



# Block Modelling Tutorial

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**Product**

Surpac™ 6.6.1

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## Introduction

### Overview

By working through the examples in this tutorial you will learn:

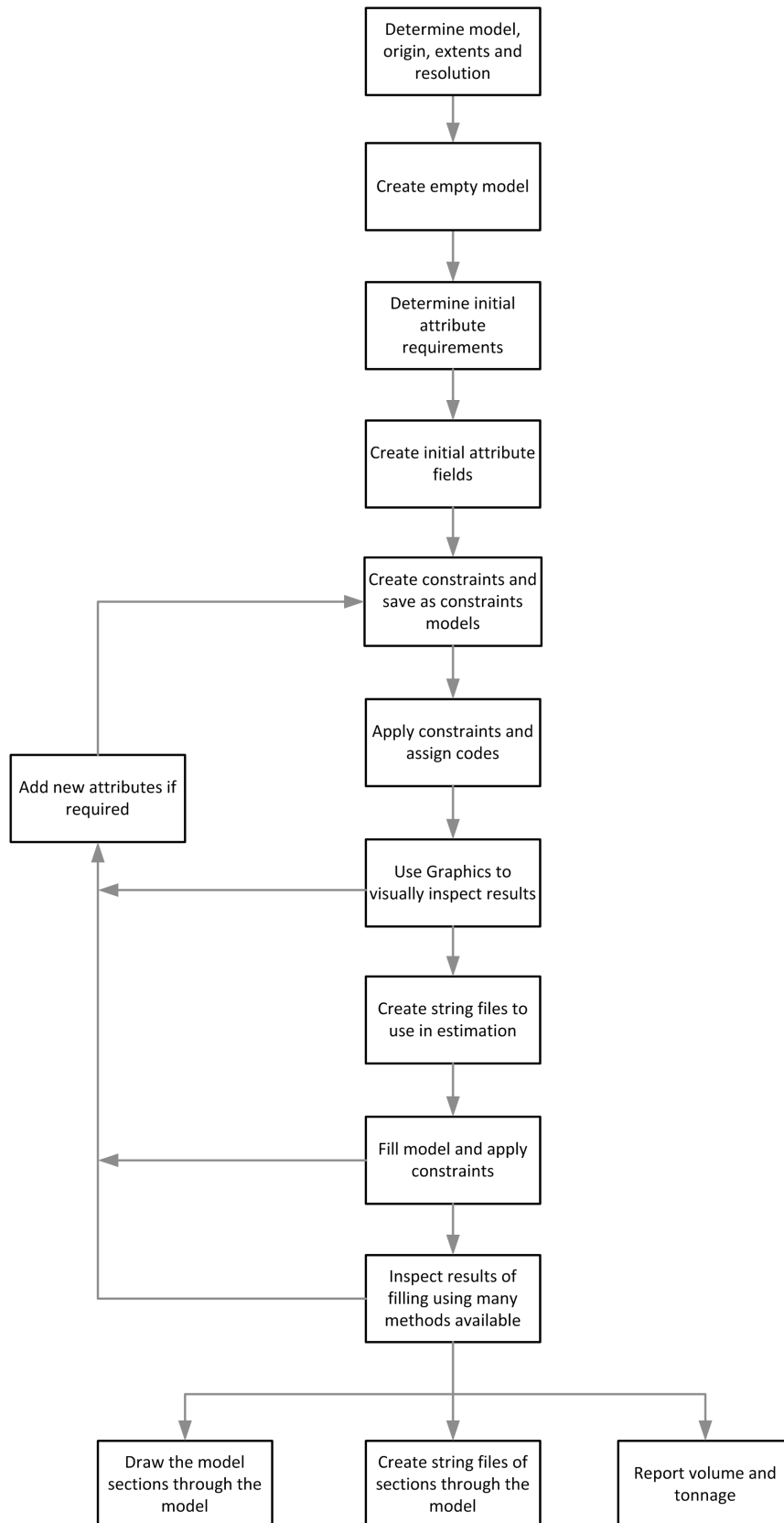
- about Surpac's block modelling module and the concept of block modelling
- to fill a block model from drillhole data from a geological database
- to constrain a block model to filter out specific blocks
- to report volume, tonnage and grade from a block model
- about column processing of a block model


### Requirements

Before you begin this tutorial, you must have:

- a good understanding of the basic Surpac concepts of strings, segments, DTMs, and string tools
- Surpac installed on your computer
- the data set accompanying this tutorial

## Workflow



 **Note:** This workflow demonstrates the steps in this tutorial. There are other ways to achieve a result.

## Block modelling concepts

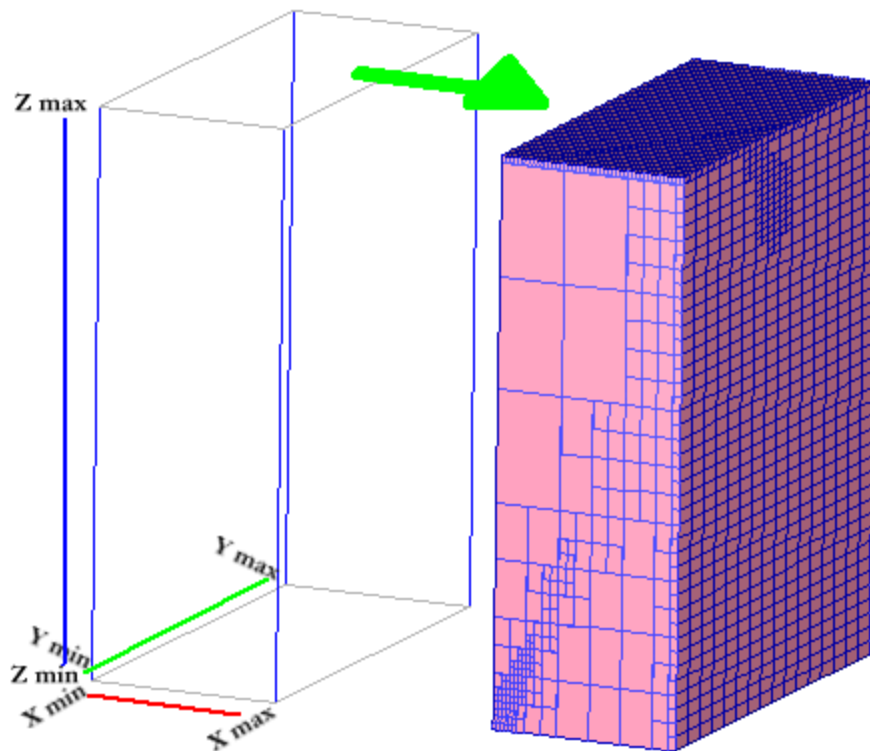
The block model is a form of spatially-referenced database that provides a means for modelling a 3D body from point and interval data, such as drillhole sample data. The block model consists of interpolated values instead of true measurements. It provides a method for estimating volume, tonnage, and average grade of a 3D body from sparse drillhole data.

### Model space

3D coordinates spatially define the model extents.

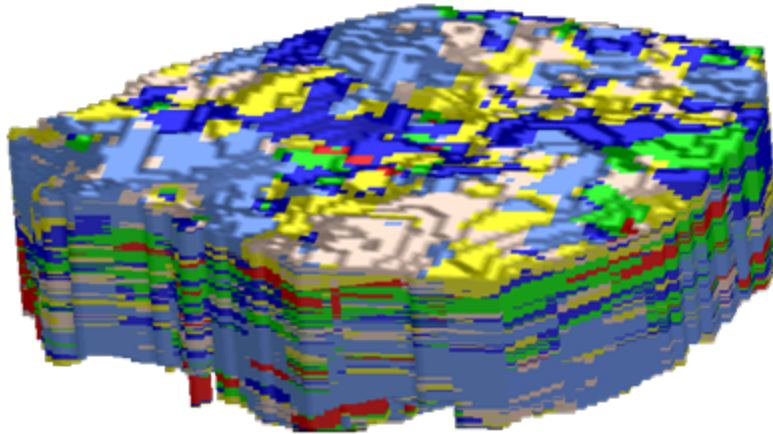
Minimum Northing (Y), Easting (X) and Elevation (Z).

Maximum Northing (Y), Easting (X) and Elevation (Z).



## Blocks and attributes

The centroid of each block defines its geometric dimensions in each axis, that is, its Y, X, and Z coordinates. Each block contains attributes for each of the properties to be modelled. The properties or attributes can contain numeric or character string values. Blocks can be of varying size, and you can define the size after the block model is created.

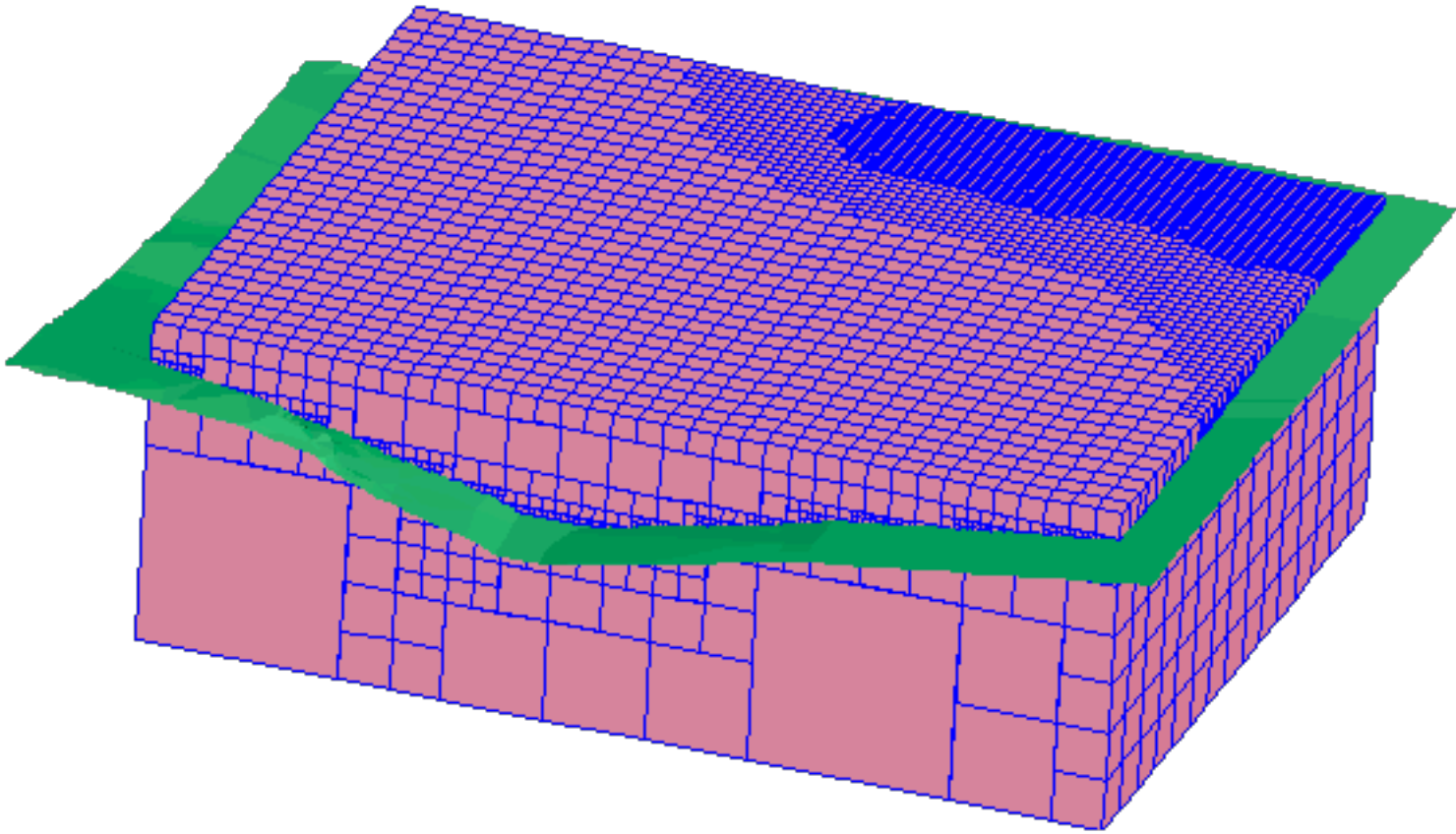


Block model of oil sands coloured by attribute values (bitumen).

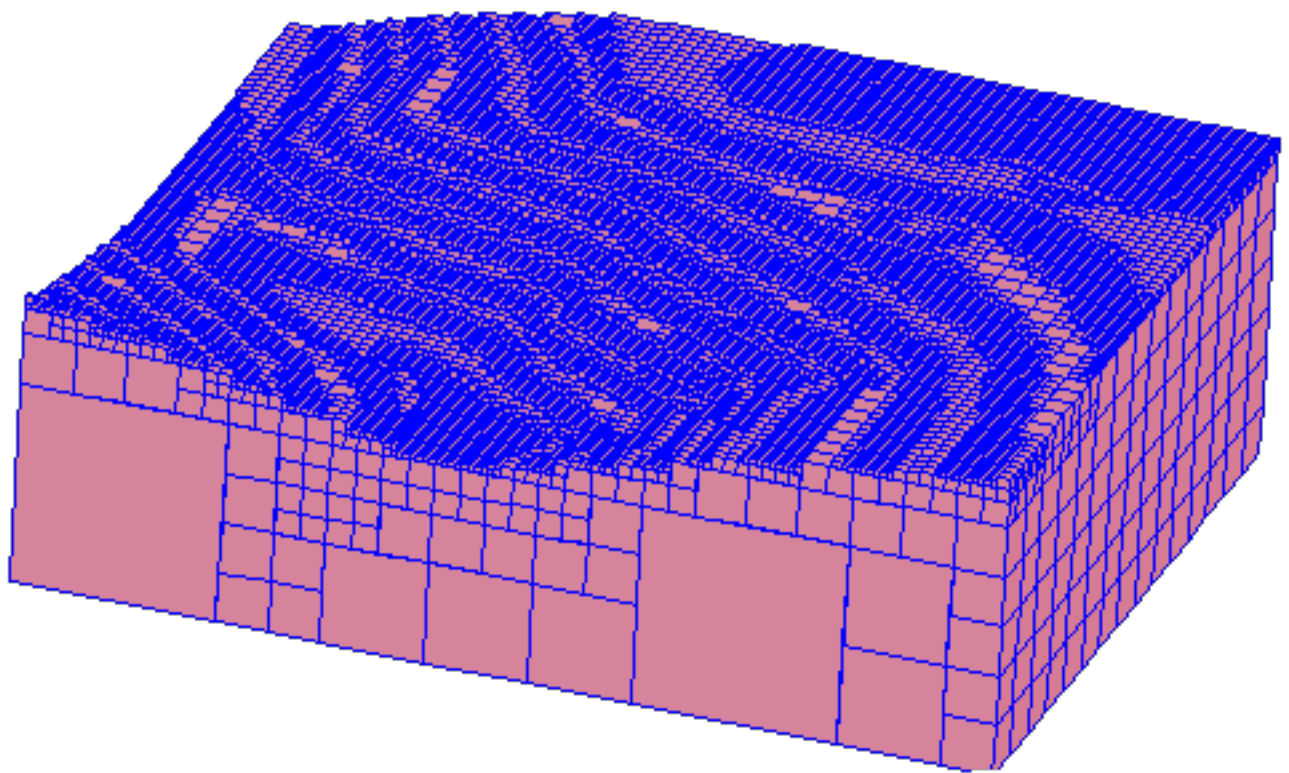
## Constraints

All block model functions can be performed with constraints. A constraint is a logical combination of one or more spatial objects on selected blocks. Objects that can be used in constraints are plane surfaces, DTMs, solids, closed strings, and block attribute values. Constraints can be saved to a file for rapid re-use. You can use a constraint as a component of another constraint.

Blocks meet a constraint (for example, below a DTM as in the following figures) if its centroid meets that constraint. This is true even if part of the block is above the DTM.



An unconstrained block model in relation to a DTM surface.



The same block model but constrained by the topography (DTM).

## Estimation

After a block model is created and all its attributes are defined, the model must be filled by some estimation method. You can do this by estimating and assigning attribute values from sample data that has X, Y, and Z coordinates, and the attribute values of interest.

The estimation methods that you can use are:

Method	Description
Nearest Neighbour	Assigns the value of the closest sample point to a block.
Inverse Distance	Assigns block values using an inverse distance estimator.
Assign Value	Assigns an explicit value to blocks in the model.
Ordinary Kriging	Assigns block values using kriging with variogram parameters developed from a geostatistical study.
Indicator Kriging	Functions concerned with a probabilistic block grade distribution derived from the kriging of indicators.
Assign from String	Assigns data from the description fields of closed segments to attribute values of blocks that are contained within those segments extended in the direction of one of the principal axes (X, Y, or Z).
Import Centroids	Assigns block values from data in a delimited or fixed format text file.

## Setting up for this tutorial

### Setting the work directory

A work directory is the default directory for saving Surpac files. Files used in this tutorial are stored in the folder `<shared_files>\demo_data\tutorials\block_modelling`.

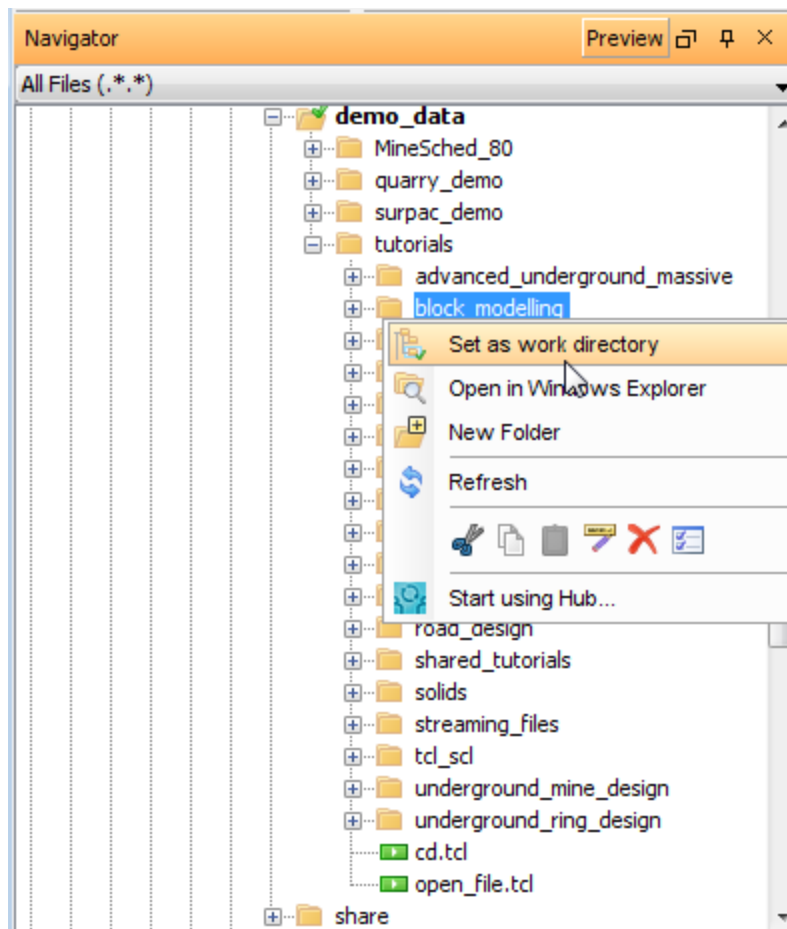
Where `<shared_files>` is the directory in which the Surpac shared files were installed.

In Windows 7, and Windows 8, the default path is

**C: \Users\Public\GEOVIA\Surpac\66\demo\_data\tutorials\block\_modelling.**

### Task: Set the work directory (Windows 7)

1. In the Surpac Navigator, right-click the **block\_modelling** folder.
2. Select **Set as work directory**.



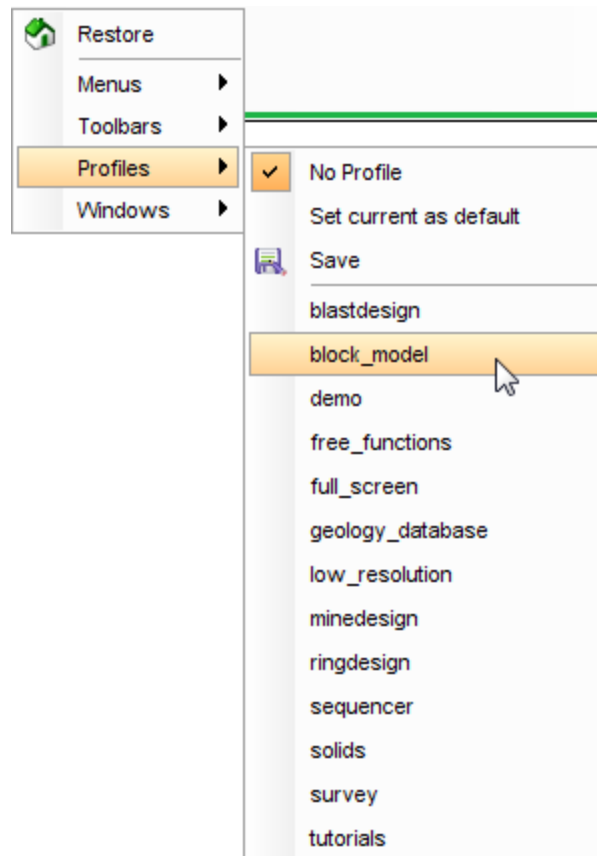
The name of the work directory is displayed in the title bar of the Surpac window.

## Displaying the toolbar and menu bar

### Task: Display the Block Modelling toolbar and menu bar

When working with the block modelling tools, it is helpful to use the **block\_model** profile. This displays the **Block model** menu bar and toolbar.

1. Right-click in the blank area next to the menus at the top of the Surpac main window.
2. From the shortcut menu, choose **Profiles > block\_model**.

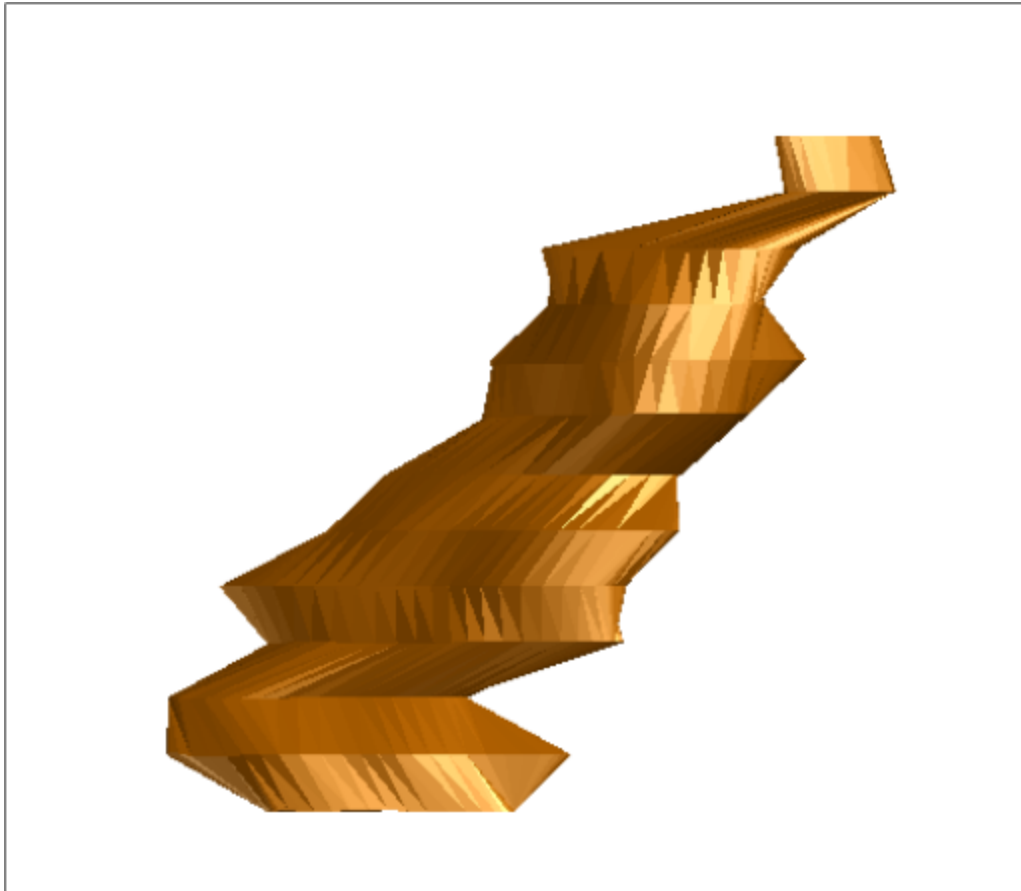


## Creating a block model

### Create a block model

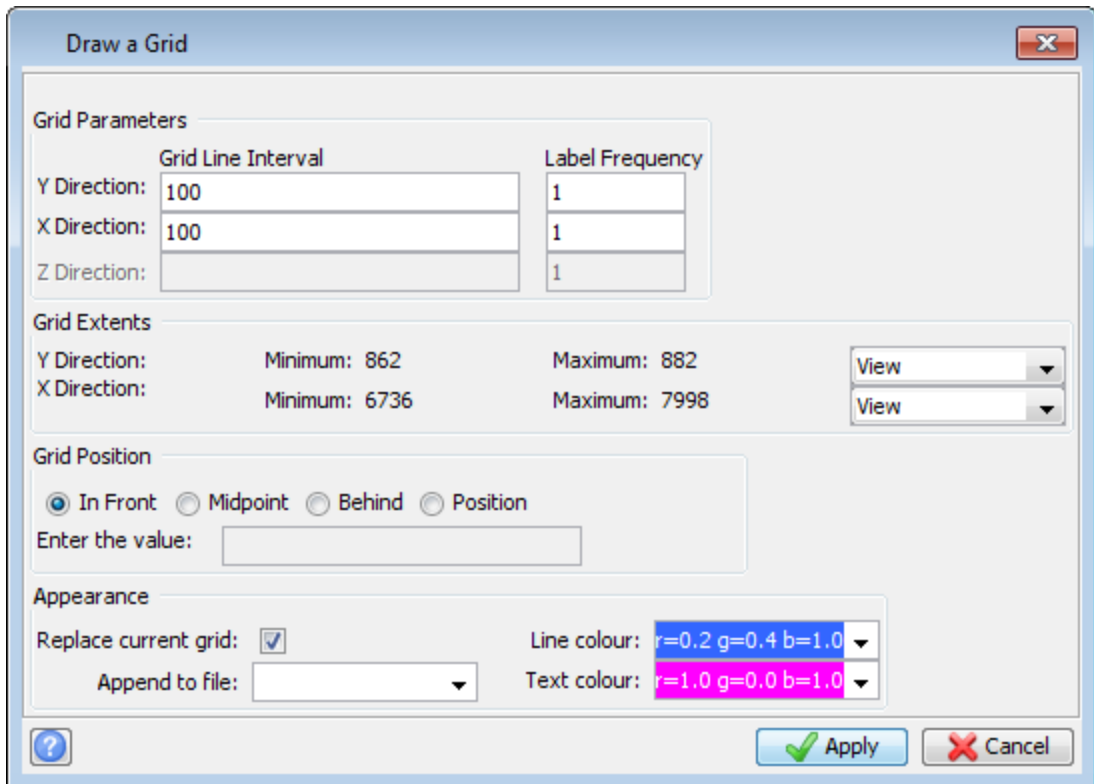
#### Task: Create a block model

1. Open **ore1.dtm** in **Graphics**.  
The solid of the ore body is displayed.

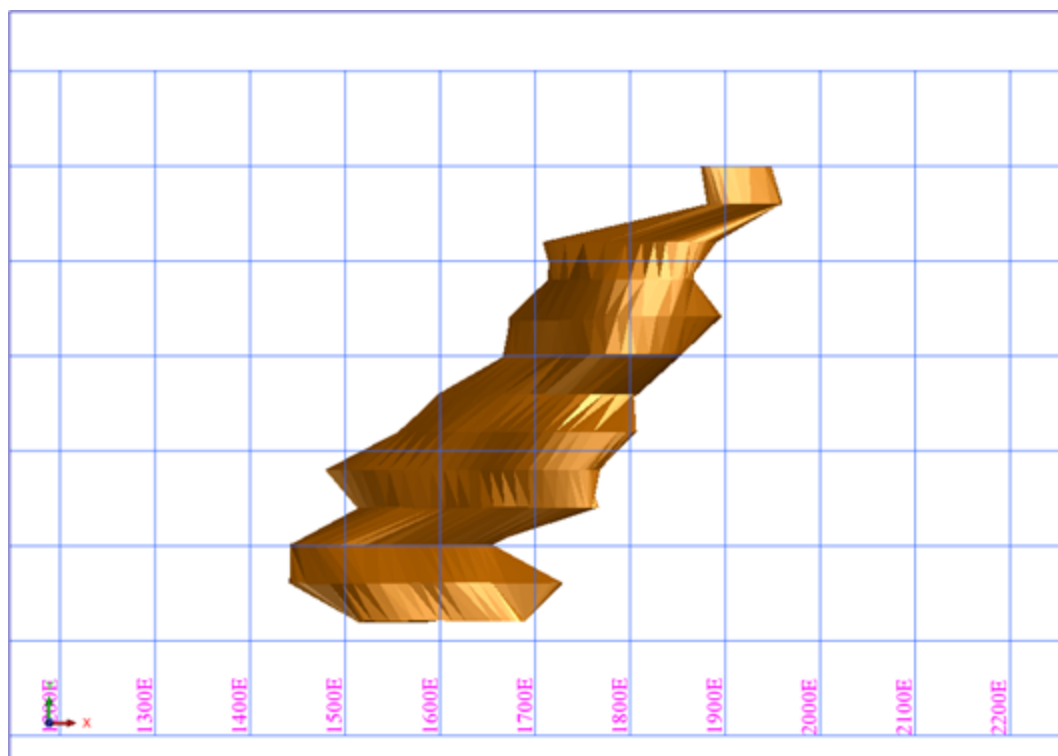



2. Choose **View > Zoom > Out**.
3. Choose **Display > 2D grid**.

- Enter the information as shown, and click **Apply**.

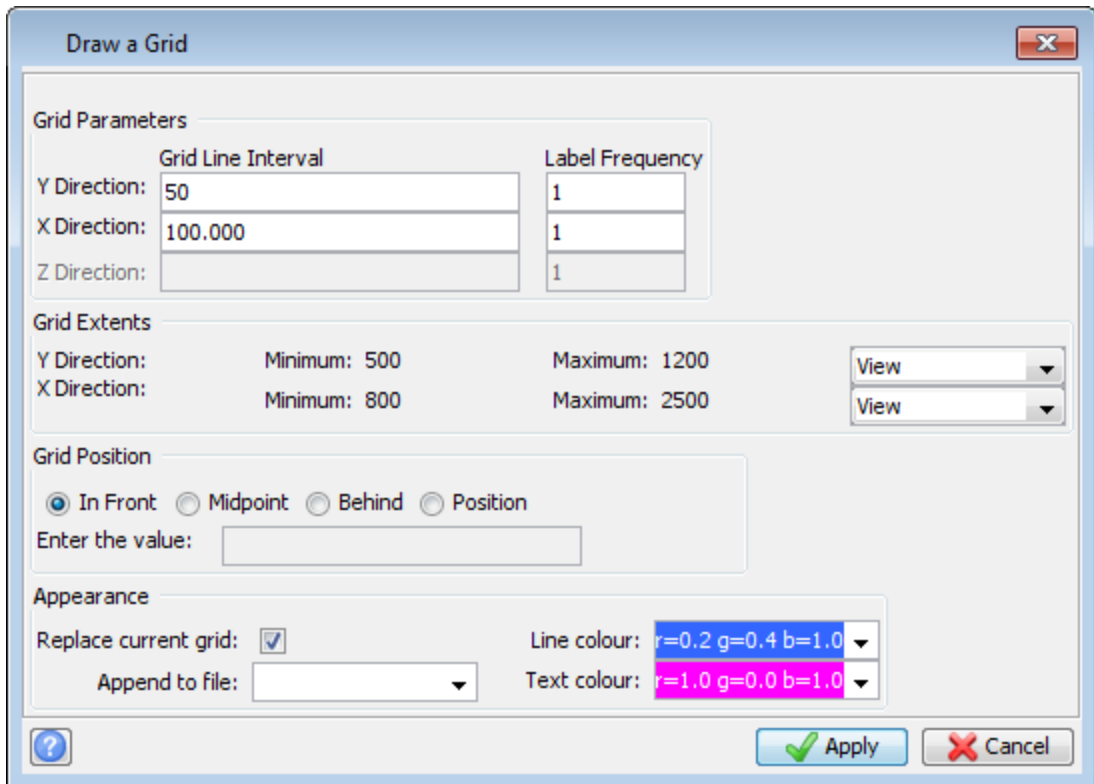


The ore body with the 2D grid in plan view is displayed.

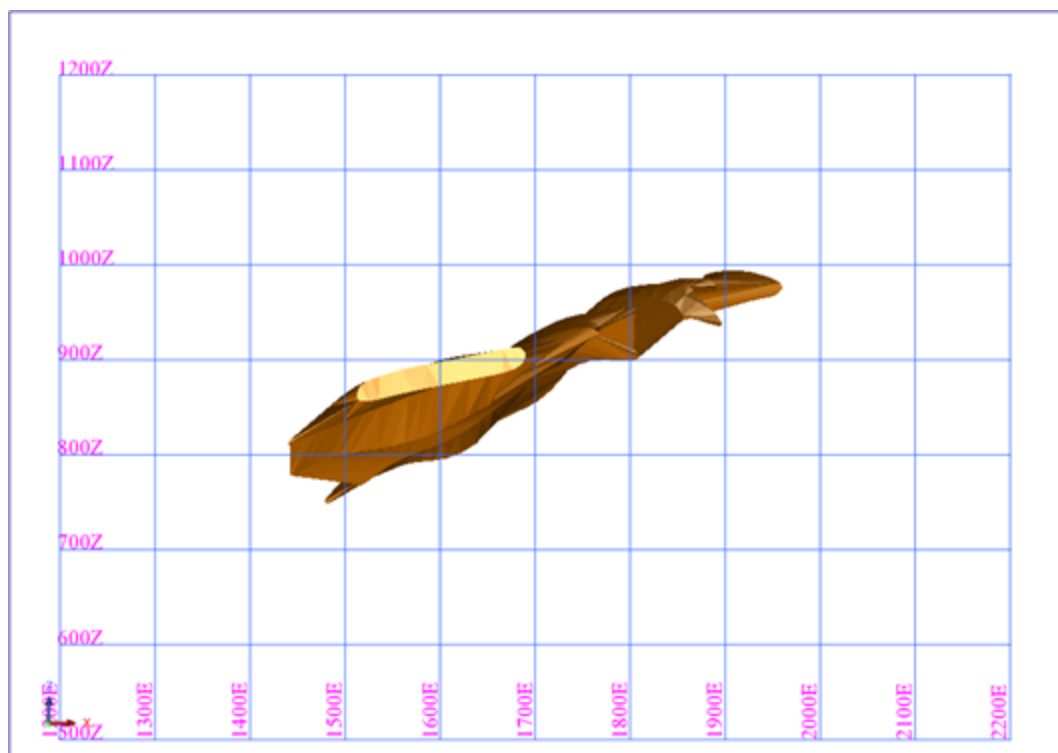


- Click the  icon to show the data in section view.
- Choose **Display > 2D grid**.

7. Enter the information as shown, and click **Apply**.



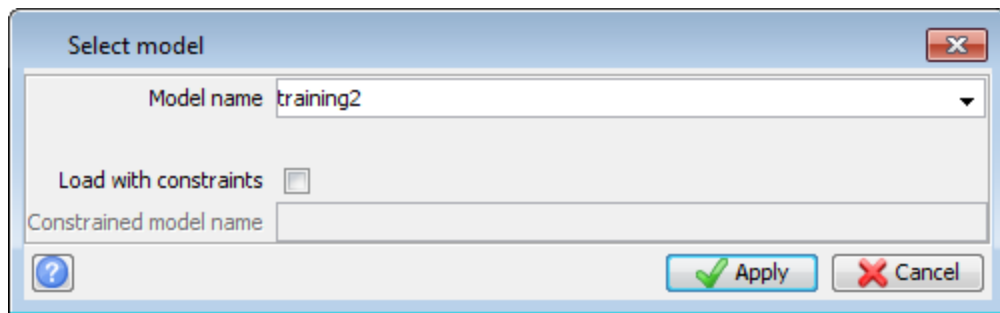
The ore body is displayed in section view with a 2D grid.



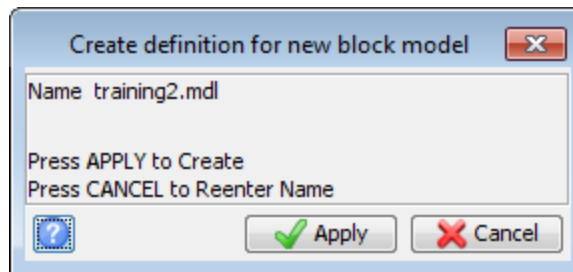
Using the previous diagrams, you can determine the origin and extents of the block model which will cover the ore solid.

You can also use the string file **ore1.str** to determine the origin and extents directly from the data. This method is described in the following steps.

8. Choose **Block model > New / Open**.
9. Enter the information as shown, and click **Apply**.



10. Click **Apply** to confirm creation of the new block model.



11. Select the **Get extents from string file** box.
12. In the **Location** box, type **ore1**, press TAB, and click **Open**.

The model's coordinates are filled in based on the values in **ore1.str**.

Creating new block model definition

Model name training2.mdl

Description

Define model using  Min/Max coords  
 Origin coords/extents

**Extents** **Rotation**

Get extents from string file ?

Coordinate extents		User block size	
	Minimum coordinates	Maximum coordinates	
Y	7119.489	Y 7600.000	Y 0
X	1441.416	X 1960.408	X 0
Z	748.881	Z 994.029	Z 0

Sub blocking None

Maintain audit trail

Apply Cancel

13. In the **Description** field type a description of the block model.
14. Adjust the values as shown to create a block model which completely covers the extents of the ore body.

Creating new block model definition

Model name training.mdl

Description This model is for training

Define model using  Min/Max coords  
 Origin coords/extents

**Extents** Rotation

Get extents from string file ?

Coordinate extents		User block size	
Minimum coordinates	Maximum coordinates		
Y 7000.000	Y 7600.000	Y 10	
X 1200.000	X 2100.000	X 10	
Z 700.000	Z 1100.000	Z 5	

Sub blocking None

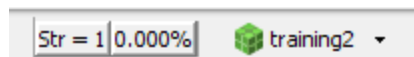
Maintain audit trail


Apply Cancel

15. Click **Apply**.

16. Enter the information as shown, and click **Create Model**.

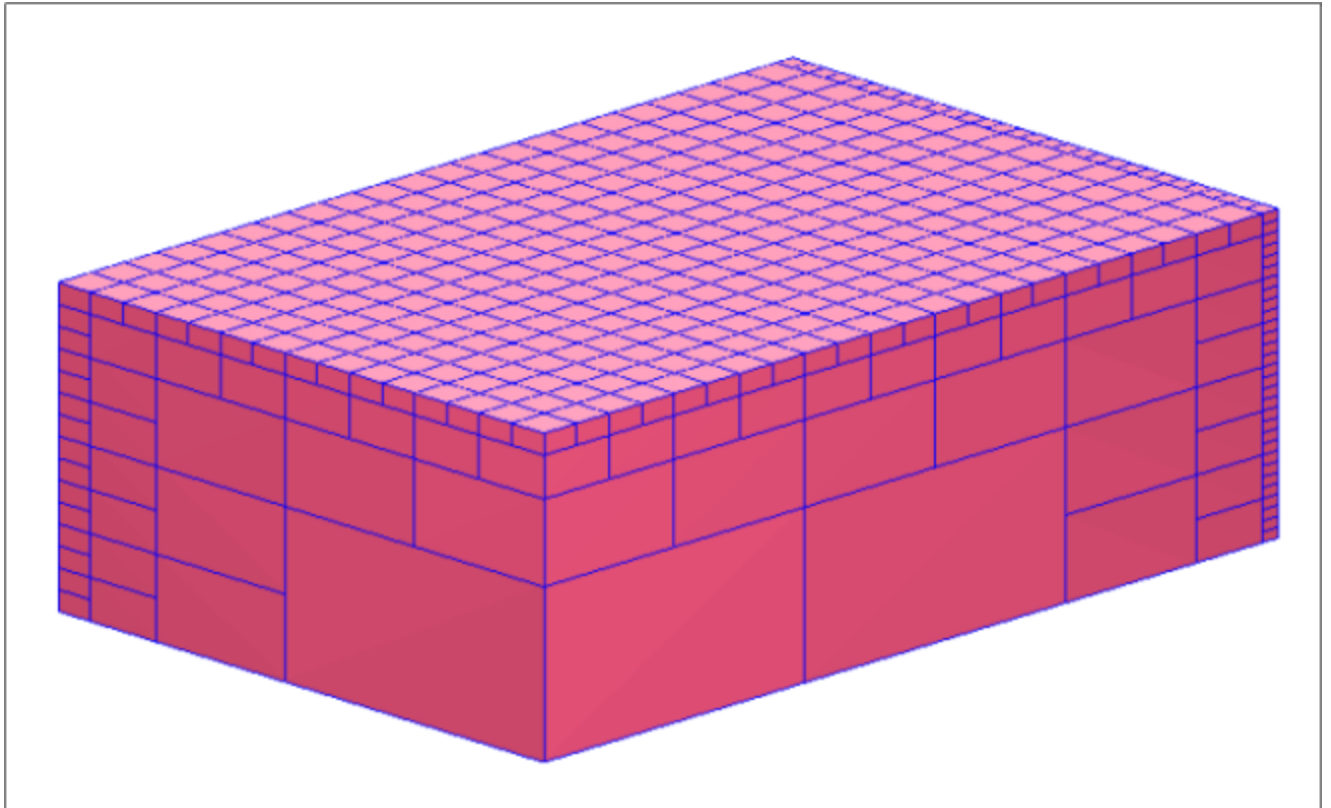
The block model is created and its name is displayed in the Status bar.



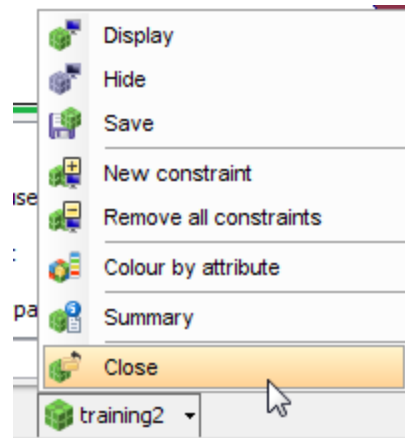
17. Click **Reset graphics** .
18. Choose **Block model > Save** to save the block model.
19. Choose **Display > Display block model**.
20. Enter the information as shown, and click **Apply**.

The block model is displayed.

21. Rotate the view in **Graphics**.



22. Right-click the block model in the status bar, and choose **Close**



**Note:** To see all of the steps performed in this task run **\_01\_create\_model.tcl**. You will need to click **Apply** on any forms presented.

## Creating model attributes

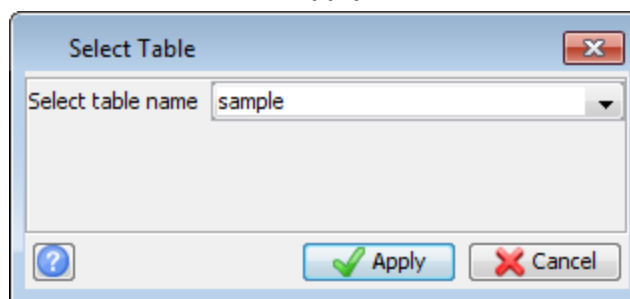
An attribute contains the information or the properties of the model space. This can be either a number with decimal places, an integer, or a character code.

### Create model attributes

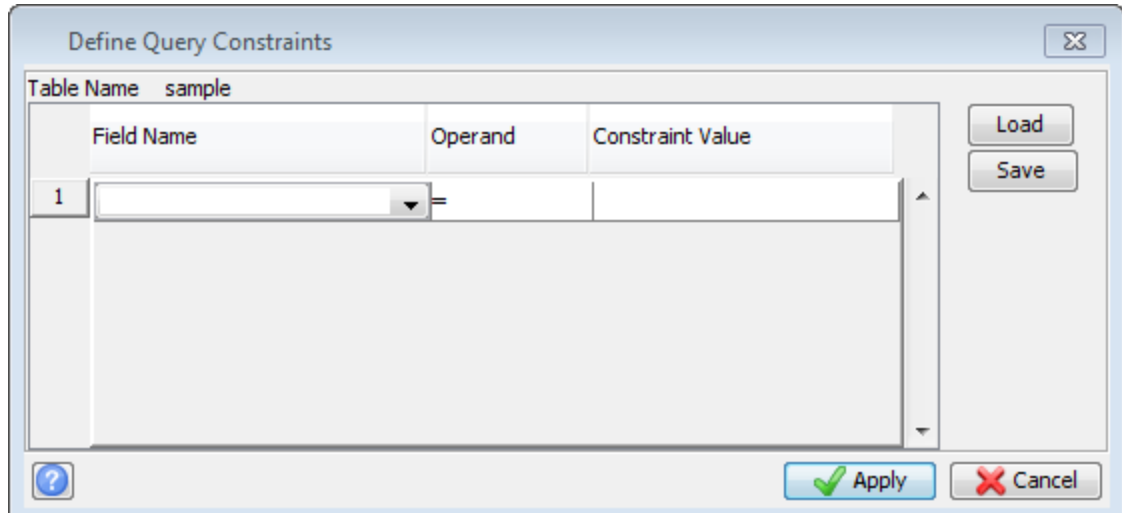
#### Task: Create model attributes

Before creating any attributes you will look at the information stored in the drillhole database, and decide what will be extracted in the compositing process.

1. Open **training2.mdl**.
2. Connect to **db1.ddb**.
3. Right-click in the blank area next to the menus at the top of the Surpac main window.
4. From the shortcut menu, choose **Profiles > geology\_database**.
5. From the **Geology Database** menu, choose **Edit > View table**.
6. Enter the information as shown, and click **Apply**.



7. Click **Apply** on the blank constraints form to look at the entire table.



8. After looking at the data in the sample table, click **Apply**.

This table data is typical of the data from a geological database that you can use to fill a block model.

	hole_id	depth_from	samp_id	depth_to	gold	gold_rpt	y_from	x_from	z_from	y_to	x_to	z_to
1	WD004	0.00	WS689231	2.00	0.030	-2.000	7362.082	1724.725	1000.000	7362.084	1724.725	998.000
2	WD004	2.00	WS689232	4.00	0.020	-2.000	7362.084	1724.725	998.000	7362.088	1724.726	996.000
3	WD004	4.00	WS689233	6.00	-1.000	-2.000	7362.088	1724.726	996.000	7362.096	1724.726	994.000
4	WD004	6.00	WS689234	8.00	-1.000	-2.000	7362.096	1724.726	994.000	7362.106	1724.727	992.000
5	WD004	8.00	WS689235	10.00	0.130	-2.000	7362.106	1724.727	992.000	7362.120	1724.728	990.000
6	WD004	10.00	WS689236	12.00	0.100	-2.000	7362.120	1724.728	990.000	7362.136	1724.730	988.000
7	WD004	12.00	WS689237	14.00	0.070	-2.000	7362.136	1724.730	988.000	7362.156	1724.732	986.000
8	WD004	14.00	WS689238	15.40	0.360	0.210	7362.156	1724.732	986.000	7362.171	1724.733	984.600

9. Choose **Database > Close**.
10. Right-click in the blank area next to the menus at the top of the Surpac main window.
11. From the shortcut menu, choose **Profiles > block\_model**.
12. Choose **Attributes > New**.
13. Enter the information as shown, and click **Apply**.

	Attribute Name	Type	Decimals	Background Value	Description / Expression
1	sg	float	2	2.8	specific gravity
2	gold	float	2	0	gold

**Note:** Using real, instead of float, will significantly increase the size of the block model. You would choose float when the attribute will contain approximately eight significant digits or fewer.

14. Choose **Block model > Summary**.

**Block model summary**

Block Model  
 Name: training2.mdl  
 Description: Block model for training purposes

Block Model Geometry

Min Coordinates	Y	7000	X	1200	Z	700
Max Coordinates	Y	7600	X	2100	Z	1100
User block Size	Y	10	X	10	Z	5
Min. block Size	Y	10	X	10	Z	5
Rotation	Bearing	0	Dip	0	Plunge	0

Block Summary

Total No. Blocks: 1857  
 Storage Efficiency %: 99.57

Attributes

	Name	Type	Decimals	Background	Description / Expression
1	gold	Float	2	0.00	gold
2	sg	Float	2	2.80	specific gravity

Save Summary?

Apply Cancel

15. After viewing the form, click **Apply**.16. Choose **Block model > Save**.The *Verify creation of file* form appears.17. Click **Yes** to write the attributes into the block model.18. Choose **Block model > Close**.

**Note:** To see all of the steps performed in this task, run `_02_create_model_attributes.tcl`. You need to click **Apply** on any forms presented.

## Constraints within a block model

### Applying constraints to a block model

Constraints are logical combinations of spatial operators and objects. You can use constraints to control the selection of blocks from which you will retrieve information and make interpolations.

It is possible to apply both simple and complex constraints to the block model to:

- fill the block model with values
- produce reports
- view models in **Graphics**
- load a constrained portion of a model

The spatial operators are:

- ABOVE
- INSIDE
- >
- <
- =

The operator you use depends on the nature of the object. The word **NOT** implies the opposite of an operation. For example, OUTSIDE is represented by the expression NOT INSIDE. When you use the AND statement, *all* conditions must be met for the constraint to apply to a block. When you use the OR statement, only one of the conditions must be satisfied.

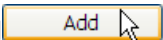
#### Create a constraint file


This function allows you to generate constraints without having to perform any other block model function. When you learn how to use constraints, you can work effectively with the Surpac block model.


You can apply one constraint at a time to a model, or combine a series of constraints, and save them as a constraint (\*.con) file.

The types of constraints supported are:

- inside/outside a solid
- above/below a surface
- satisfy the conditions of a block attribute
- inside/outside a string
- above/below a defined plane

After each constraint is defined, you must click **Add** .

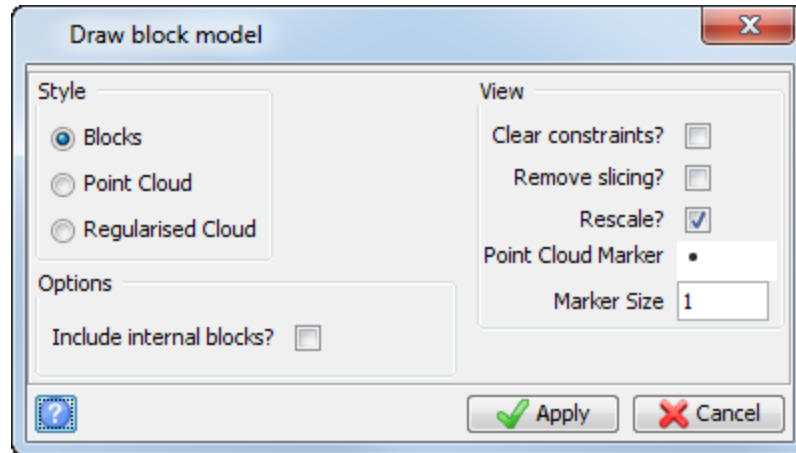
 **Note:** If a constraint combination is not defined, Surpac will assume the AND statement applies to all constraints. That is, a AND b must be satisfied.

 **Caution:** The constraint file records the *results* of running a constraint. When you open the .con file, the same blocks will pass the constraint every time, even if their attribute values have changed. No additional blocks will pass the constraint. The .con file is effectively a static list of blocks that passed the constraint at a specific date and time.

#### Task: Apply constraints to a block model

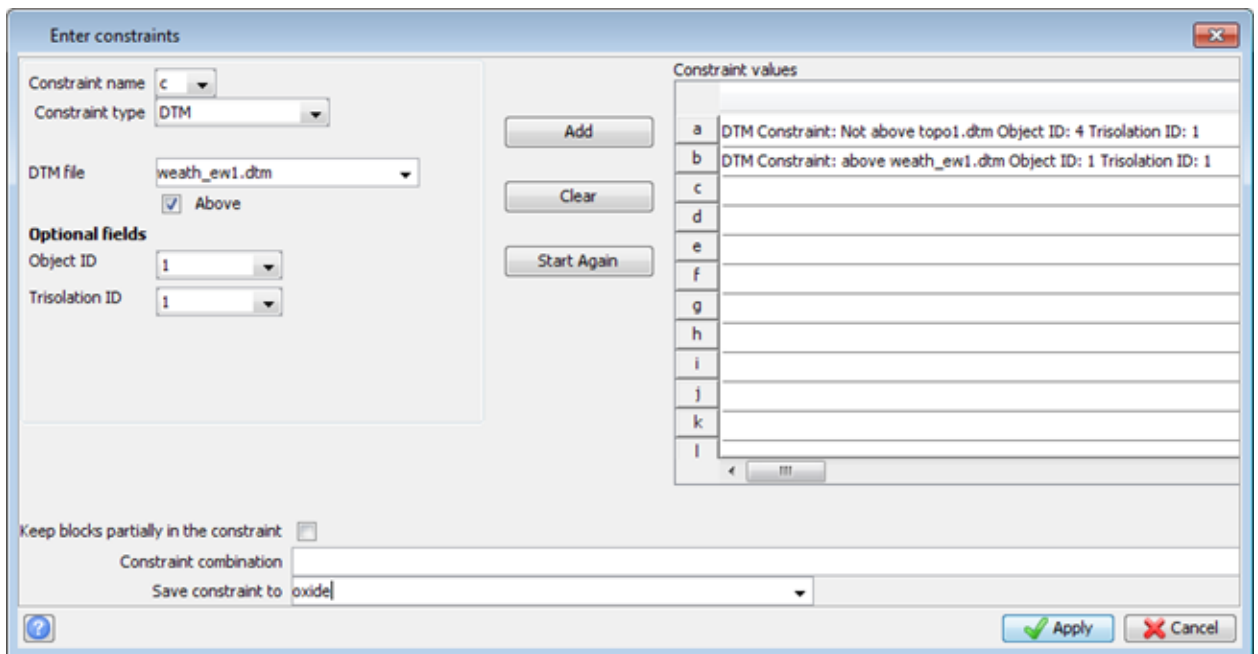
1. Open **training2.mdl**.
2. Choose **Block model > Display**.

- Alternatively, click the **training2** button on the Status bar, and choose **Display**.
3. Enter the information as shown, and click **Apply**.



The entire block model is shown with no constraints.

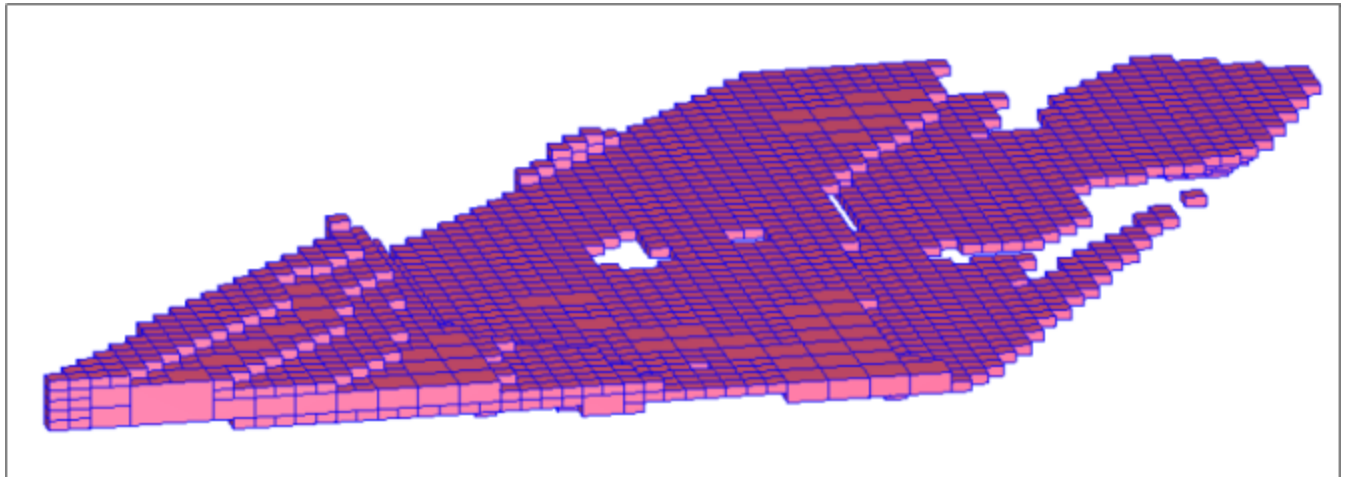
4. Choose **Constraints > New constraint file**.
5. Enter the two constraints as shown, and click **Apply**.



**Note:** After you have entered the constraint, you save it by filling in the **Save constraint to** box, and clicking **Apply**.

6. Drag and drop **oxide.con** into **Graphics**.

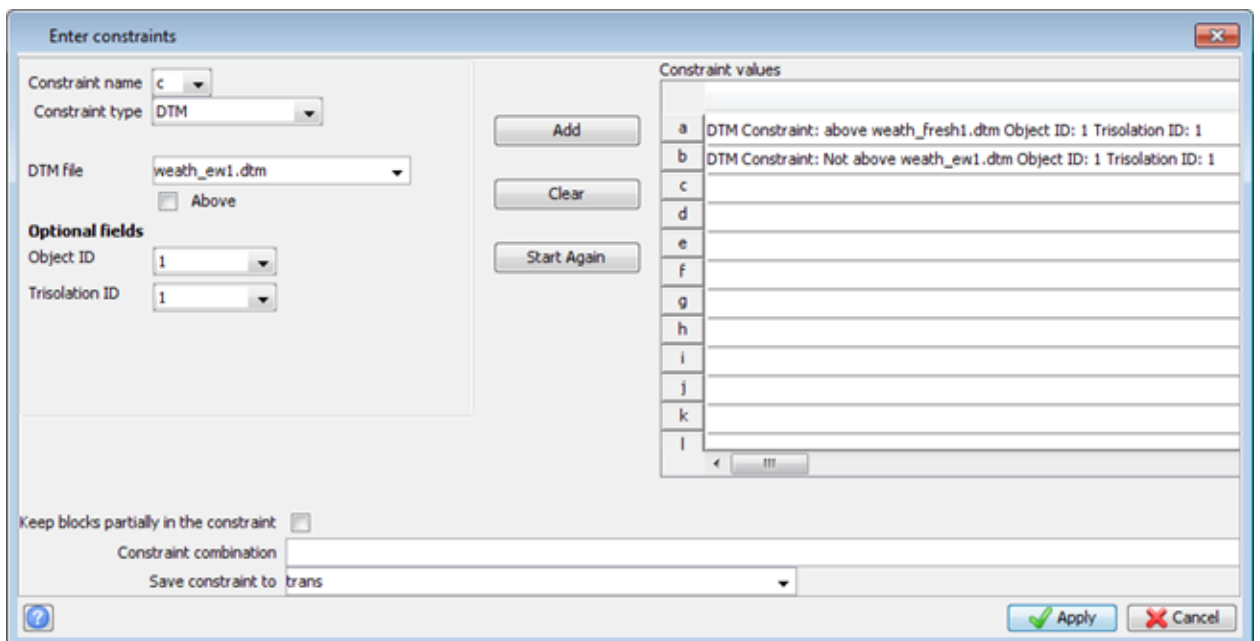
The blocks below the topography, and above the weathering layer, are displayed in **Graphics**.



You will now repeat the previous process to create constraints for the transitional zone and fresh rock zone.

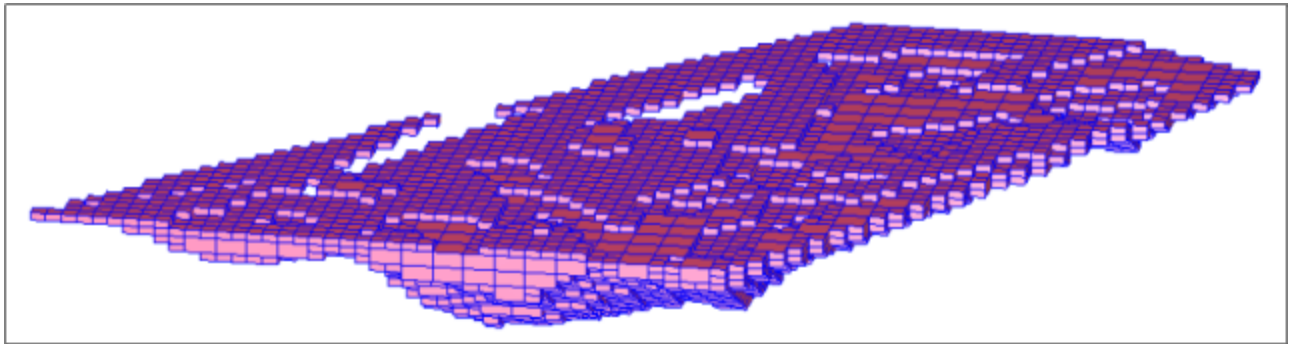
**trans.con** is above **weath\_fresh1.dtm** and below **weath\_ew1.dtm**.

7. Choose **Constraints > Remove all graphical constraints**.
8. Choose **Constraints > New constraint file**.
9. Enter the information as shown, and click **Apply**.



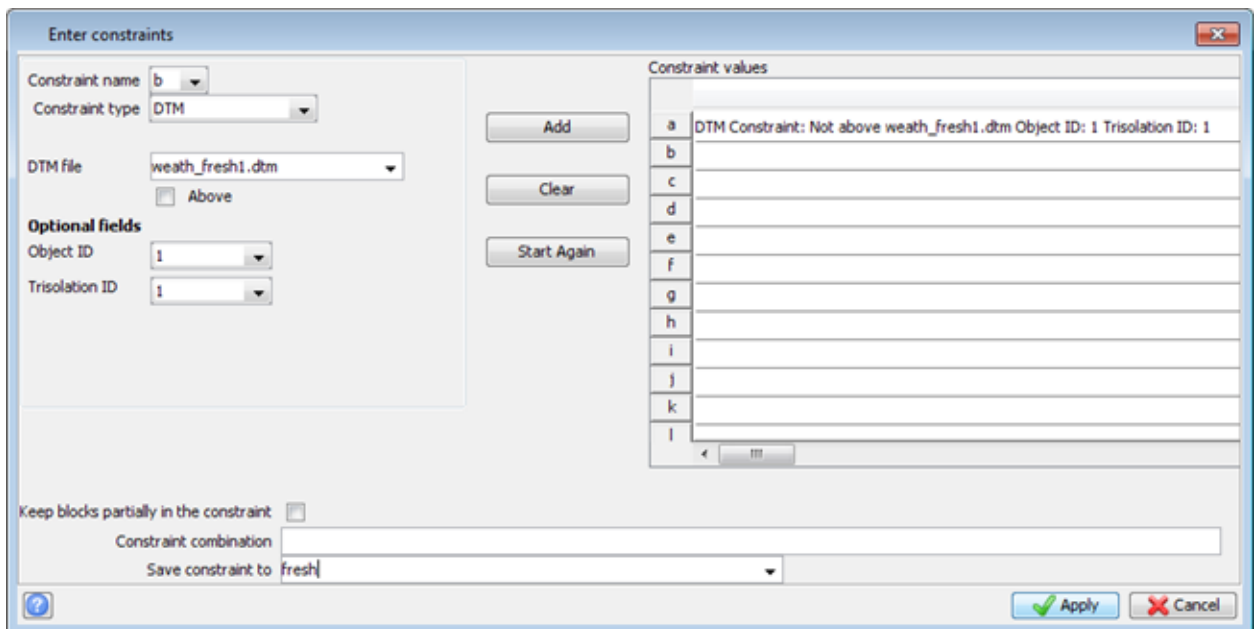
10. Drag and drop **trans.con** into **Graphics**.

The blocks in the transitional zone are displayed as shown.



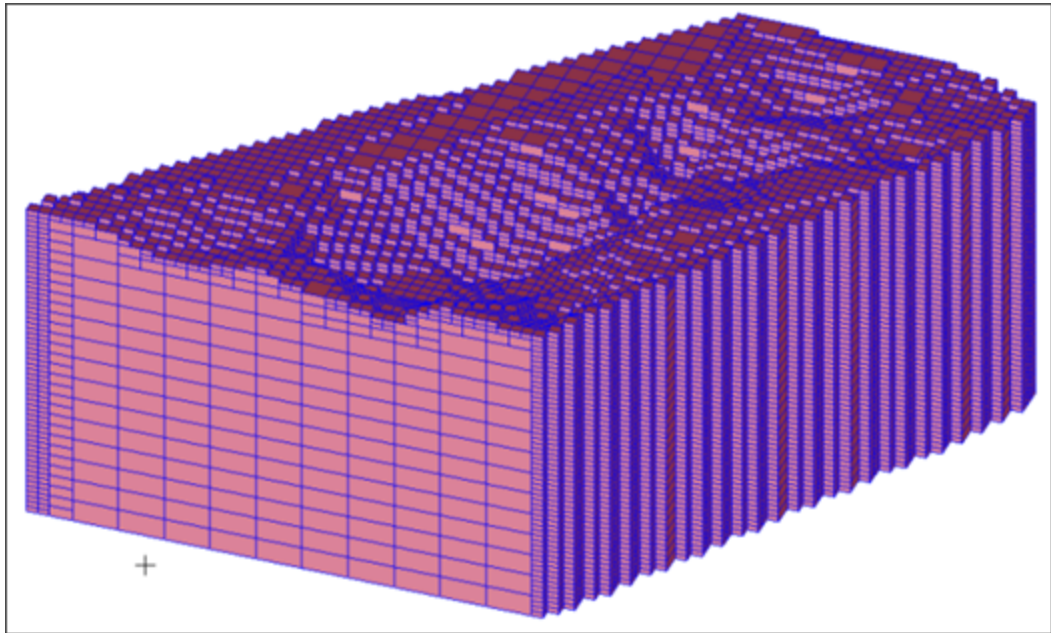
**fresh.con** is below **weath\_fresh1.dtm**.

11. Choose **Constraints > Remove last graphical constraint**.
12. Choose **Constraints > New constraint file**.
13. Enter the information as shown, and click **Apply**.




14. Open **fresh.con** in **Graphics**.

The fresh rock layer is displayed as shown:



15. Choose **Block model > Close**.

 **Note:** To see all of the steps performed in this task, run `_03_applying_constraints.tcl`. You need to click **Apply** on any forms presented.

## Estimation or filling the block model

### Assign Value

#### Task: Fill the block model using Assign Value

1. Open **training2.mdl**.
2. Choose **Estimation > Assign value**.
3. Enter the information as shown, and click **Apply**.

	Attribute Name	Value
1	sg	2.2

Constrain interpolation

Apply Cancel

4. Enter the information as shown, and click **Apply**.

Constraint name: b  
 Constraint type: CONSTRAINT  
 Constraints file: OXIDE.CON  
 Inside:

Add  
 Clear  
 Start Again

Constraint values
a
b
c
d
e
f
g
h
i
j
k
l

Constraint File: inside OXIDE.CON

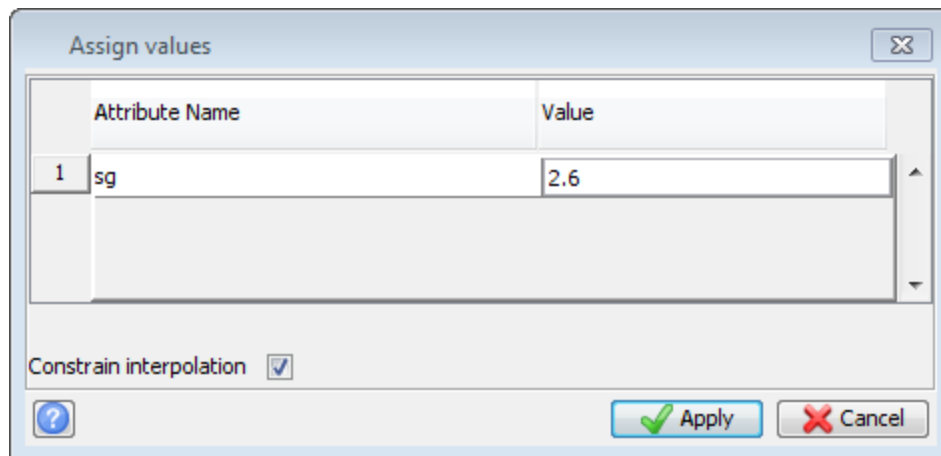
Keep blocks partially in the constraint:   
 Constraint combination:  
 Save constraint to:

Apply Cancel

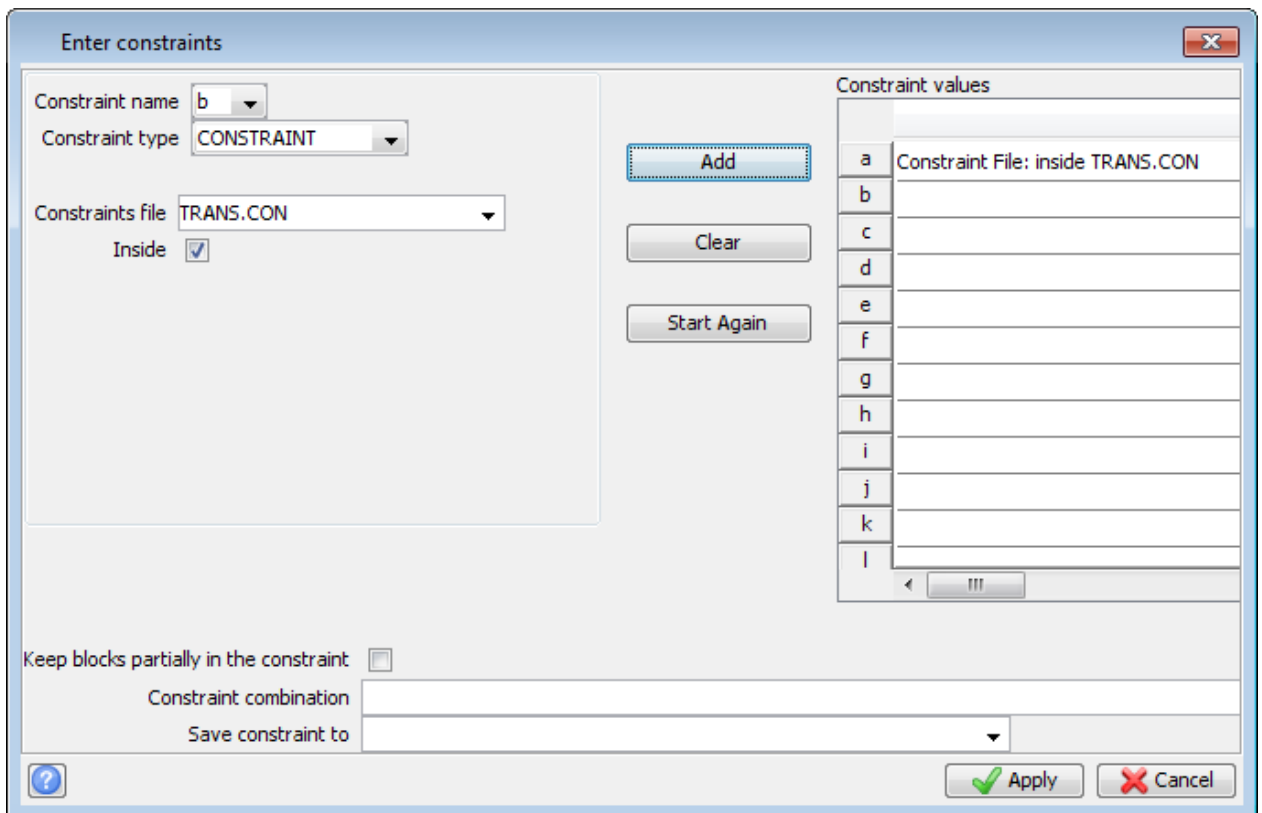
The *Verify creation of file* form appears.

5. Click **Yes**, to write the assigned value to the block model.  
 You will now repeat this process of filling the attribute sg. You will assign sg a value of 2.6 inside **trans.con** and a value of 2.8 inside **fresh.con**.

6. Choose **Estimation > Assign value**.
7. Enter the information as shown, and click **Apply**.

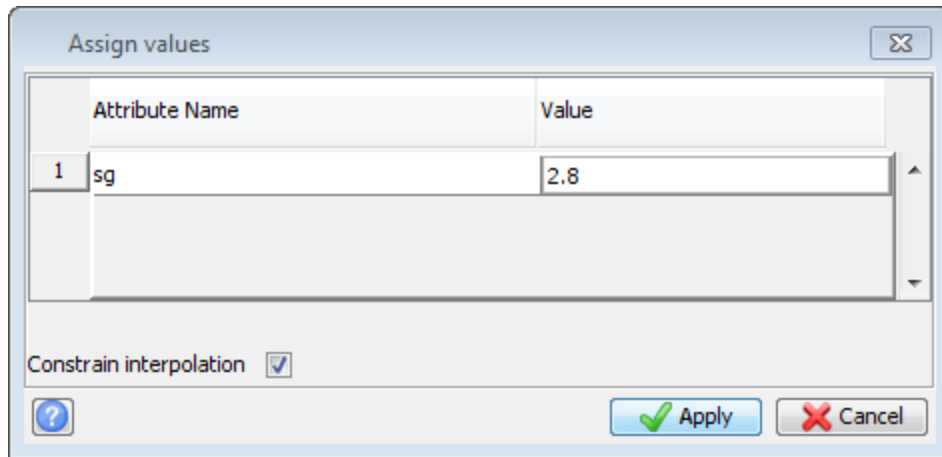


8. Enter the information as shown, and click **Apply**.

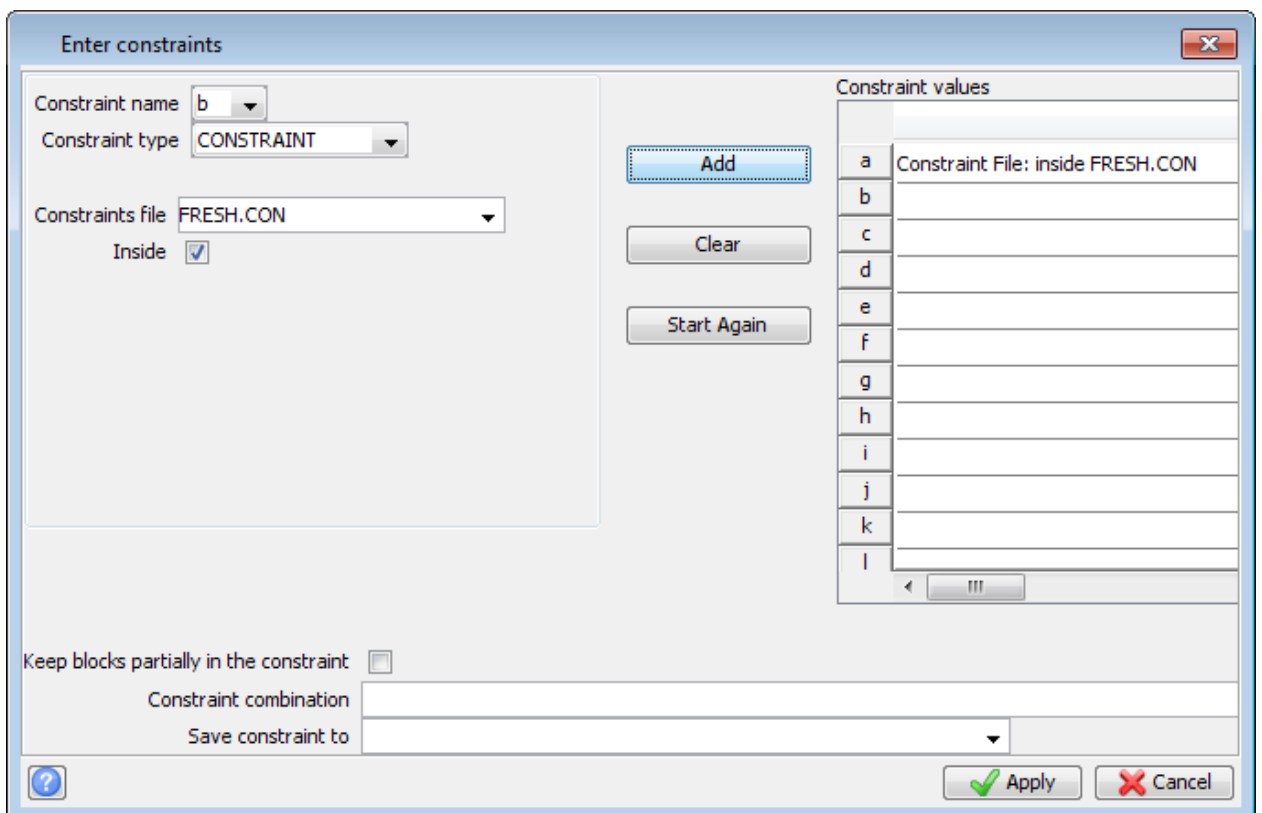


9. Click **Yes** on the confirmation form.
10. Choose **Estimation > Assign value**.

11. Enter the information as shown, and click **Apply**.



12. Enter the information as shown, and click **Apply**.



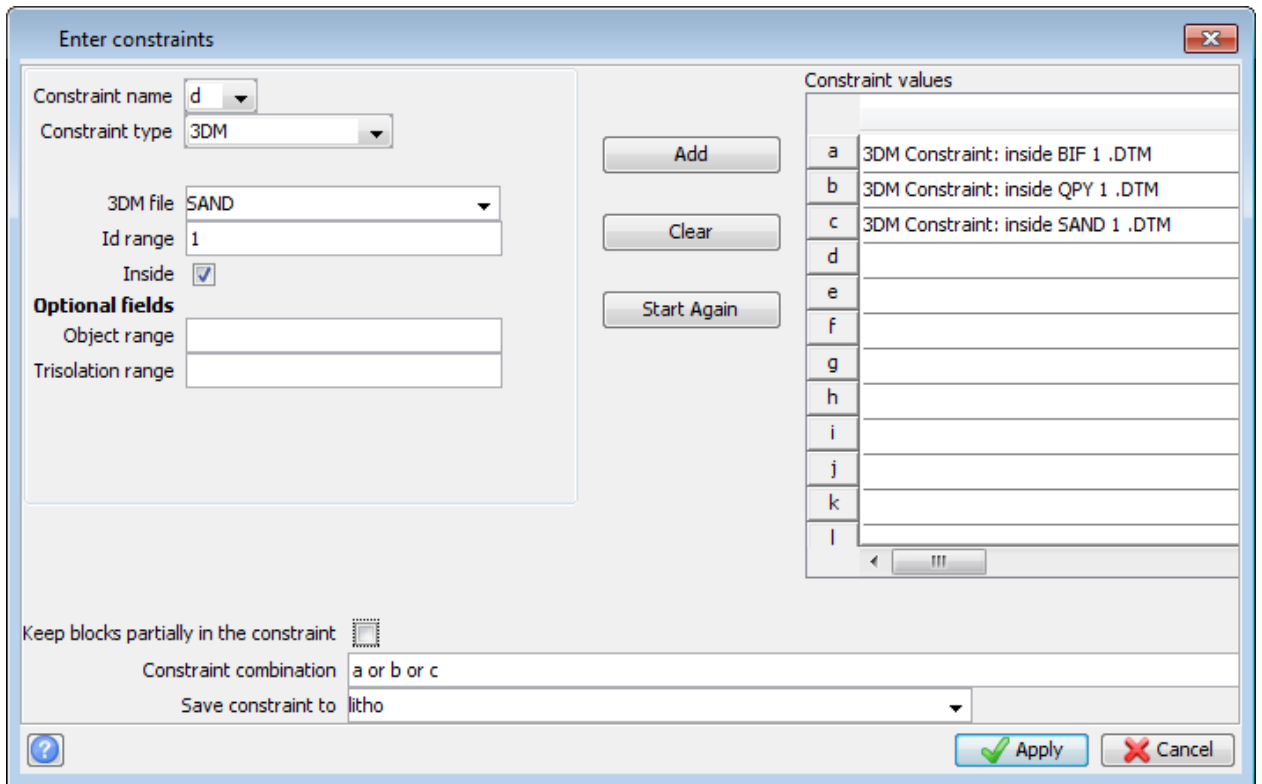
13. Click **Yes** on the confirmation form.

You will now create another constraint for viewing purposes. The file **litho.con** will contain all the blocks inside the solids **sand1.dtm**, **bif1.dtm** and **qpy1.dtm**.

**Note:** Make sure you use the OR statement in the **constraint combination** box as shown.

14. Choose **Constraints > New constraints file**.

15. Enter the information as shown, and click **Apply**.



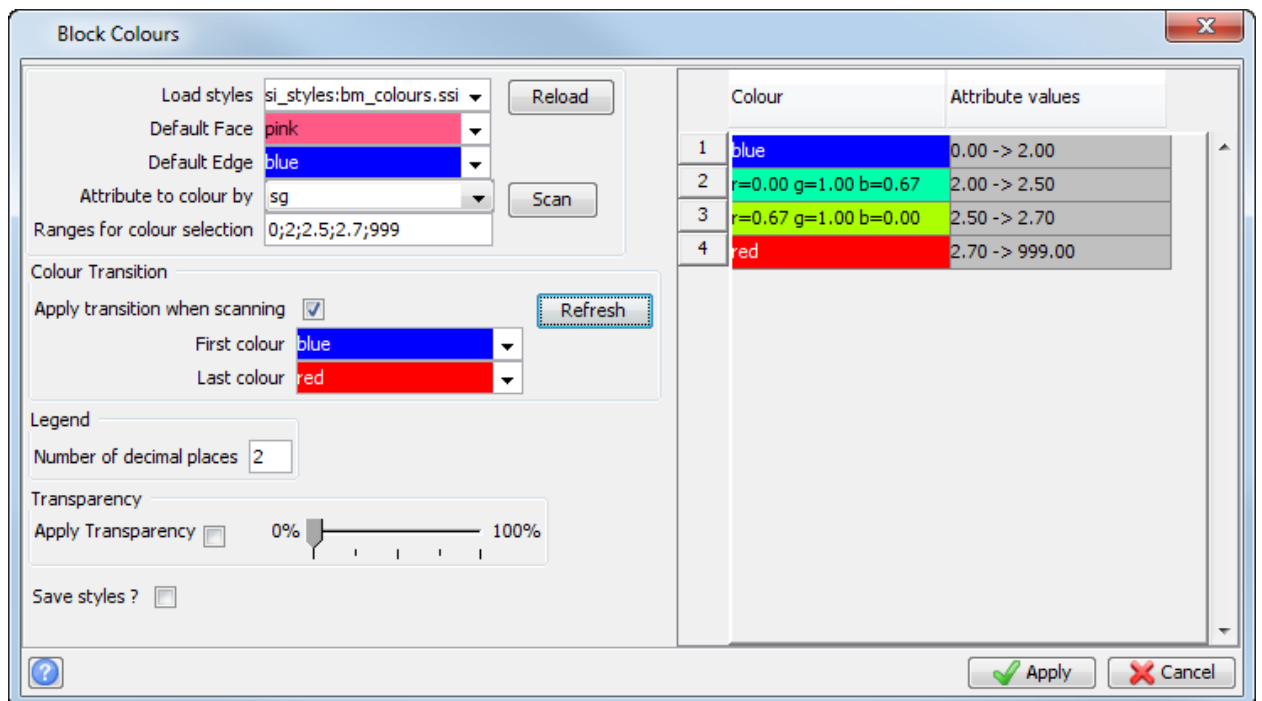
You will now colour the blocks based on numerical attributes.

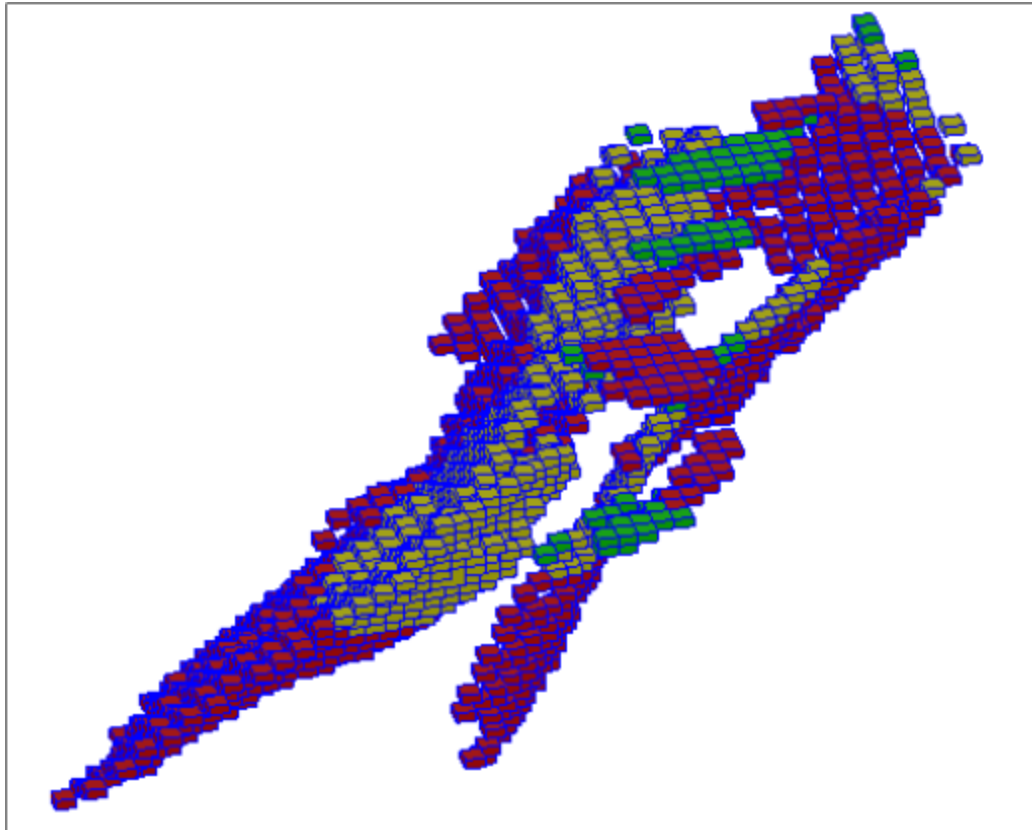
16. Choose **Display > Display block model**, and click **Apply**.

17. Open **litho.con** in **Graphics**.

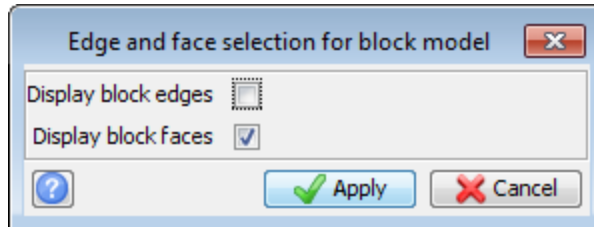
18. Choose **Display > Colour model by attribute**.

19. Enter the values as shown, click **Refresh**, and click **Apply**.

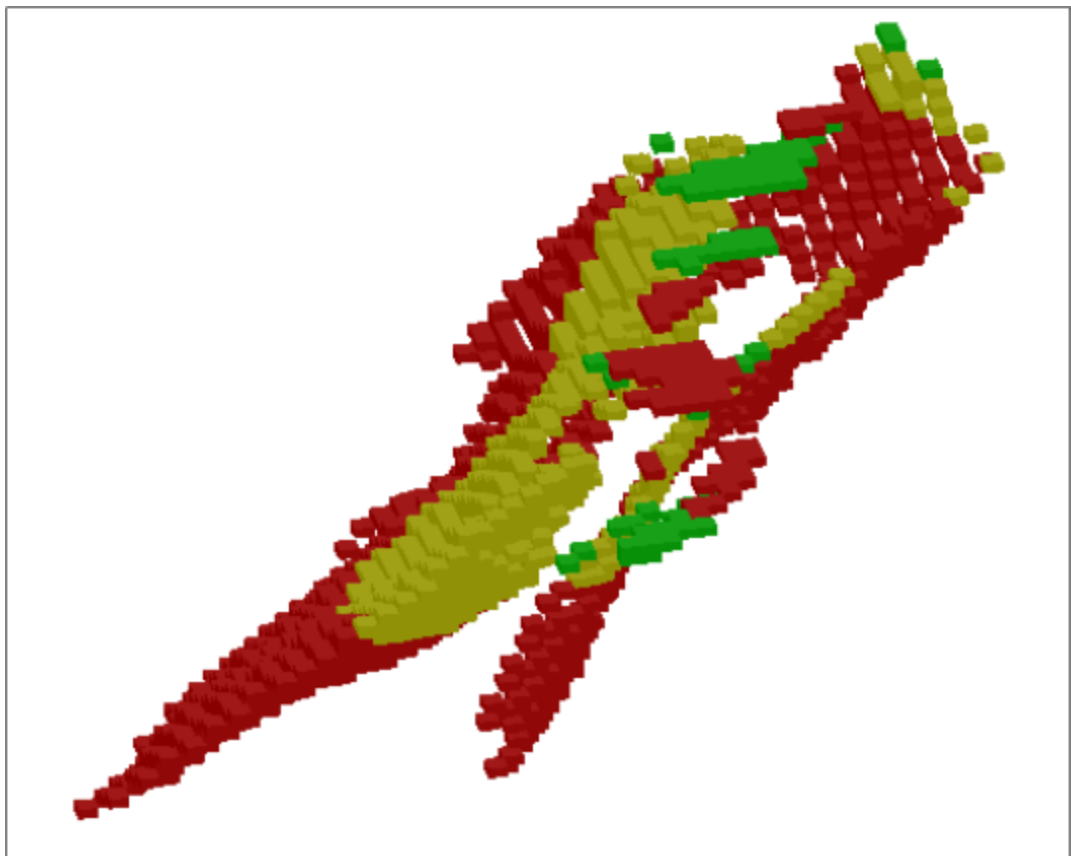





- Choose **Display > Edge and face visibility**, clear **Display block edges** as shown, and then click **Apply**.



The visual effect is much better, as seen in the following image.



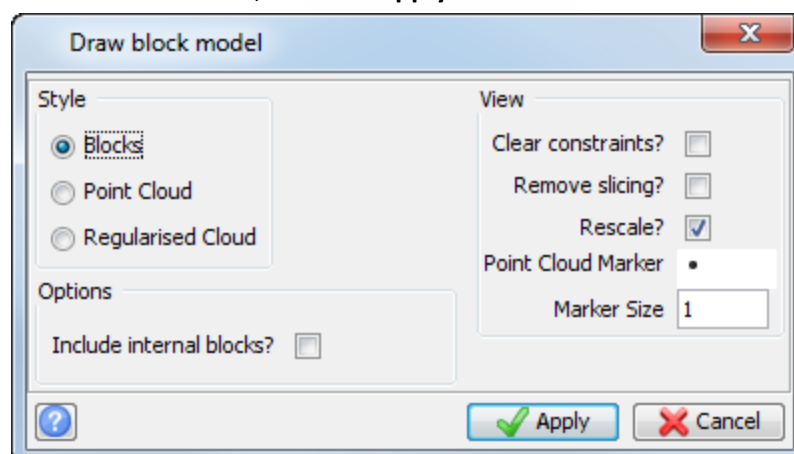
21. Choose **Block model** > **Close**.

 **Note:** To see all of the steps performed in this task, run `_04_assign_value.tcl`. You need to click **Apply** on any forms presented.

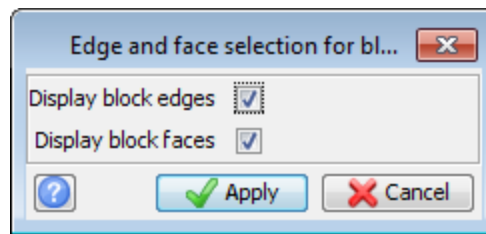
## Nearest neighbour

### Task: Fill the BIF zone using nearest neighbour

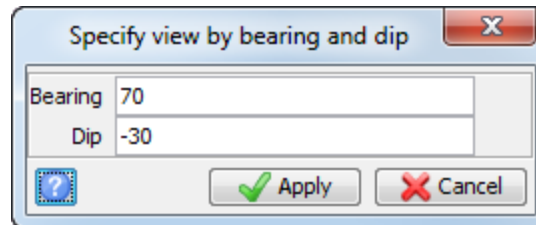
1. Open **training2.mdl**.
2. Choose **Block Model** > **Display**.
3. Enter the information as shown, and click **Apply**.



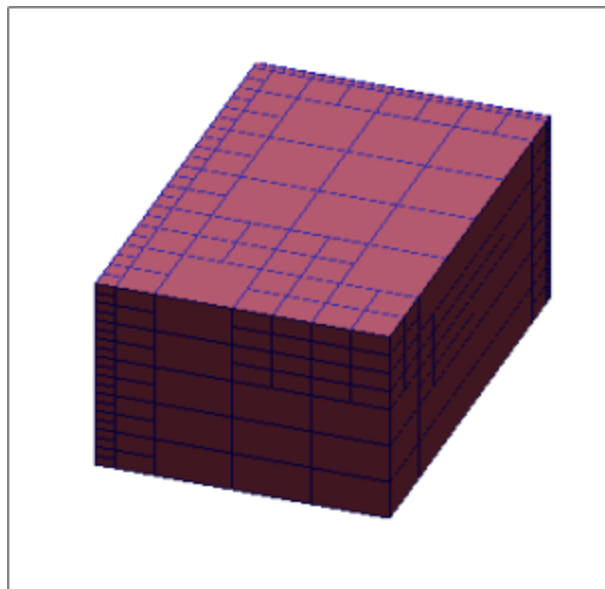
4. Choose **Display > Edge and face visibility**, select **Display block edges** as shown, and then click **Apply**.



5. Choose **View > Data view options > View by bearing & dip**.
6. Enter the information as shown, and click **Apply**.



7. Choose **View > Zoom > Out**.  
The block model is displayed.



8. Choose **Constraints > New graphical constraint**.

9. Enter the information as shown, and click **Apply**.

**Enter constraints**

Constraint name:

Constraint type:

3DM file:

Id range:

Inside:

**Optional fields**

Object range:

Trisolation range:

Buttons: Add, Clear, Start Again

Constraint values table:

Constraint name	Constraint value
a	3DM Constraint: inside BIF 1 .DTM
b	
c	
d	
e	
f	
g	
h	
i	
j	
k	
l	

Keep blocks partially in the constraint:

Constraint combination:

Save constraint to:

Buttons: Apply, Cancel

10. Choose **Estimation > Nearest Neighbour**.

11. Enter the information as shown, and click **Apply**.

**Data source specifications**

Data source type:  BLOCK MODEL,  STRING FILE

**STRING FILE**

Location:

Id range:

String range:

Constrain data:

Save constrained sample points?:

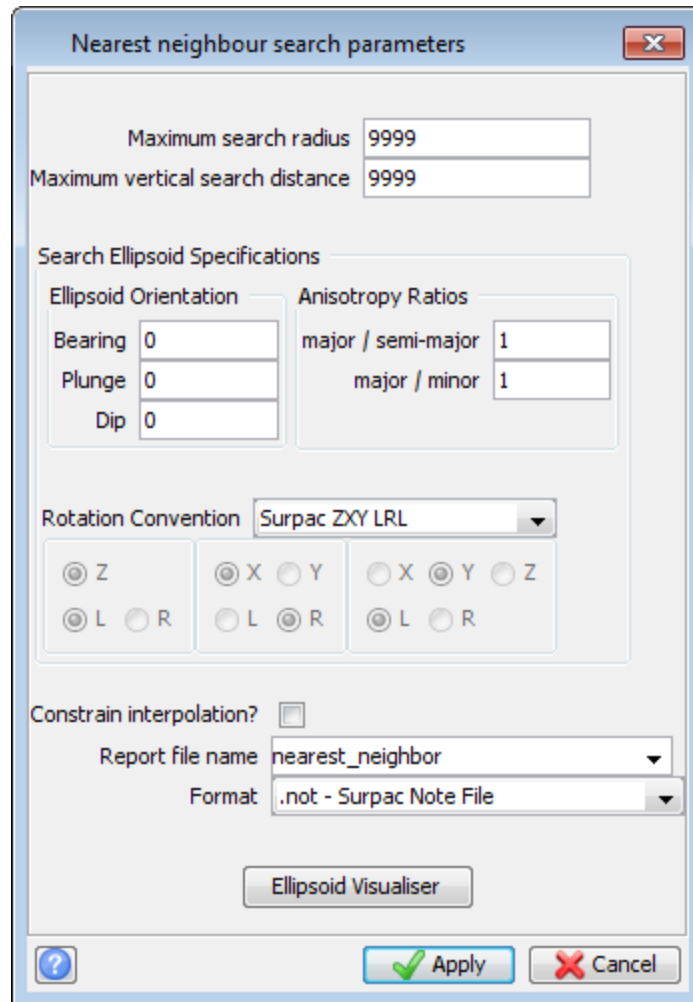
Output location:

Output id number:

Attribute to Fill	Description Field	Attribute Name	Anisotropic dist to nearest
1	gold	1	

Buttons: Apply, Cancel

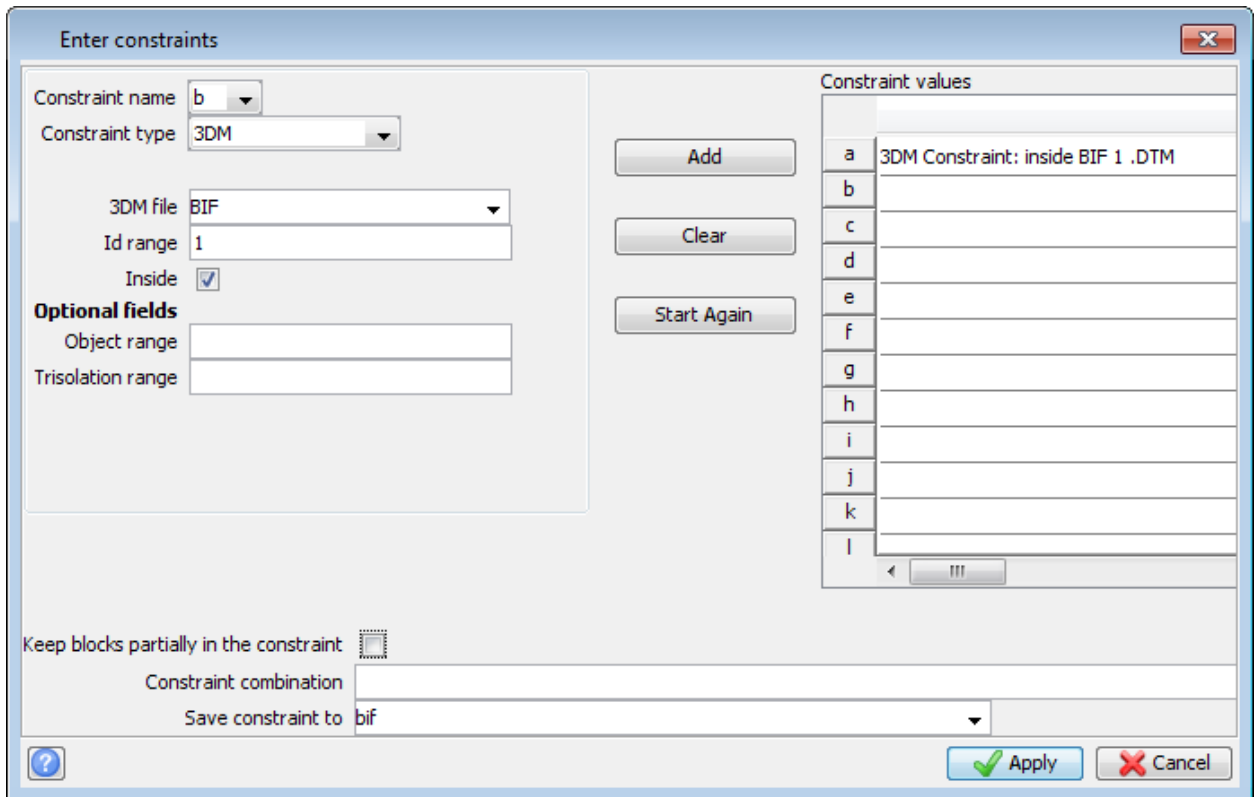
12. Enter the information as shown, and click **Apply**.



On the Status bar, you can see the progress of the estimation.

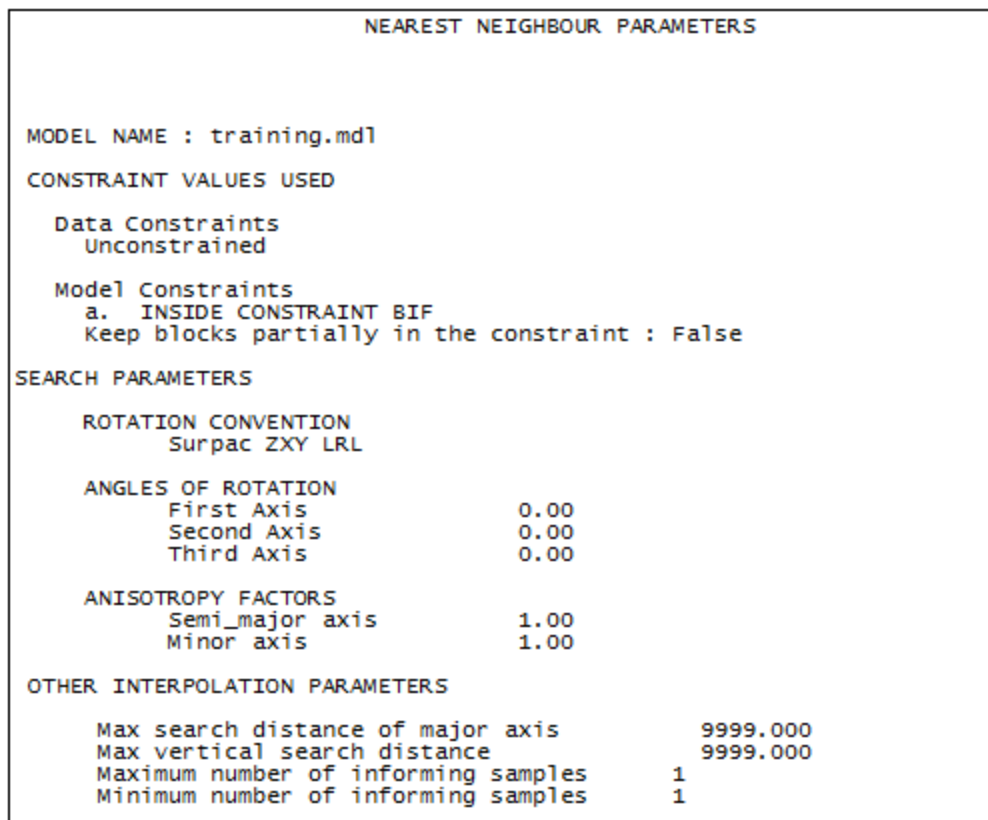


13. Enter the information as shown, and click **Apply**.



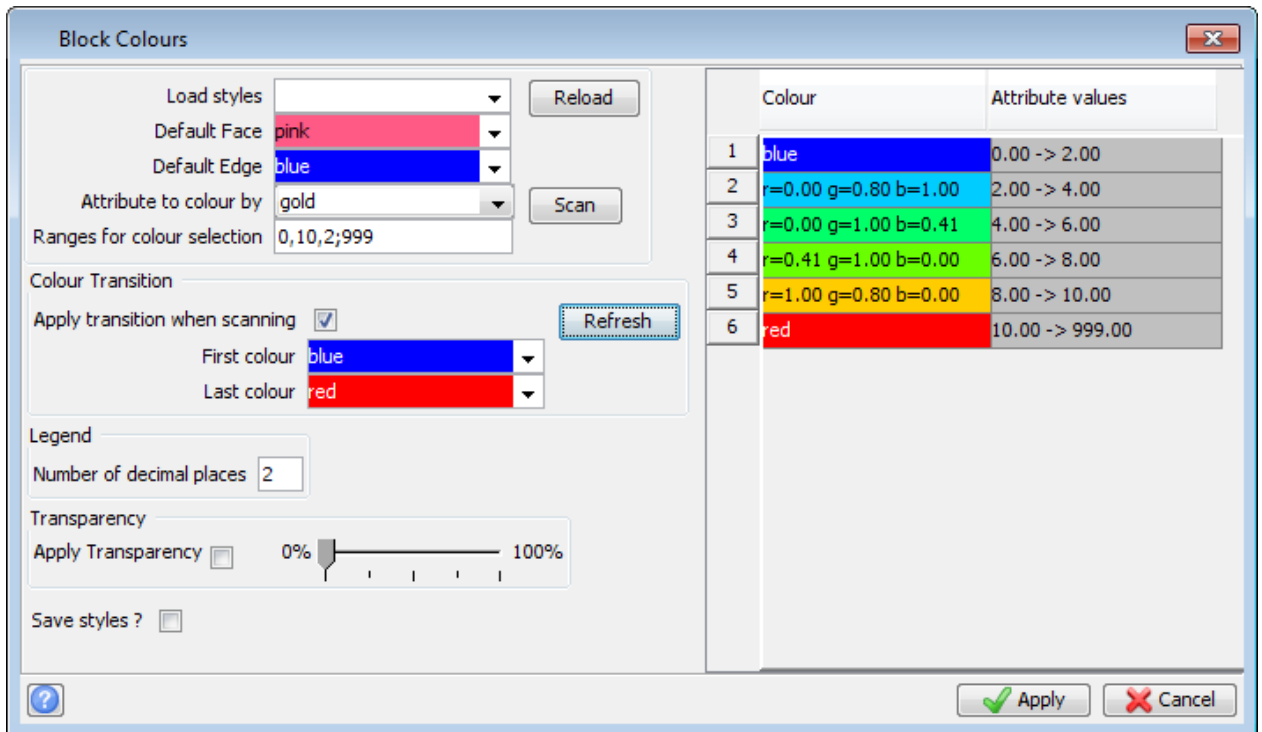
After the filling is completed, a report called **nearest\_neighbour.not** is produced.

14. Open **nearest\_neighbour.not**.

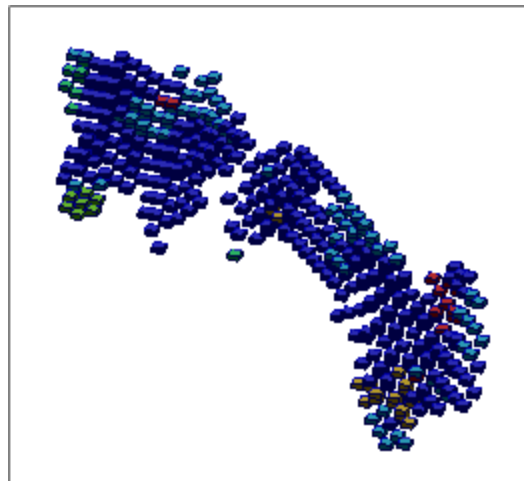


15. Choose **Display > Colour model by attribute**.

16. Enter the information as shown, click **Refresh**, and click **Apply**.



The constrained and coloured block model for the bif1 zone is displayed.



17. Choose **Block Model > Save**.
18. Choose **Block Model > Close**.

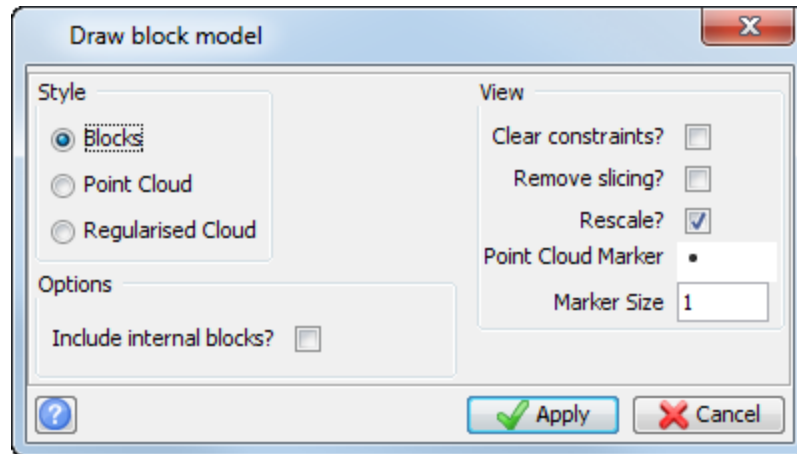
**Note:** To see all of the steps performed in this task, run `_05a_nearest_neighbour.tcl`. You need to click **Apply** on any forms presented.

## Inverse distance

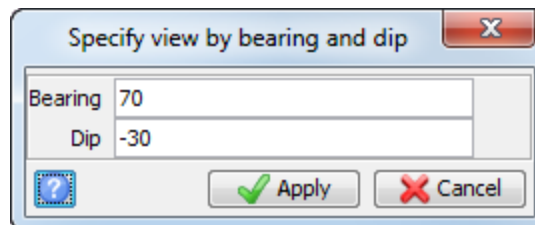
**Task: Fill the sand zone using inverse distance**

1. Open **training2.mdl**.
2. Choose **Block Model > Display**.

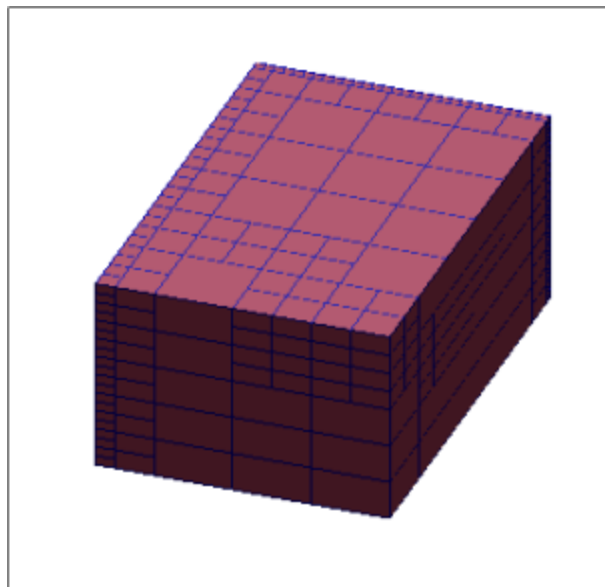
3. Enter the information as shown, and click **Apply**.



4. Choose **View > Data view options > View by bearing and dip**.
5. Enter the information as shown, and click **Apply**.



6. Choose **View > Zoom > Out**.  
The block model is displayed.



7. Choose **Constraints > New graphical constraint**.

8. Enter the information as shown, and click **Apply**.

**Enter constraints**

Constraint name: **b**  
 Constraint type: **3DM**  
 3DM file: **SAND**  
 Id range: **1**  
 Inside:   
**Optional fields**  
 Object range:   
 Trisolation range:   
 Add  
 Clear  
 Start Again

**Constraint values**

a	3DM Constraint: inside SAND 1 .DTM
b	
c	
d	
e	
f	
g	
h	
i	
j	
k	
l	

Keep blocks partially in the constraint:   
 Constraint combination:   
 Save constraint to: **sand**  
 Apply Cancel

9. Choose **Estimation > Inverse Distance**.

10. Enter the information as shown, and click **Apply**.

**Data source specifications**

Data source type:  BLOCK MODEL  STRING FILE

**STRING FILE**  
 Location: **cmps**  
 Id range: **1**  
 String range: **1**  
 Constrain data:   
 Save constrained sample points?:   
 Output location:   
 Output id number: **1**

Attribute to Fill	Description Field	Attribute Name	Anisotropic dist to nearest sample	Average anisotropic dist to samples
1 gold	1			

**ALERT**  
 Constraining the data source uses a block model constraint to determine which sample points to select. Consequently, if using a geometric constraint like inside a 3DM, above a DTM, etc., the sample points selected will not comply exactly with the geometric boundary. Rather they will be consistent with the block model constraint of the geometric boundary. This is an approximation which is dependent on the block model resolution.

Apply Cancel

11. Enter the information as shown, and click **Apply**.

**Enter constraints**

Constraint name:

Constraint type:

Constraints file:

Inside:

Buttons: Add, Clear, Start Again

Constraint values	
a	Constraint File: inside SAND.CON
b	
c	
d	
e	
f	
g	
h	
i	
j	
k	
l	

Keep blocks partially in the constraint:

Constraint combination:

Save constraint to:

Buttons: Apply, Cancel

12. Enter the information as shown, and click **Apply**.

13. Enter the information as shown, and click **Apply**.

After the filling is complete, a report called **training\_id2.not** is produced.

```

INVERSE DISTANCE PARAMETERS

MODEL NAME : training.mdl

CONSTRAINT VALUES USED

Data Constraints
a.  INSIDE CONSTRAINT SAND
    Keep blocks partially in the constraint : True

Model Constraints
Unconstrained

SEARCH PARAMETERS

ROTATION CONVENTION
Surpac ZXY LRL

ANGLES OF ROTATION
First Axis      35.00
Second Axis     0.00
Third Axis      0.00

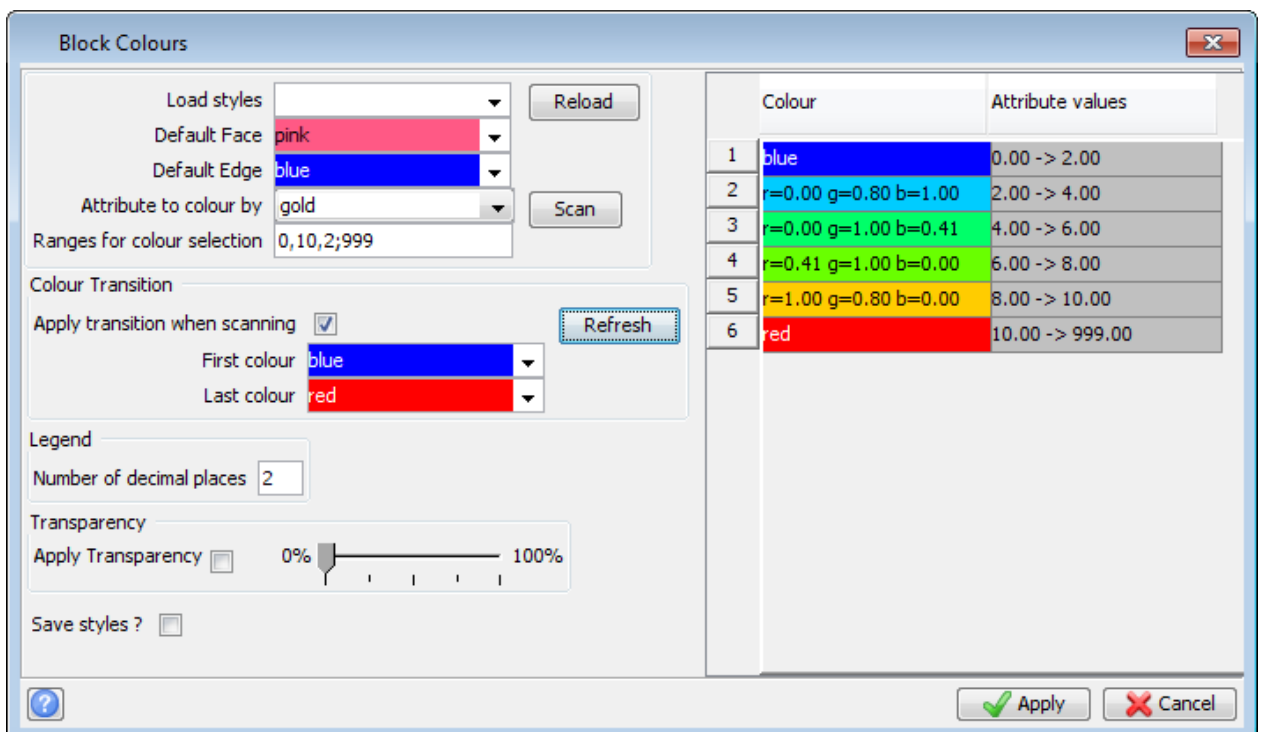
ANISOTROPY FACTORS
Semi_major axis 2.00
Minor axis      6.00

OTHER INTERPOLATION PARAMETERS

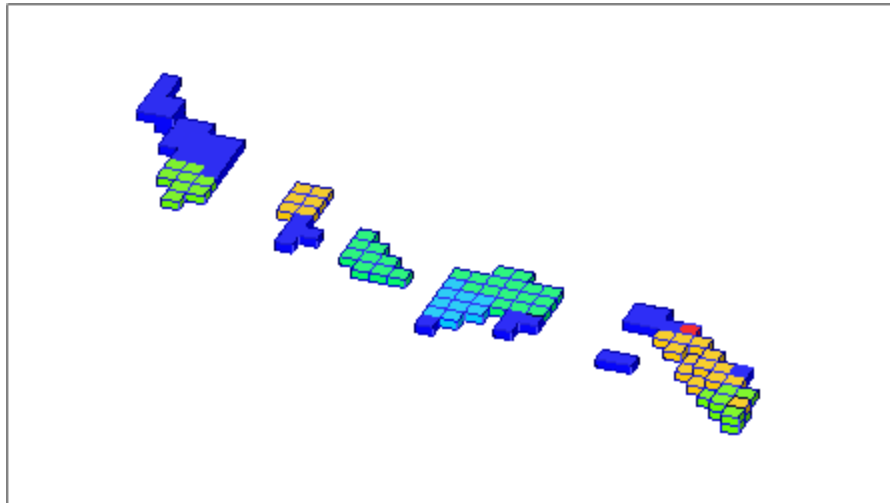
Max search distance of major axis      40.000
Max vertical search distance           999.000
Maximum number of informing samples    10
Minimum number of informing samples    2
    
```

14. Choose **Display > Colour model by attribute**.

15. Enter the information as shown, click **Refresh**, and then click **Apply**.



The constrained and coloured block model for the **Sand1** zone is displayed.



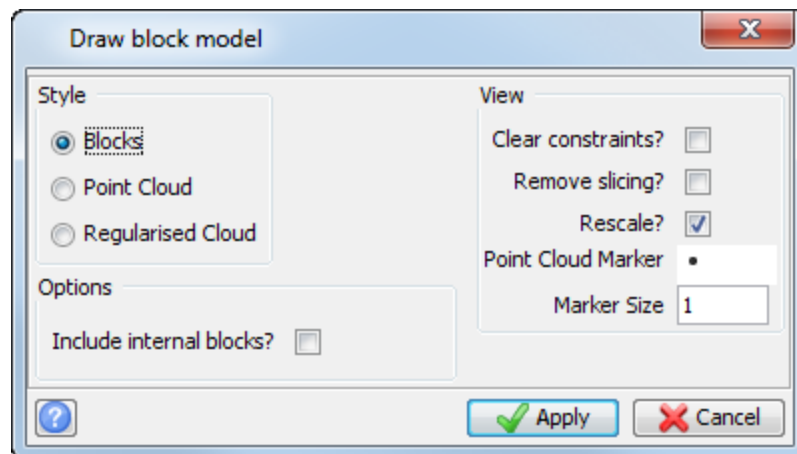
16. Choose **Block Model > Save**.
17. Choose **Block Model > Close**.

**Note:** To see all of the steps performed in this task, run `_05b_inverse_distance.tcl`. You will need to click **Apply** on any forms presented.

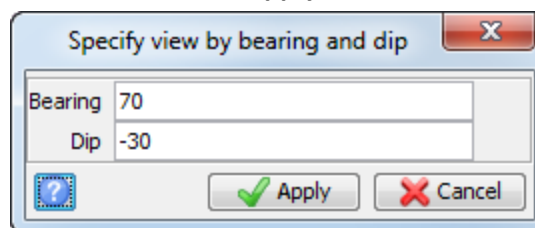
## Ordinary kriging

### Task: Fill the QPY zone using ordinary kriging

1. Open **training2.mdl**.
2. Choose **Block Model > Display**.
3. Enter the information as shown, and click **Apply**.

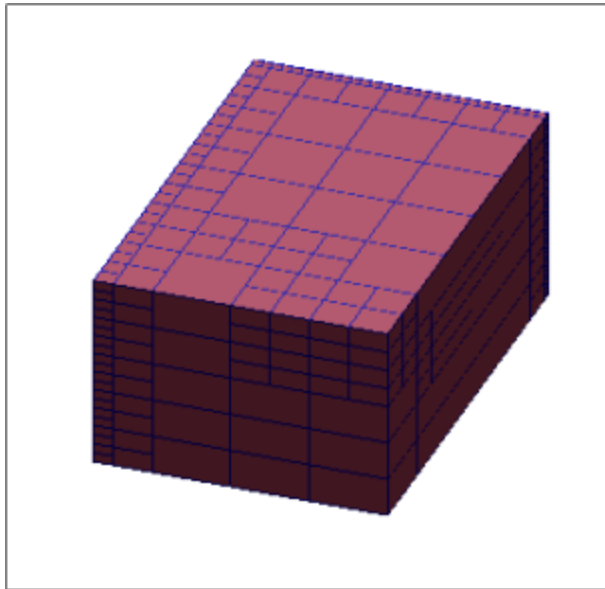


4. Choose **View > Data view options > View by bearing and dip**.
5. Enter the information as shown, and click **Apply**.

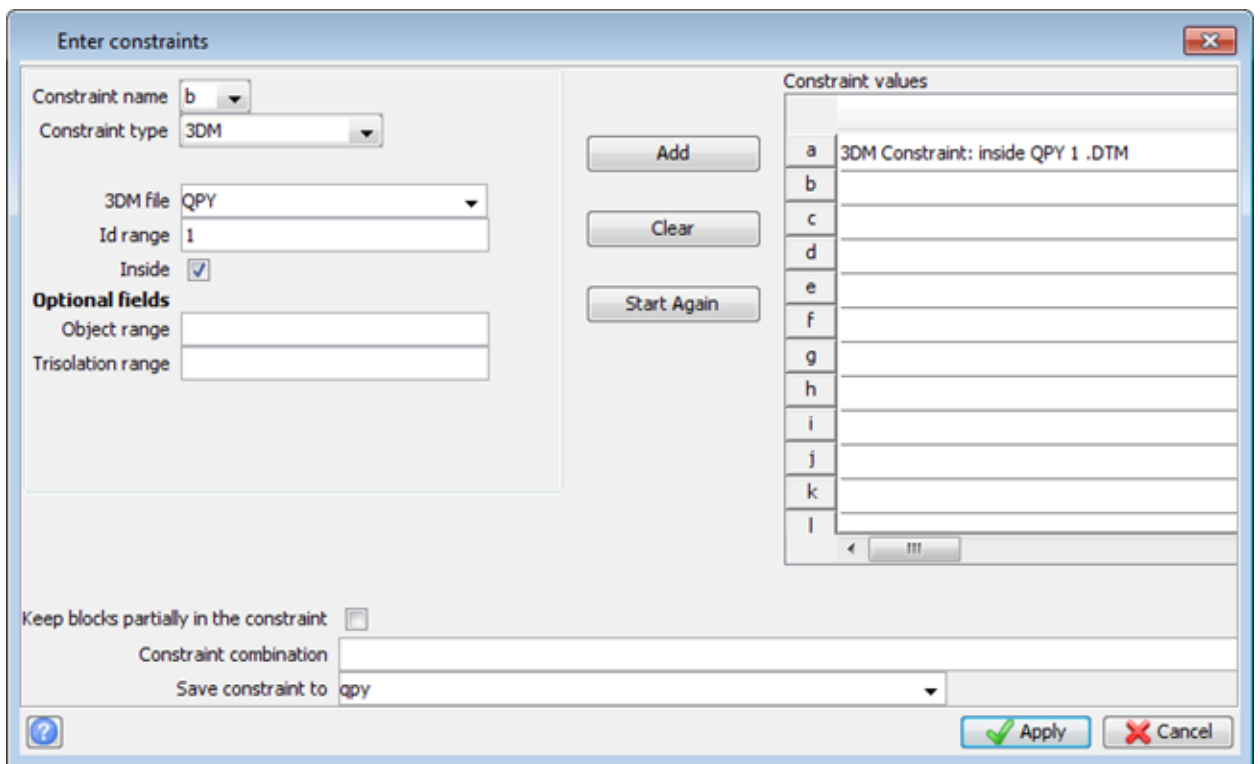


6. Choose **View > Zoom > Out**.

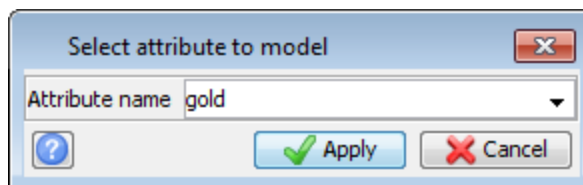
The block model is displayed.



7. Choose **Constraints > New graphical constraint**.
8. Enter the information as shown, and click **Apply**.



9. Choose **Estimation > Ordinary Kriging**.
10. Enter the information as shown, and click **Apply**.



11. Enter the information as shown, and click **Apply**.

Parameter	Value
Anisotropic dist to nearest sample	anisotropic_distance
Average anisotropic dist to samples	average_distance
Number of samples	number_samples
Kriging variance	kriging_variance
Block variance	block_variance
Kriging efficiency	kriging_efficiency
Number of negative weights	negative_weights
Lagrange multiplier	lagrange
Conditional bias slope	conditional_bias

12. Enter the information as shown, and click **Apply**.

Data source type:  STRING FILE  BLOCK MODEL

**STRING FILE**

Location: cmpq

Id range: 1

String range: 1

D field: 1

**BLOCK MODEL**

Model name:

Attribute:

Constrain data:

Save constrained sample points?:

Output location:

Output id number: 1

13. Enter the information as shown, and click **Apply**.

**Search parameters**

Search type  Ellipsoid  Octant

Minimum number of samples to select: 10  
 Maximum number of samples to select: 20

Maximum search radius: 99999  
 Maximum vertical search distance: 99999

Constrain by drill hole?   
 Desc field: D2  
 Maximum number of samples per drill hole: 15

**Search Ellipsoid Specifications**

**Ellipsoid Orientation**  
 Bearing: 15  
 Plunge: 0  
 Dip: 40

**Anisotropy Ratios**  
 major / semi-major: 1.3  
 major / minor: 4.2

Rotation Convention: Surpac ZXY LRL

Z  X  Y  X  Y  Z  
 L  R  L  R  L  R

Ellipsoid Visualiser

Apply Cancel

14. Enter the information as shown, and click **Apply**.

**Kriging parameters**

Variogram file name:

Variogram model: Spherical

Rotation Convention: Surpac ZXY LRL

Number of structures: 1

Structure	Nugget	Sill	Range	Bearing	Plunge	Dip	Major/Semi	Major/Minor
1	2.5	7.4	56	15	0	40	1.3	4.2
2		0	0	15	0	40	1.3	4.2
3		0	0	15	0	40	1.3	4.2
4		0	0	15	0	40	1.3	4.2
5		0	0	15	0	40	1.3	4.2

Number of discretisation points: X 3 Y 3 Z 3

Include debug output:

Report file name: ordinary\_kriging

Constrain interpolation:

Format: .not - Surpac Note File

15. Enter the information as shown, and click **Apply**.

**Enter constraints**

Constraint name: b

Constraint type: 3DM

3DM file: QPY

Id range: 1

Inside:

**Optional fields**

Object range:

Trisolation range:

Buttons: Add, Clear, Start Again

**Constraint values**

a	3DM Constraint: inside QPY 1 .DTM
b	
c	
d	
e	
f	
g	
h	
i	
j	
k	
l	

Keep blocks partially in the constraint:

Constraint combination:

Save constraint to: qpy

After the model is filled, a report file called **ordinary\_kriging.not** is produced.

```

KRIGING RUN PARAMETERS

MODEL NAME : training.mdl

CONSTRAINT VALUES USED
Data Constraints
Unconstrained
Model Constraints
a. INSIDE CONSTRAINT QPY
Keep blocks partially in the constraint : False

SEARCH PARAMETERS
ROTATION CONVENTION
Surpac ZXY LRL

ANGLES OF ROTATION
First Axis      15.00
Second Axis     0.00
Third Axis      40.00

ANISOTROPY FACTORS
Semi-major axis  1.30
Minor axis       4.20

OTHER INTERPOLATION PARAMETERS
Max search distance of major axis  99999.000
Max vertical search distance       99999.000
Maximum number of informing samples 20
Minimum number of informing samples 10

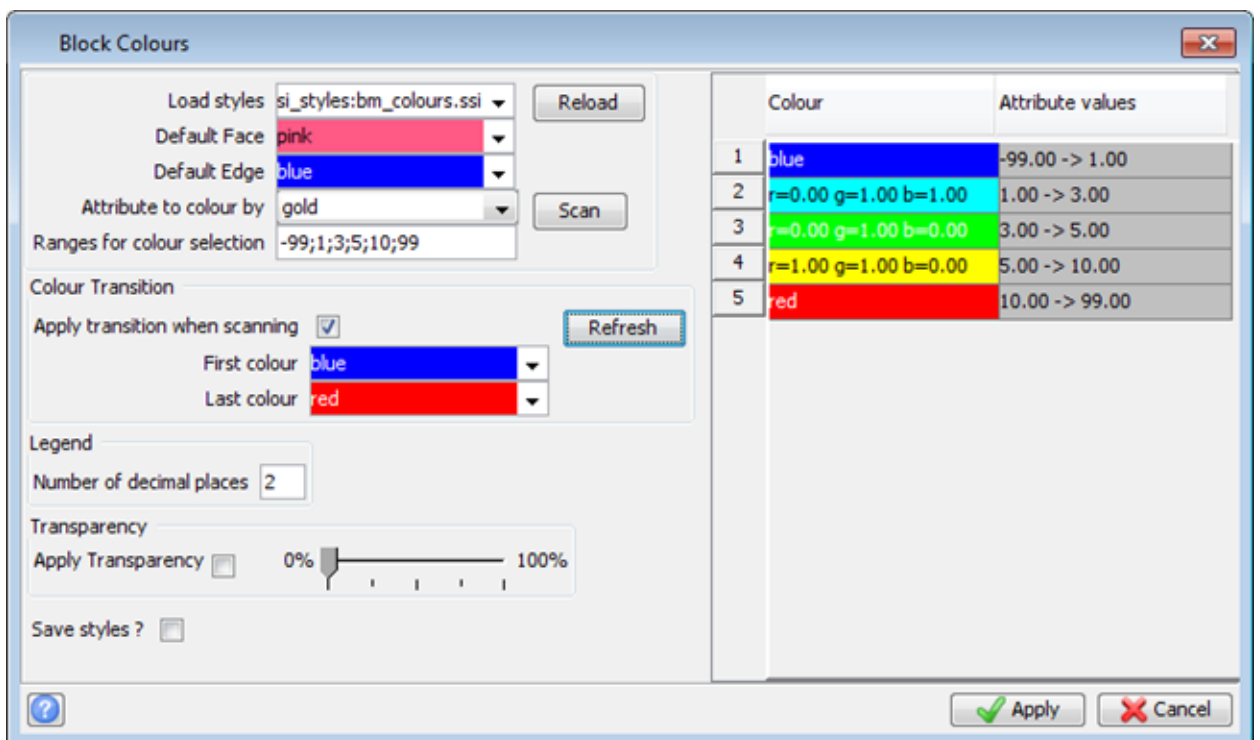
KRIGING TYPE = ORDINARY KRIGING

VARIOGRAM MODEL = Spherical
Cumulative sill  9.900000
Nugget effect    2.500000

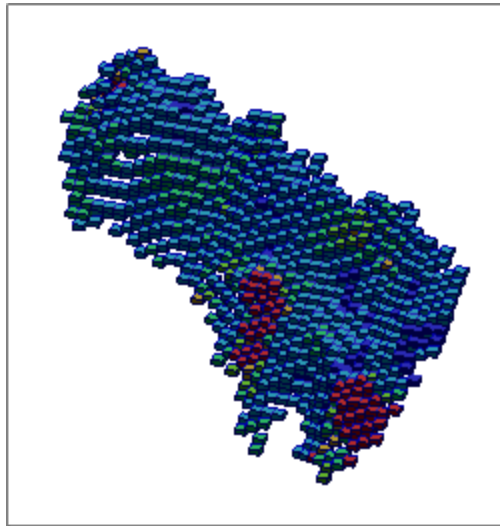
MODEL  C VALUE  RANGE  AZIMUTH  PLUNGE  DIP  SEMI-MAJOR-RATIO  MINOR-RATIO
1      7.400000  56.000  15.000  0.000  40.000  1.300  4.200

BLOCK VARIANCE 5.15516
    
```


16. Choose **Display > Colour model by attribute**.
17. Enter the information as shown, click **Refresh**, and click **Apply**.



The constrained and coloured block model for the QPY zone is displayed.



18. Choose **Block Model** > **Save**.
19. Choose **Block Model** > **Close**.

 **Note:** To see all of the steps performed in this task, run `_05c_ordinary_kriging.tcl`. You need to click **Apply** on any forms presented.

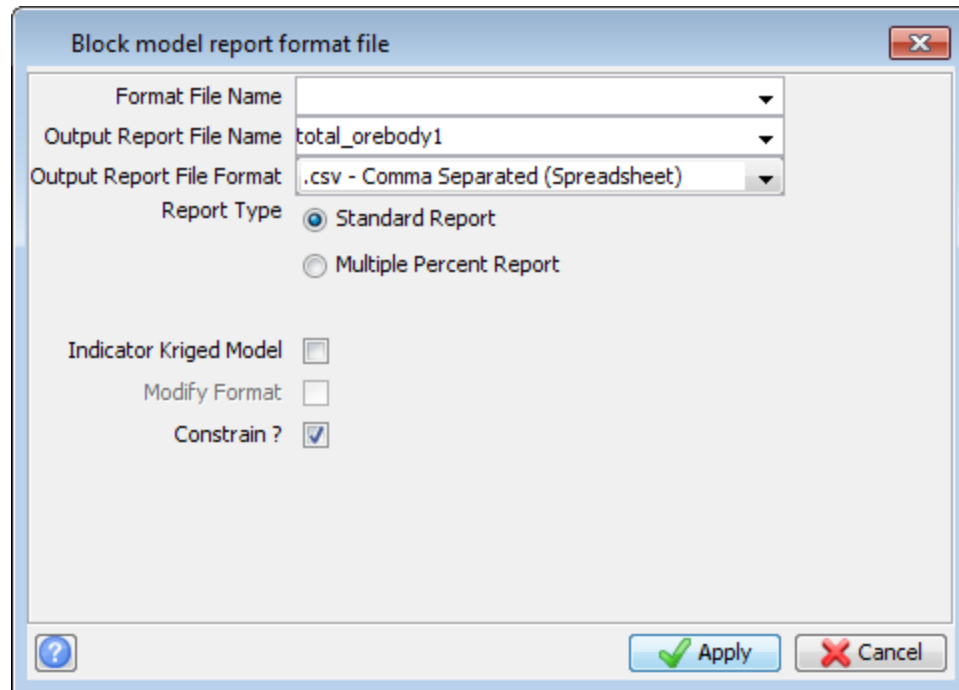
## Block model reporting

### Block model report

#### Task: Create a block model report

You will now produce a report for the entire deposit.

1. Connect to **training2.mdl**.
2. Choose **Block model > Report**.
3. Enter the information as shown, and click **Apply**.



The screenshot shows a dialog box titled "Block model report format file" with a close button (X) in the top right corner. The dialog contains the following fields and options:

- Format File Name:** An empty dropdown menu.
- Output Report File Name:** A text field containing "total\_orebody1".
- Output Report File Format:** A dropdown menu showing ".csv - Comma Separated (Spreadsheet)".
- Report Type:** Two radio buttons: "Standard Report" (selected) and "Multiple Percent Report".
- Indicator Kriged Model:** A checkbox that is unchecked.
- Modify Format:** A checkbox that is unchecked.
- Constrain ?** A checkbox that is checked.

At the bottom of the dialog, there is a help icon (question mark in a circle) on the left, and two buttons on the right: "Apply" (with a green checkmark icon) and "Cancel" (with a red X icon).

4. Enter the information as shown, and click **Apply**.

Block model report

Report description  
Report for total ore body with grades above 0.00g/t and constrained by a mine design Pit1.

Format headers?  
 Remove lines with zero volume?  
Report volume and tonnes to 0 decimal places

Report attributes	Display?	Low cut	Upper cut	Weight by	Report	Expression
a gold	<input checked="" type="checkbox"/>			Mass	Average	

Volume adjustment  
 Use volume adjustment?  
Attribute: anisotropic\_distance

Density adjustment  
 None  
 Attribute: sg  
 Value


Geometric grouping  
Group geometrically: None

	Grouping attributes	Numeric range
1	z	800,1100,50
2	gold	0;1;3;5;10;999

Fill all cells for the group attribute?  
 Pivot compatible?

Use partial percentages?  
Precision: 3  
Attribute to store partial percentage values:

Apply Cancel

 **Note:** The report can be weighted by mass and, in this case, the specific gravity attribute must be supplied.

**Grouping Attributes:** You can group the results based on any attribute or Y, X, Z. If you are grouping by more than one attribute, the order in which they are specified will have an influence on the format of the report. In the above example, if the attribute GOLD is reported based on the cutoff values of 0;1;3;5;10;999 and these cutoffs are to be reported on each 50m elevation range between 800 and 1100, you would enter the Z value first, and the GOLD values second. The results will be divided into 50m elevation ranges within which the numbers are split into grade ranges.

5. Enter the information as shown, and click **Apply**.  
This will constrain the report to the material within the pit and below the topography.

6. Open **total\_orebody1.csv**.  
The report is displayed in Microsoft Excel.

	A	B	C	D	E	F	G
1	Z1	Z2	Gold1	Gold2	Volume	Tonnes	Gold
2	850	900	0	3	176500	494200	1.34
3			3	5	6000	16800	3.72
4			5	10	16000	44800	7.45
5			10	999	5500	15400	11.59
6	900	950	0	3	1771000	4885300	1.36
7			3	5	124500	343300	3.82
8			5	10	116000	317700	7.93
9			10	999	9000	25200	12.78
10	950	1000	0	3	4742000	12396200	1.39
11			3	5	89500	231700	3.77
12			5	10	64000	167800	7.54
13			10	999	58500	152200	20.15
14	1000	1050	0	3	194000	539900	1.42
15			3	5	0	0	0
16			5	10	0	0	0
17			10	999	0	0	0

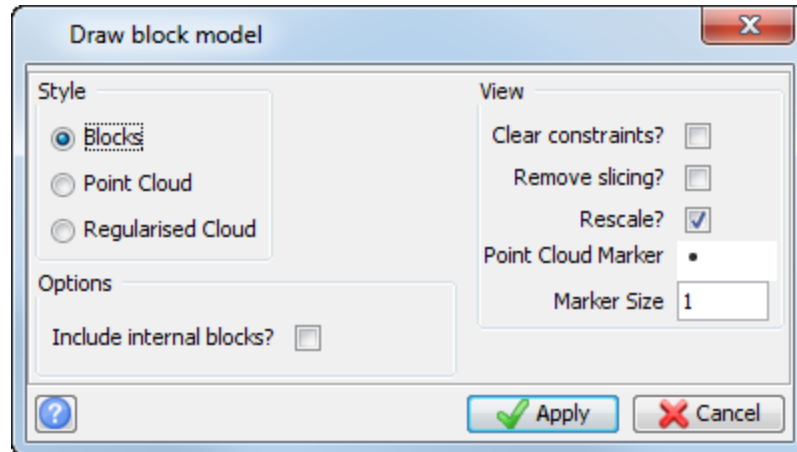
**Note:** To see all of the steps performed in this task, run **\_06\_block\_model\_reporting.tcl**. You need to click **Apply** on any forms presented.

## Creating calculated attributes

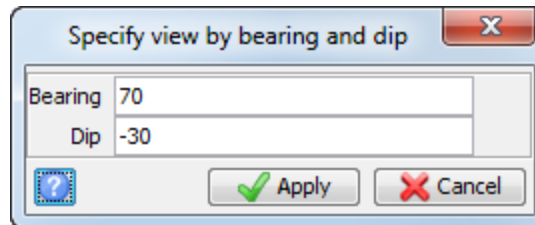
### Task: Create calculated attributes

It is possible to create attributes, in the Surpac block model, that are calculated from the values of other attributes, or from standard values. These attributes, called calculated attributes, are very powerful tools for generating reportable values. They do not increase the memory allocation needed for the block model.

1. Connect to **training2.mdl**.
2. Choose **Block Model > Display**.
3. Enter the information as shown, and click **Apply**.

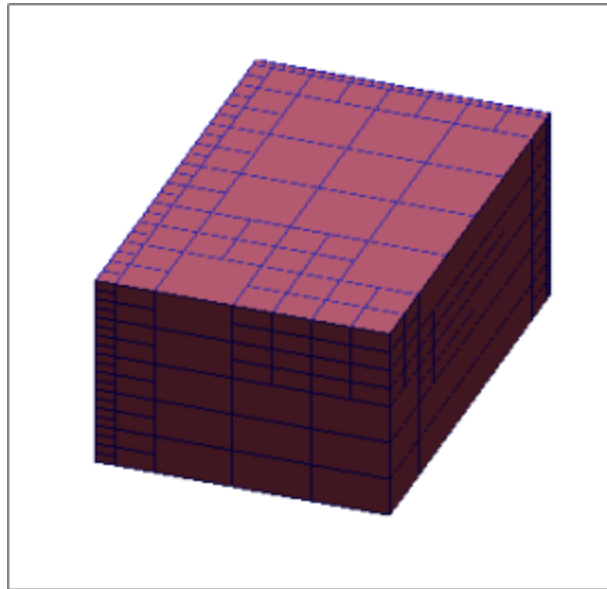


4. Choose **View > Data view options > View by bearing and dip**.
5. Enter the information as shown, and click **Apply**.



6. Choose **View > Zoom > Out**.

The block model is displayed.



7. Choose **Constraints > New graphical constraint**.
8. Enter the information as shown, and click **Apply**.

Enter constraints
✕

Constraint name

Constraint type

3DM file

Id range

Inside

**Optional fields**

Object range

Trisolation range

Add

Clear

Start Again

Constraint values

a	3DM Constraint: inside QPY 1 .DTM
b	
c	
d	
e	
f	
g	
h	
i	
j	
k	
l	

Keep blocks partially in the constraint

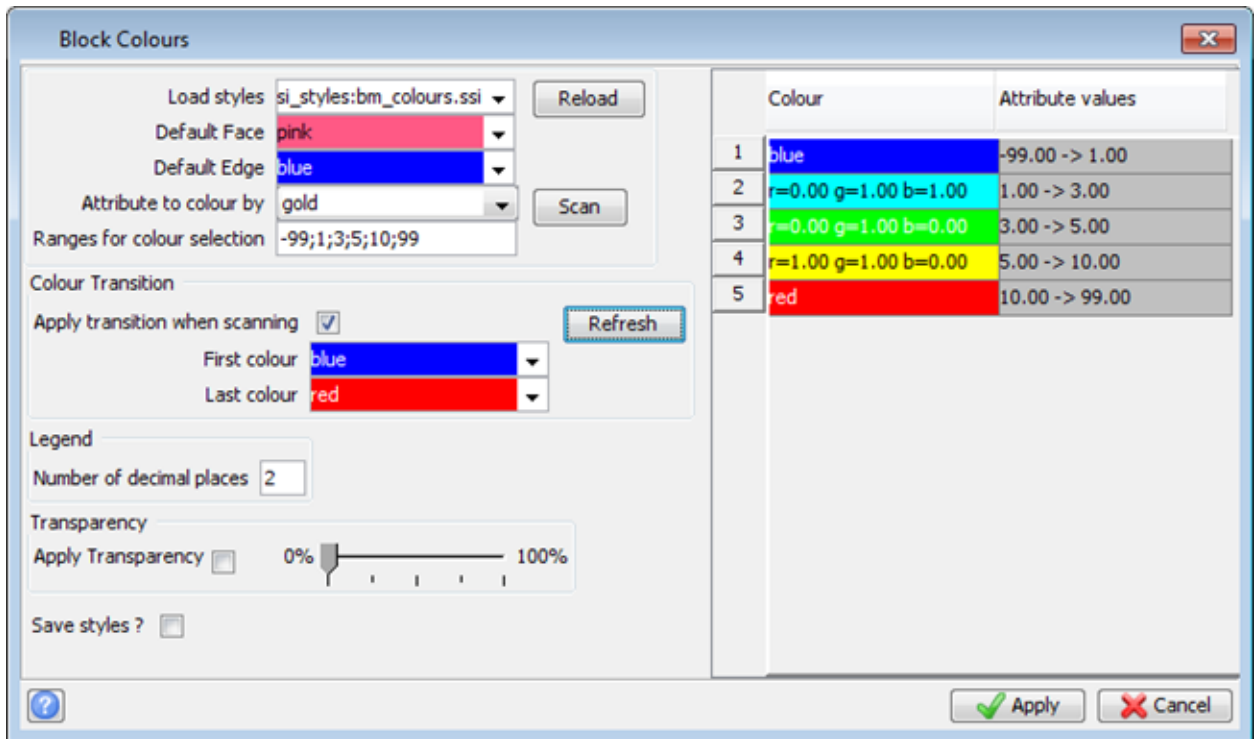
Constraint combination

Save constraint to

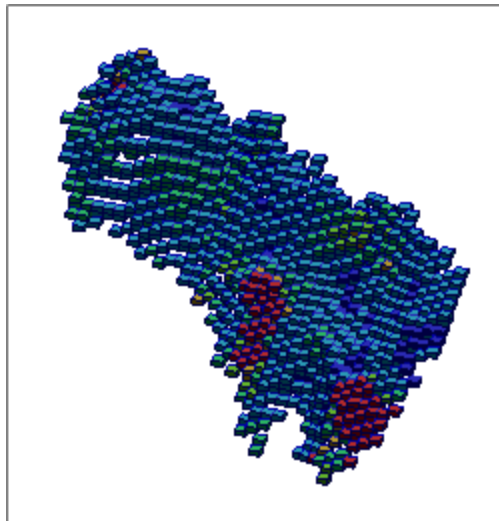
?
✔ Apply
✖ Cancel

9. Choose **Display > Colour model by attribute**.

10. Enter the information as shown, click **Refresh**, and then click **Apply**.



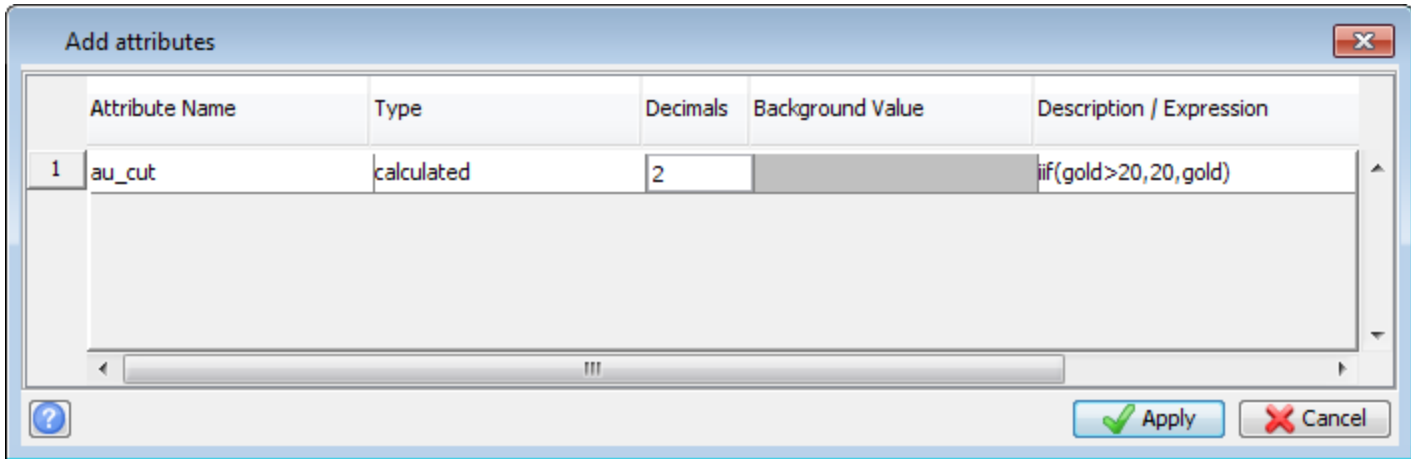
The constrained and coloured block model for the QPY zone is displayed.



11. Choose **Attributes > New**.

You will add a new calculated attribute and in the expression field, entering the mathematical formula for calculating the cut grade.

12. Enter the information as shown, and click **Apply**.

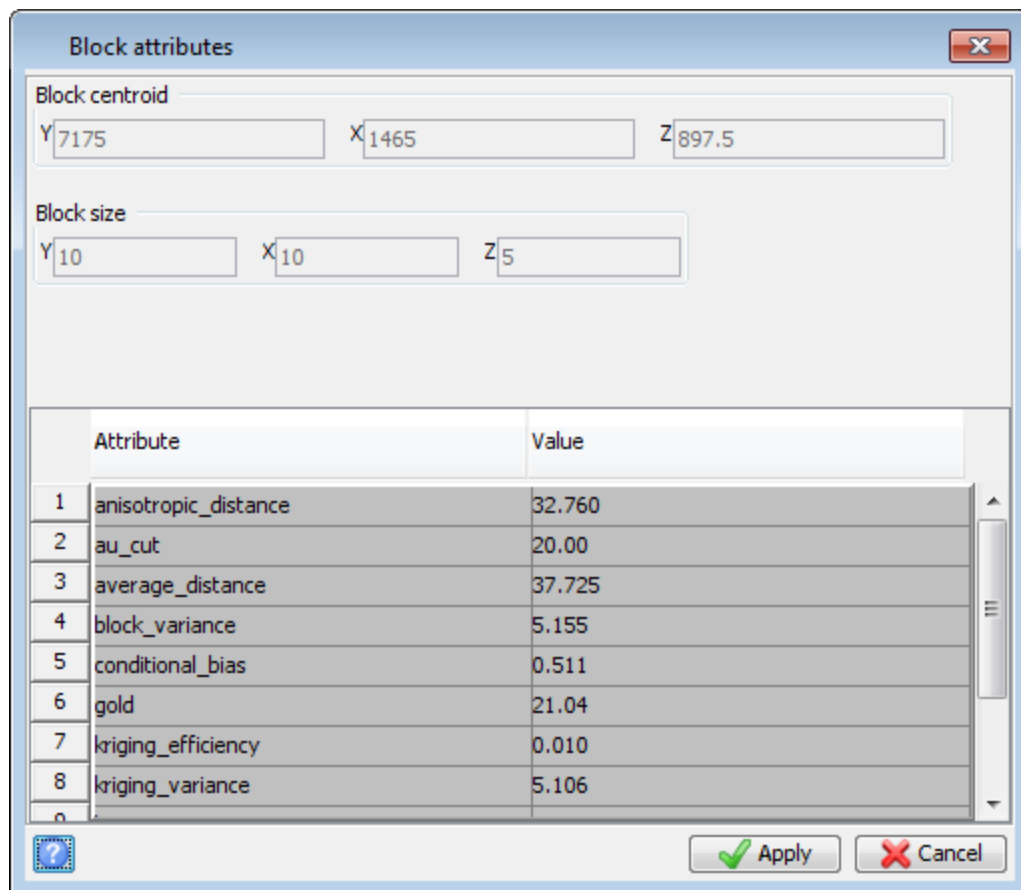


**Note:** To create a calculated top cut, the expression is `iif(gold>20,20,gold)` which means that if gold is greater than 20, then make gold 20, else the gold value remains as the existing value of gold.

The new attribute is created.

13. Choose **Display > View attributes for one block**.

14. Click a few blocks from the upper range to see that the top value for **au\_cut** is now limited to 20.



15. Choose **Block model > Save**.

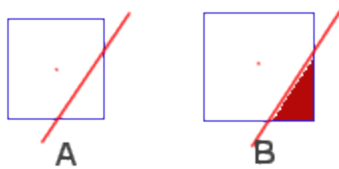
16. Choose **Block Model > Close**.

## Partial percentage reporting

The traditional constraints functions test all blocks to check whether they are inside or outside the constraint using the position of the centroid. This test is done on the minimum size blocks in the model (sub-blocks).

Occasionally, the centroid is outside the constraint, yet a significant part of the block is still inside the constraint (as shown in figure A). Usually, this is not a significant issue - the blocks in question are at the minimum block size, some blocks are inside and some are outside, and so the model evens itself up. However, for some reporting, such as volume reconciliation, this is not accurate enough.

The partial percentage function tests these inconclusive blocks and determines a fractional value between 0 and 1 that is proportion of the block that is inside the constraint. For example, 0 means that the block is totally out of the constraint, 1 is totally in and 0.2 is 20% inside (figure B). These values are stored in a specified attribute.



How the percentage is calculated is very simple. With traditional constraints, the model is sub-blocked down to the minimum block size, and then the inside/outside test is performed on the block centroid. The partial percentage calculation takes it further. Rather than stopping at the minimum block size, this function will sub-block further, depending on the precision factor that you enter. The higher the precision factor, the more times the block is sub-blocked beyond the minimum block size.

The function then performs the standard constraint on these smaller blocks, and counts the ones that are inside and outside the constraint. This count becomes the percentage. The percentage is always stored in the block at minimum block size. So it becomes a trade-off.

The higher the precision factor, the more precise the partial percentage calculation. However, many more blocks are created for the higher precision factors, and so the function will be slower. For example, a percentage calculation with a precision factor of 5 will create 4096 times the number of blocks than a calculation at precision 1.

Performing partial percentage calculations on underground models can be very time consuming because you need to create an attribute and run the partial percentage function for each stope in the model. An alternative way to determine partial percentage volume is to use the geometric grouping function in the block model report. The partial percentage volumes, for each location, are then generated in the report. However, the percentage value for each block is not stored as an attribute in the blocks of your model.

## Partial percent reporting from the block model report

### Task: Report partial percent using geometric grouping in the block model report

1. Connect to **training2.mdl**.
2. Choose **Block model > Report**.  
The *Block model report format file* form is displayed.

3. Enter the information as shown, and click **Apply**.

Block model report format file

Format File Name: geo\_group\_report.bmr

Output Report File Name: geo\_group\_report

Output Report File Format: .not - Surpac Note File

Report Type:  Standard Report  Multiple Percent Report

Indicator Kriged Model:

Modify Format:

Constrain?:

Apply Cancel

The *Block model report* form is displayed.

4. Enter the information as shown, and click **Apply**.

Block model report

Report description  
Report with geometric grouping

Format headers?  
 Remove lines with zero volume?  
 Report volume and tonnes to 0 decimal places

Report attributes	Display?	Low cut	Upper cut	Weight by	Report	Expression
a gold	<input checked="" type="checkbox"/>			Mass	Average	

Volume adjustment  
 Use volume adjustment?  
 Attribute anisotropic\_distance

Density adjustment  
 None  
 Attribute sg  
 Value

Geometric grouping  
 Group geometrically Solids  
 File name orebody1.dtm  
 Object range

Grouping attributes	Numeric range
1 gold	-99;0;1;5;99

Use partial percentages?  
 Precision 3  
 Attribute to store partial percentage values pp\_bmr

Fill all cells for the group attribute?  
 Pivot compatible?

Apply Cancel

The report opens.

Block model report				
Constraints used				
Unconstrained				
Geometric grouping				
Solid file : orebody1.dtm				
Object range :				
Partial percentage precision : 3				
Object 2 - Trisolation 1				
	Gold	Volume	Tonnes	Gold
-----				
-99.0 -> 0.0		0	0	0.00
0.0 -> 1.0		2389	6036	0.98
1.0 -> 5.0		186953	515079	1.57
5.0 -> 99.0		17164	47315	13.46
Trisolation Total		206506	568430	2.56
Object 4 - Trisolation 1				
	Gold	Volume	Tonnes	Gold
-----				
-99.0 -> 0.0		0	0	0.00
0.0 -> 1.0		2396	5489	0.99
1.0 -> 5.0		14241	36234	2.04
5.0 -> 99.0		2463	5478	7.55
Trisolation Total		19100	47200	2.56
Object 6 - Trisolation 1				
	Gold	Volume	Tonnes	Gold
-----				
-99.0 -> 0.0		0	0	0.00
0.0 -> 1.0		2156	5498	0.98
1.0 -> 5.0		797118	2158482	2.45
5.0 -> 99.0		150896	416127	8.67
Trisolation Total		950170	2580107	3.45
Object 6 - Trisolation 2				
	Gold	Volume	Tonnes	Gold
-----				
-99.0 -> 0.0		0	0	0.00
0.0 -> 1.0		475	1230	0.99
1.0 -> 5.0		40643	105775	1.67
5.0 -> 99.0		6044	14317	7.46
Trisolation Total		47161	121322	2.35
	Gold	Volume	Tonnes	Gold
-----				
Grand Total	1222937	3317059		3.25
-----				

**Note:** Because you specified a new attribute for partial percentage (**pp\_bmr**), that attribute is automatically created and filled with values throughout the block model.

5. Choose **Block model > Save**.
6. Choose **Block model > Close**.

**Note:** To see all of the steps performed in this task, run **\_08a\_partial\_percentages\_report.tcl**. You need to click **Apply** on any forms presented.

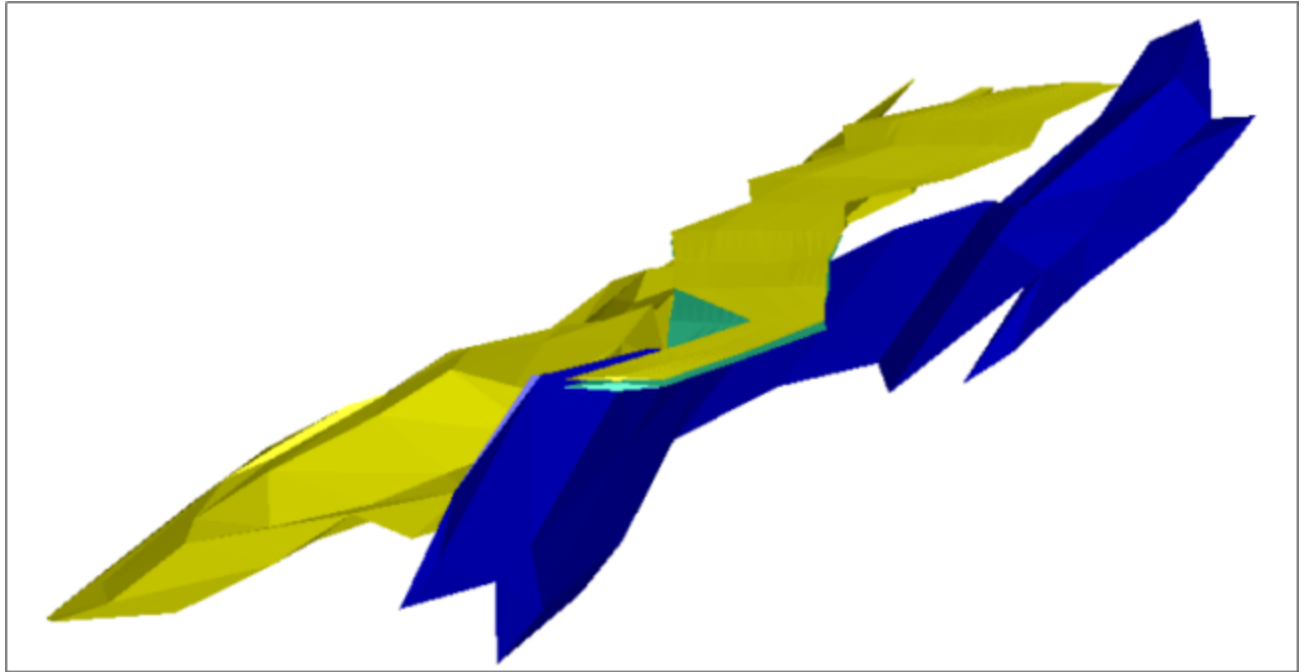
## Simple partial percent reporting

### Task: Create partial percentage report

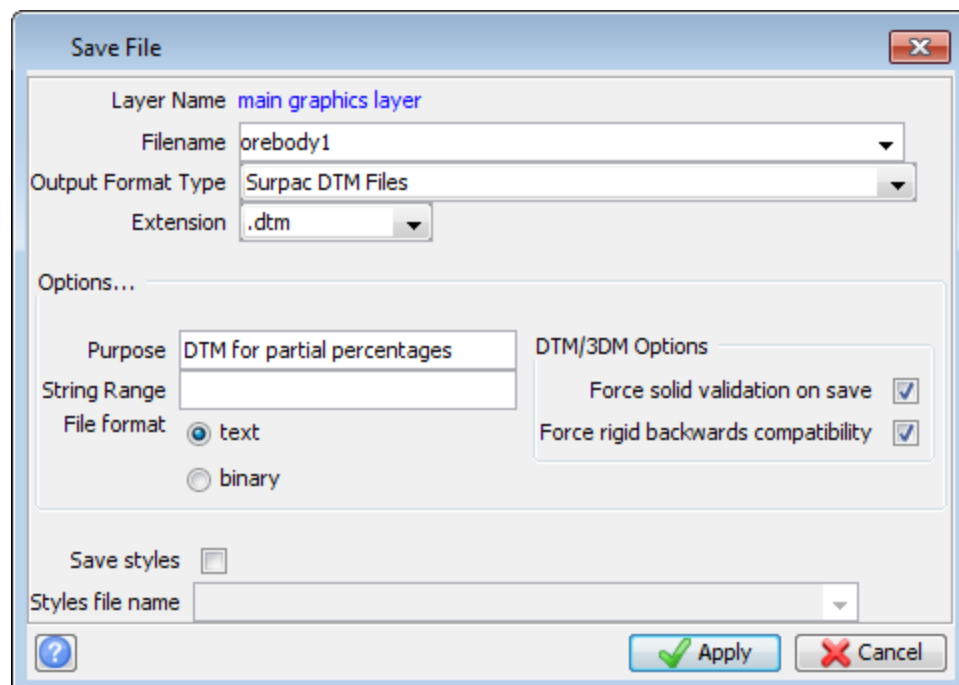
First you will create a solid of an ore body.

1. Open **training2.mdl**.
2. Append **bif1.dtm**, **qpy1.dtm**, **sand1.dtm** into **Graphics**.  
 **Note:** You append DTMs to a layer by holding down the CTRL key while dragging and dropping the DTMs into **Graphics**.

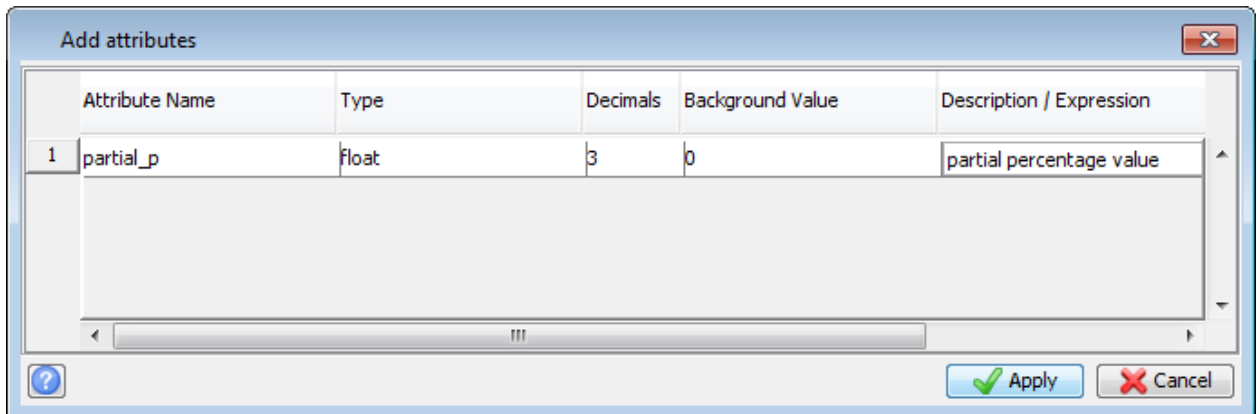
The DTMs are displayed.



3. Choose **File > Save > string/DTM**.
4. Enter the information as shown, and click **Apply** to save the results to **orebody1.dtm**.

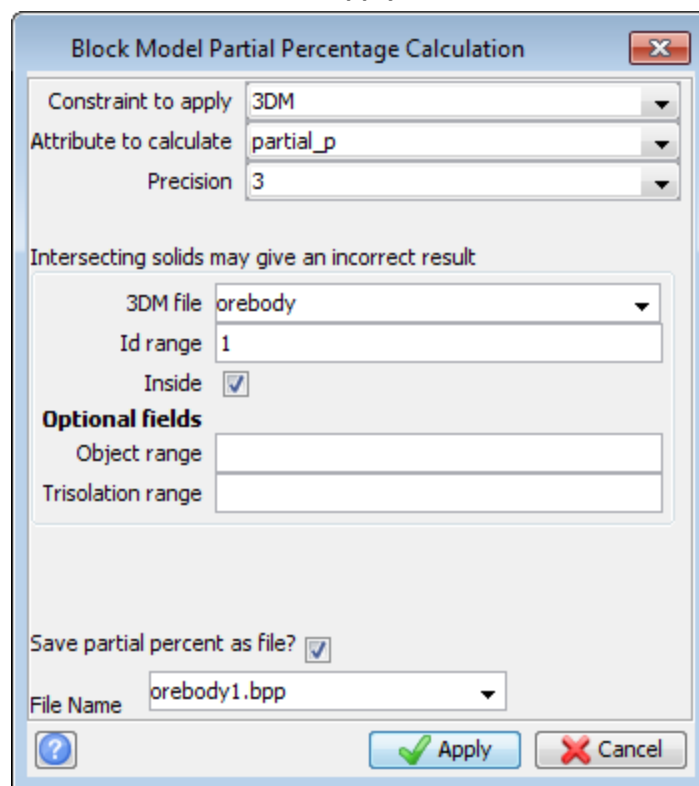


5. If you are prompted to overwrite an existing **orebody1.dtm**, choose **Yes**.
6. Choose **Attributes > New** to create a new attribute to store the partial percentage value.
7. Enter the information as shown, and click **Apply**.



You will now give the new block attribute a value based on its position relative to the ore body.

8. Choose **Estimation > Partial Percentage**.
9. Enter the information as shown, and click **Apply**.



**Note:** It is possible to use a string, DTM surface, 3D model or several other options for **Constraint to apply**.

The results are a partial percentage volume calculation for the blocks along the edge of the ore body.

The precision option determines how many times the block will be split into smaller blocks for testing, to see if it is in or out of the constraint. As an example, a precision of 2 splits the block into two parts in each direction, almost as if it were sub-blocking, and

then tests these smaller blocks against the DTM surface. A precision of 3 splits the blocks 3 times in each direction. The larger the precision value the longer the process will take.

Saving a partial percentage result to a file allows it to be used again without the need to run the estimation function. It also allows for several variables to be filled at one time.

Once completed, a report can be generated to give the volume in the ore body. This is done by using the partial attribute as a weighting attribute.

You will now generate two reports to see the difference, once without making use of the partial attribute, and then a second time using the partial attribute as a weighting field.

10. Select **Block model > Report**.
11. Enter the information as shown, and click **Apply**.

Block model report format file

Format File Name

Output Report File Name bmrpt\_without\_partial\_p

Output Report File Format .not - Surpac Note File

Report Type

Standard Report

Multiple Percent Report

Indicator Kriged Model

Modify Format

Constrain?

Apply Cancel

12. Enter the information as shown, and click **Apply**.

Block model report

Report description  
Ore body report from training2 block model without using Partial Percentage attribute

Format headers?  
 Remove lines with zero volume?  
 Report volume and tonnes to 2 decimal places

Report attributes	Display?	Low cut	Upper cut	Weight by	Report	Expression
a gold	<input checked="" type="checkbox"/>			Mass	Average	

Volume adjustment  
 Use volume adjustment?  
 Attribute anisotropic\_distance

Density adjustment  
 None  
 Attribute sg  
 Value

Geometric grouping  
 Group geometrically None

Grouping attributes	Numeric range
1 gold	0;3;9;999

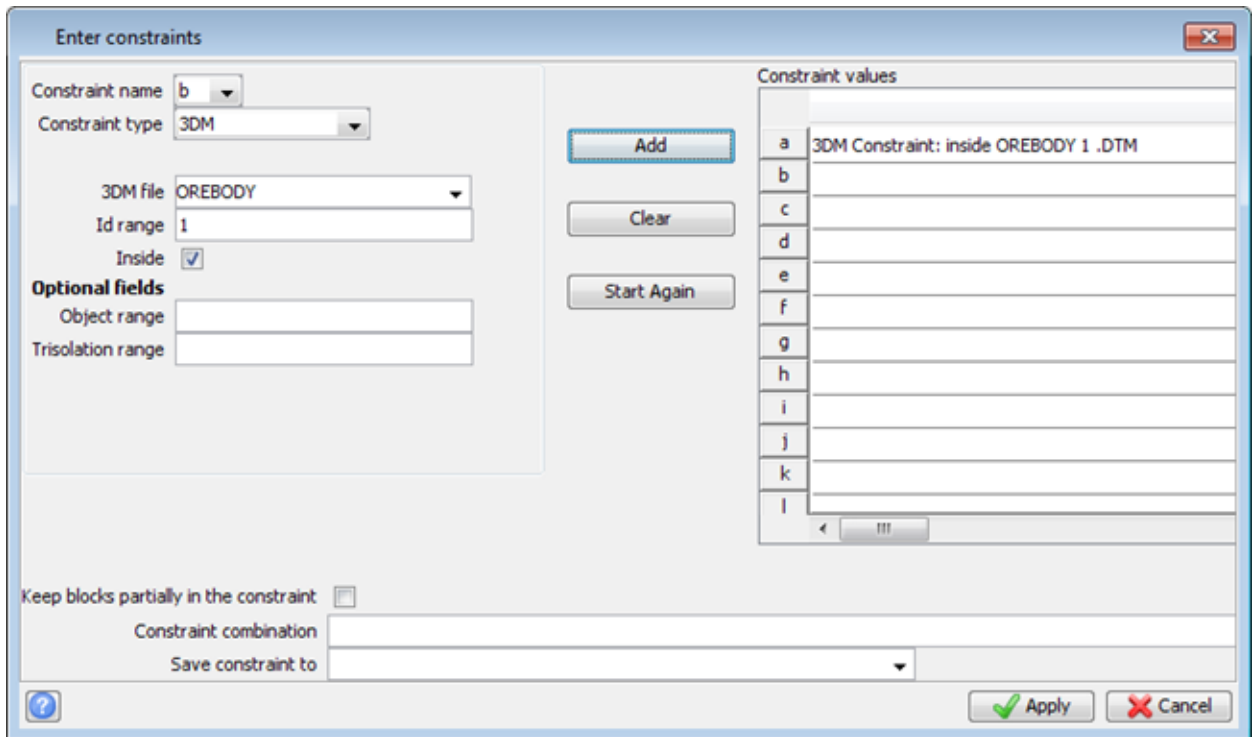
Use partial percentages?  
 Precision 3  
 Attribute to store partial percentage values

Fill all cells for the group attribute?  
 Pivot compatible?

Apply Cancel

This generates a report for the volume without making use of the partially-filled blocks.

13. Enter the information as shown, and click **Apply**.



Surpac generates the report, and displays it.

```

                                Block model report
Orebody report from training block model without using partial percentage attribute
Constraints used
a.  INSIDE 3DM OREBODY 1

Keep blocks partially in the constraint : False

-----
      Gold      Volume      Tonnes      Gold
-----
0.0 -> 3.0  721500.00  1950999.95  2.03
3.0 -> 9.0  422500.00  1151199.97  4.65
9.0 -> 999.0  65500.00  181300.00  13.44
-----
Grand Total  1209500.00  3283499.92  3.58
-----
    
```

14. Choose **Block model > Report**.

15. Enter the information as shown, and click **Apply**.

The screenshot shows a dialog box titled "Block model report format file". It contains the following settings:

- Format File Name: (empty dropdown)
- Output Report File Name: bmrpt\_with\_partial\_p
- Output Report File Format: .not - Surpac Note File
- Report Type:  Standard Report,  Multiple Percent Report
- Indicator Kriged Model:
- Modify Format:
- Constrain?:

At the bottom right, there are two buttons: "Apply" (with a green checkmark icon) and "Cancel" (with a red X icon). A help icon (?) is located at the bottom left.

16. Enter the information as shown, and click **Apply**.

Block model report

Report description  
Ore body report from training2.mdl using a Partial Percentage attribute

Format headers?  
 Remove lines with zero volume?  
 Report volume and tonnes to 2 decimal places

Report attributes	Display?	Low cut	Upper cut	Weight by	Report	Expression
a gold	<input checked="" type="checkbox"/>			Mass	Average	

Volume adjustment  
 Use volume adjustment?  
 Attribute partial\_p

Density adjustment  
 None  
 Attribute sg  
 Value

Geometric grouping  
 Group geometrically None

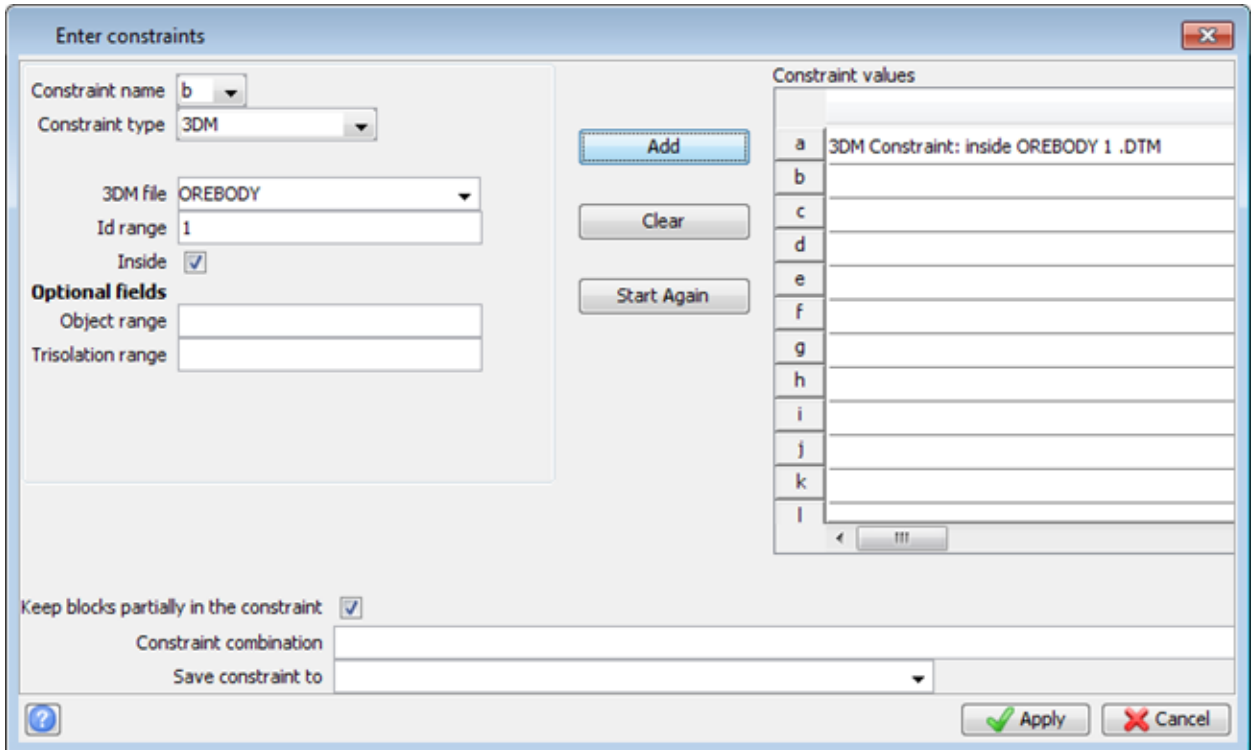
Grouping attributes	Numeric range
1 gold	0;3;9;999

Use partial percentages?  
 Precision 3  
 Attribute to store partial percentage values

Fill all cells for the group attribute?  
 Pivot compatible?

Apply Cancel

17. Enter the information as shown, and click **Apply**.



**Note:** Make sure that this time you select the **Keep blocks partially in the constraint** check box.

The report is displayed.

```

Block model report
Orebody report from training.mdl using a partial percentage attribute
Constraints used
a.  INSIDE 3DM OREBODY 1
    Keep blocks partially in the constraint : True

Attribute used for volume adjustment : partial_p

      Gold      Volume      Tonnes      Gold
-----
0.0 -> 3.0    888682.62    2406003.26    1.15
3.0 -> 9.0    291750.00    793980.06     4.58
9.0 -> 999.0  42503.91    117075.78    13.12
-----
Grand Total  1222936.52    3317059.10     2.39
    
```

You should see that the difference between the two reports in terms of volume is about 1.1%, and in terms of the gold content, 8% of the grade. If the blocks were larger (for example 20x20x20) partial percentages would show a greater effect on the result.


- 18. Choose **Block model** > **Save**.
- 19. Choose **Block model** > **Close**.

**Note:** To see all of the steps performed in this task, run `_08b_partial_percentages.tcl`. You need to click **Apply** on any forms presented.

## Multiple percentage reporting

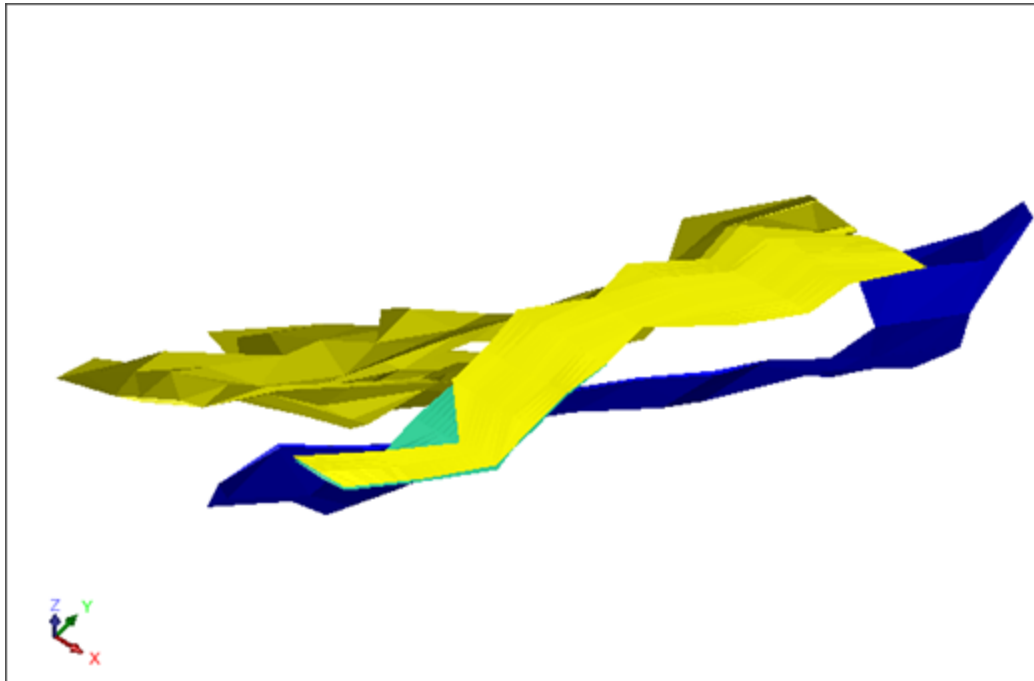
When you create the block model report, you can create another type of report called a 'multiple percent report'. A multiple percent report is useful when you have fractional attributes stored in each block. For example, you could store fractional attributes for rock type (such as sandstone\_frac, or mudstone\_frac).

The output of the report is grouped by all of the attributes you chose.

 **Note:** To assign values to a fractional attribute, run **Estimation > Partial Percentage** and, for the intersecting solid, use a solid that represents the specific rock type you are working with.

### Task: Report on grade, grouped by rock type

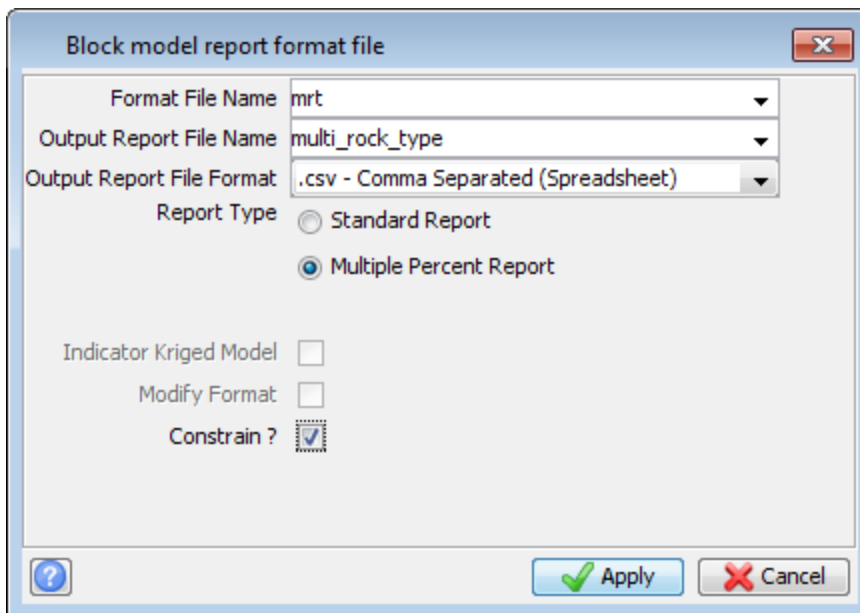
1. Connect to **training.mdl**.
2. Open **bif1.dtm**, **qpy.dtm**, and **sand1.dtm**.



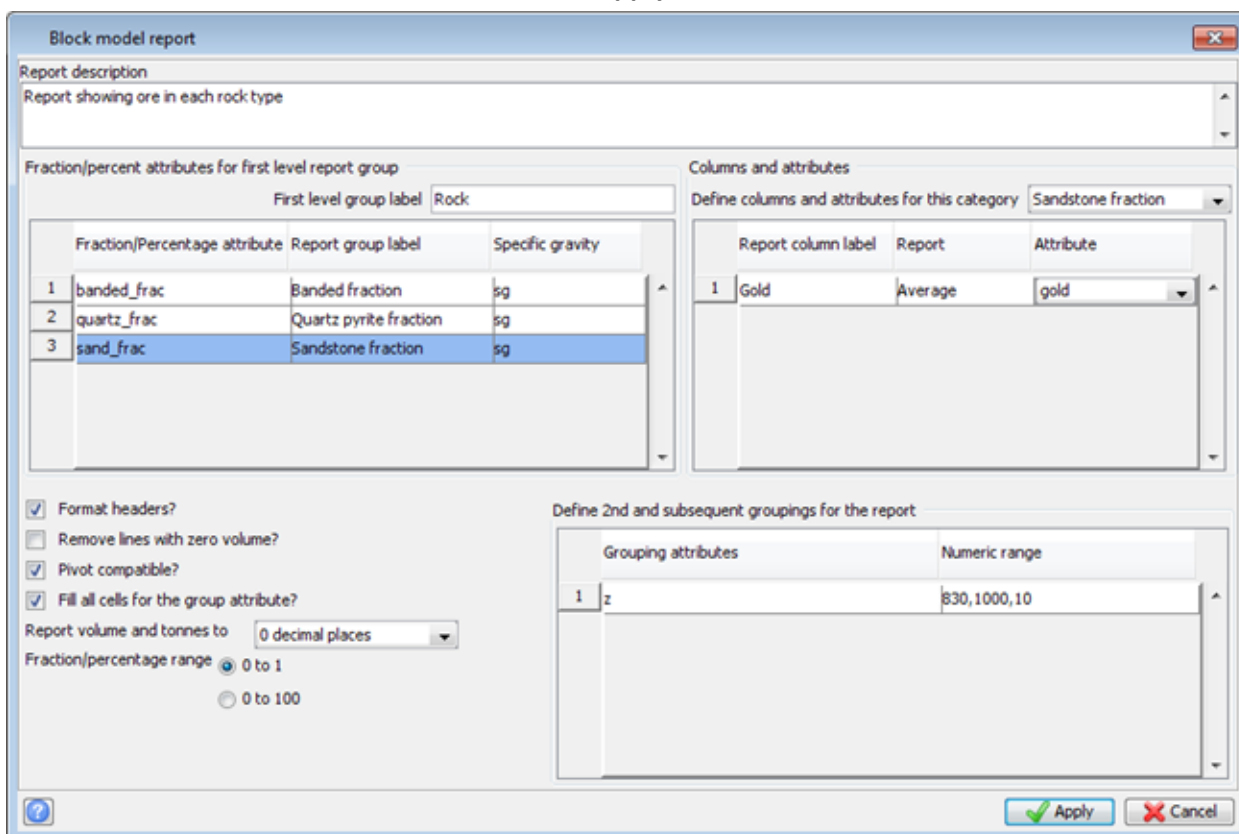
These solids represent three rock zones: banded iron formation, quartz pyrite, and sandstone respectively.

3. Choose **Block Model > Report**.

4. Enter the information as shown, and click **Apply**.



5. Enter the information as shown, and click **Apply**.



**Note:** You must define the attribute as **Gold** in the **Column and attributes** table for each of the fraction/percentage attributes. To do this, select the **Banded fraction** row, and then select **Gold** in the **Attribute** cell. Then select the **Quartz pyrite fraction** row and select **Gold** in the **Attribute** cell.

6. Enter the information as shown, and click **Apply**.

**Enter constraints**

Constraint name:

Constraint type:

Z =

Above

Buttons: Add, Clear, Start Again

Constraint values	
a	Z Value Constraint: above Z=830
b	
c	
d	
e	
f	
g	
h	
i	
j	
k	
l	

Keep blocks partially in the constraint


Constraint combination:

Save constraint to:

Buttons: Apply, Cancel

The report opens with volume, tonnes, and grade grouped by rock type, and then grouped by elevation.

	A	B	C	D	E	F
1	Rock	Z1	Z2	Volume	Tonnes	Gold
2	Banded fraction	830	840	134	375	0
3	Banded fraction	840	850	746	2089	0.69
4	Banded fraction	850	860	1757	4919	0.61
5	Banded fraction	860	870	2634	7375	2.96
6	Banded fraction	870	880	3494	9784	3.14
7	Banded fraction	880	890	4865	13623	1.23
8	Banded fraction	890	900	6827	19116	1.11
9	Banded fraction	900	910	10124	28347	1.47
10	Banded fraction	910	920	13232	37051	0.6
11	Banded fraction	920	930	16973	47523	0.6
12	Banded fraction	930	940	21440	60026	0.66
13	Banded fraction	940	950	25847	71977	1.03
14	Banded fraction	950	960	27746	76875	0.97
15	Banded fraction	960	970	26266	72434	1.42
16	Banded fraction	970	980	22097	60071	1.07
17	Banded fraction	980	990	15727	40936	1.31
18	Banded fraction	990	1000	6592	15894	0.57
19	Quartz pyrite fraction	830	840	631	1766	1.13
20	Quartz pyrite fraction	840	850	2862	8014	1.44
21	Quartz pyrite fraction	850	860	8322	23302	1.95
22	Quartz pyrite fraction	860	870	18197	50952	1.92
23	Quartz pyrite fraction	870	880	32145	90005	2.56

 **Note:** To see all of the steps performed in this task, run `_08c_multiple_attribute.tcl`. You need to click **Apply** on any forms presented.

## Model reblocking

### Model reblocking

#### Task: Perform model reblocking

In Surpac you can create a new model with different block sizes from those in the current model by reblocking.

In this example, you will reblock the model in all three directions.

1. Connect to **training2.mdl**.
2. Choose **Block model > Simple reblocking**.
3. Enter the information as shown, and click **Apply**.

Block Model Reblock

Output model name: training\_reblocked2  
Description: Training exercise

Reblocking type: Standard Reblocking

New user block size (X, Y, Z): 20, 20, 10

New minimum block size (Y, X, Z): 10, 10, 5  
SG Attribute (optional): sg

	Attribute Name	Type	Include?	Reblocking method	SG Attrib
1	anisotropic_distance	Float	<input checked="" type="checkbox"/>	Mean - negative values as 0	
2	au_cut	calculated	<input checked="" type="checkbox"/>	No Action Required	
3	average_distance	Float	<input checked="" type="checkbox"/>	Mean - negative values as 0	
4	block_variance	Float	<input checked="" type="checkbox"/>	Mean - negative values as 0	

Apply Cancel

The model **training\_reblocked2** is created with the specified block size and becomes the active model.

**Note:** It is important that you define numeric attributes that should not be averaged during reblocking as calculated attributes. For example, tonnage should be defined as a calculated attribute based on block size and density, with the generic formula **tonnage =  $_{next} \times _{yext} \times _{zext} \times sg$** .

4. Choose **Block model > Summary**.

The model summary is displayed. The new **User block size** is 20 x 20 x 10.

**Block model summary**

Block Model  
 Name: training\_reblocked2.mdl  
 Description: Training exercise

Block Model Geometry

Min Coordinates	Y 7000	X 1200	Z 700
Max Coordinates	Y 7600	X 2100	Z 1100
User block Size	Y 20	X 20	Z 10
Min. block Size	Y 10	X 10	Z 5
Rotation	Bearing 0	Dip 0	Plunge 0

Block Summary

Total No. Blocks: 29675  
 Storage Efficiency %: 93.13

Attributes

	Name	Type	Decimals	Background	Description / Expression
1	anisotropic_distance	Float	3	-99.000	
2	au_cut	Calculated	-	-	if(gold>20,20,gold)
3	average_distance	Float	3	-99.000	
4	block_variance	Float	3	-99.000	

Save Summary?

Apply Cancel

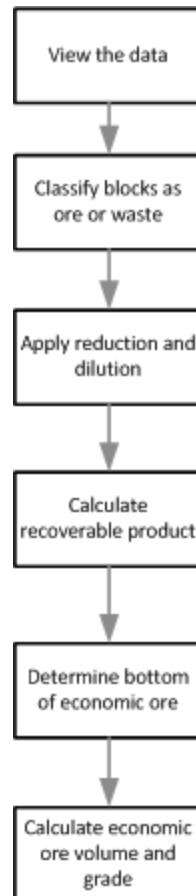
**Note:** To see all of the steps performed in this task, run `_09_model_reblocking.tcl`. You need to click **Apply** on any forms presented.

## Column processing

In this section you will take an existing block model and use the functions for column processing in block models to evaluate the economics of the block model.

The data is a block model that contains only one attribute, grade, and a DTM that represents surface topography.

### Workflow

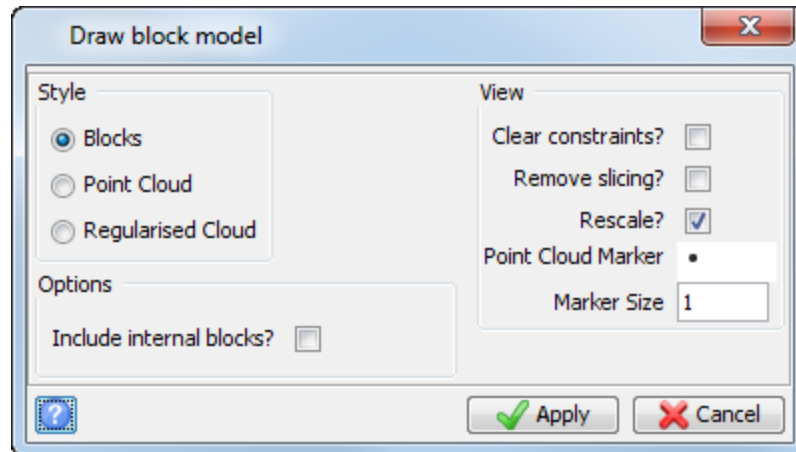


### Viewing the data

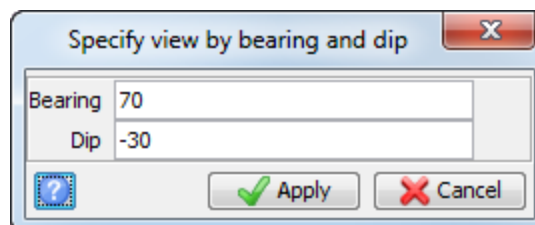
#### Task: View the data

1. Connect to **blockmodel.mdl**.
2. Choose **Block model > Display**.

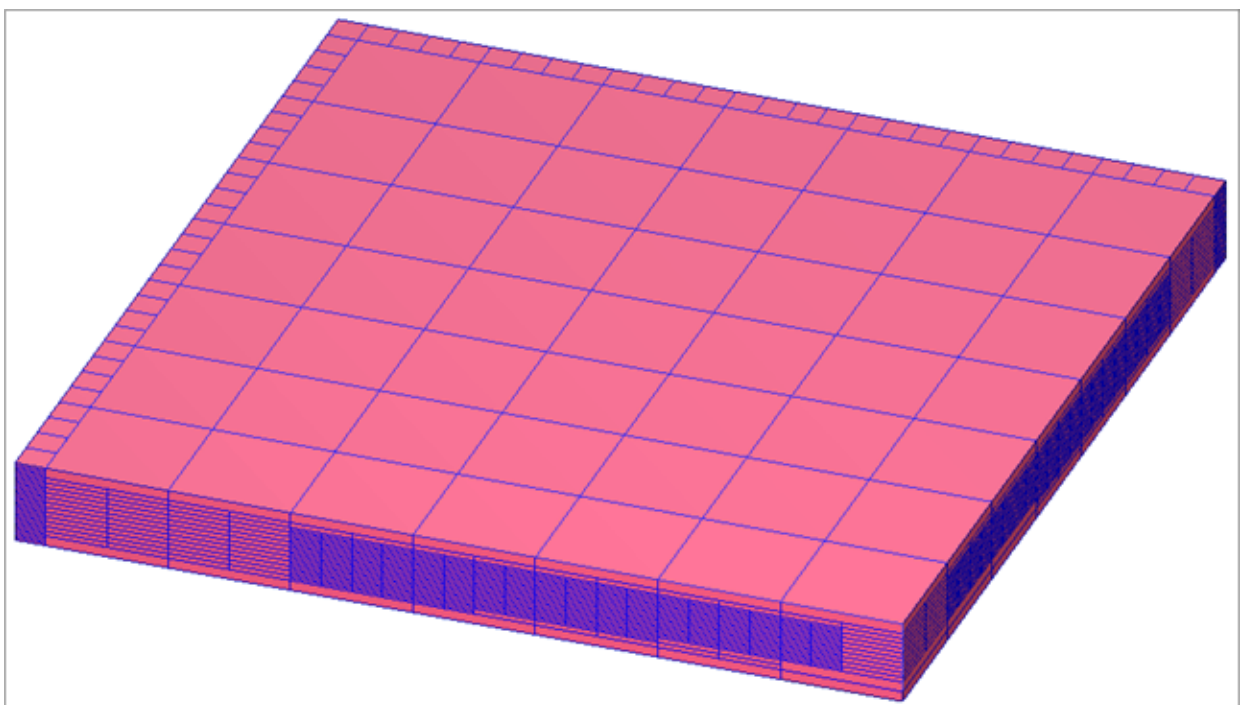
3. Enter the information as shown, and click **Apply**.



4. Choose **View > Data view options > View by bearing and dip**.
5. Enter the information as shown, and click **Apply**.

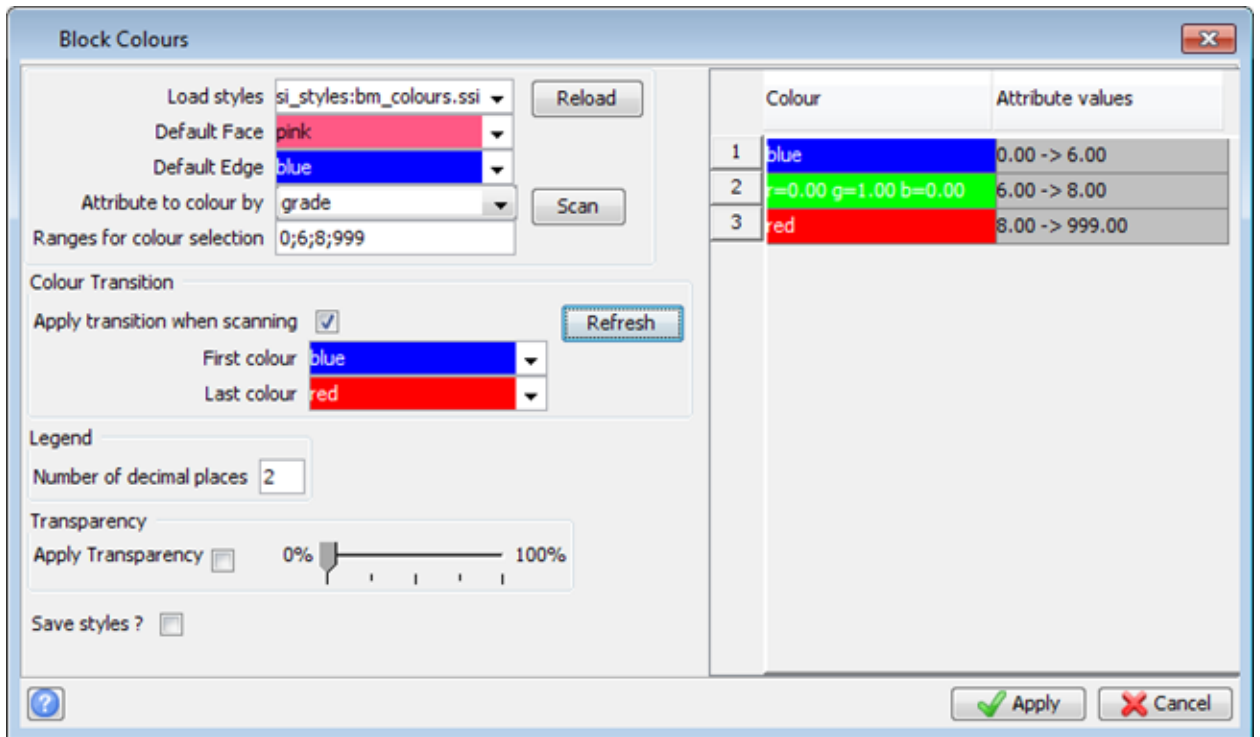


The block model is displayed.



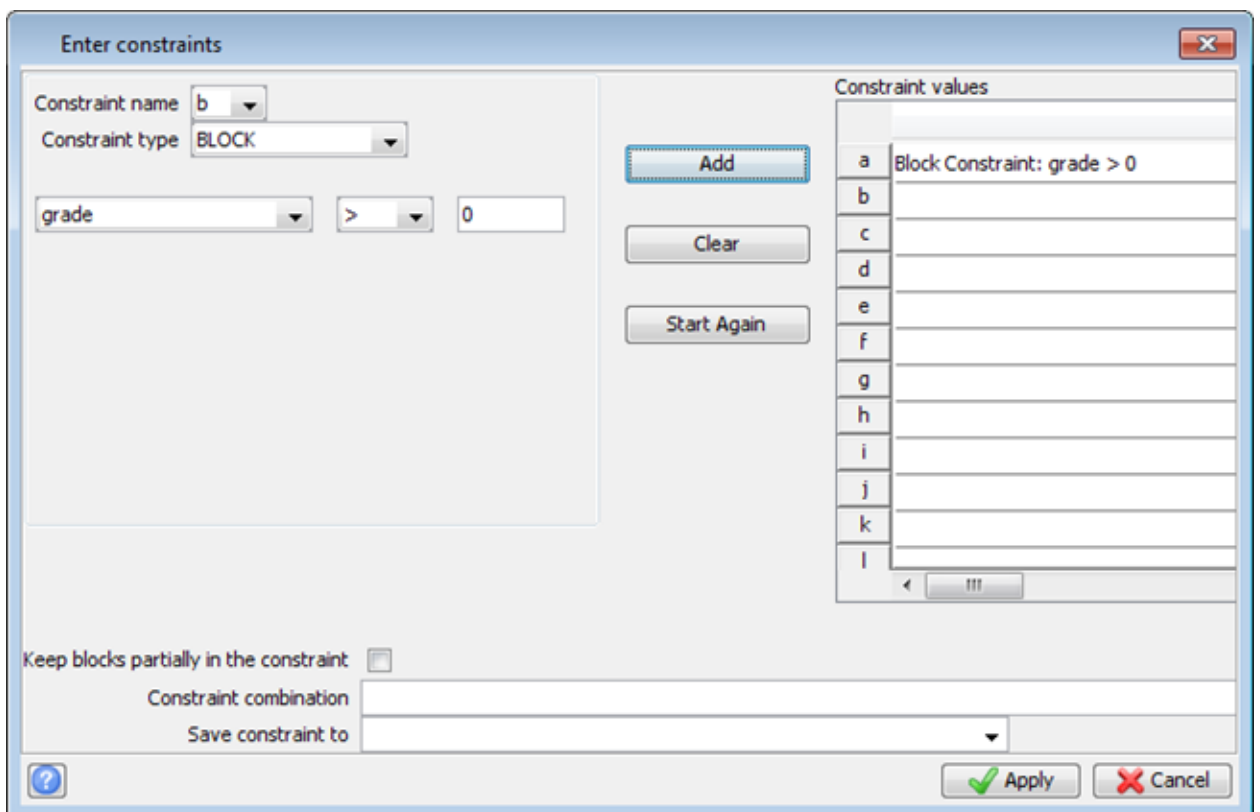
6. Choose **Display > Colour model by attribute**.

7. Enter the information as shown, click **Refresh**, and then click **Apply**.



8. Choose **Display > New graphical constraint**.

9. Enter the information as shown, and click **Apply**.



10. Choose **View > Data view options > View by bearing and dip**.

- Enter the information as shown, and click **Apply**.

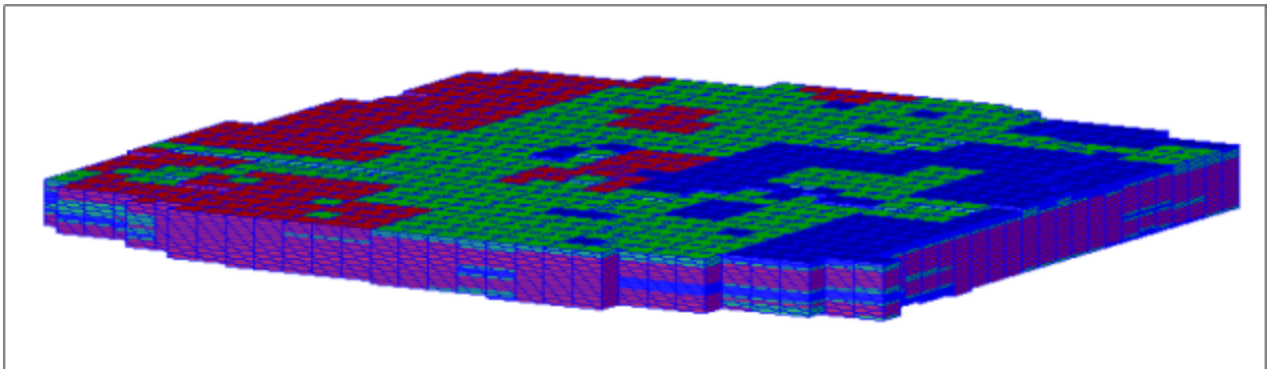
Specify view by bearing and dip

Bearing 330

Dip -10

Apply Cancel

The model is displayed.



The blocks in this model are 35 metres in the x and y dimensions and 3 metres high. Because the vertical extent of this model is limited compared to the horizontal extent, you will vertically exaggerate this model by a factor of 5.

- Choose **View > Data view options > View scale factors**.
- Enter the information as shown, and click **Apply**.

Set view scaling parameters

X direction 1

Y direction 1

Z direction 5

Apply Cancel

After exaggerating the model five times, to get the view at a bearing of 330 degrees and a dip of -20 degrees, you need to set the View by Bearing and Dip to a dip of -4, that is, the dip you want divided by the vertical exaggeration.

- Choose **View > Data view options > View by bearing and dip**.
- Enter the information as shown, and click **Apply**.

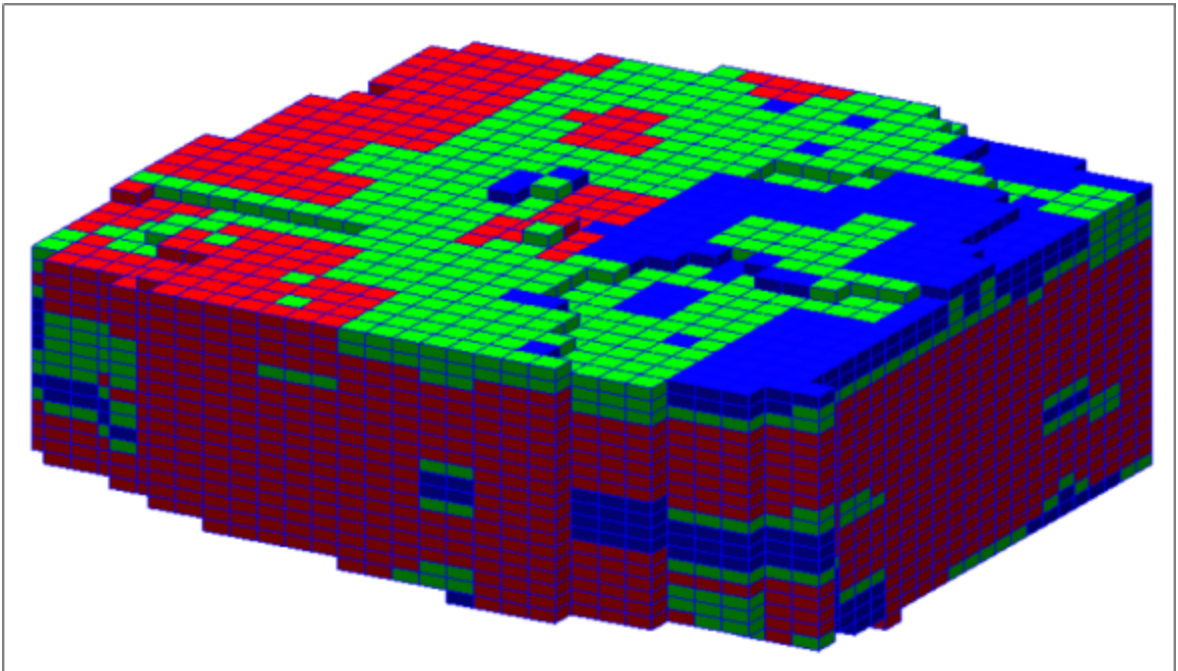
Specify view by bearing and dip

Bearing 330

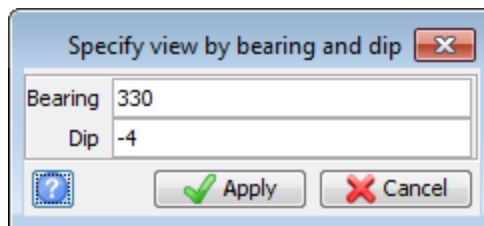
Dip -4

Apply Cancel

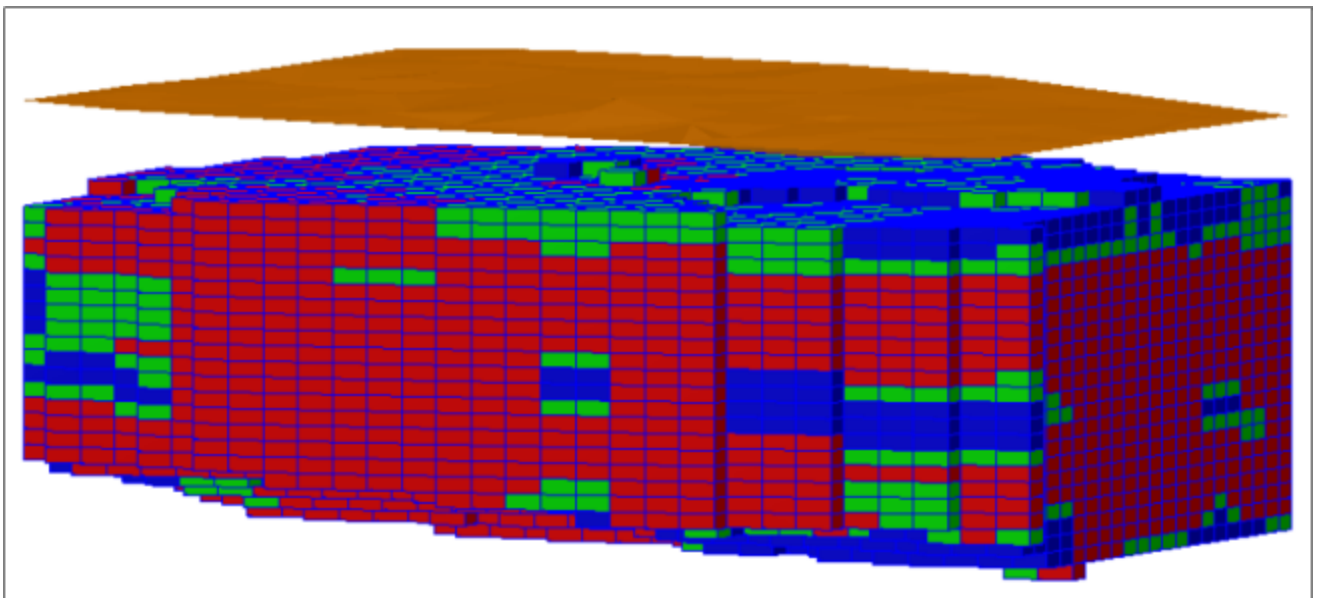
The view of the model is rotated slightly.




16. Open **blocktopo1.dtm**.
17. Choose **View > Data view options > View by bearing and dip**.
18. Enter the information as shown, and click **Apply**.

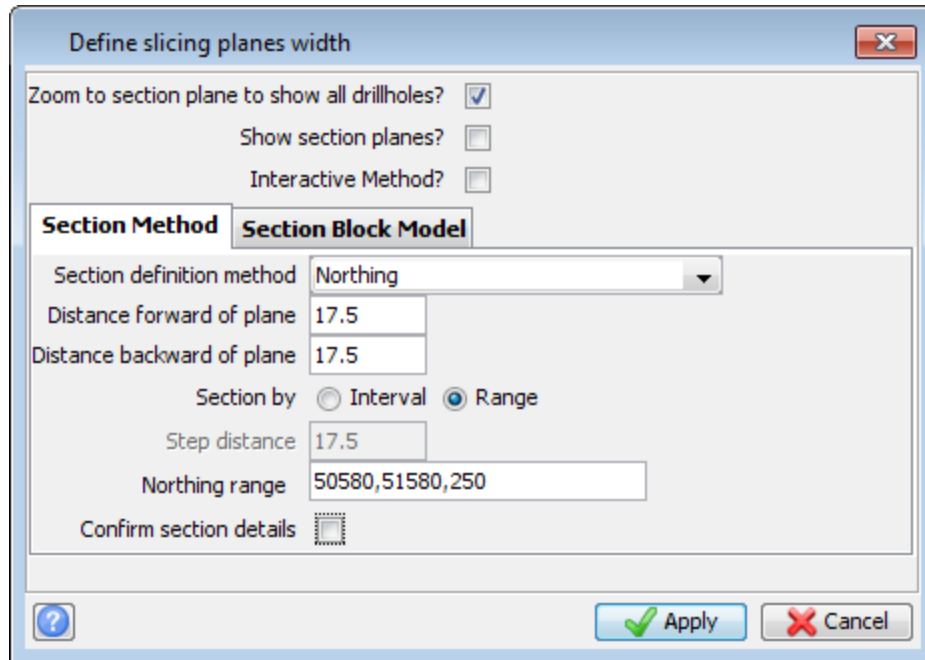


The view of the model was changed to Plan when you opened the DTM, now it is reset. Notice the separation between the topography and the highest blocks with any grade. This separation is called the overburden.



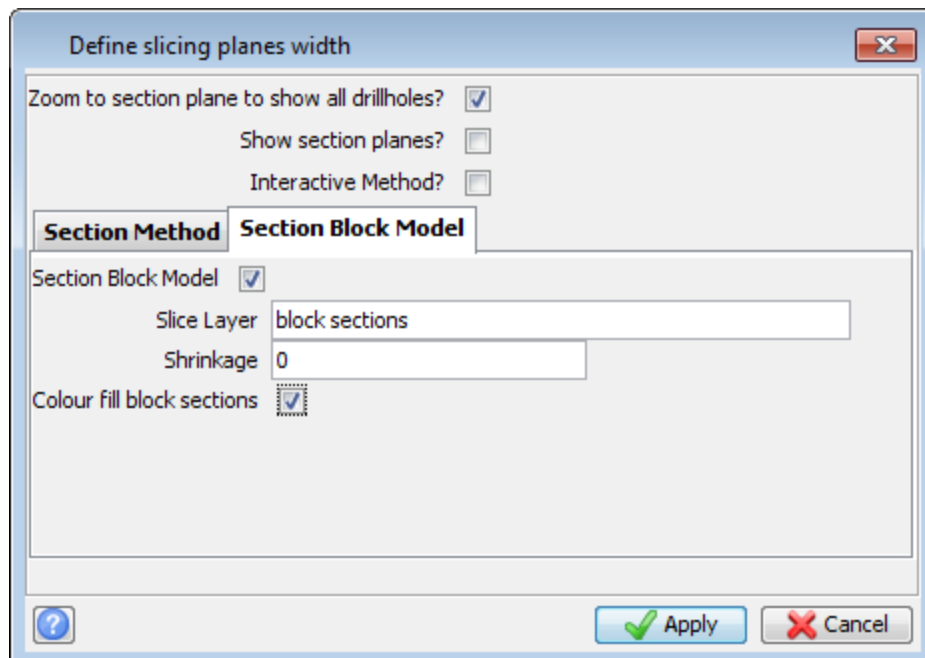
You will now slice the model to see the internal structure.

19. In the **Layers** pane, right-click on the layer **blocktopo1.dtm**, and choose **Delete layer**.
20. Click **Zoom all** .  
This moves the data back to plan view
21. Choose **Database > Sections > Define**.
22. Enter the information as shown on the **Section Method** tab.



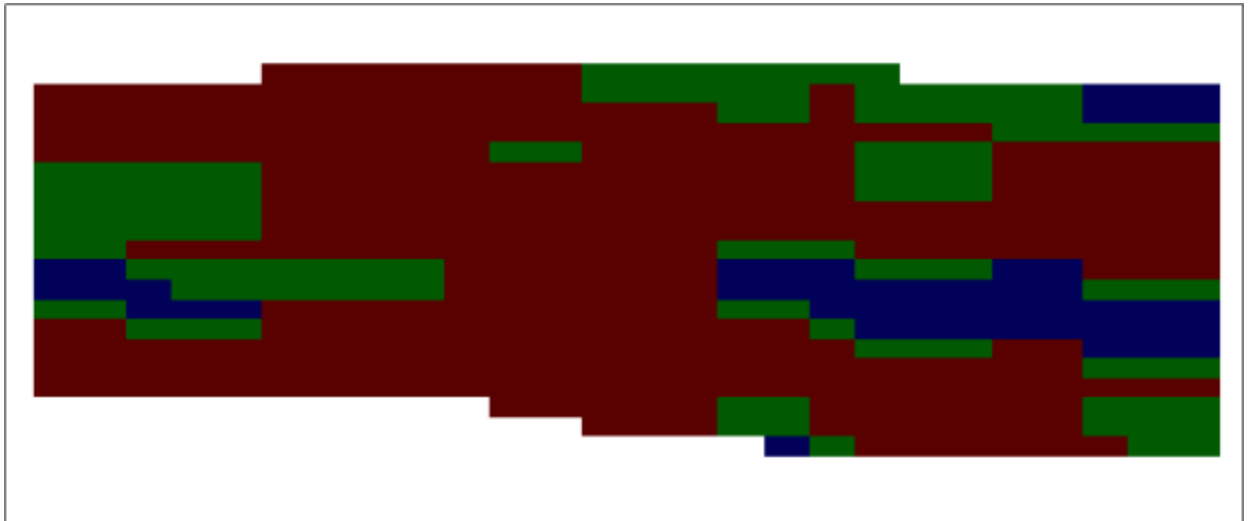
The screenshot shows the 'Define slicing planes width' dialog box with the 'Section Method' tab selected. The 'Section Block Model' tab is also visible. The 'Section definition method' is set to 'Northing'. The 'Distance forward of plane' and 'Distance backward of plane' are both set to 17.5. The 'Section by' radio buttons are set to 'Range'. The 'Step distance' is 17.5 and the 'Northing range' is 50580,51580,250. The 'Zoom to section plane to show all drillholes?' checkbox is checked. The 'Show section planes?' and 'Interactive Method?' checkboxes are unchecked. The 'Confirm section details' checkbox is also unchecked. The 'Apply' and 'Cancel' buttons are visible at the bottom right.



23. Enter the information as shown on the **Section Block Model** tab, and click **Apply**.




The screenshot shows the 'Define slicing planes width' dialog box with the 'Section Block Model' tab selected. The 'Section Block Model' checkbox is checked. The 'Slice Layer' is set to 'block sections'. The 'Shrinkage' is set to 0. The 'Colour fill block sections' checkbox is checked. The 'Zoom to section plane to show all drillholes?' checkbox is checked. The 'Show section planes?' and 'Interactive Method?' checkboxes are unchecked. The 'Apply' and 'Cancel' buttons are visible at the bottom right.

The first section through the block model is displayed.



24. Click **Next section**  to view each of the four sections.  
You should now have a good idea of how the block model looks and are ready to start the economic modelling process.
25. Choose **Block model > Close**
26. Click **Reset graphics** .

 **Note:** To see all of the steps performed in this task, run `_10_viewing_the_data.tcl`. You need to click **Apply** on any forms presented.

## Classify blocks

### Task: Classify blocks into ore and waste

1. Open **blockmodel.mdl**.
2. Choose **Column processing > Column tops**.
3. Enter the information as shown, and click **Apply**.

4. Enter the information as shown, and click **Apply**.

The 'Enter constraints' dialog box is shown with the following settings:

- Constraint name: b
- Constraint type: BLOCK
- Constraint value: grade > 8
- Constraint values list: a Block Constraint: grade > 8
- Keep blocks partially in the constraint:
- Constraint combination: (empty)
- Save constraint to: (empty)

This will search down through the block model extracting a point at the top of the first block in each column where the grade is greater than 8.

The result will be a string file called **top\_cutoff1.str**. The **Nominal value above top** value from the *Tops of columns* form is the default elevation which will be assigned if no blocks in the column satisfy the constraint. As a general rule, when extracting upper surfaces, the nominal z elevation should be set to an elevation below your model and when extracting lower surfaces it should be set to an elevation above your model.

5. Choose **Column processing > Column tops**.  
 6. Enter the information as shown, and click **Apply**.

The 'Tops of columns' dialog box is shown with the following settings:

- Direction of column: Z
- Nominal value above top: 400
- Output file:
  - Location: bot\_cutoff
  - ID: 1
- Constrain report?:

This time the search is in the Z direction (positive Z is up), and the nominal elevation is set to 400.

7. Enter the information as shown below, and click **Apply**.

Enter constraints

Constraint name: b

Constraint type: BLOCK

grade > 8

Buttons: Add, Clear, Start Again

Constraint values table:

	Constraint values
a	Block Constraint: grade > 8
b	
c	
d	
e	
f	
g	
h	
i	
j	
k	
l	

Keep blocks partially in the constraint:

Constraint combination: [ ]

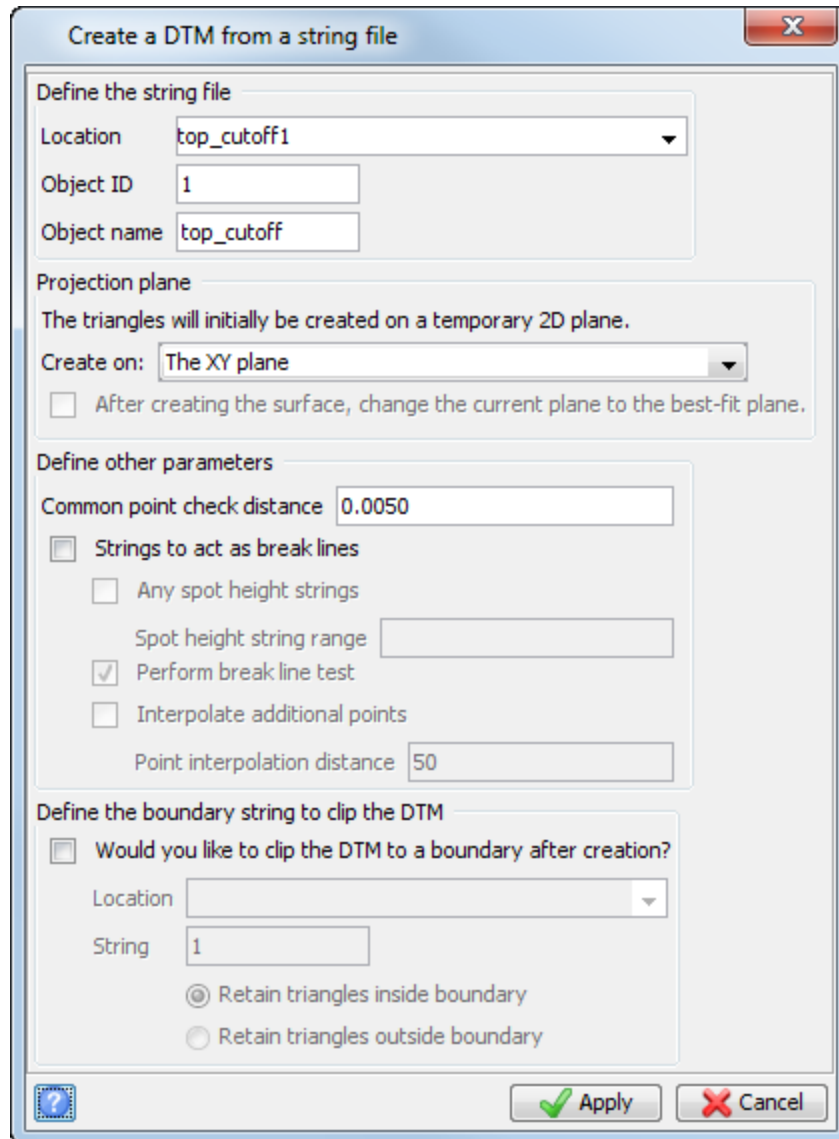
Save constraint to: [ ]

Buttons: Apply, Cancel

You will now use the string files **top\_cutoff1.str** and **bot\_cutoff1.str** to create DTMs.

8. Choose **Surfaces > DTM File functions > Create DTM from string file**.

9. Enter the information as shown, and click **Apply**.



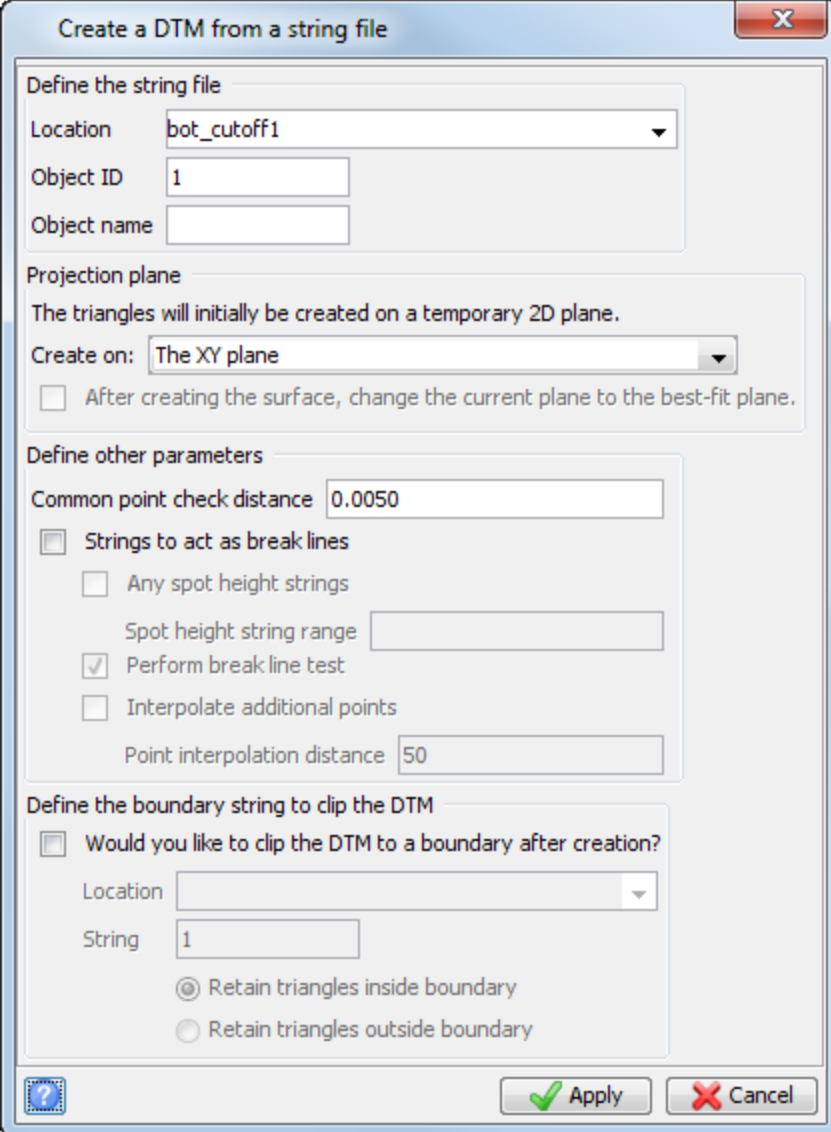
A report is displayed.

```

-----
DTM FORMATION
-----

DTM formed from      : top_cutoff1.str
DTM File             : top_cutoff1.dtm
Object ID            : 1
Object name          : top_cutoff
Number of Triangles  : 1568
Maximum/Minimum E   : 48497.500 / 47517.500
Maximum/Minimum N   : 51497.500 / 50517.500
Maximum/Minimum Z   : 311.000 / 200.000
Strings to act as breaklines : N
Common point check distance : 0.005
    
```

10. Choose **Surfaces > DTM File functions > Create DTM from string file**.
11. Enter the information as shown, and click **Apply**.



**Create a DTM from a string file**

Define the string file

Location: bot\_cutoff1

Object ID: 1

Object name:

Projection plane

The triangles will initially be created on a temporary 2D plane.

Create on: The XY plane

After creating the surface, change the current plane to the best-fit plane.

Define other parameters

Common point check distance: 0.0050

Strings to act as break lines

Any spot height strings

Spot height string range:

Perform break line test

Interpolate additional points

Point interpolation distance: 50

Define the boundary string to clip the DTM

Would you like to clip the DTM to a boundary after creation?

Location:

String: 1

Retain triangles inside boundary

Retain triangles outside boundary

Apply Cancel

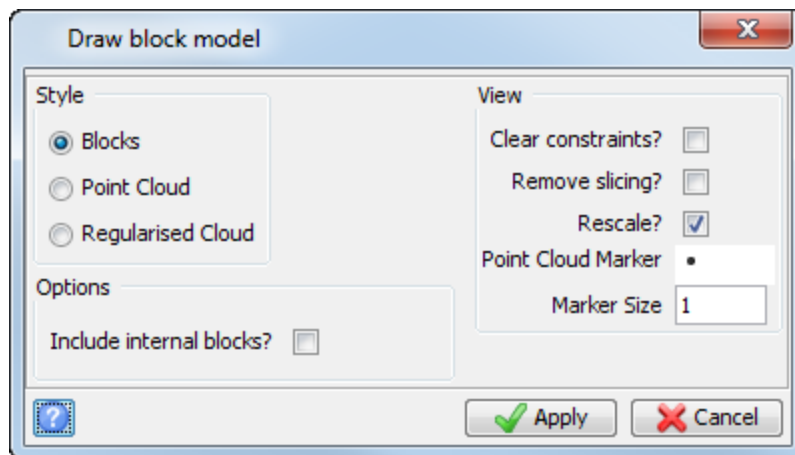
The report for the formation of this DTM is displayed.

```

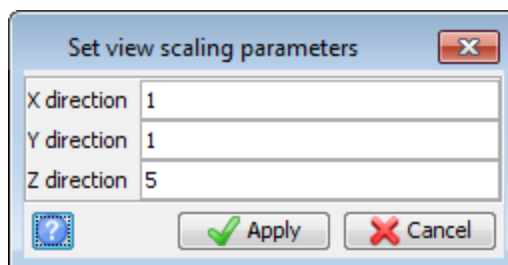
-----
DTM FORMATION
-----

DTM formed from      : bot_cutoff1.str
DTM File             : bot_cutoff1.dtm
Object ID           : 1
Object name          : bot_cutoff
Number of Triangles  : 1568
Maximum/Minimum E   : 48497.500 / 47517.500
Maximum/Minimum N   : 51497.500 / 50517.500
Maximum/Minimum Z   : 400.000 / 236.000
Strings to act as breaklines : N
Common point check distance : 0.005
    
```

12. Choose **Block model > Display**.
13. Enter the information as shown, and click **Apply**.

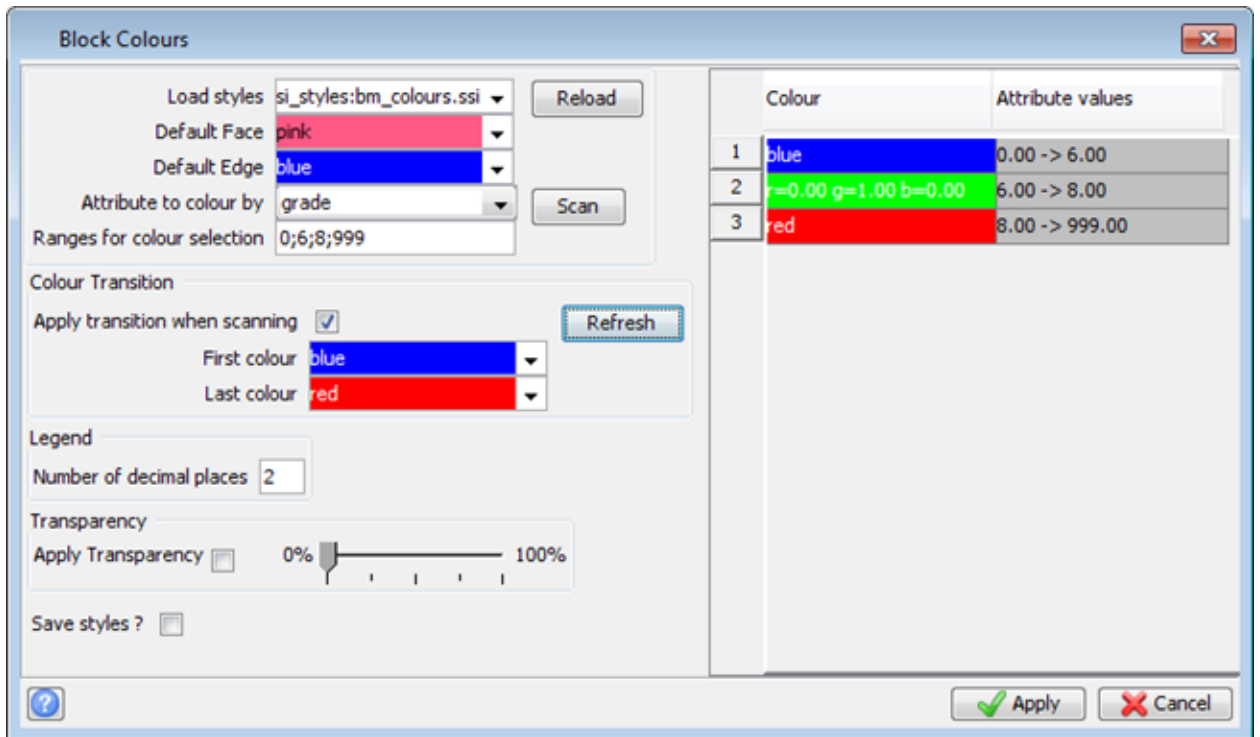


14. Choose **View > Data view options > View scale factors**.
15. Enter the information as shown, and click **Apply**.



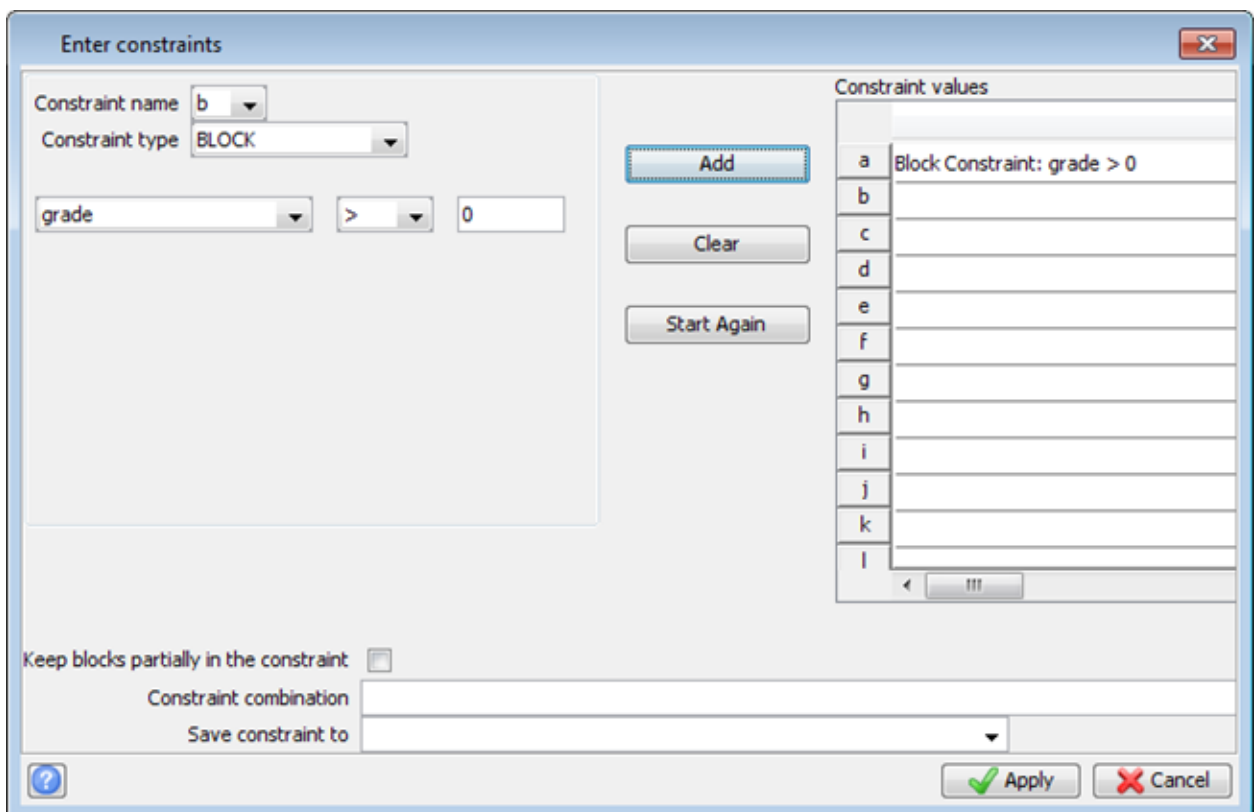
16. Choose **Display > Colour model by attribute**.

17. Enter the information as shown, click **Refresh**, and then click **Apply**.



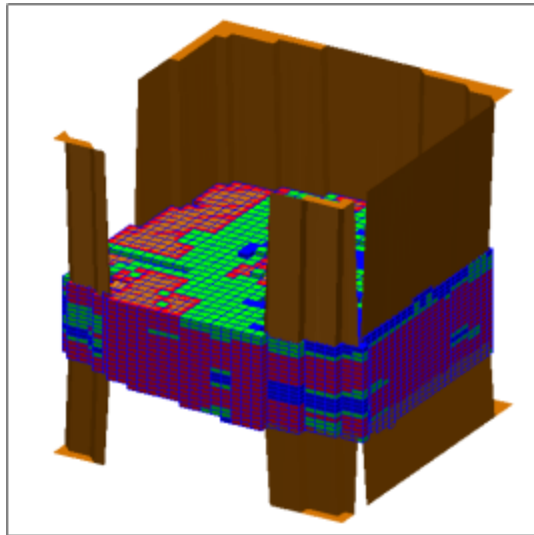
18. Choose **Display > New graphical constraint**.

19. Enter the information as shown, and click **Apply**.

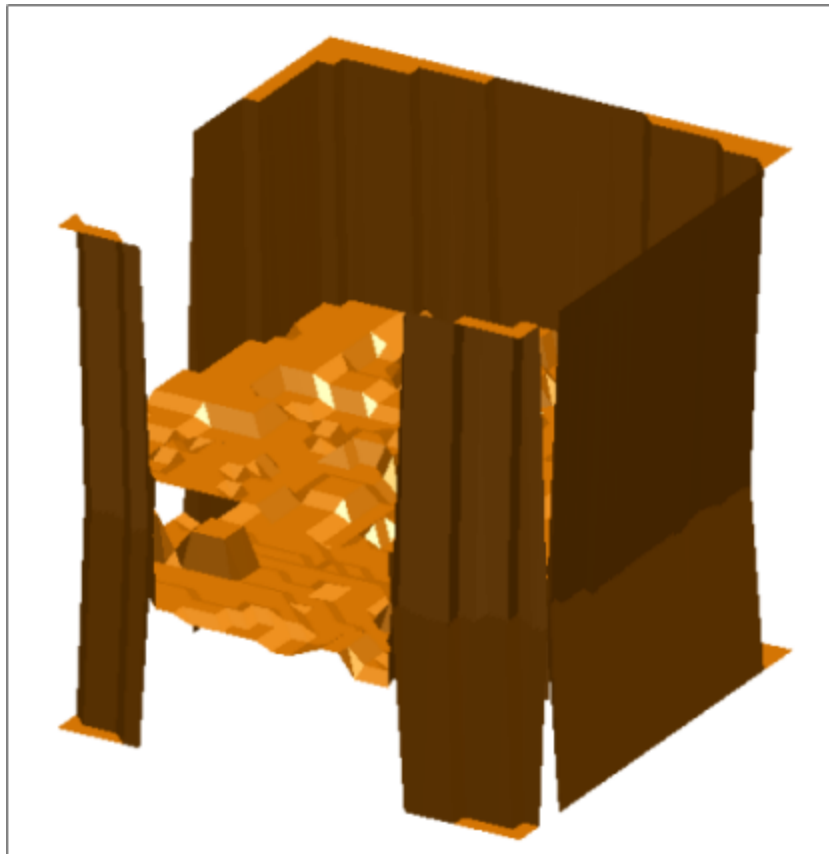


20. Open **top\_cutoff1.dtm** and **bot\_cutoff1.dtm**.

The block model with top and bottom cutoffs is displayed.

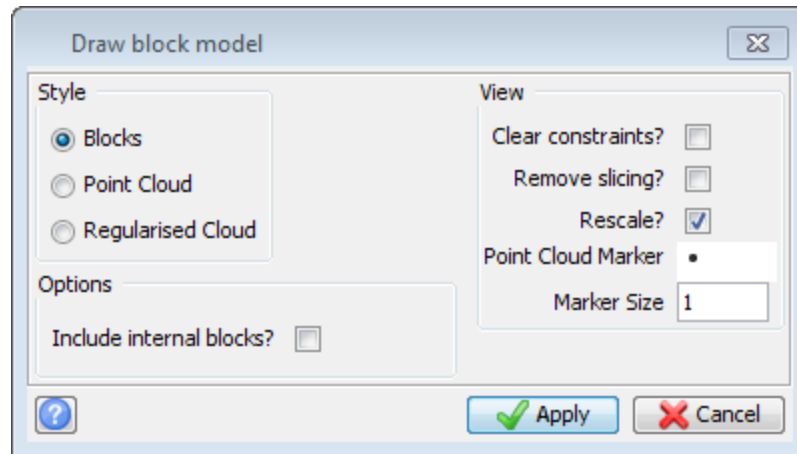


21. Click the **blockmodel** button on the Status bar, and select **Hide**. Only the upper and lower cutoff DTM surfaces are displayed.





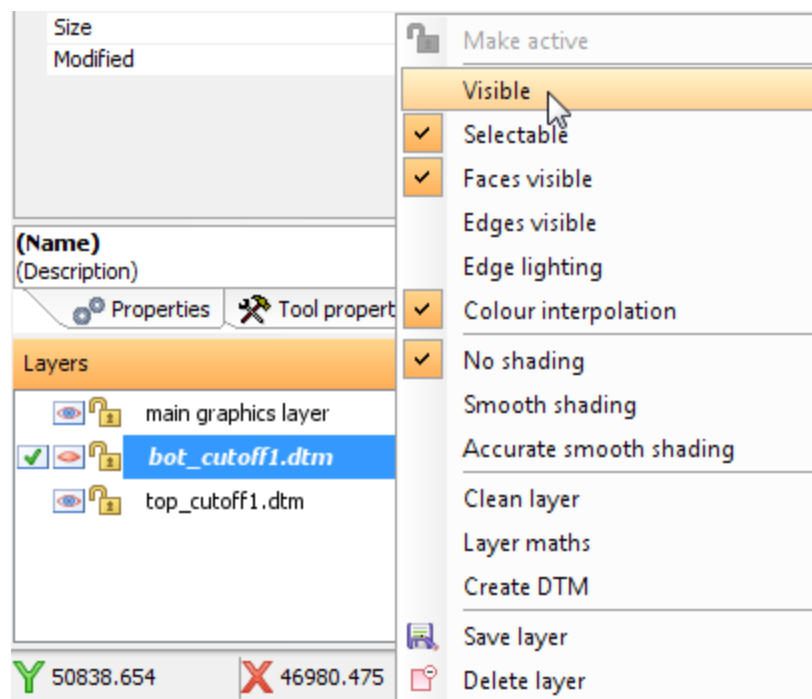
22. Click the **blockmodel** button on the Status bar, and choose **Display**.

23. Enter the information as shown, and click **Apply**.



The block model is redisplayed.

24. In the **Layers** pane, make **bot\_cutoff1.dtm** the active layer.  
 25. Right-click the **bot\_cutoff1.dtm** layer and clear the **Visible** option.  
 The visibility icon changes from  to  to show that the layer is no longer visible in **Graphics**.



26. Make the **top\_cutoff1.dtm** layer invisible.  
 Only the block model is now visible.

The next step is to add two attributes to the model which will be filled in the Ore/Waste discrimination function.

27. Choose **Attributes > New**.

28. Enter the information as shown, and click **Apply**.

	Attribute Name	Type	Decimals	Background Value	Description / Expression
1	composite_grade	float	4	-99	Composite grade
2	ore_waste_flag	integer			Flag for ore or waste

**Note:** Right-click on the number 1 to add a row to the table.

The **ore\_waste\_flag** is a flag which will signify an ore block if set to 1, and a waste block if set to 0. The **composite\_grade** attribute will store the grade for a contiguous set of ore and waste blocks in a column.

29. Choose **Column processing > Ore/Waste discrimination**.

30. Enter the information as shown, and click **Apply**.

Block model ore/waste discrimination

**Digging Zones**

None  
 Truck & Shovel  
 Dragline

Depth to lower zone

**Maximise**

Ore Volume  
 Ore Grade  
 Contained Product

**Minimum thicknesses**

Ore  Waste

upper zone  
middle zone  
lower zone

**Attributes to composite (list master first)**

Attribute	Composite
1 grade	composite_grade

**Standard** **Advanced**

**Standard Classification**

Cutoff

Ore attribute

Ore Value

Waste Value

Direction of columns

Constrain discrimination?

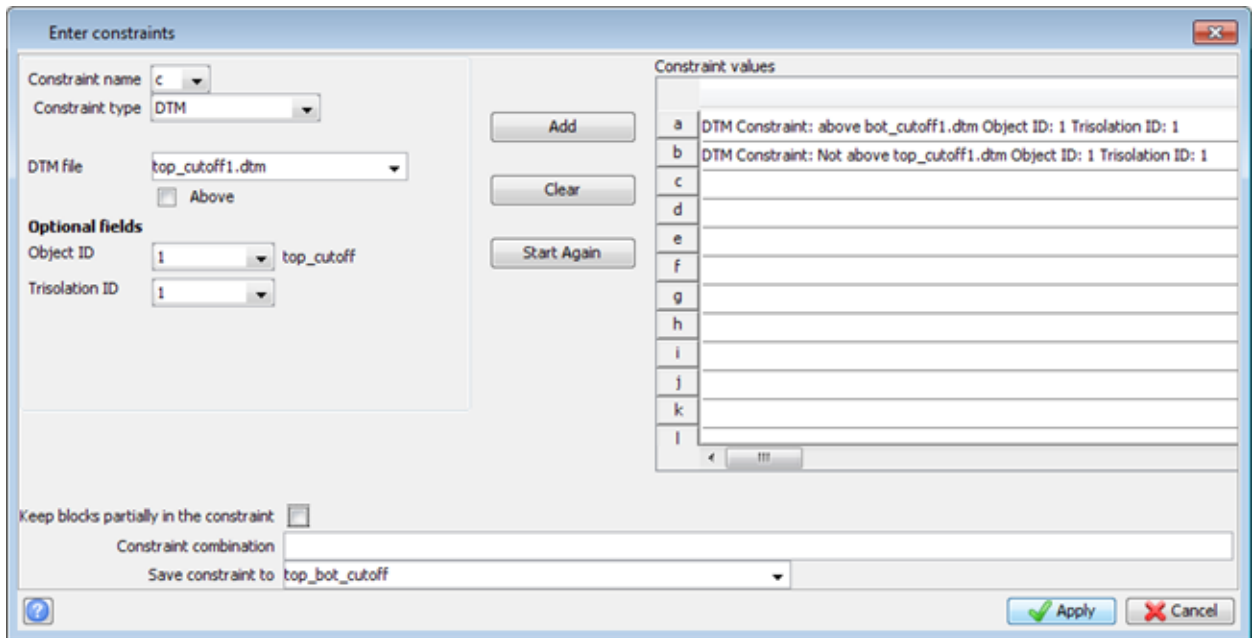
Report file name

Format

**Note:** You are specifying minimum mining thicknesses of ore, a waste of 6 metres, and a cutoff grade of 8. This function classifies blocks as ORE or WASTE according to a cutoff grade and minimum thickness criteria.

The ore/waste classification is stored as an integer value in the **ore\_waste\_flag** attribute, which allows you to colour the model on ore/waste. A master attribute is specified (**grade**), and an attribute to store the composite grade for each resulting ore and waste layer.

31. Enter the information as shown, and click **Apply**.



**Note:** It is very important that you apply this function using these two constraints. This way, no outlying sub-grade waste blocks will be included in the top or bottom ore layers. This constraint file is saved for future processing.

A summary is shown below.

```

BLOCK MODEL ORE/WASTE DISCRIMINATION REPORT

Block model: nmine
Description: North Mine Test Model May 25, 1996
Bench mining method:None

Master attribute: grade (composite_grade)
Cutoff: 8.000

Minimum thicknesses:   Ore   Waste
                       6.000 6.000

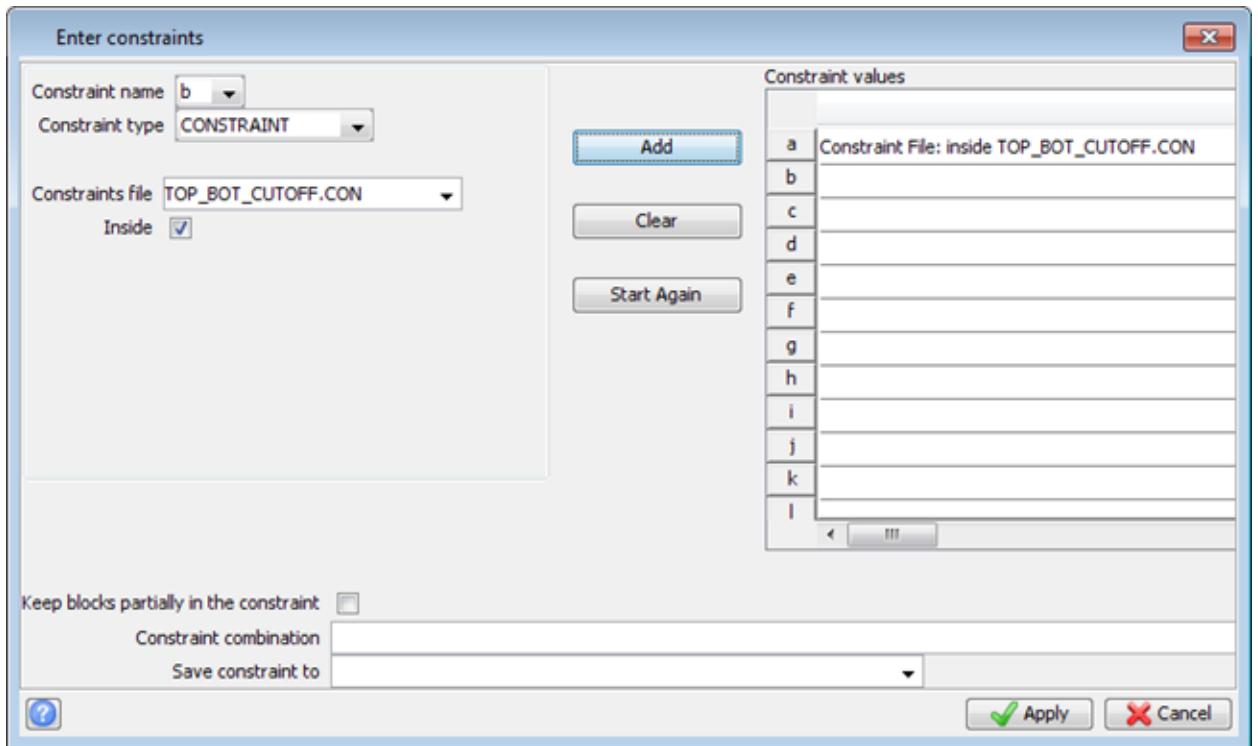
Mining objective: Maximise contained product

Other composited attributes:
Ore attribute: ore_waste_flag
Ore value: 1
Waste Value: 0
    
```

You will now colour the model on the **ore\_waste\_flag** attribute. Ensure you are viewing only the blocks within your new constraint file - **top\_bot\_cutoff.con**.

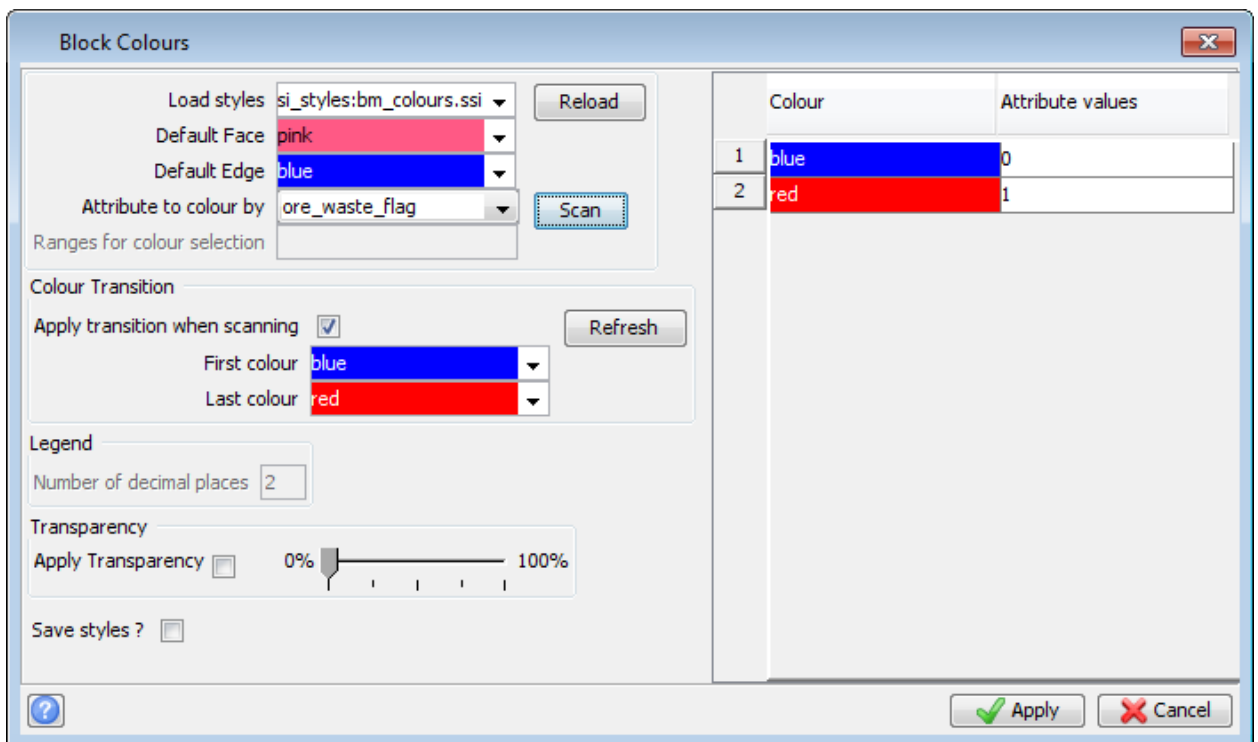
32. Choose **Constraints > New graphical constraint**.

33. Enter the information as shown, and click **Apply**.



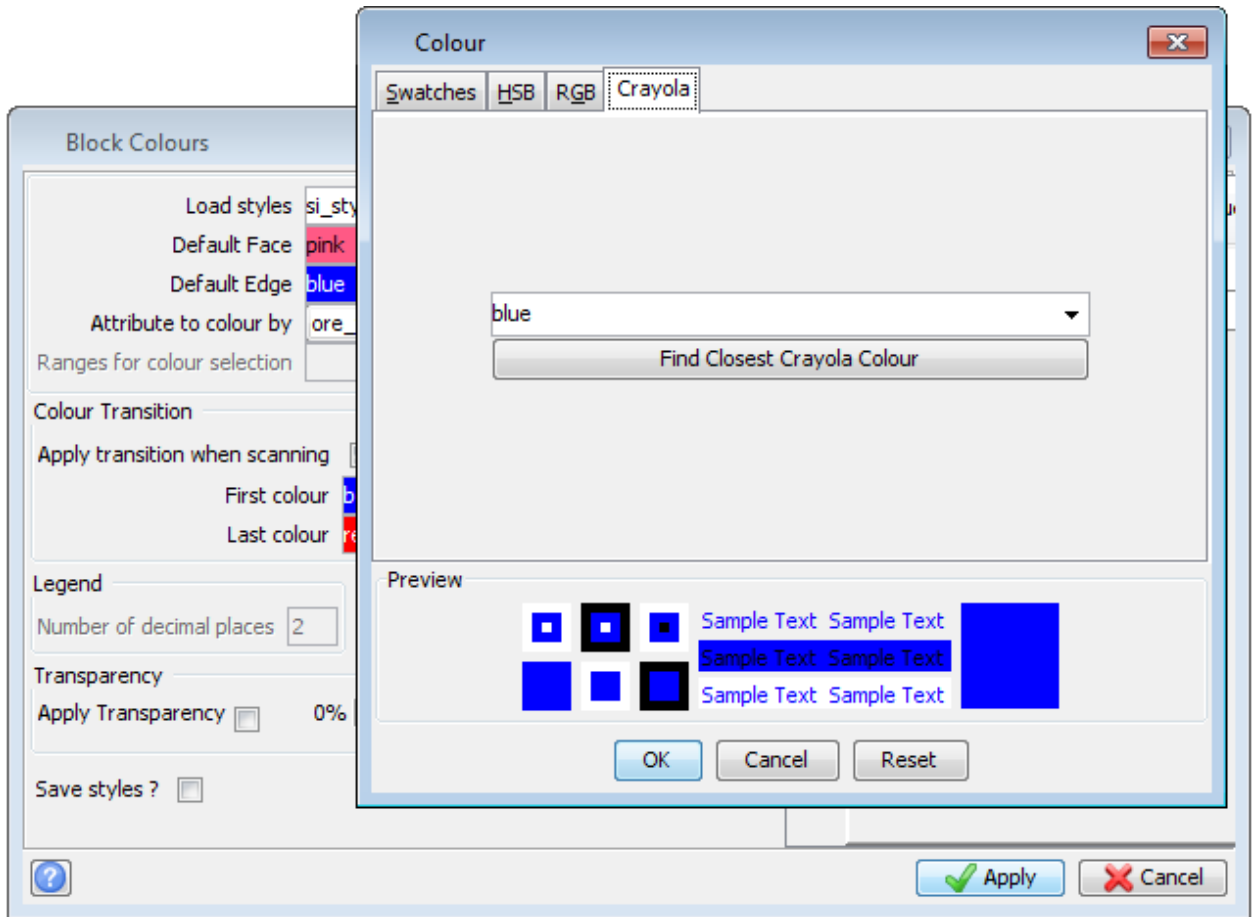
34. Choose **Display > Colour model by attribute**.

35. Select **ore\_waste\_flag** for **Attribute to colour by**, and then click **Scan**.



36. Click the down arrow on row 1 to bring up the **Colour chooser**.

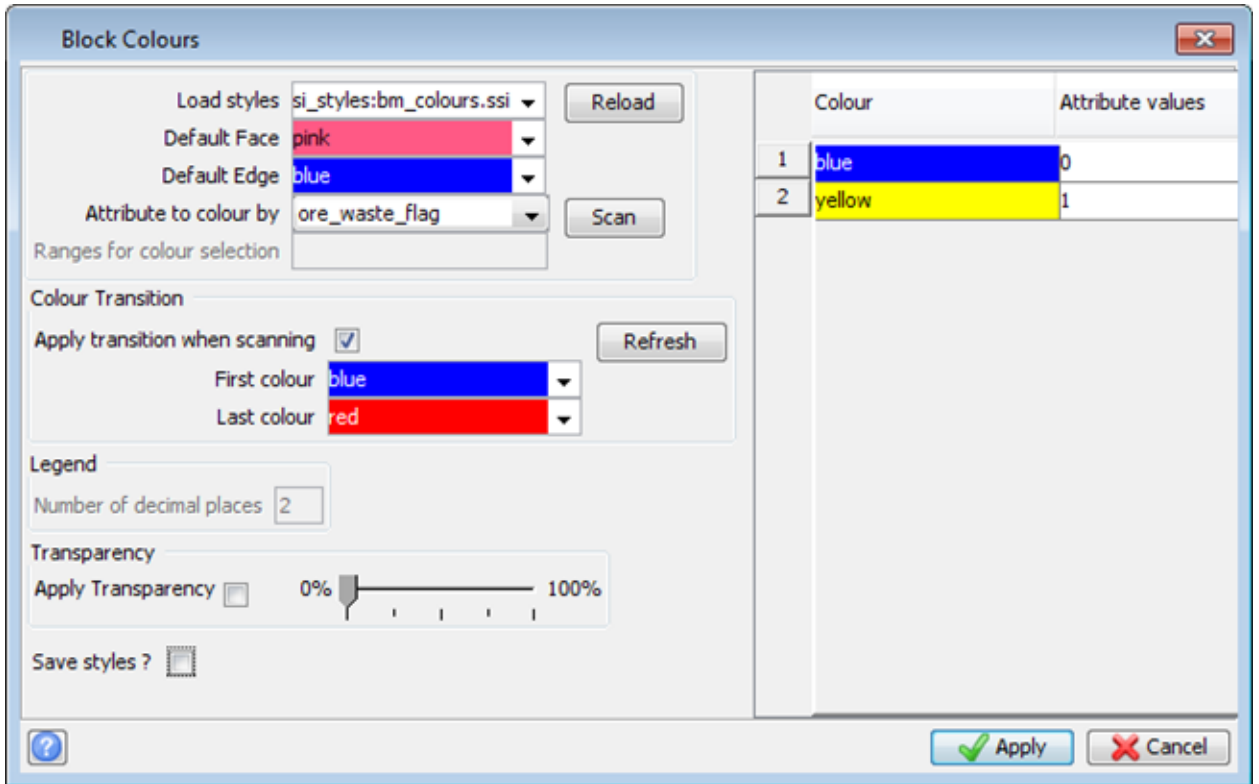
37. Click the **Crayola** tab, type in **blue**, and click **OK**.




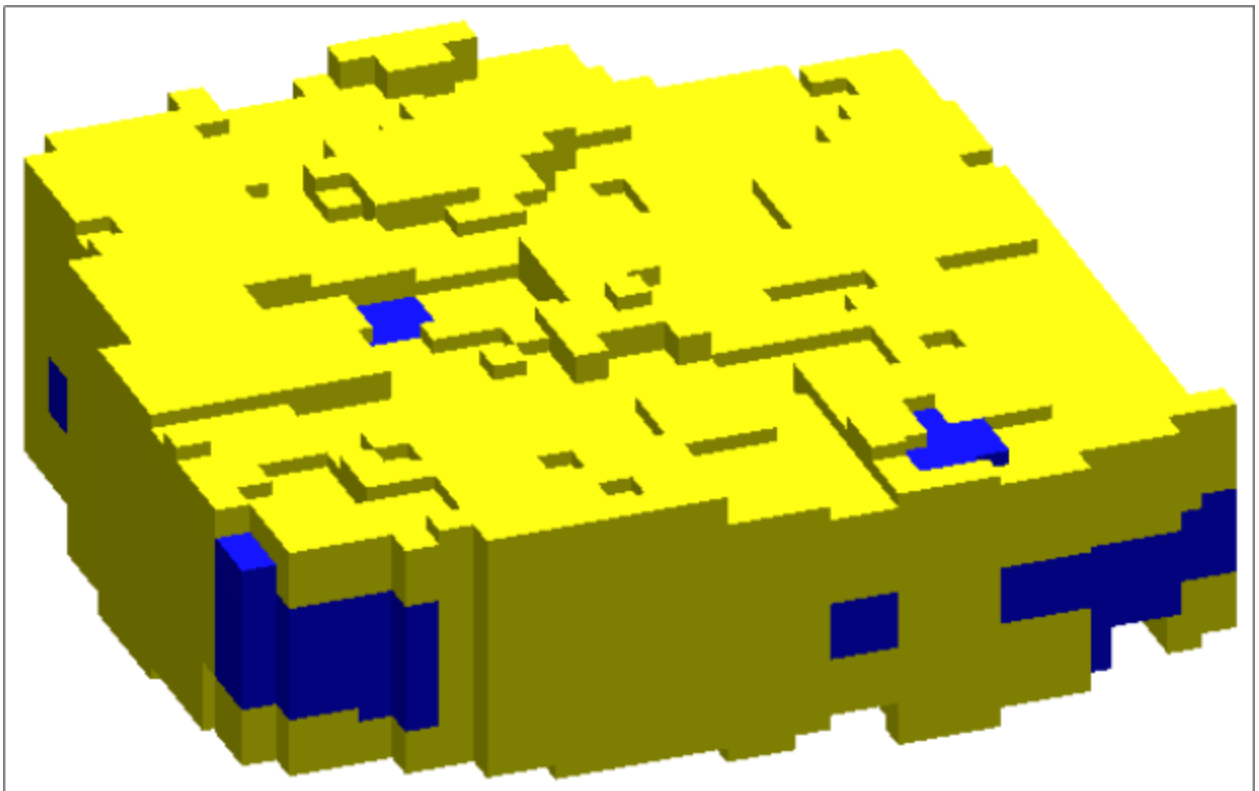
The waste blocks are now coloured blue.

38. Click the down arrow on row 2 to display the **Colour chooser**.
39. Click the **Crayola** tab, type in **yellow**, and click **OK**.
- The ore blocks are now coloured yellow.

40. Click **Apply** on the *Block Colours* form.



41. Click **Toggle display polygon & triangle edges**  to turn edges off.  
This will colour the model as shown:



The minimum mining thickness of 6 metres (2 blocks in elevation) has been taken into account.

42. Choose **Display > View attributes for one block** and click on a block.  
The composite grade is reported. This is the average grade for all contiguous ore or waste blocks in that column. If you select a block above or below this block in the same layer, it will have the same composite grade. All ore layers have a composite grade greater than 8 and all waste layers have a composite grade less than 8. You will now display waste blocks only so you can see their distribution in the model.
43. Choose **Constraints > New graphical constraint**.
44. Enter the information as shown, and click **Apply**.

**Enter constraints**

Constraint name:

Constraint type:

=

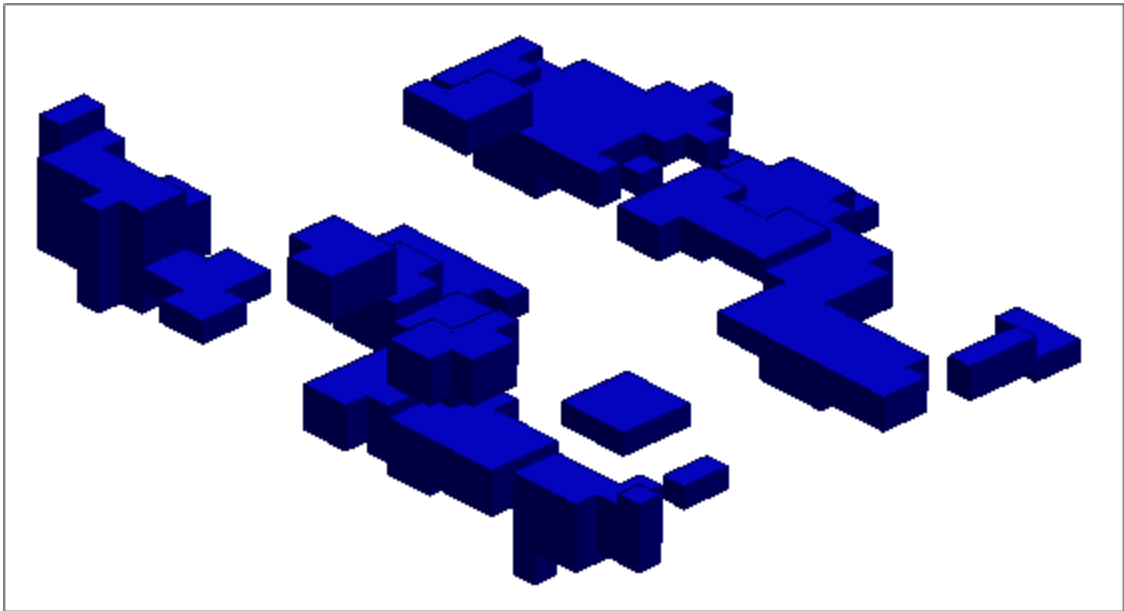
Constraint values	
a	Block Constraint: ore_waste_flag = 0
b	
c	
d	
e	
f	
g	
h	
i	
j	
k	
l	

Keep blocks partially in the constraint

Constraint combination:

Save constraint to:

The waste blocks are displayed.



45. Choose **Block model** > **Save**.
46. Choose **Block model** > **Close**.

**Note:** To see all of the steps performed in this task, run `_11_classify_blocks.tcl`. You need to click **Apply** on any forms presented.

## Reduction and dilution

### Task: Calculate dilution and reduction

1. Open **blockmodel.mdl**.
2. Choose **Attributes** > **New**.
3. Add an attribute called **diluted\_grade** as shown:

	Attribute Name	Type	Decimals	Background Value	Description / Expression
1	diluted_grade	float	4	-99	Diluted grade

4. Choose **Column processing** > **Dilution and reduction**.

5. Enter the information as shown, and click **Apply**.

6. Enter the information as shown, and click **Apply**.

The *Verify creation of file* form appears.

- Click **Yes**.  
The report is displayed.

```

Block Model Dilution / Reduction Report

Block model: nmine
Description: North Mine Test Model May 25, 1996
Bench mining method:None

Dilution at top of column      : 1.000
Reduction at top of column     : 1.000
Dilution at bottom of column  : 1.000
Reduction at bottom of column  : 1.000

Thicknesses:          Upper Contact      Lower Contact
                    Dilution Reduction  Dilution Reduction
                    1.000      1.000      1.000      1.000

Composited attributes:
grade (diluted_grade)

Ore attribute: ore_waste_flag
Ore value: 1
Waste Value: 0

WASTE diluted above 8.000 has been reclassified as ORE
ORE diluted below 8.000 has been reclassified as WASTE
    
```

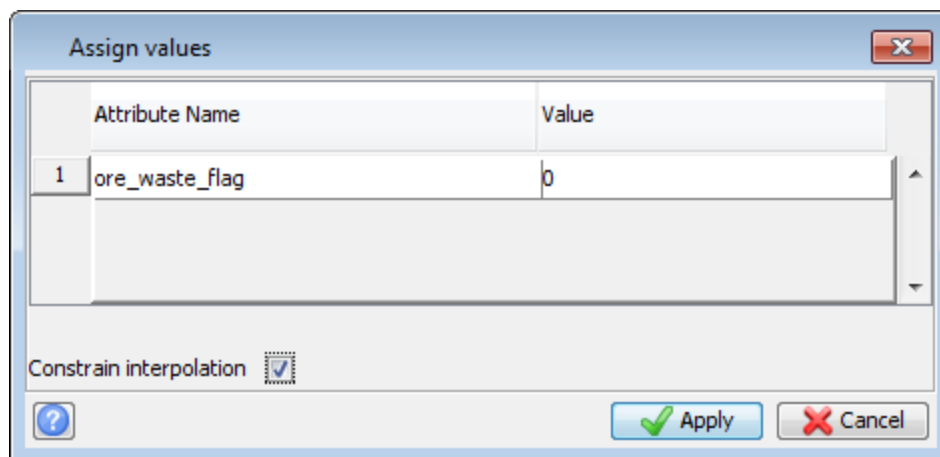
- Choose **Block model > Close**.

**Note:** To see all of the steps performed in this task run `_12_dilution_and_reduction.tcl`. You will need to click **Apply** on any forms presented.

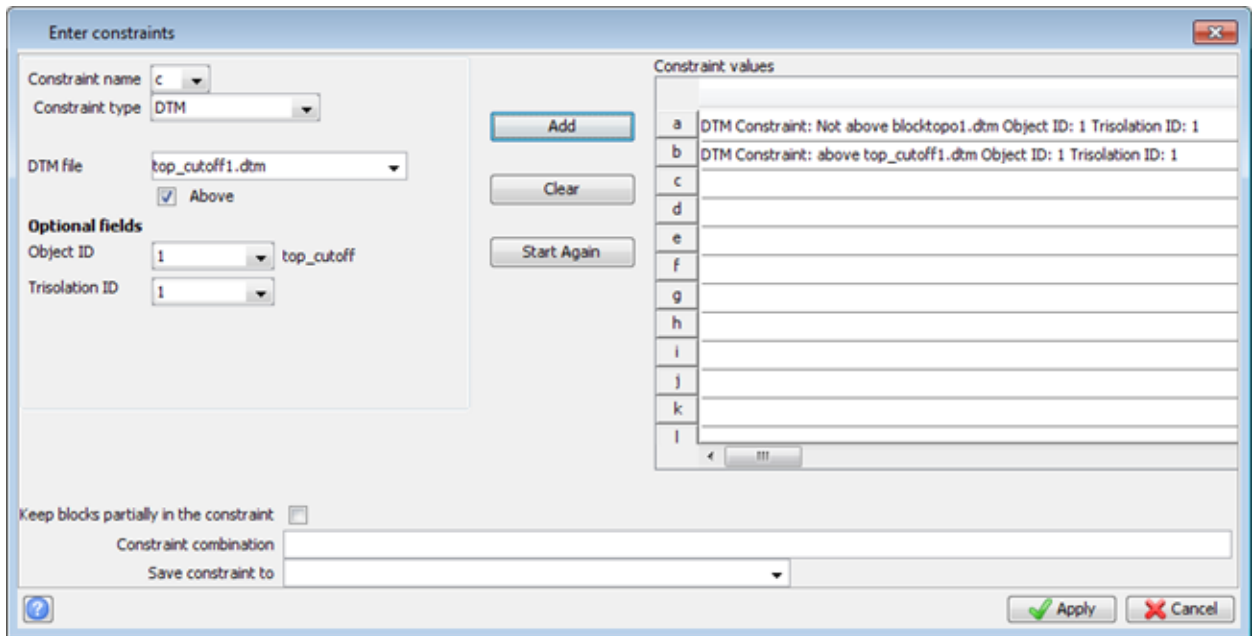
## Recoverable product

### Task: Calculate recoverable product

- Connect to **blockmodel.mdl**.
- Choose **Estimation > Assign value**.
- Enter the information as shown, and click **Apply**.



4. Enter the information as shown, and click **Apply**.



This assigns those blocks above the top of the ore, and below the topography (that is, the overburden) blocks to waste.

The *Verify creation of file* form appears.

5. Click **Yes**.

**Note:** Before you run the **Recoverable product** function, you should add the attributes which will store the results of this function.

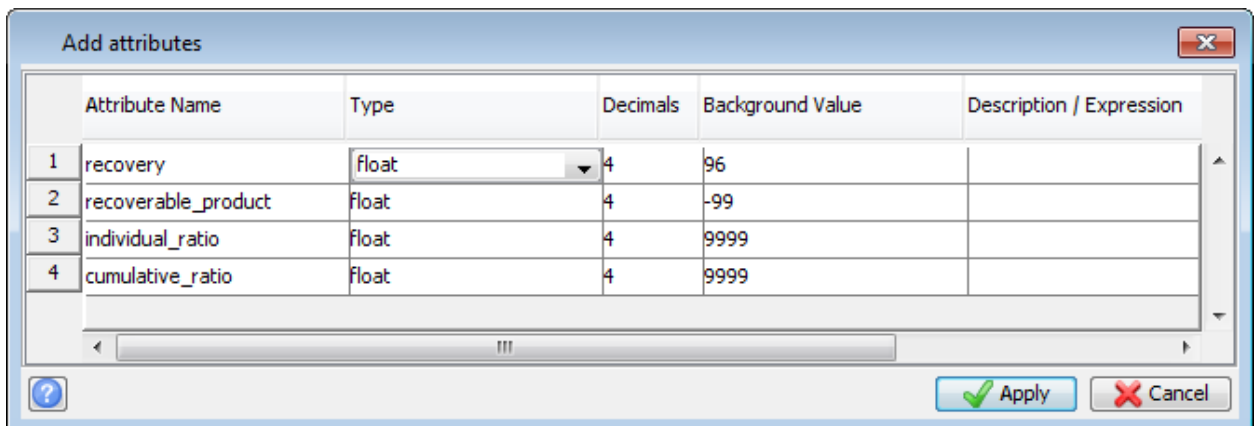
The attributes do not have to be added ahead of time in this function. If the attributes specified to store the results do not exist, they will be created.

However, it is a better practice to add them first for two reasons:

- If they are added by the function, they are created as real attributes and not floats and therefore will require double the storage space.
- You have control of the background values when adding them yourself. For data management reasons you will want to standardize your background values. In this tutorial you are using a background value of -99.

6. Choose **Attributes > New**.

7. Enter the information as shown, and click **Apply**.



Unlike most other attributes, the ratio attributes are given a high background value. A high value of the ratio of volume to product denotes less economic material. You will be searching for the first value below a certain value. If you picked a low background value, when searching for the first block below a certain value using the column tops function, you would always find the top or bottom of the model because this is outside of the constraint and so remains at the background value.

8. Choose **Column processing > Recoverable product**.
9. Enter the information as shown, and click **Apply**.

The report is displayed.

```

BLOCK MODEL RECOVERABLE PRODUCT RATIO REPORT

Block model: nmine
Description: North Mine Test Model May 25, 1996

Grade attribute   : diluted_grade
Recovery attribute: recovery
Ore attribute     : ore_waste_flag
Ore value: 1
Waste value: 0

Ore density:      2.100
Product density:  1.010

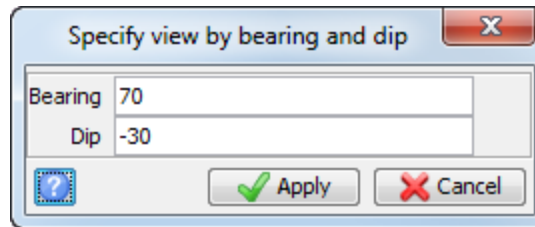
Attributes written:
Recoverable product:          recoverable_product
Cumulative volume/product ratio: cumulative_ratio
Individual volume/product ratio: individual_ratio

```

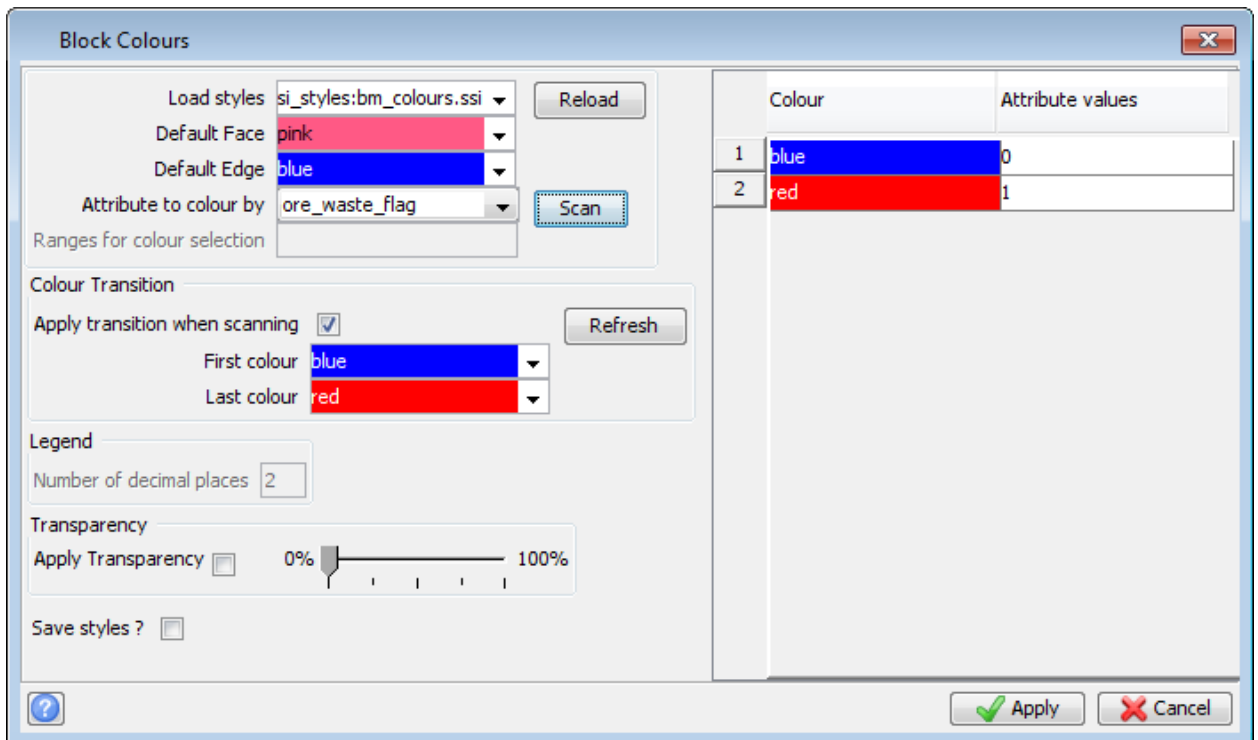
**Note:** You would expect an ore layer with only a small amount of overlying waste to have a lower individual ratio than an ore layer with a higher thickness of overlying waste. Also, you would expect the uppermost ore layer to have the same value for the individual and cumulative ratios.

10. Choose **Block model > Display**.
11. Choose **View > Data view options > View by bearing and dip**.

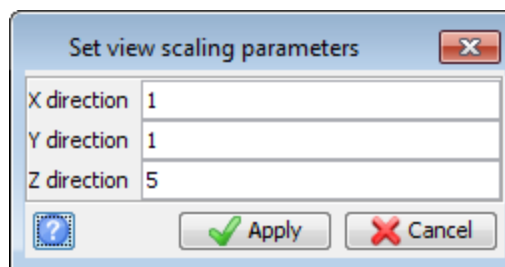
12. Enter the information as shown, and click **Apply**.



13. Choose **Display > Colour model by attribute**.  
 14. Select **ore\_waste\_flag** for **Attribute to colour by**, and click **Scan**.



15. Click **Apply**.  
 16. Choose **View > Data view options > View scale factors**.  
 17. Enter the information as shown, and click **Apply**.



18. Drag and drop **top\_bot\_cutoff.con** into **Graphics**.  
 19. Choose **Display > View attributes for one block**.  
 20. Click an ore block.

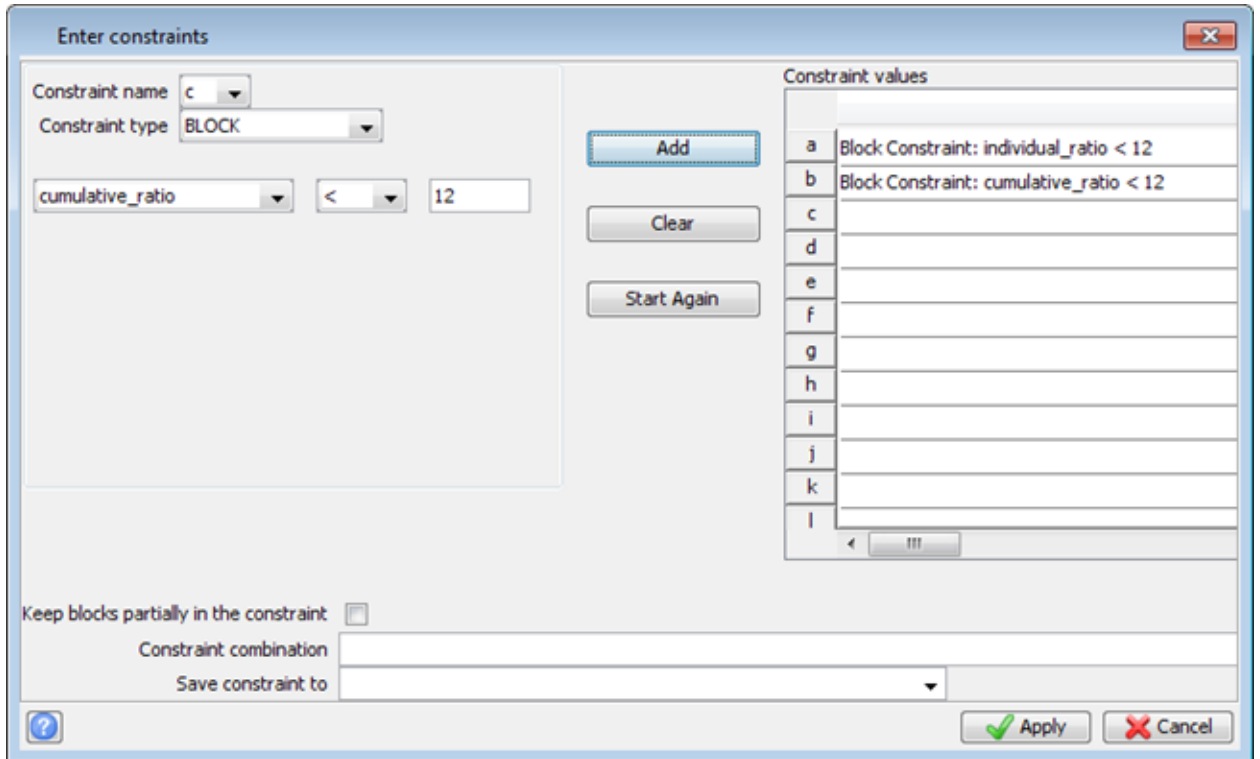
You will see results similar to the following.

	Attribute	Value
1	composite_grade	12.0808
2	cumulative_ratio	5.5188
3	diluted_grade	11.9664
4	grade	8.4081
5	individual_ratio	5.5188
6	ore_waste_flag	1
7	recoverable_product	0.2389
8	recovery	96.0000

The final steps of the process are to extract and create surfaces representing the top and bottom of economic ore. The bottom of economic ore will be a surface created when searching up through the model, using the Column Tops function, for the first block where both individual and cumulative ratios are below a cutoff ratio. For this exercise you will use a cutoff ratio of 12.

21. Choose **Column processing > Column tops**.
22. Enter the information as shown, and click **Apply**.

23. Enter the information as shown, and click **Apply**.



24. Choose **Surfaces > DTM File functions > Create DTM from string file**.

25. Enter the information as shown, and click **Apply**.

**Create a DTM from a string file**

Define the string file

Location: bot\_ore12

Object ID: 1

Object name:

Define other parameters

Common point check distance: 0.0050

Strings to act as break lines

Any spot height strings

Spot height string range:

Perform break line test

Interpolate additional points

Point interpolation distance: 50

Define the boundary string to clip the DTM

Would you like to clip the DTM to a boundary after creation?

Location:

String: 1

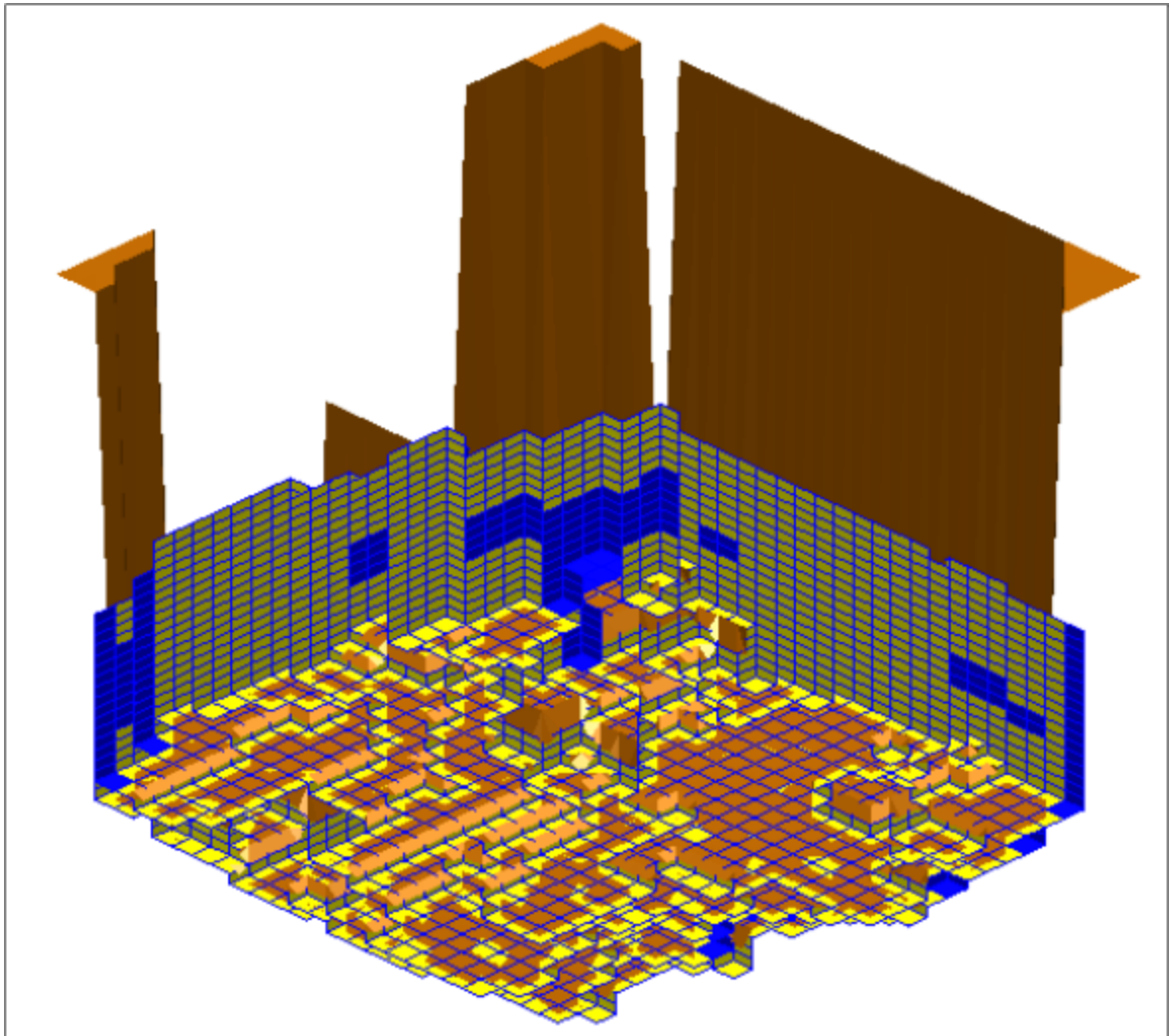
Retain triangles inside boundary

Retain triangles outside boundary

Apply Cancel

26. Open **bot\_ore12.dtm** in **Graphics**.

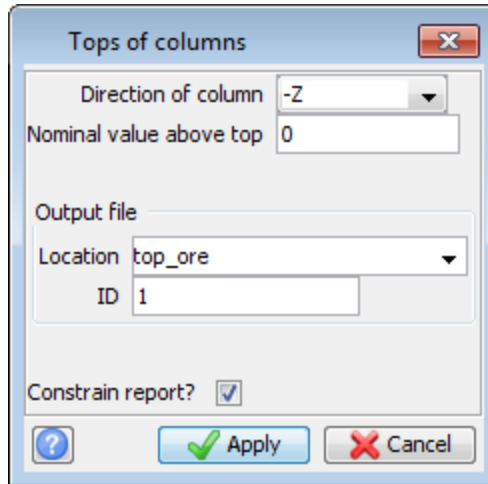
27. View the block model from below, as shown.  
The economic bottom of ore matches the lowest occurrence of ore in all parts of the model except for the southwest.



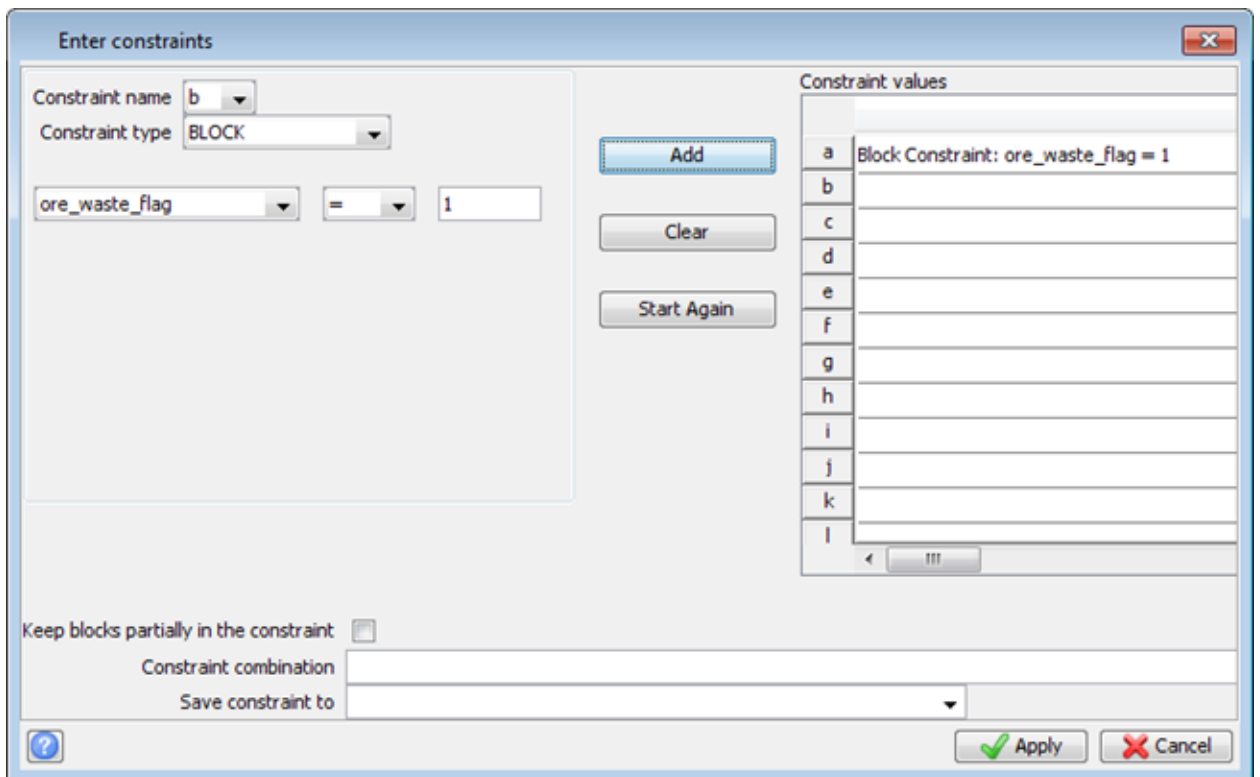
The top of the ore will be the first occurrence of ore searching down through the model (that is, the ore\_waste\_flag =1). If this ore is not economic, as in the southwest of the model, it will be excluded by the fact that the economic bottom of ore is at an elevation of 400 here. This is a reason why the nominal values are important when using the column tops functions.

28. Choose **Column processing > Column tops**.

29. Enter the information as shown, and click **Apply**.



30. Enter the information as shown, and click **Apply**.



31. Choose **Surfaces > DTM File functions > Create DTM from string file**.

32. Enter the information as shown, and click **Apply**.

**Create a DTM from a string file**

Define the string file

Location: top\_ore1

Object ID: 1

Object name:

Define other parameters

Common point check distance: 0.0050

Strings to act as break lines

Any spot height strings

Spot height string range:

Perform break line test

Interpolate additional points

Point interpolation distance: 50

Define the boundary string to clip the DTM

Would you like to clip the DTM to a boundary after creation?

Location:

String: 1

Retain triangles inside boundary

Retain triangles outside boundary

Apply Cancel

You can now generate a block model report to calculate volume, tons, average grade, and recoverable product of the economic ore.

33. Choose **Block Model > Report**.

34. Enter the information as shown, and click **Apply**.

Block model report format file

Format File Name

Output Report File Name economic\_ore

Output Report File Format .not - Surpac Note File

Report Type  Standard Report  
 Multiple Percent Report

Indicator Kriged Model

Modify Format

Constrain ?

? Apply Cancel

35. Enter the information as shown, and click **Apply**.

Block model report

Report description  
Volume tonne report for column-processed block model.  
Training exercise by BP.

Format headers?  
 Remove lines with zero volume?  
Report volume and tonnes to 0 decimal places

	Report attributes	Display?	Low cut	Upper cut	Weight by	Report	Expression
a	diluted_grade	<input checked="" type="checkbox"/>			Volume	Average	
b	recoverable_product	<input checked="" type="checkbox"/>			Volume	Aggregate	

Volume adjustment  
 Use volume adjustment?  
Attribute composite\_grade

Geometric grouping  
Group geometrically None


Use partial percentages?  
Precision 3  
Attribute to store partial percentage values

Density adjustment  
 None  
 Attribute  
 Value

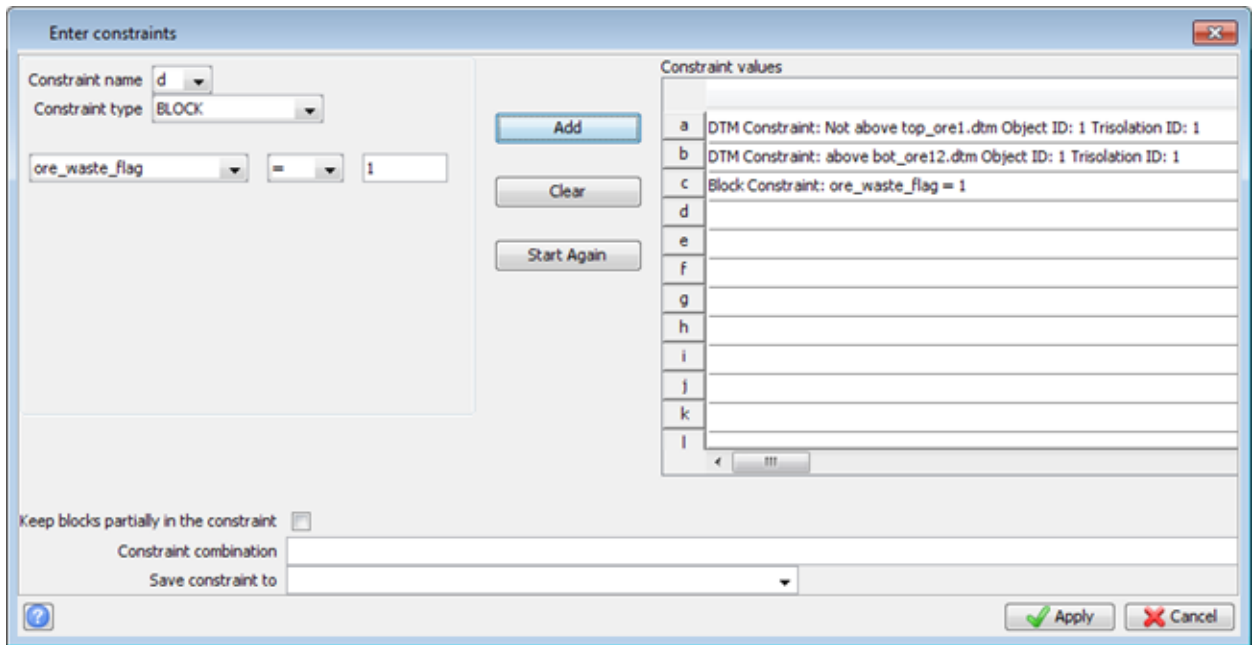
	Grouping attributes	Numeric range
1	z	230,326,12

Fill all cells for the group attribute?  
 Pivot compatible?

Apply Cancel

 **Note:** Right-click on the first row to add another row to the table.

36. Enter the information as shown, and click **Apply**.



The resulting report is shown.

```

Block model report
Volume tonne report for column processed block model.
Training exercise by BP.

Constraints used
a. NOT ABOVE DTM top_ore1.dtm Object ID 1 Trisolation ID 1
b. ABOVE DTM bot_ore12.dtm Object ID 1 Trisolation ID 1
c. = BLOCK ore_waste_flag 1

Keep blocks partially in the constraint : False
    
```

Z	Volume	Diluted Grade	Recoverable Product
230.0 -> 242.0	227850	12.0942	55004.0799
242.0 -> 254.0	5876325	11.5315	1352578.9644
254.0 -> 266.0	7963725	11.2510	1788453.4180
266.0 -> 278.0	8955975	11.3107	2021948.7487
278.0 -> 290.0	9841650	11.2219	2204456.8254
290.0 -> 302.0	7971075	11.0438	1757139.3914
302.0 -> 314.0	1514100	11.0622	334321.5204
314.0 -> 326.0	0	0.0000	0.0000
<b>Grand Total</b>	<b>42350700</b>	<b>11.2546</b>	<b>9513902.9481</b>

37. Choose **Block model > Close**.

**Note:** To see all of the steps performed in this task, run `_13_recoverable_product.tcl`. You will need to click **Apply** on any forms presented.

## Thicknesses

### Task: Calculate column thickness

1. Open **blockmodel.mdl**.
2. Choose **Column processing > Thickness**.

3. Enter the information as shown, and click **Apply**.

**Block model thickness**

Enter attribute properties

Class attribute ore\_waste\_flag

Class Value 1

Attributes to composite

1	diluted_grade
---	---------------

Attributes to aggregate

1	
---	--

Output string file:

Location ore\_thickness

Id 12

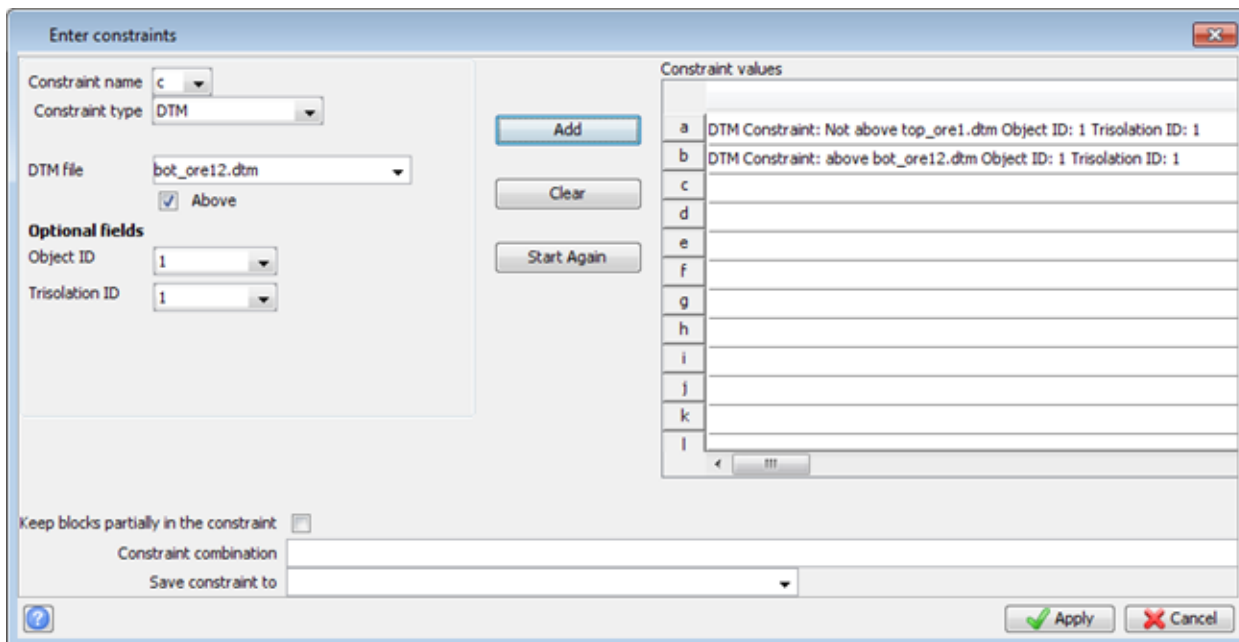
Direction of columns -Z

Constrain extraction?

Report file name thickness\_report

Format .not - Surpac Note File

4. Enter the information as shown, and click **Apply**.



A report is generated.

```

                                BLOCK MODEL THICKNESS REPORT

Block model: nmine
Description: North Mine Test Model May 25, 1996

Results written to: ore_thickness12.str

    Class thicknesses are in String 1
    Non-class thicknesses are in String 2

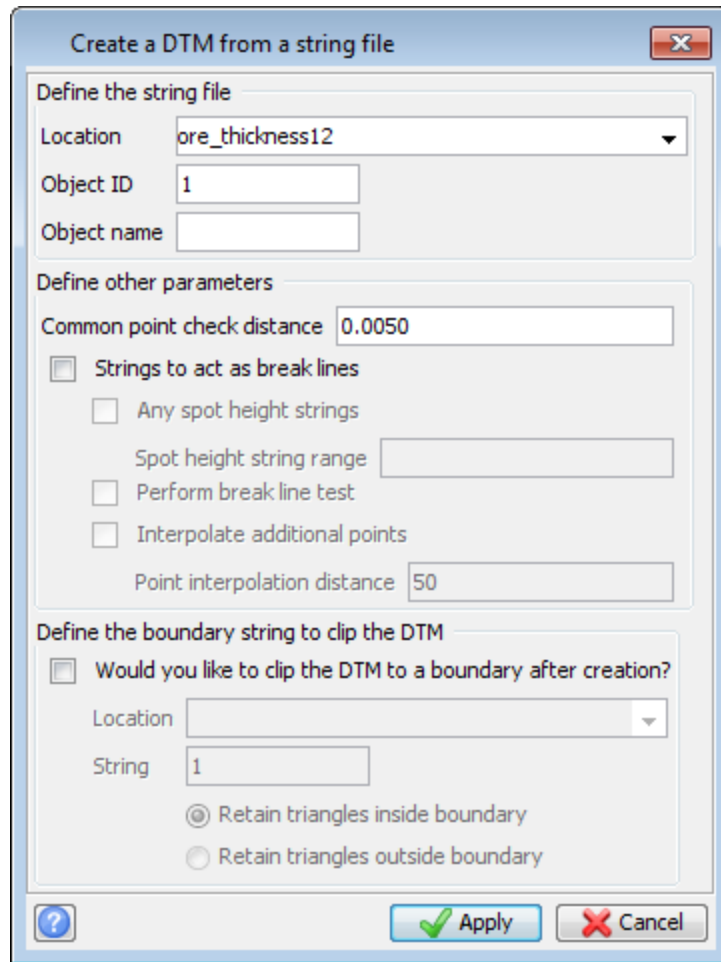
    D fields:
        D1 - thickness
        D2 - diluted_grade

Class attribute: ore_waste_flag
Class value: 1
    
```

**Note:** In the resultant string file, String 1 contains the ore thickness and average diluted grade in the first and second description fields. There is also a string 2 in this file which contains the thickness of all other material (in this case, this represents interburden thickness), and the average diluted\_grade. String 2 *must* be deleted from this file before you can create a DTM of ore thicknesses and grades, or the values from strings 1 and 2 will be averaged when creating the DTM, which will give you a meaningless result.

5. Open **ore\_thickness12.strin Graphics**.
6. Choose **Edit > String > Delete range**, and delete string 2 from **ore\_thickness12.str**.
7. Save **ore\_thickness12.str**.
8. Choose **Surfaces > DTM file functions > Create DTM from string file**.

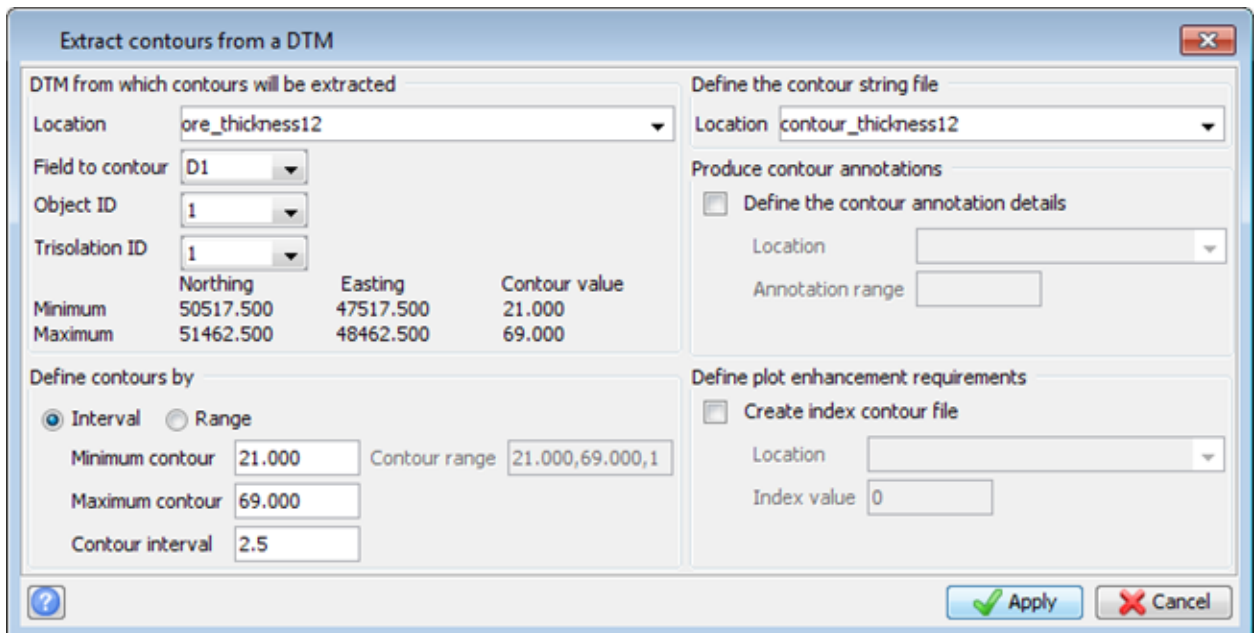
9. Enter the information as shown, and click **Apply**.



You can now extract contours of the ore thickness.

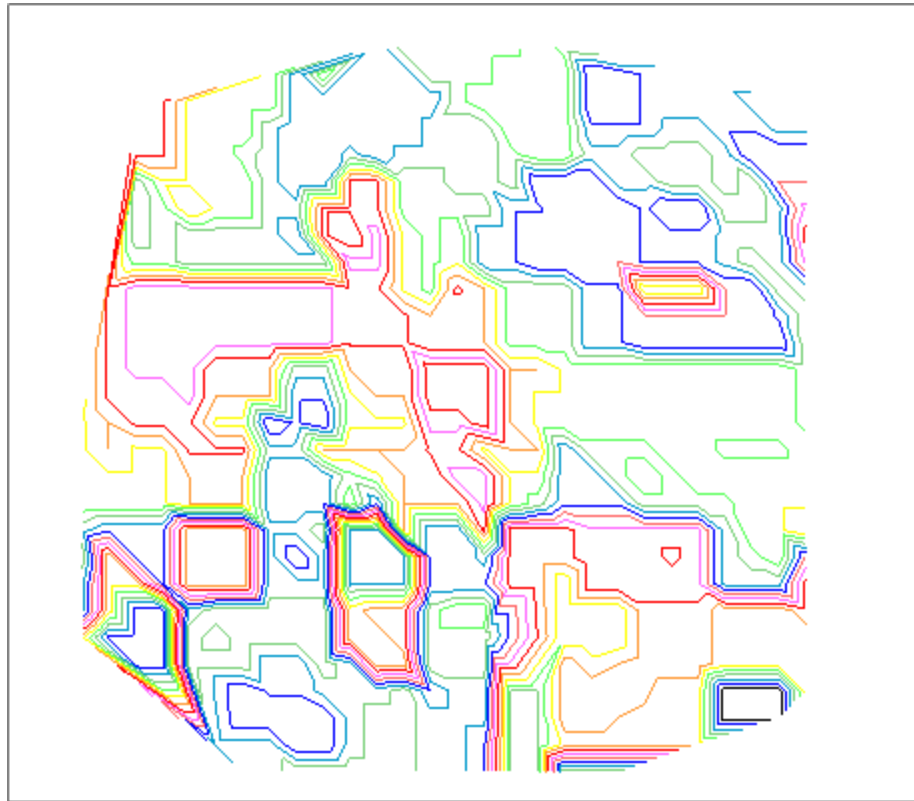
10. Choose **Surfaces > Contouring > Contour DTM file**.

11. Enter the information as shown, and click **Apply**.



12. Open **contour\_thickness12.str** in **Graphics**.

The contours are displayed.



**Note:** To see all of the steps performed in this task, run `_14_thicknesses.tcl`. You need to click **Apply** on any forms presented.