

Digital Terrain Modelling

A number of computer programs exist that allow the production of Digital Terrain Models and these will be discussed later.

A Digital Terrain Model (DTM) is however, a network of triangles that represent a three dimensional surface.

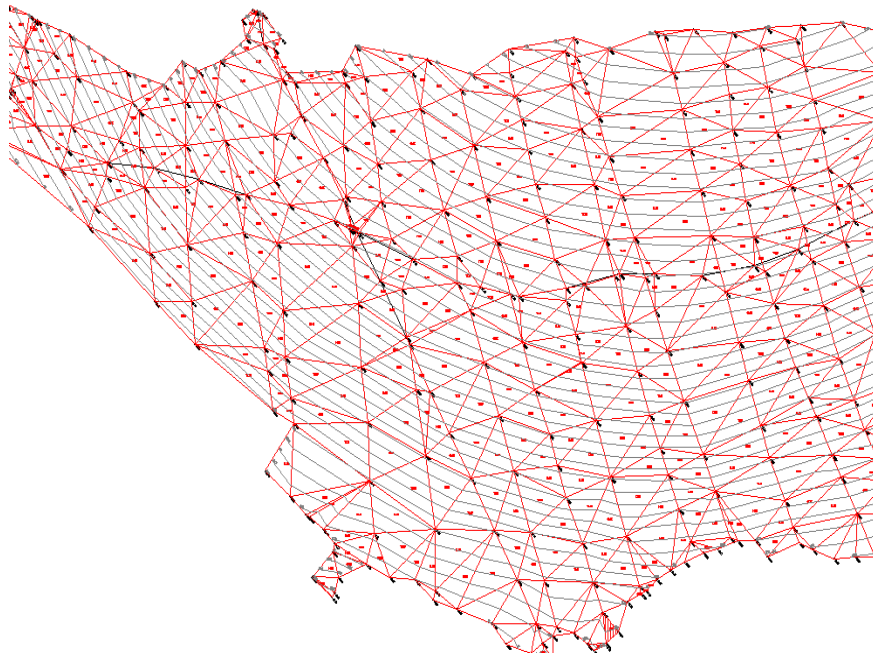


Fig 1 Triangles established between points surveyed on site, together with the 0.25m interval contours produced. (Survey of land adjacent to Bute quarry, Miskin, 2013)

The Digital Terrain Model can be produced using manually entered coordinates or coordinate information downloaded from your typical total station, GPS or LIDAR system to your processing software.

We will discuss types of survey equipment, additional processing packages available and type and format of deliverables later.

Once a DTM has been produced, contours, perspective views and sections may be extracted from its surface.

See the following examples

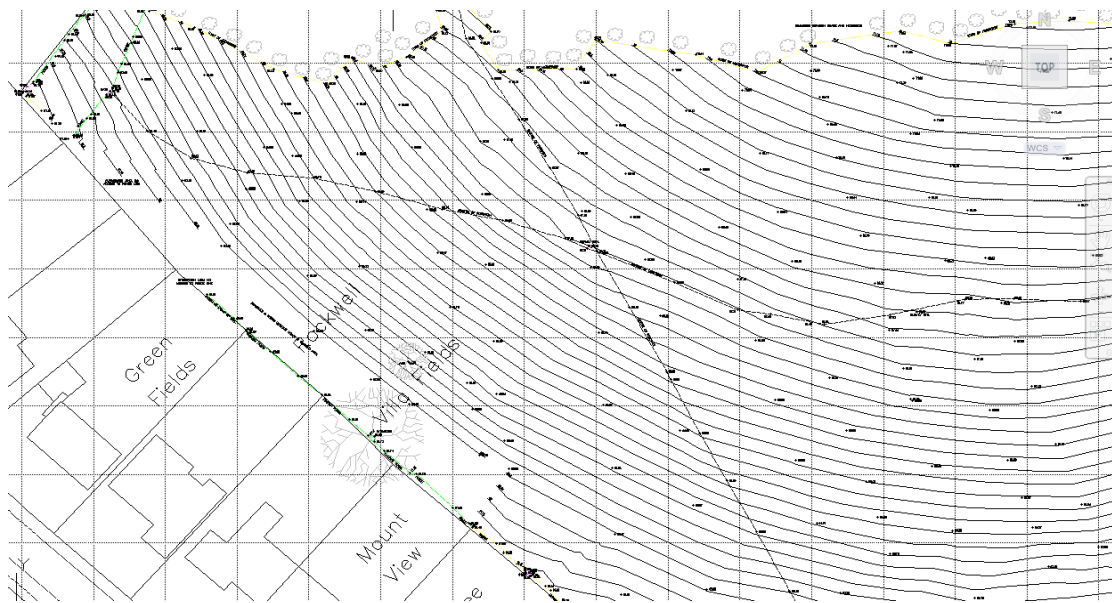


Fig 2 Contoured plan produced by Digital Terrain Model inserted onto digital OS base map (Survey of land adjacent to Bute quarry, Miskin, 2013)

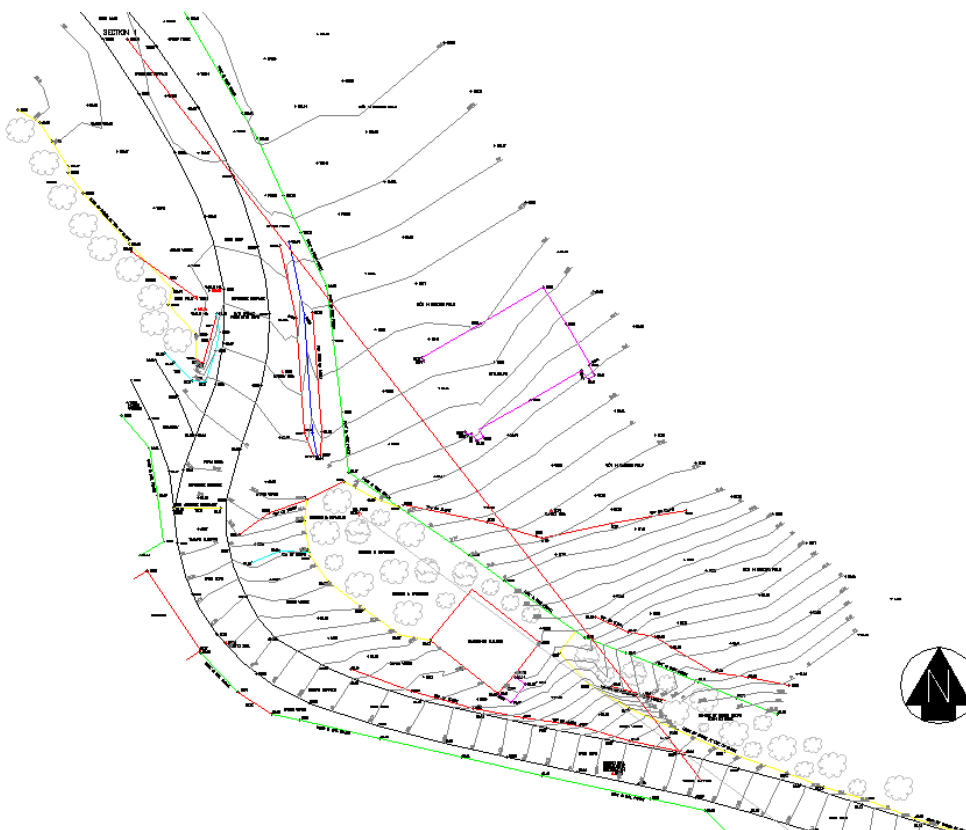


Fig 3 Provides an example of a contoured plan showing the position of long section (Survey for realignment of farm access, near Llandeilo, 2013)

E1 Northing								
	A	B	C	D	E	F	G	H
1	Chainage	Level		Easting	Northing			
2	0	100.217		264512.5	221348.48			
3	2.273	100.269						
4	3.845	100.313						
5	4.947	100.318						
6	6.795	100.305						
7	7.554	100.301						
8	11.141	100.228						
9	11.232	100.227						
10	11.251	100.227						
11	11.316	100.227						
12	14.414	100.22						
13	15.835	100.193						
14	16.849	100.122						
15	17.37	100.063						
16	17.529	100.06						
17	20.845	99.813						
18	21.313	99.786						
19	24.389	99.569						
20	26.951	99.421						
21	28.335	99.345						
22	28.396	99.348						
23	28.975	99.28						
24	30.845	99.062						
25	32.79	98.874						
26	34.298	98.675						
27	34.441	98.652						
28	34.768	98.591						
29	37.993	98.162						
30	38.08	98.149						

Fig 5 Shows the long section extracted from the contoured plan in fig 3 as a csv file. The csv file contains the chainage and levels of changes in grade and also includes the eastings and northings of the start point, changes in direction and the end point of the long section produced.

Digital Terrain Models can also be used to calculate the volumes between two DTM surfaces or between one DTM surface and a datum plane.

We must also consider some of the terms we will encounter when discussing Digital Terrain models:

Entities:

Entity numbers are numerical codes which represent different types of features. These include the following:

1. Field features such as fence lines, utility covers etc.
2. Design features including an edge of a design formation.
3. Plot features such as contour lines.

Strings:

A string is located by one, two or three coordinated points. Within the modelling program Geocomp, five types of sting exist. These can be seen below:

1. A point string.
2. A straight line string between two points.
3. An arc string, defined by the three points on the arc.
4. An arc string, defined by a centre point and two tangent points.
5. A circle string defined by the centre point and a point on the circumference.

Breaklines:

A breakline is a common change of grade line. At a constant grade from end to end it joins a pair of points on a surface. Examples would include a top of slope or toe of batter.

Spatial Data System:

Within Geocomp, this allows the user to create and edit two and three dimensional graphical data.

Polygons:

A polygon is a user defined group of points within a spatial data system. The points can be chosen by point number, string number or entity.

Digital Terrain Models are defined by boundary strings. Fixed changes in grade within the DTM must then be established with the use of breaklines. Once an entity is allocated as a breakline, the modelling process will not allow any of the triangle sides produced to cross it.

Where required boundaries within boundaries can be established (see fig 3), this allows areas where access was not possible to be excluded by the modelling process, ensuring only actual surveyed areas are included and removes the possibility of future litigation against your company.

Without defining boundaries and breaklines the Digital Terrain Modelling program will create triangles between all suitable points, changes in grade will not be identified and in most cases a contoured model will be produced that bears little relationship to the actual topography of your site.

However, where points have been taken on a regular grid and at close proximity to each other, the model will not look too dissimilar to the actual relief and this could ultimately result in series problems further down the line. For this reason it is imperative that great care is taken when identifying the breaklines to be used in the production of your model.

You will not want to use all the points surveyed to produce your Digital Terrain Model.

Invert levels of manhole chambers, overhead cable heights, eave and roof ridges will produce points which although required to allow the designer to calculate drainage runs and consider the impact of the proposed development on the surrounding area, will if used when producing your DTM lead to the production of spikes and dips within the model.

When processing the data, these points must be identified, and the modelling process set to exclude them from the production of your Digital Terrain Model.

As discussed earlier a number of programs exist to produce Digital Terrain Models, these include:

1. Geocomp, from Geocomp Systems PTY Ltd, Australia
2. Terra Model, from Geocomp Systems PTY Ltd, Australia
3. LSS Elite, from McCarthy Taylor Systems Ltd, Gloucester, UK
4. PDS Ground Modelling and Highway Design
5. M.O.S.S

More information concerning these programs, including contact details are to be found on Blackboard.

