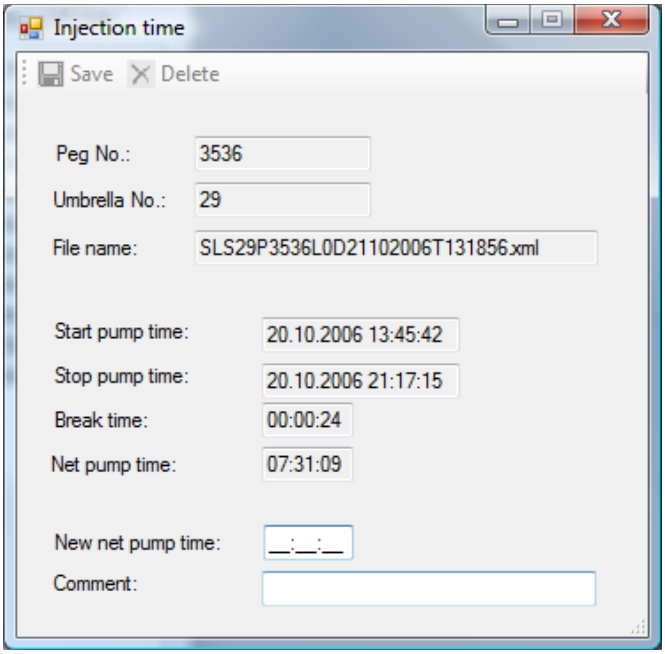


Fig. 114 Injection time

To correct the injection time in the *Summing up* report of the current selected file enter a new pump time and a comment. After saving, the values are displayed in the fields *Correction* and *Comment* of the *Summing up* report.
Menu item is enabled when the tab *Summing up* is active.

4.12.3 Pump times

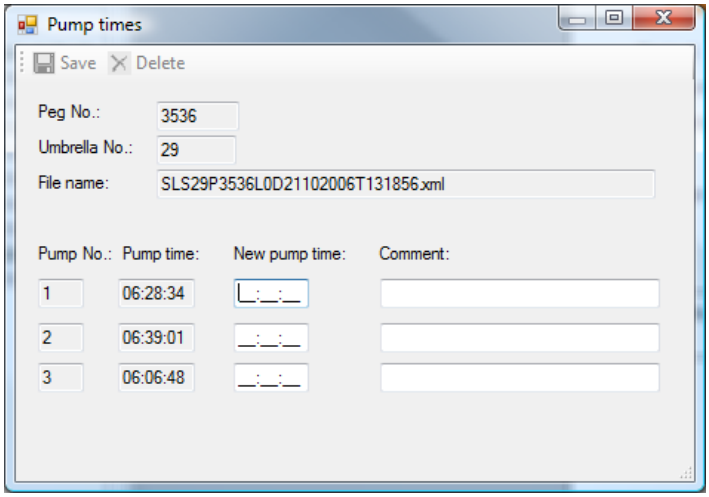


Fig. 115 Pump times

To correct the pump times in the *Details* report of the current selected file, insert the new pump times and comments. After saving, the values are displayed in the fields *Pump times* of the *Details* report header.

Menu item is enabled when the tab *Details* is active.

4.12.4 Amount

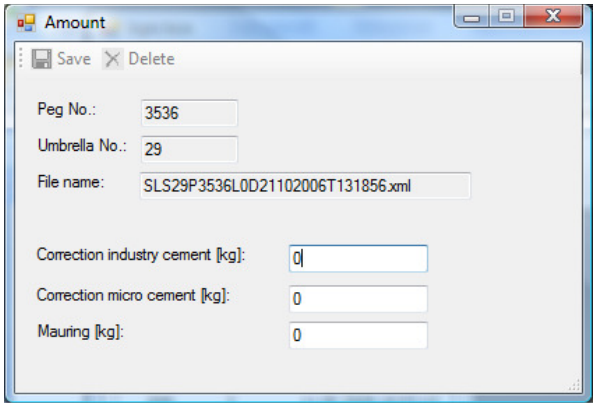


Fig. 116 Amount

For the correction of the amount of industry cement, micro cement and mauring in the *Summing up* report of the current selected file. After saving, the values are displayed in the fields *Correction amount* and *Mauring amount* at the bottom of the *Summing up* report.

Menu item is enabled when the tab *Summing up* is active.

4.13 *Menu Injection report*

4.13.1 Drill plan

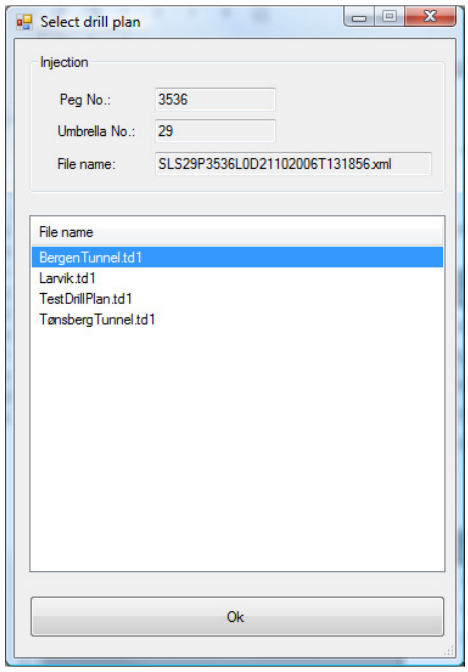


Fig. 117 Select drill plan

In this menu a drill plan file can be selected which is used in the selected injection report.

With the menu *Drill plan\Delete* the selected drill plan is deleted from the injection report.

Menu item is enabled when the tab *Injection* is active.

4.13.2 Drill log

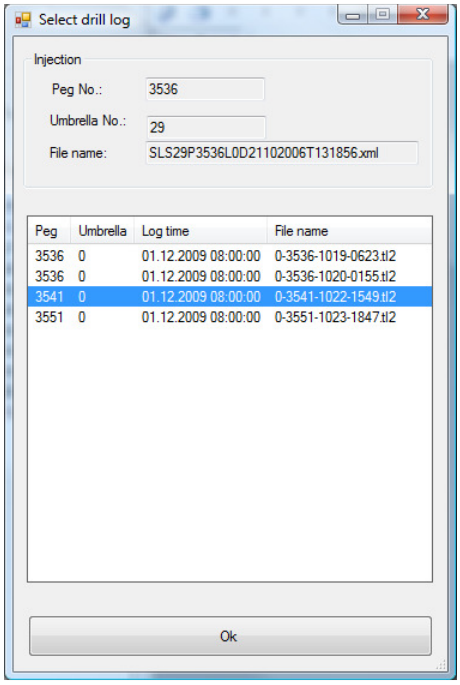


Fig. 118 Select drill log

In this menu a drill log file can be selected which is used in the selected injection report.

With the menu *Drill log|Delete* the selected drill log is deleted from the injection report.

4.13.3 Set values

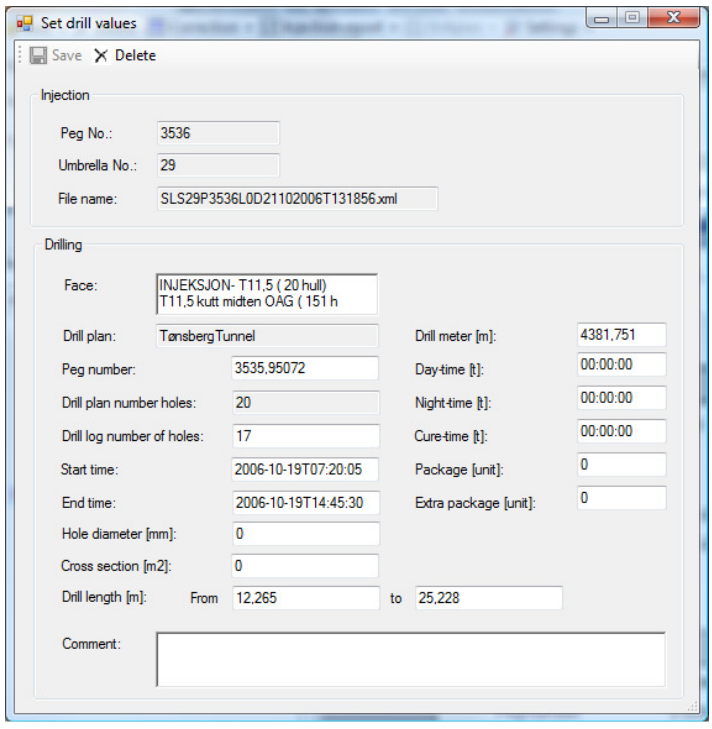


Fig. 119 Set values

All available drill information from the drill log file is predefined in the menu. The user can set additional drill information which isn't available in the drill log file (e.g. Package).

Also existing drill information can be overwritten. The overwritten values are marked with a gray color in the injection report.

4.14 *Menu Drill plan*

The drill plan can be displayed in three different views Geometry, Production and Column view. Geometry view shows the constructed holes in the drill plan. Production view shows the drilled holes in the drill plan. If no drill plan exists the column drill plan can be used. From the menu D*rill plan*| *View drill plan* in the toolbar or the context menu in the drill plan graphic the different views can be selected.

4.14.1 View drill plan

Selection of the drill plan view *Geometry*, *Production* or *Column*.

4.14.1.1 Drill plan column parameter

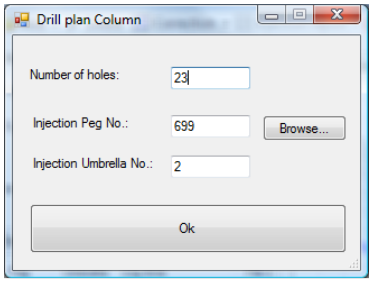


Fig. 120 Drill plan column parameter

To configure the *Column* drill plan set the number of holes which should be shown in the drill plan (max. 100 holes), the peg number and umbrella number of the injection. With button *Browse* a list of all peg numbers with the associated umbrella numbers are displayed.

4.14.1.2 Drill plan Geometry/Production parameter

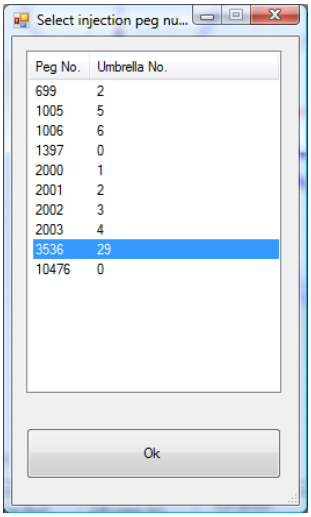


Fig. 121 Select injection peg number

Selection of an injection peg number with the associated umbrella number for the selected *Geometry* or *Production* drill plan.

4.14.2 View value

With view value the drill plan view can be toggled from amount to pressure. In the pressure view the highest pressure of each hole and in amount view the injected amount of all recipes for each hole is displayed.

4.14.3 View drill parameters

The view of the *Diagram drill parameters* can be toggled from flow to average view. In flow view selection of the different flow views drill speed, feed pressure and so on is possible.

4.14.4 View injection parameters

In this menu the view of the *Diagram injection parameters* can be toggled from amount to injected time.

4.14.5 Print

Prints the shown drill plan or hole details list.

4.14.6 Export

Exports the shown drill plan or hole details list.

4.15 *Menu AF*

This menu is only for reporting of AF log files. It is visible when in *Settings*|*General* AF log file is enabled.

4.15.1 Counter balance

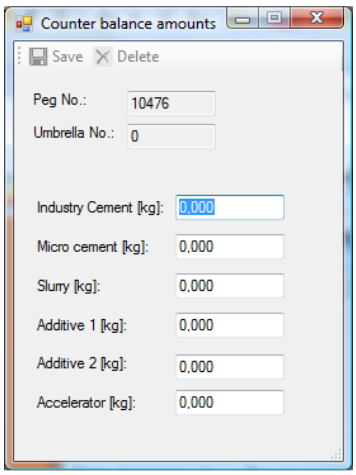


Fig. 122 Counter balance

It is for insertion of the injected cement, additives and accelerator. After saving, the values are displayed in the fields *Counter balance with automatic batching* in the *Summing up* report.

4.15.2 Recipes

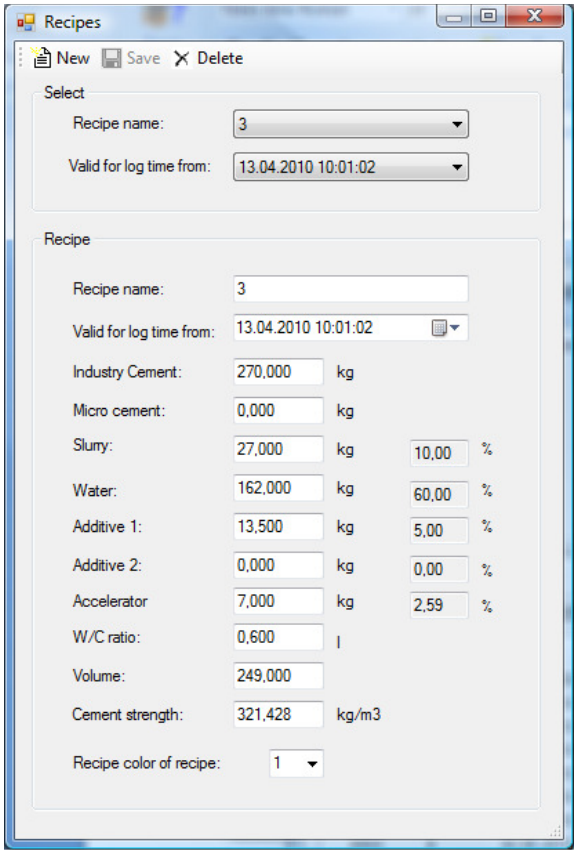


Fig. 123 Recipes

A recipe is identified due the recipe name and the log time. The user has to set with *Valid for log time from* the time from which the recipe is valid. So it can be used recipes with the same names but different composition for log files of different time periods.
To add a new recipe click new, enter the values and save the recipe. To change an existing recipe select the recipe name and log time from the selections on the top, set the time from which time it is valid, change the values and save the recipe. The *Recipe color of recipe* corresponds to the defined colors in *Settings|Drill log*.

4.15.3 Correct log files

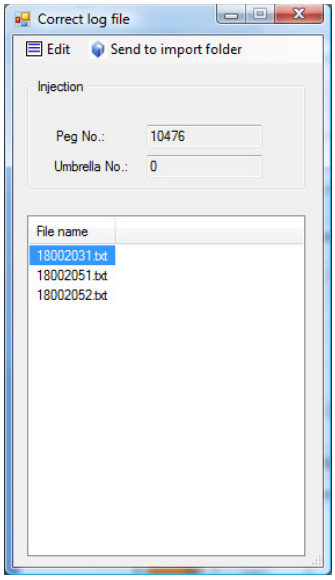


Fig. 124 Correct log files

To correct log files (e.g. correct the recipe number) select the log file from the list and click *Edit*. The log file will be opened in a text editor see **Feil! Fant ikke referansekilden.**. After editing and saving the file in the editor click *Send to import folder*. The file is stored in the import folder and will be imported when the menu is closed. The user have to be care not to corrupt the log file, no syntax check is performed.

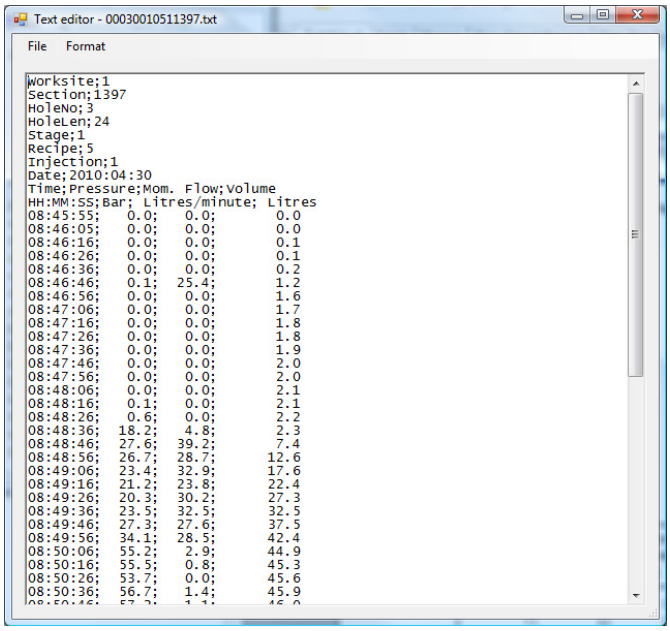


Fig. 125 Text editor

MWD

The Bever Control MWD (**M**easuring **W**hile **D**rilling) module is a geological interpretation application. Here all the provided drill information such as penetration rate, depth, position, hammer pressure, rotation pressure and water pressure/flow can be analyzed.
The main features of this interpretation are:

- Hardness (Normalized penetration rate)
- Fracturing/homogeneity (Rms, floating variances, value of penetration rate/rotation pressure.

All the settings in the program will be stored in a XML file. For a quick setup or start on a project a default XML file can be provided from Bever Control AS.

The MWD module can be started by using the MWD button in the top menu in the As built production screen or by right clicking on the desired log(s). The log or log files to be used in the module must be marked in the table of log files. See Fig.126.

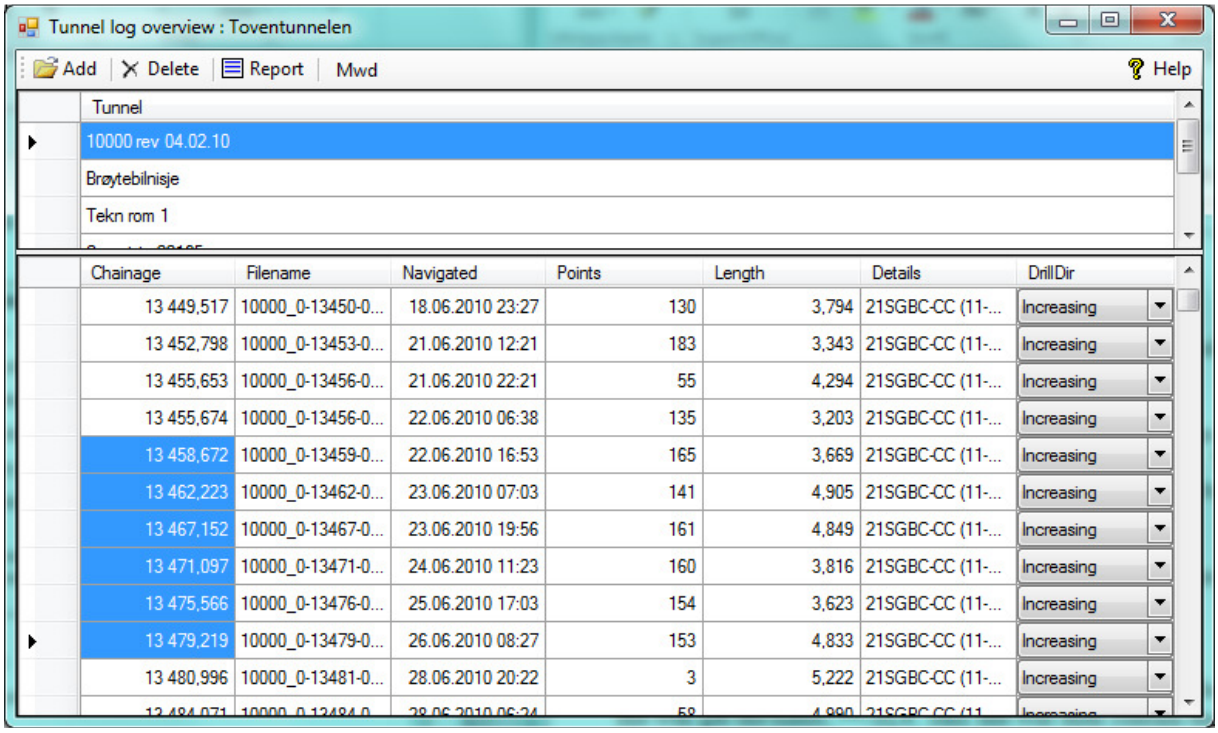


Fig. 126

Atlas Copco log files, have to be arranged in a certain matter (Description needed. Provided on request)
AMV log files will be read as they are.

5 How to convert/export log files to other format

Right click on the file, choose MWD – export and choose the place to save the file. The new file will get the name; **-TL4. This file will then contain the hole types chosen by the user. To set hole types choose Settings from the menu in the MWD module and then – 11.hole types. The once marked will be exported

6 Main Screen

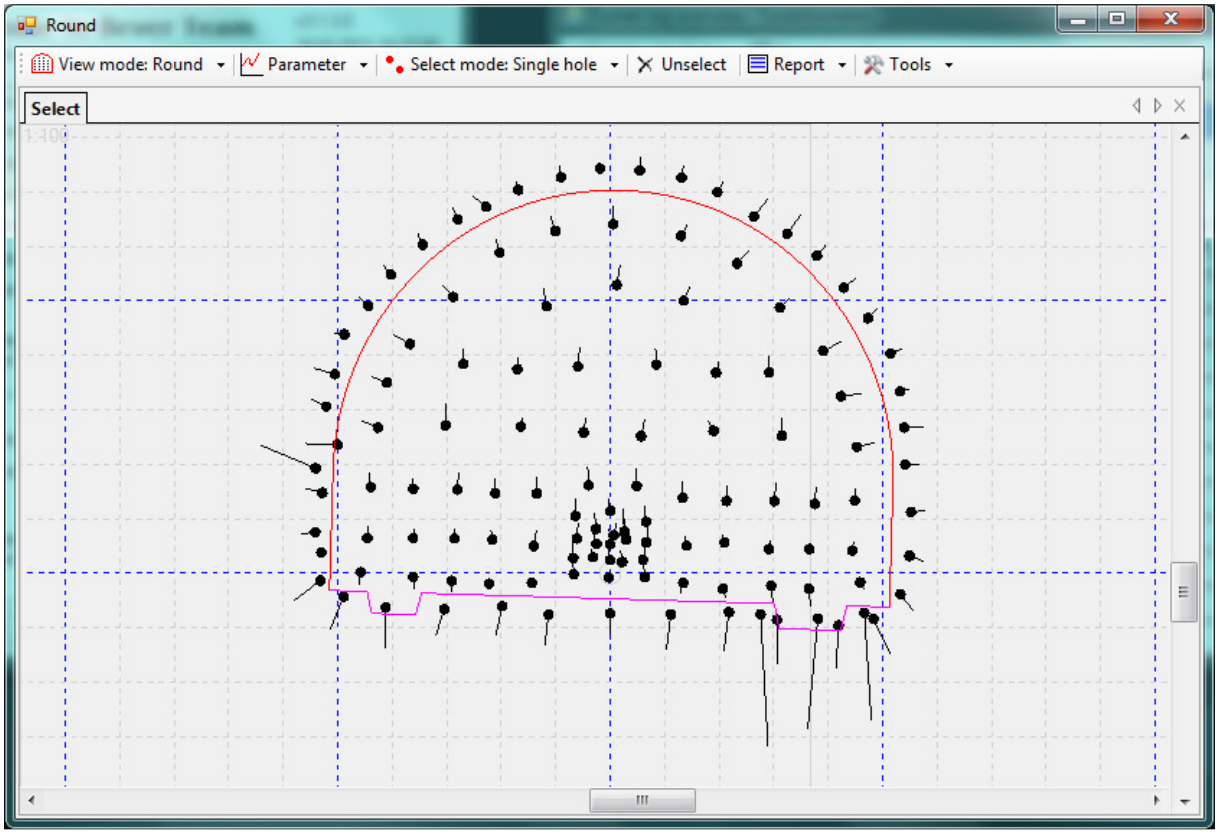


Fig. 127 Main Screen

Tool bar buttons:

View mode – Toggle between Round, Round 3D, Surface, Shell, iso-surface and linear.
Parameter – Choose witch parameter to look at.
Select mode – Toggle between different ways to select holes in the round, single, Multiple and Track (draw around the desired holes).
Unselect - Remove selected holes.
Report - Choose an excel report or an export to a picture with meta data attached.
Tools - Settings, Recalculate, Update view and Legend (description of chosen parameter)

How to Zoom and Pan in main window:

Right click with the mouse and hold. Move right/ left to Zoom and back/forward to Pan. When displayed in 3D use the left mouse button to navigate the data around.

7 Settings

The settings can be calibrated down to each drill hammer. This is only for experienced users to do. It is also necessary to have some log files to do the fine tuning and settings.

Workflow to do the basic settings will be:

1. Find average drill rates, like penetration.
2. Define drifter parameters
3. Define drifters – important that they have the same name as in the log file overview and with a boom number attached to the name. Example: AMV (11295 BCA 24.51)-1
4. Define hole types – Must be connected to a drifter, visible and with a defined color.
5. Define color scales – Type 0 = user defined. From 1 – 5 itwill be defined by the program.
6. Define road – important that the name is the same as the defined tunnel in Bever Team.

7.1 *Average rates*

This can be found using the report tool in the *As built Production* main window. Create a report and look at the rates in this.

7.2 *Define drifter parameters*

The parameters must be added in the MWD module and under the *Tool – Settings* menu. Choose main chapter 03 Drifter parameters and chapter 01 Drifter parameters. Click and use the button on the right.

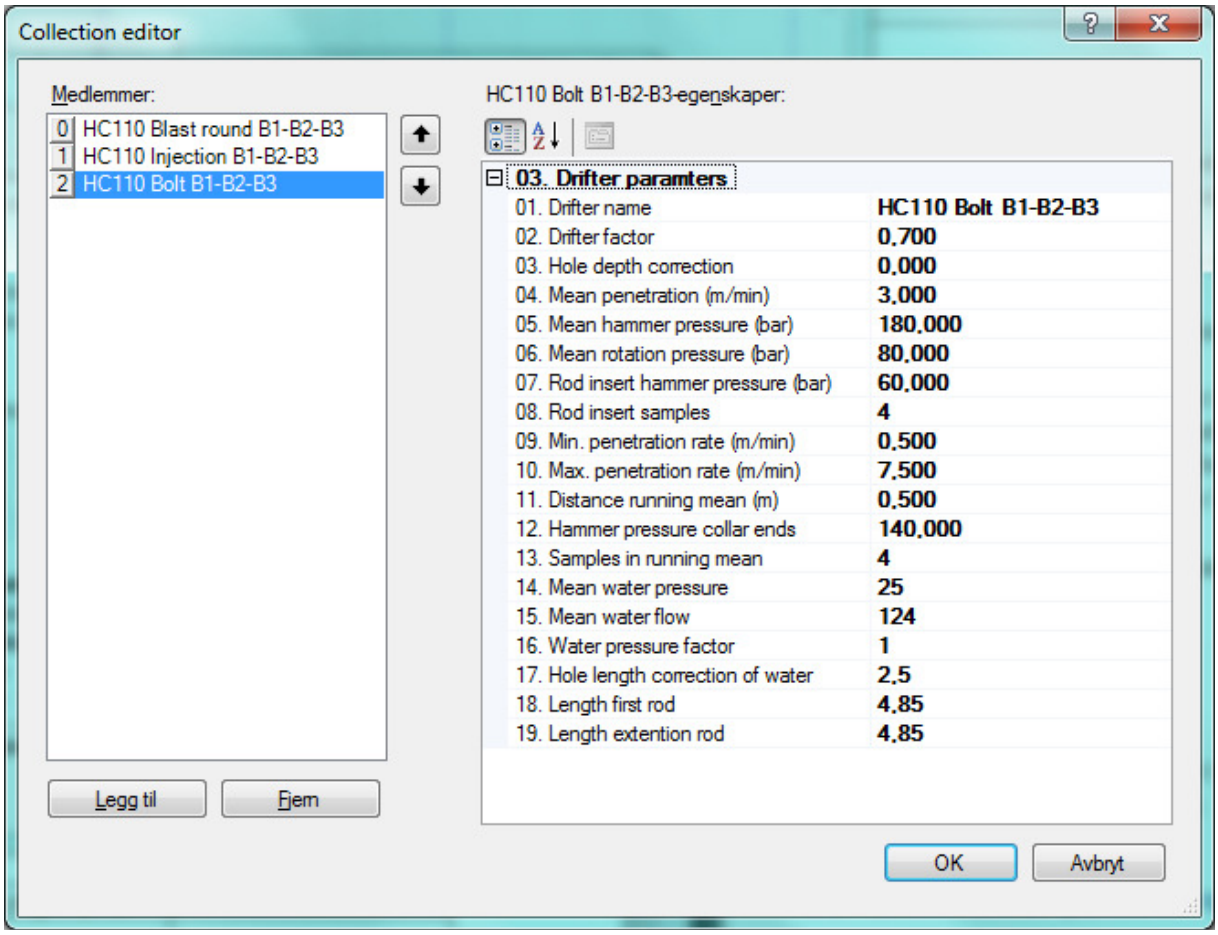


Fig. 128 Drifter Parameters

Nr.	Text	View setting	Value ex.
3-01	Drifter name	Define the name to use on the drifter	HC110 Bolt B1-B2-B3
3-02	Drifter factor	Hammer compensation	0,700
3-03	Hole depth correction	Compensation for long holes	0,000 %/meter
3-04	Mean penetration	Average value	3,000 m/min
3-05	Mean hammer pressure	Average value	180,000 bar
3-06	Mean rotation pressure	Average value	80,000 bar
3-07	Rod insert hammer pressure	Detection of rod change when under the value	60,000 bar
3-08	Rod insert samples	The number of samples to be removed on the rod change peak	4
3-09	Min. penetration rate	Filter value (app will add average when outside this value)	0,500 m/min
3-10	Max penetration rate	Filter value (app will add average when outside this value)	7,500 m/min
3-11	Distance running, mean	Average value over this distance, used in RMS calculations	0,500 meter
3-12	Hammer pressure collar	Detection of collar end drilling for	140,000 bar

	ends	removal of the noise/peak	
3-13	Samples in running mean	How many mean samples to be put back in calculations when noise/peaks are removed	4
3-14	Mean water pressure	Average value	25 bar
3-15	Mean water flow	Average value	124 liter
3-16	Water pressure factor	Correction to flow when pressure changes	1
3-17	Hole length correction of water	Correction per rod	2,5 %
3-18	Length first rod	Length from graph, not steel length	4,85 meter
3-19	Length extension rod	Length from graph, not steel length	4,85 meter

7.3 *Define drifters*

The parameters must be added in the MWD module and under the *Tool – Settings* menu.

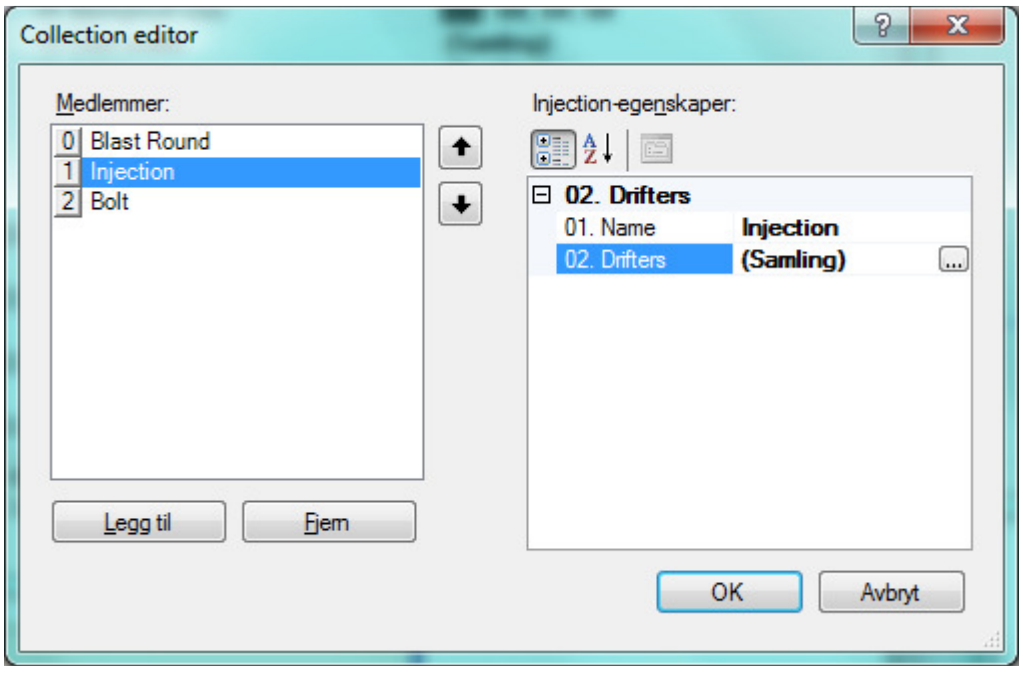


Fig. 129 Define drifters

The different drifter classes are to be defined here. At least one class must be defined for each project. In Fig. 129 there are three classes, Blast Round, Injection and Bolt. These classes needs to be connected to a specific jumbo and a drifter. This is done in the right frame, click on the line marked; *02. Drifters* and the button there. The window in Fig. 130 will then appear. In this window the Jumbo and boom must be added in the left frame and connected with the right drifter in the right frame.

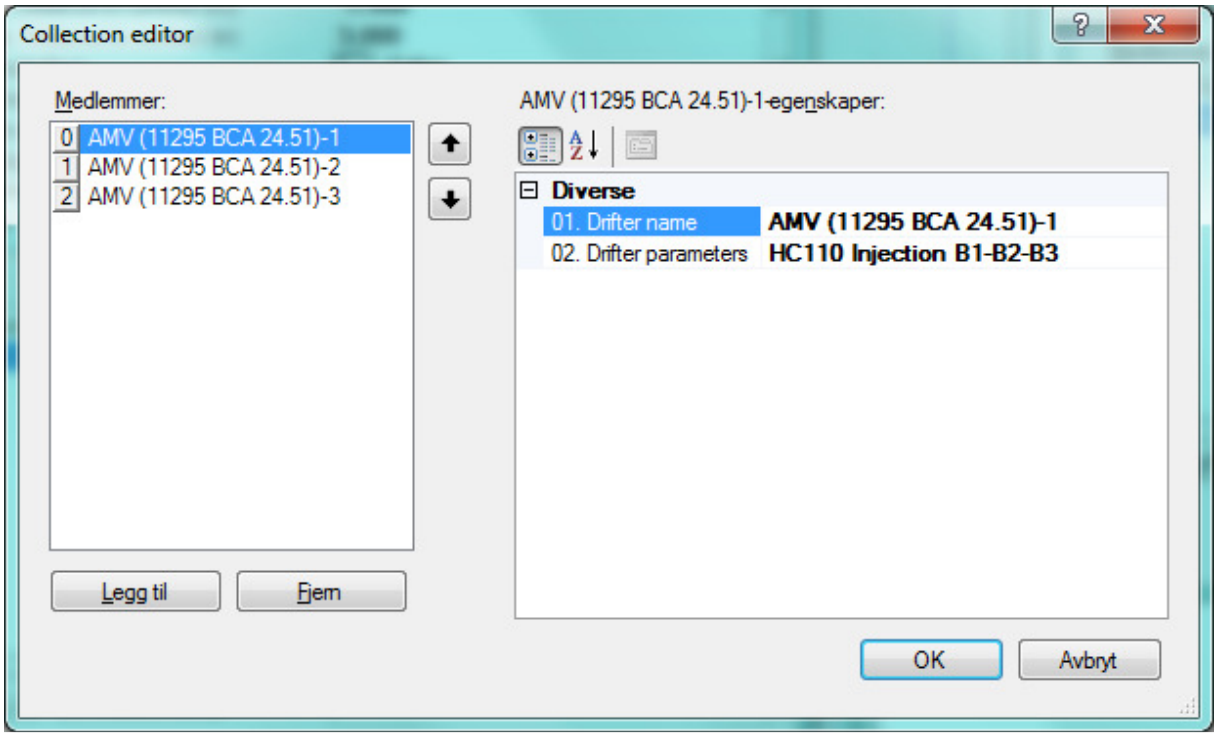


Fig. 130 Define drifters, connect to parameters

7.4 *Define Hole types*

The parameters must be added in the MWD module and under the *Tool – Settings* menu.

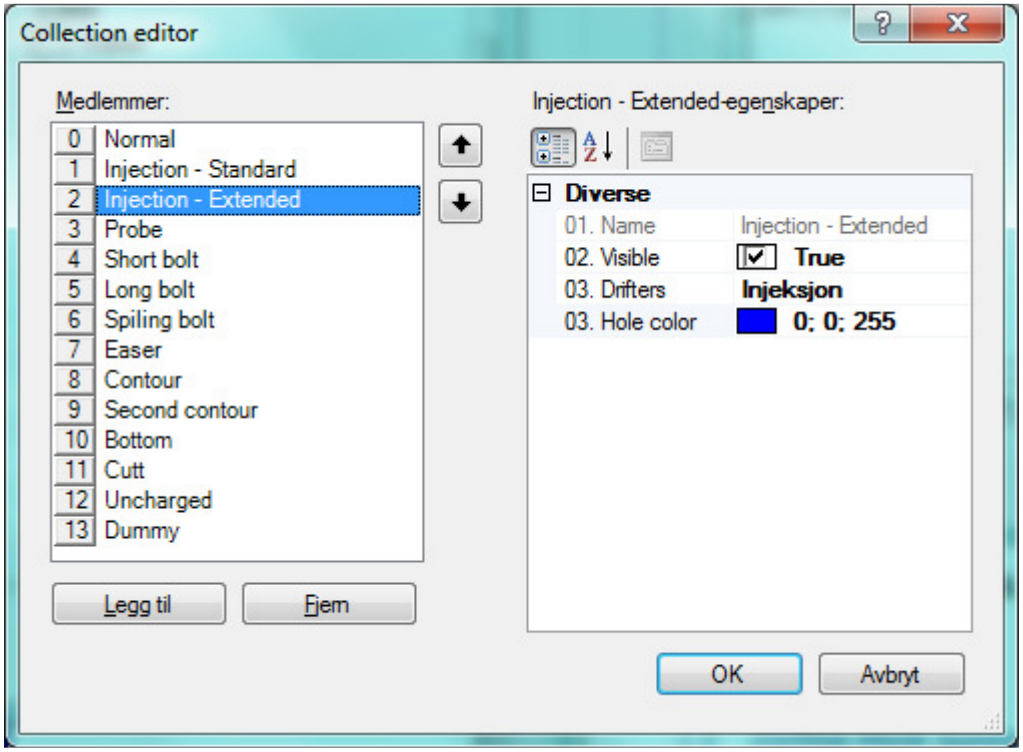


Fig. 131 Define hole types, how to display and whom to export

All the desired hole types must be added in the list on the left hand side. In the frame on the right hand side the color must be chosen, the drifter class connected and if the hole type shall be visible or not. Mark that the hole types that is set to visible here will be exported to the .TL4 file type.

7.5 *Define color scales*

The parameters must be added in the MWD module and under the *Tool – Settings* menu.

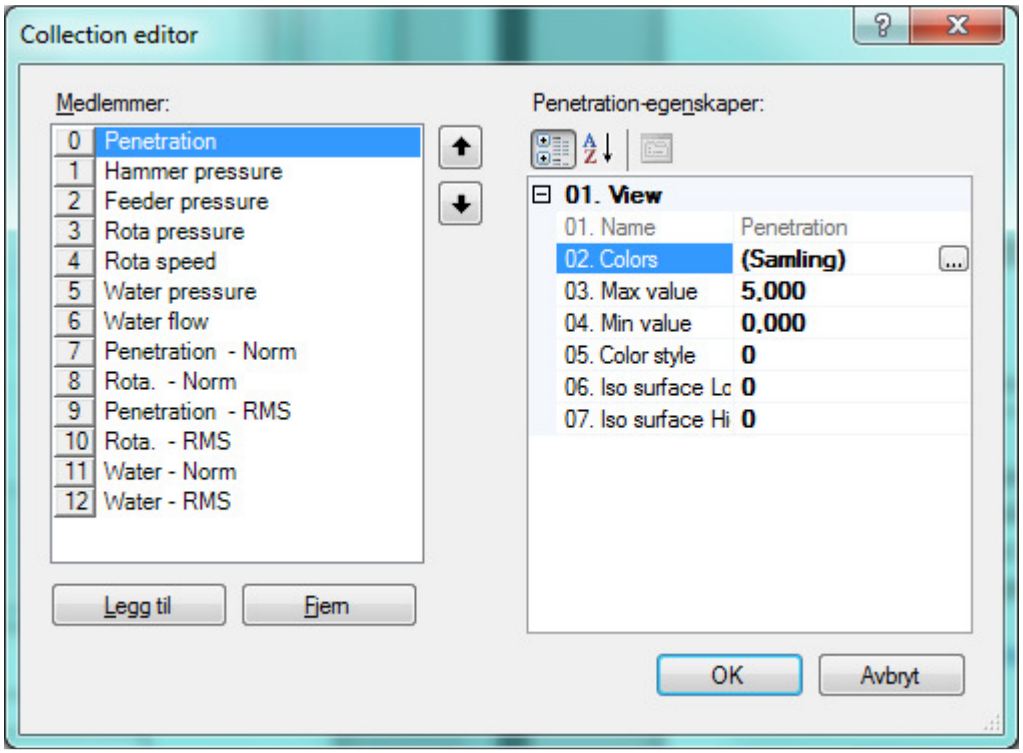


Fig. 132 Color scales

Add all the classes/members in the parameter list on the left hand side.
The table on the right hand side:

01	Name	Name of the parameter	Penetration
02	Colors	Opens up a new window where to choose the color. See Fig. 133	Collection
03	Max value	Max parameter value to be colored	5,000 m/min
04	Min value	Min parameter value to be colored	0,000 m/min
05	Color style	0= user settings and 1-5 are default program settings	0
06	Iso surface low level	At witch value the low level iso surface shall be displayed	0
07	Iso surface high level	At witch value the high level iso	0

		surface shall be displayed	

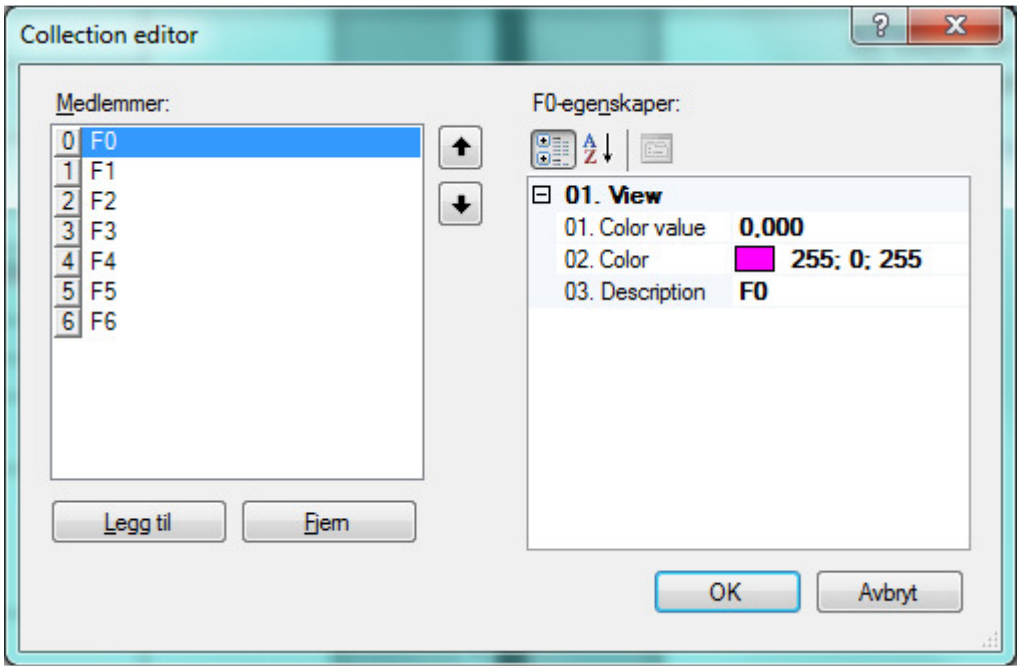


Fig. 133

The different colors in user settings are defined here. Also the text to be displayed in reports and in *Legend* are set here. In Fig. 133 it is six members in the table but it could also be displayed with two members, i.e. soft rock and hard rock.

7.6 *Define a road*

If it is necessary to show the chainage/station numbers and to have a visual road the settings in the main chapter *04. Road definition* must be set.

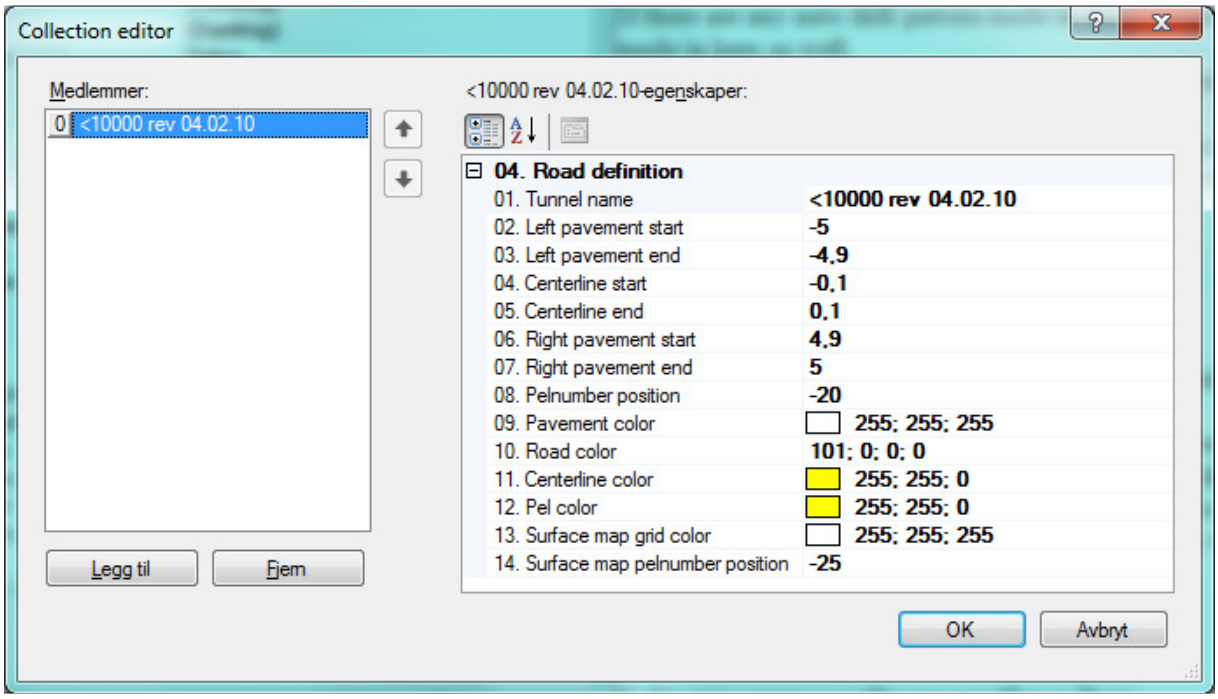


Fig. 134 Road definition

It is very important that the road member have the same name as the actual tunnel in Bever Team 3.
The table on the right hand side:

Nr.	Text	View setting	Value ex.
4-01	Tunnel name	Set the tunnel name, must be the same as the original in BT3	<10000 rev 04.04.10
4-02	Left pavement start	Define the width of the left side line	-5 meters
4-03	Left pavement end	Define the width of the left side line	-4,9 meters
4-04	Center line start	Define the width of the center line	-0,1 meter
4-05	Center line end	Define the width of the center line	0,1 meter
4-06	Right pavement start	Define the width of the right side line	4,9 meters
4-07	Right pavement end	Define the width of the right side line	5 meters
4-08	Pelnumber position	Where the chainage/station number shall be displayed	-20 meters
4-09	Pavement color	Color of the left and right lines	White
4-10	Road color	Color of the road	Black
4-11	Centerline color	Color of the tunnel line	Yellow
4-12	Pel color	Color of the Cainage/station values	Yellow
4-13	Surface map grid color	Color of the grid in surface map view	White
4-14	Surface map pelnumber position	Where the chainage/station number shall be displayed in surface map view	-25 meters

Note! Minus values are always on the left side of the tunnel line and positive values are always on the right side of the tunnel line.

7.7 *Main Settings Menu*

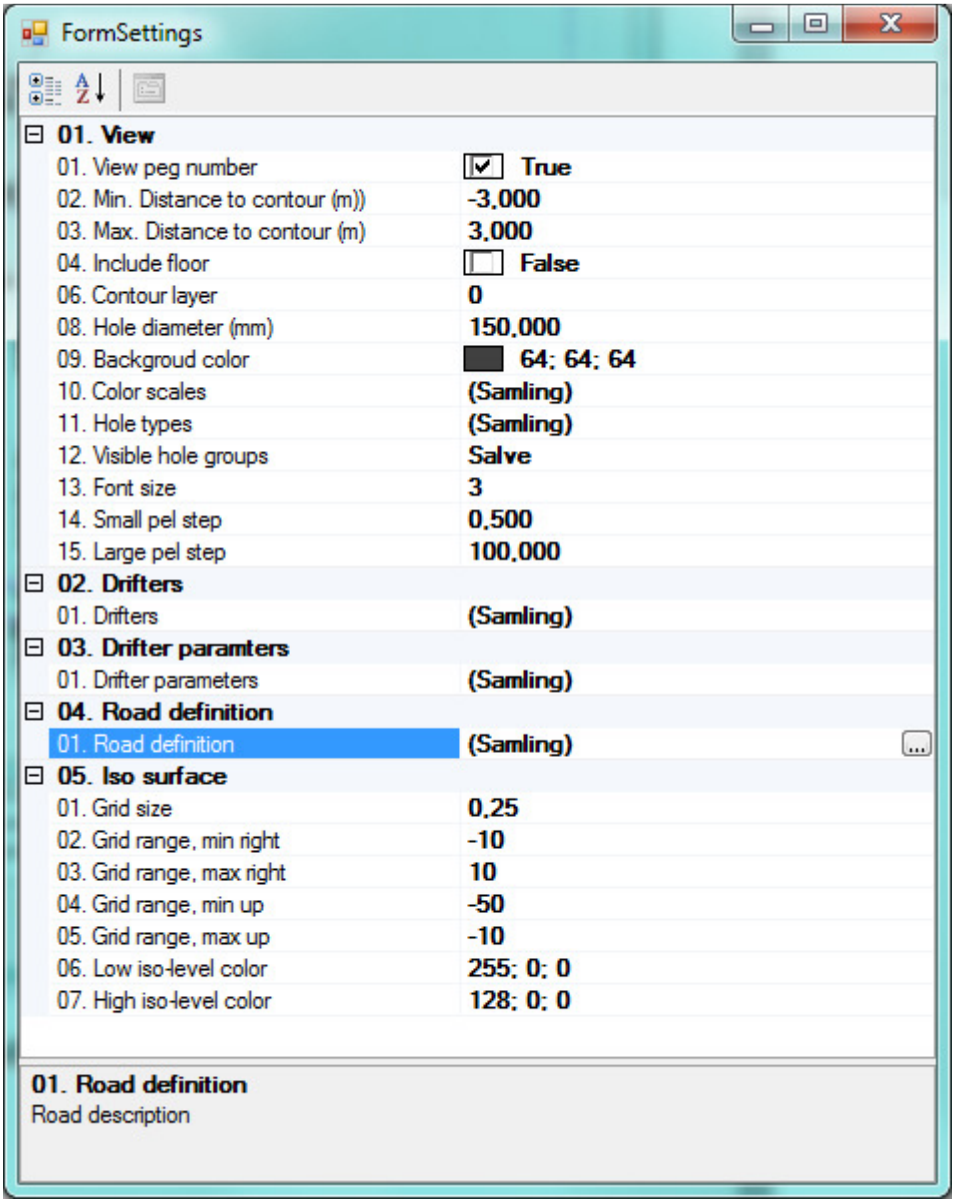


Fig. 135 Main settings menu

Nr.	Text	View setting	Value ex.
1-01	View peg number	Turn on/off chainage/station	True
1-02	Min Distance to contour	Hole filter along the contour. Distance from theoretical contur and in.	-3,000 m
1-03	Max distance to contour	Hole filter along the contour. Distance from theoretical contur and out.	3,000 m
1-04	Include floor	Holes along the floor will be incuded if active.	Off
1-05	Contour layer	Contour layer from BT3 project data	0

1-08	Hole diameter	Hole size in the graphics	150,000 mm
1-09	Background color	Color of the backgraound in graphics window	Black
1-10	Color Scales	See chapter 3.5	Collection
1-11	Hole types	See chapter 3.4	Collection
1-12	Visible hole groups	Witch holes to be active an visible in the graphics and calculation	Salve
1-13	Font size	Font Size	3
1-14	Small pel step	Step in chainage/station when in Linear view	0,500 meter
1-15	Large pel step	Step in chainage/station when in 3D/iso and flattened view	100,000 meters
2-1	Drifters	See chapter 3.3	Collection
3-1	Drifter parameters	See chapter 3.2	Collection
4-1	Road definition	See chapter 3.6	Collection
5-1	Grid size	Size of cubes in the iso view	0,25 meter
5-2	Grid range, min right	Distance from center/tunnel line to look for and create data, left side	-10 meters
5-3	Grid range, max right	Distance from center/tunnel line to look for and create data, right side	10 meters
5-4	Grid range, min up	Distance from center/tunnel line to look for and create data, up	-50 meter
5-5	Grid range, min down	Distance from center/tunnel line to look for and create data, down	-10 meter
5-6	Low iso level color	Color on cubes in iso view	Red
5-7	High iso level color	Color on cubes in iso view	Brown

7.8 *Iso surface*

The iso surface view shows a 3D surface of a parameter in the tunnel room. The size of the cube is user defined and the value is shown as a surface in this when the value is correct/ interpolated.

8 Calculations

Our MWD recording includes logging of:

- Hole position
- Depth
- Penetration rate

- Feed pressure (trust)
- Rotation pressure (torque)
- Hammer pressure (percussion)
- Water pressure
- Water flow
-

Data is presented in trend curves and as 3D displays on round, probe and grouting bore holes.

8.1 *MWD interpretation on blast drilling, injection drilling, probe drilling gives a complete documentation scheme*

The method of MWD interpretations is more informative and safe if the same analysis is made on all type of drilling with setting parameters that is optimized for blast round drilling, injection drilling and probe drilling. Blast drilling gives the best data for estimation since we have so many holes, injection drilling is also good with many holes. Probe drilling on single hole is not so easy so often the geologist should consider also to look into the trend graphs on different MWD parameters at own choice. Injection drilling gives data at the right time in the production cycle, while probe drilling gives the early warning indication. Blast drilling gives the best "as observed" documentation.

8.2 *Export to Excel spreadsheet*

All logged parameters and calculated parameters can be copied to an Excel Spreadsheet for customer evaluation or in house estimation. This will be an interesting feature for the probe drilling where the amount of data is not so large and a customized analysis may be of certain interest.

8.3 *MWD Rock Estimation Module Calculations*

"**Hardness**" and "**Fracturing**".

Estimation of rock properties from the drilling performance is based on methods to compensate from variations due to drilling performance as much as possible. Our implemented methods are based on these steps in calculations:
Sample of long hole drilling parameters every 2-5 cm (penetration rate, feed pressure, percussion (hammer) pressure, rotation pressure, water pressure and water flow.
Sample of blast drilling parameters for every 2-10 cm
Sample of bolt drilling parameters for every 2-10 cm
Establish a drilling machine average penetration rate
Establish a drilling machine average feed pressure
Establish a drilling machine average percussion pressure
Establish a drilling machine average rotation pressure

Hardness estimation

Penetration rate is the major response parameters of hardness that indicates how hard the rock is to drill. Our algorithm has these steps in our current implementation:
Select the penetration log for one hole at a time
Filtering of data to cancel bad data, rod exchange disturbance and/or collar disturbance
Normalize the penetration rate to % deviation from average value
Compensation for drilling depth
Compensation for control changes in percussion pressure (feed pressure inclusive)
Visualization of this value is called "normalized penetration rate" scaled in % and displayed in trends, 2D mapping and 3D as wished
Based on geology judgments the "normalized penetration rate" shall be calibrated to rock properties and you can then assign scale and color mapping to describe rock hardness classes (type of rock). Legend can be defined by user. These calibrations must be done based on initial logged MWD data as well as geologists description of rock hardness.
Hardness visualization of "normalized penetration rate" in color maps scaled with rock hardness, 2D mapping and 3D as wanted.

Fracturing estimation (homogeneity)
Frequent variations on penetration rate and rotation pressure are the major response parameter to fracturing. High rotation pressure may also indicate fracturing of the rock but we estimate from the variations as calculated from the "root mean square" value. Our algorithm has these steps in our current implementation:

Select the normalized penetration log/ rotation log for one hole at a time
Calculate "root mean square" of the normalized values above
Visualization of this value is called "rms of penetration rate/rotation pressure" and will be displayed in trends, 2D mapping and 3D as wished
Based on geology judgments the "rms of penetration rate/rotation pressure" shall be calibrated to rock properties and you can then assign scale and color mapping to describe rock fracturing classes (type of rock). Legend can be defined by user. These calibrations must be done based on initial logged MWD data as well as geologists description of rock hardness
Fracturing visualization of "rms normalized penetration rate /rotation pressure" in color maps scaled with fracturing, 2D mapping and 3D as wanted.

Water estimation
We have also implemented a water indicator that gives a warning on significant changes in flushing water due to changed flushing resistance (compensated for water pump pressure variations).

8.4 *Compensation for control changes in percussion pressure (feed pressure inclusive)*

The drilling energy is mainly put into the percussion process. Before the drill control systems were very simple and did not change on the feed setting rotation or percussion during drilling. Then the penetration rate variations were direct influenced by the rock properties. In modern control systems the systems itself behave very dynamic with functions like:
Collaring settings at low percussion pressure and feed pressure.
Jamming control initiates a ramping function of reduction/increasing percussion and feed pressure.
Jamming control are triggered by high rotation pressure.

Fault control initiates also reduction/increasing percussion and feed pressure.
Fault control is triggered by very high penetration rate.
Percussion and feed pressures are adjusted proportional in the control system

When we are calculating the normalized penetration rate (indicator for rock hardness) we have implemented these functions:

Filtering scheme of parameter values can be applied for the normalized penetration rate. We may set low limit values on percussion pressure (rod change and collaring period). Normal penetration rate will then be replaced with an averaging value.
A linear compensation scheme that calculate expected penetration rate if percussion pressure was as normal. For example if there is a penetration rate of 3 m/min and it drops to 1.5 m/min due to jamming and reduced percussion pressure. To normalize this situation we then lift the normal penetration rate by a factor x delta percussion pressure. The best way to evaluate this factor is to check on the effect on trend curves with reduced percussion pressure

Normalized penetration rate = Penetration rate/Average penetration rate + percussion compensation
Rock Hardness = Normalized penetration rate with adjusted scale set by the geologists

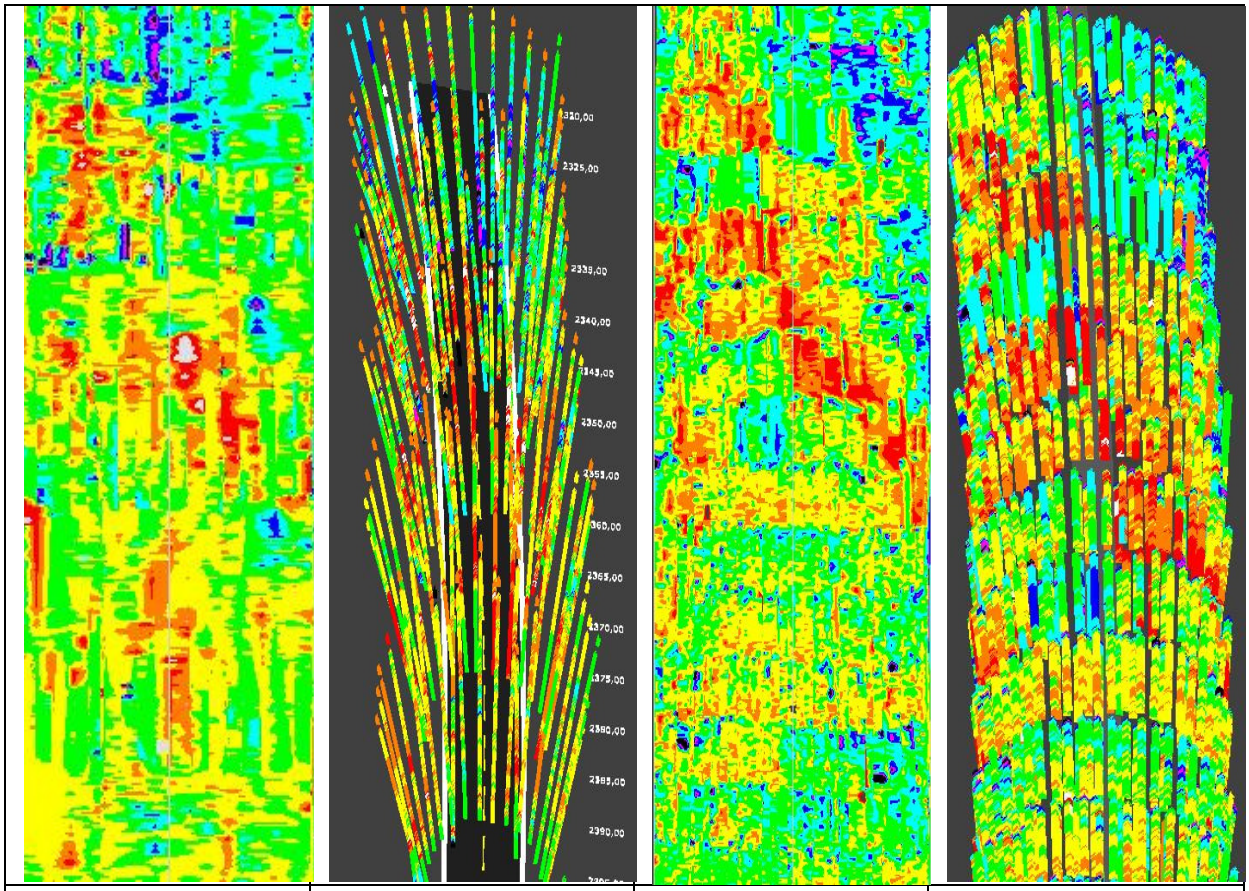
The unit of normalized penetration rate is % deviation from the average value.

8.5 *Penetration rate/rotation pressure*

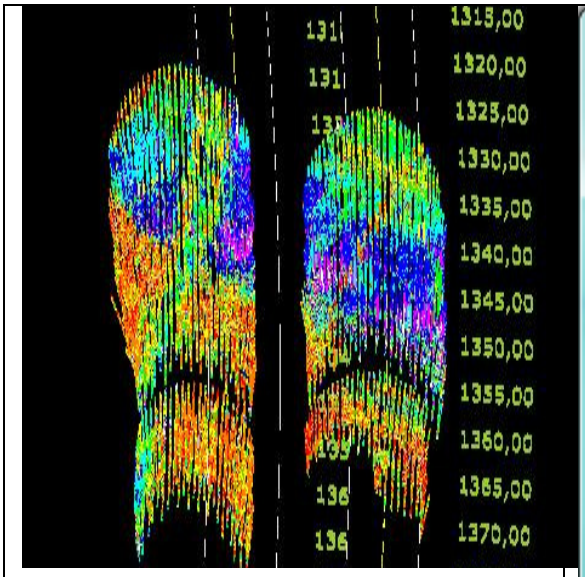
We are calculating the rms value for both parameters. The user choose from experience which parameter gives best indications. Both will indicate if the rock is fractured or homogenous by showing high values when the variations are large. RMS is a kind of averaging value of the standard deviation.

9 Views and interpretations

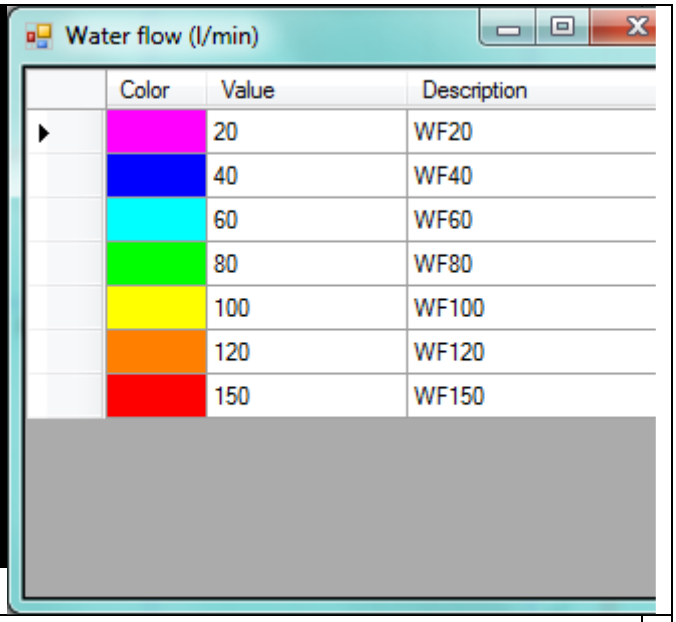
Examples of different views and reports. It is also possible to have several tunnels aligned in som of the views. Thorvald



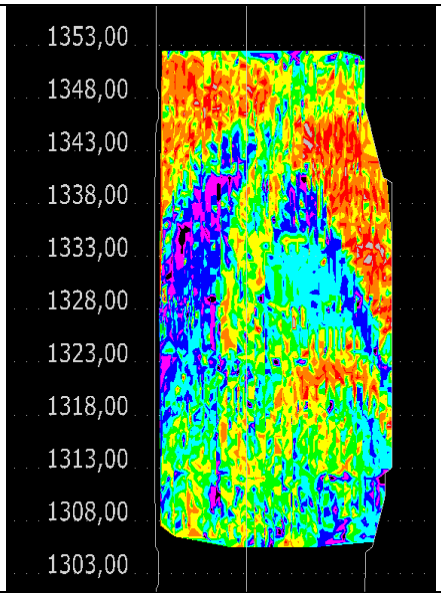
Injection drilling 20 meter long holes	Blast drilling 5 meter long rounds
Tunnel Strindheim 11000 example	Tunnel Strindheim 11000 example
Mapped view to left, 3d view to right	Mapped view to left, 3d view to right



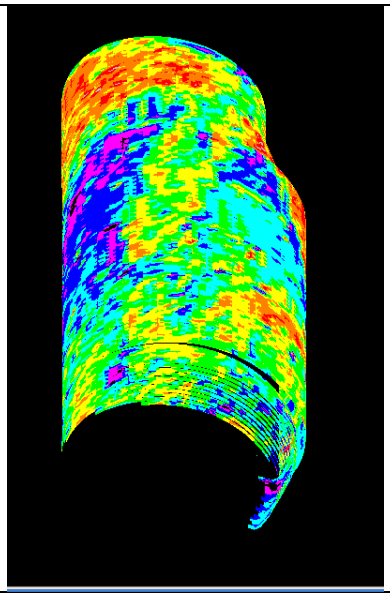
View of rounds shoving single holes in 3D display



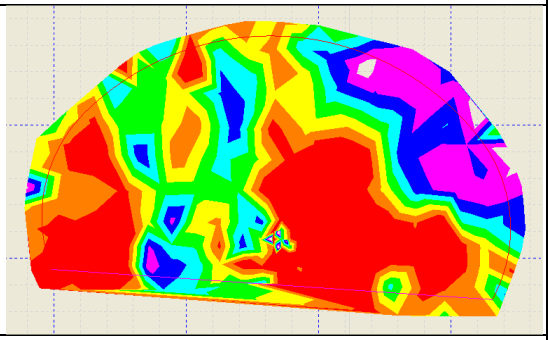
Legend defined by client. Label text, Value and colour can be selected



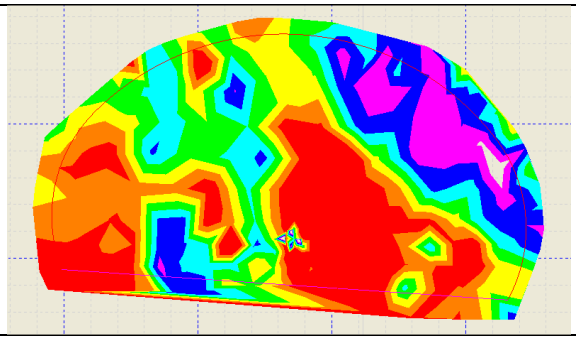
Surface map with borderline and peg no (station/chainage).



3D shell, with the same sections as seen at left.



Linear view with penetration rate as parameter.



Linear view with penetration rate as parameter.

Program Files and Folders

The Install procedure will create different folders and files. Some are for the program and other for libraries and settings.

1 Windows XP

The program will be installed under:

C:\Program Files\Bever Control\Bever Team 3\Binaries

In here are all the program files and subfolders created. One to be aware of is the DOC folder. This folder contains all the report templates. If any changes are to be made with the templates just open the desired excel file, change and save. It is very important to save the changed file(s) to a second folder as well before any program updates, since the update procedure will overwrite the user changed files.

Libraries and settings folders are found under:

C:\Documents and Settings*current user*\my documents\Bever Team

It is recommended to use this as the default folder for databases as well when using the program on a single computer and with no network database.
Just add a folder and name i.e. databases.
If there are any auto drill pattern made in the program an Auto folder will automatically be made in here as well.
The Favorites folder contains contours and drill patterns sent to favorites from the program, like libraries.
The Settings folder contains various personal settings in the program, like colors on the contour layers, fixed points definition ASO. It also contains the resent project to open.

2 Windows 7 / Vista

The program will be installed under:

C:\Program Files\Bever Control\Bever Team 3\Binaries

In here are all the program files and subfolders created. One to be aware of is the DOC folder. This folder contains all the report templates. If any changes are to be made with the templates just open the desired excel file, change and save. It is very important to save the changed file(s) to a second folder as well before any program updates, since the update procedure will overwrite the user changed files.

Libraries and settings folders are found under:

C:\Users*current user*\Documents\Bever Team

It is recommended to use this as the default folder for databases as well when using the program on a single computer and with no network database.
Just add a folder and name i.e. databases.
If there are any auto drill pattern made in the program an Auto folder will automatically be made in here as well.
The Favorites folder contains contours and drill patterns sent to favorites from the program, like libraries.
The Settings folder contains various personal settings in the program, like colors on the contour layers, fixed points definition ASO. It also contains the resent project to open.

System requirements

Minimum:

Operating system: Windows XP, Vista or 7.
Processor: Intel 1.0 GHz processor or similar
RAM: 512 MB
500 MB of available hard-disk space for installation.

Recommended:

Operating system: Windows XP, Vista or 7.
Processor: Intel Core i5 processor or similar.
RAM: 4 GB
500 MB of available hard-disk space for installation.