KTF software
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Ground Modelling, Road Design and Land Survey software for Civil Engineering, Environmental and Landscape applications working within CAD.



# Car park / sports pitch / plateau design

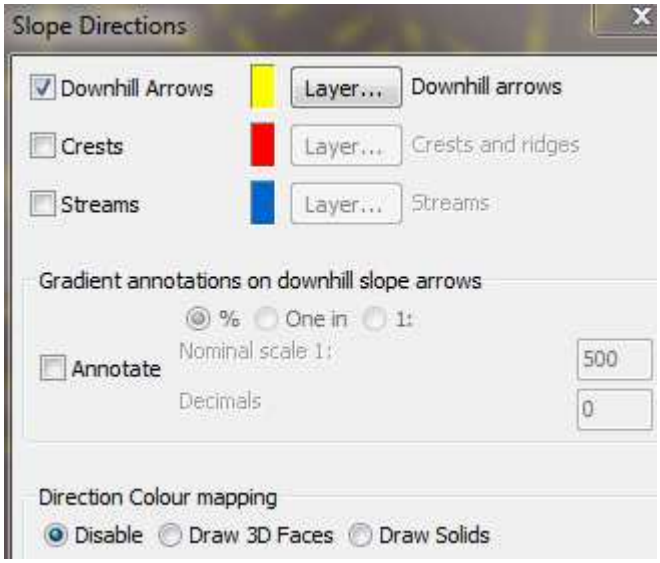
The objective here is to position a proposed surface with a specified slope to achieve a balance (or specific amount of fill for example) of cut and fill. Starting with a ground model representing the existing site :-

Step 1 Represent the outline of the single surface feature

If the feature is rectangular use menu item *3D utilities > Draw rectangular plateau* drawing horizontally and with an elevation of 0.000. For general use this can be a closed 2D Polyline defining the edges of a single surface (one plane).

Step 2 Display downhill slope directions

To help decide the direction that the design plateau is to slope (if it is not to represent a horizontal surface) use menu item *Ground Modelling, Analysis and Colour mapping, Slope* with dialogue options Flow arrows and Downhill Arrows selected.

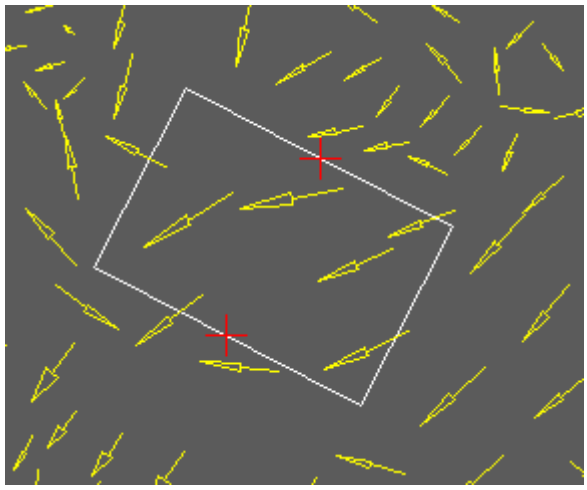


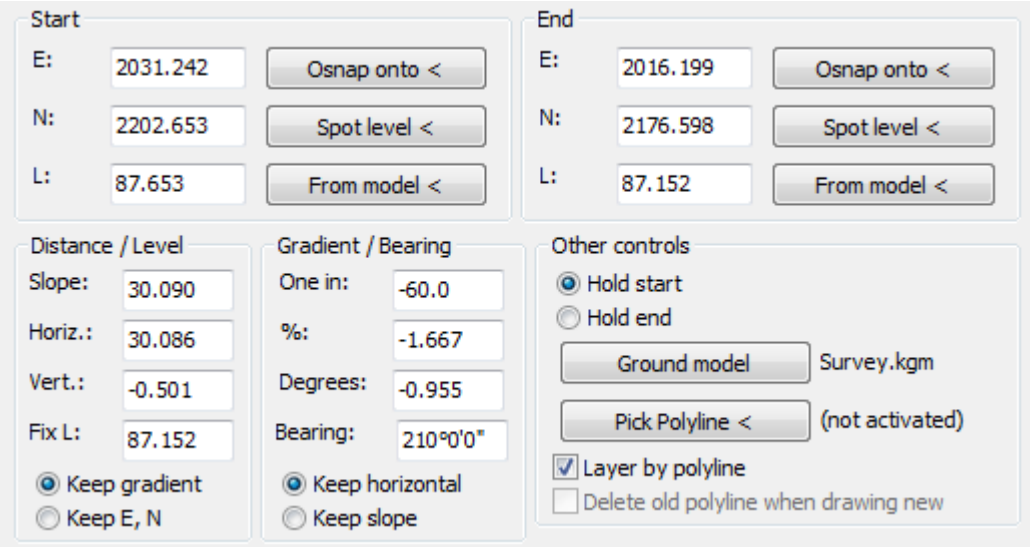

Step 3 Assign slope to the single surface feature

Menu item *3D utilities, Enquire and define Slope* enables the drawing of a slope definition Polyline (a 3D Polyline with two vertices that defines the slope) at a specified direction and gradient.

The red crosses indicate the Start and End locations where initial level values are in this case from the model. Set the design gradient and the direction of slope (bearing). The End location will be modified (Hold start is “on”).

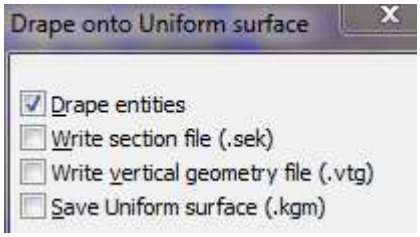
Outputs are Draw 3D Polyline (the slope definition Polyline) and Draw arrow to annotate the slope.






The top red cross was used from the start and returned a level from the model of 87.653. After picking the lower location the gradient was set to one in -60 and the direction of slope to a whole circle bearing of 210 degrees.

Now use the slope definition Polyline to apply the slope to the single surface feature with menu item *Design, Vertical, Drape onto Uniform surface*.




Select the Polyline representing the single surface feature and at the "1st point.." prompt use End object snap to get the x,y,z of the start of the slope definition polyline and at the "2nd point.." prompt get the x,y,z of the end. At the "3rd point.." prompt just Return and the only output that is required is to Drape. The original 2D Polyline representing the feature is now a 3D Polyline respecting the slope and with Z values "near" to the existing ground.

## Step 4 Initial volume calculation

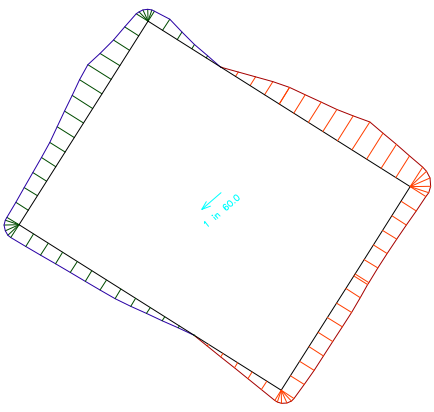
Use menu item *Ground Modelling, Create Model, from Drawing entities* to create a design model from the 3D Polyline created above (name it for example Car Park Design.kgm) and *Active and Passive triangles, Define from Polyline(s)* if the shape of the single surface (i.e. concave conditions) has meant that passive triangles need to be identified. Use *Ground Modelling, Volumes* to calculate the volume between the existing site and Car Park Design.kgm with the only output required being the volume. To optimise for a balance of cut and fill accept the default of No to Re-calculate vertical shift. If a non zero balance is required Yes will enable the entry of the intended amount of cut and fill.

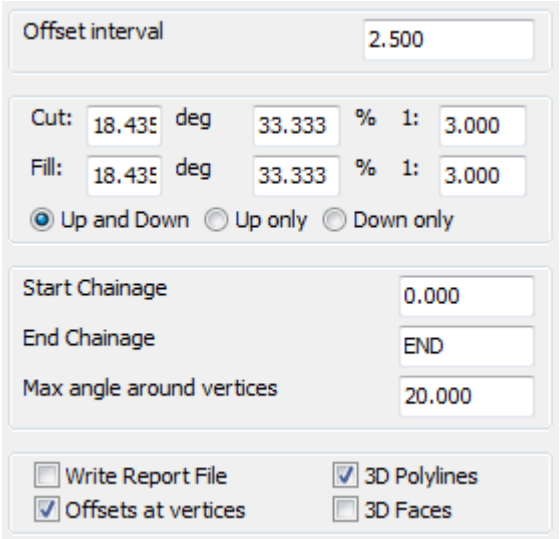
## *Step* 5 Optimising for cut and fill

Enter MV at the command prompt to raise or lower the design 3D Polyline – the default value is suggested following the volume calculation above. *Ground Modelling, Create Model, from Drawing entities* from the raised or lowered design 3D Polyline and replace the initial Car Park Design.kgm. Run *Active and Passive triangles, Define from Polyline(s)* again if this was done in Step 4 above. *Ground Modelling, Volumes* again to confirm that the balance is close enough to the intended result (within 1 or 2 cubic metre for typical use).

## Step 6 Relate the design 3D Polyline to the model

Menu item *Ground Modelling, Embankments*. Specify batter gradients for cut and fill and set Offsets at vertices "on".



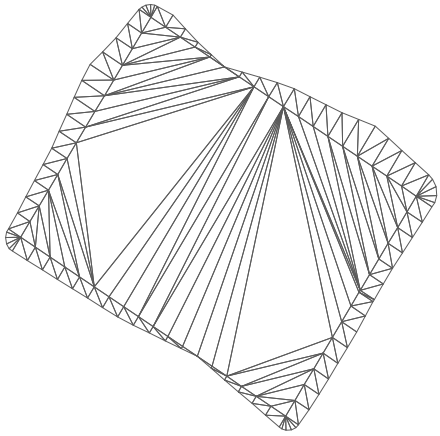



Step 7 Create design model including embankments

Menu item *Ground Modelling, Create Model* to make a model from the design 3D Polyline and embankment information to enable a volume calculation including embankments. There are two options here :-

**a**. If only the design information as indicated above is to be used in the calculation then the quickest way to make the model will be with *from Embankment offsets* that will ignore all other entities in the selection set except the 3D Polylines drawn at right angles from the design 3D Polyline.

**b**. In a more general 3D wire frame design sense design models are made from 3D Polylines representing the tops and bottoms of embankments, channels and road centre lines etc. so use menu item *Create model, from Drawing entities*. The embankment offsets are not required so freeze their layers or delete them before making the selection set. It is important to generate triangles that are "well conditioned" to represent the embankments and to help this use menu item *Polyline utilities, Additional vertices* with an interval of say 2.5 metres applied to the design 3D Polyline (same as used in embankment calculations). *Ground Modelling, Draw Triangles* and if "concave conditions" exist around the edge of the design model use menu item *Active and Passive triangles, Define from Polyline(s)* to define the active and passive triangles.



Step 8 Volume calculations including embankments

*Ground Modelling, Volumes* to calculate the volume between the existing site model and this time the design model including embankments. A previous balance of cut and fill will probably now be different due to the embankments. In typical use this will be a small difference but depending on the nature of the existing site it may be necessary on rare occasions to revert to stage 5. Note that the existing embankments will need to be replaced from the modified (raised or lowered) design 3D Polyline and the process repeated from stage 5.

Make a difference model if colour mapping is required to illustrate areas of differing amounts of cut and fill. If a difference model has been created assign its active and passive triangles before using menu item *Ground Modelling, Analysis and Colour mapping, Z value.*