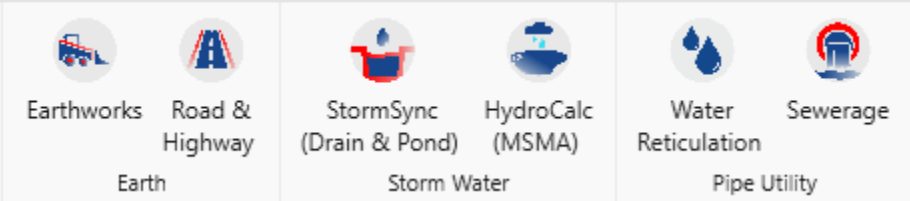
Understanding MiTS: A Simple Guide

General · https://mes100.com/docs/understanding-mits-a-simple-guide/

MiTS consists of 6 modules namely:

1. Earthworks
2. Road & Highway
3. StormSync (Drain & Pond) – DraNet
4. HydroCalc (MSMA) – PondCAD
5. Water Reticulation – LoopWin
6. Sewerage – SewNet

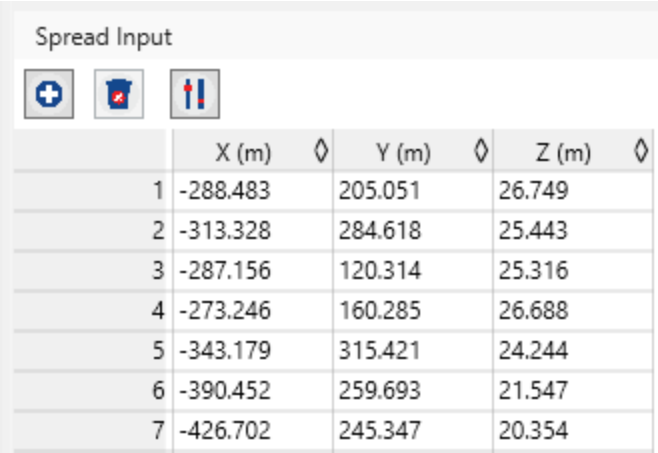


Earthworks

Survey Point

Survey Point is represented by a 3D Point (consist of X, Y and Z values). X & Y are the position and Z is the elevation and they represent the Terrain (Ground Level).

Users are allowed to create survey points in the software, or import points from external files such as dwg. We can also create survey points from a selected region in Google Earth.



	X (m)	Y (m)	Z (m)
1	-288.483	205.051	26.749
2	-313.328	284.618	25.443
3	-287.156	120.314	25.316
4	-273.246	160.285	26.688
5	-343.179	315.421	24.244
6	-390.452	259.693	21.547
7	-426.702	245.347	20.354

Image 1.1.1: Example of X, Y and Z coordinates of survey points listed under the spread input

A SurveyPointCollection means a set of survey points that form a ‘Point Group’. We can have several ‘Point Group’, and each group can have their own name and appearance (Color, Visibility, Point Size, etc).

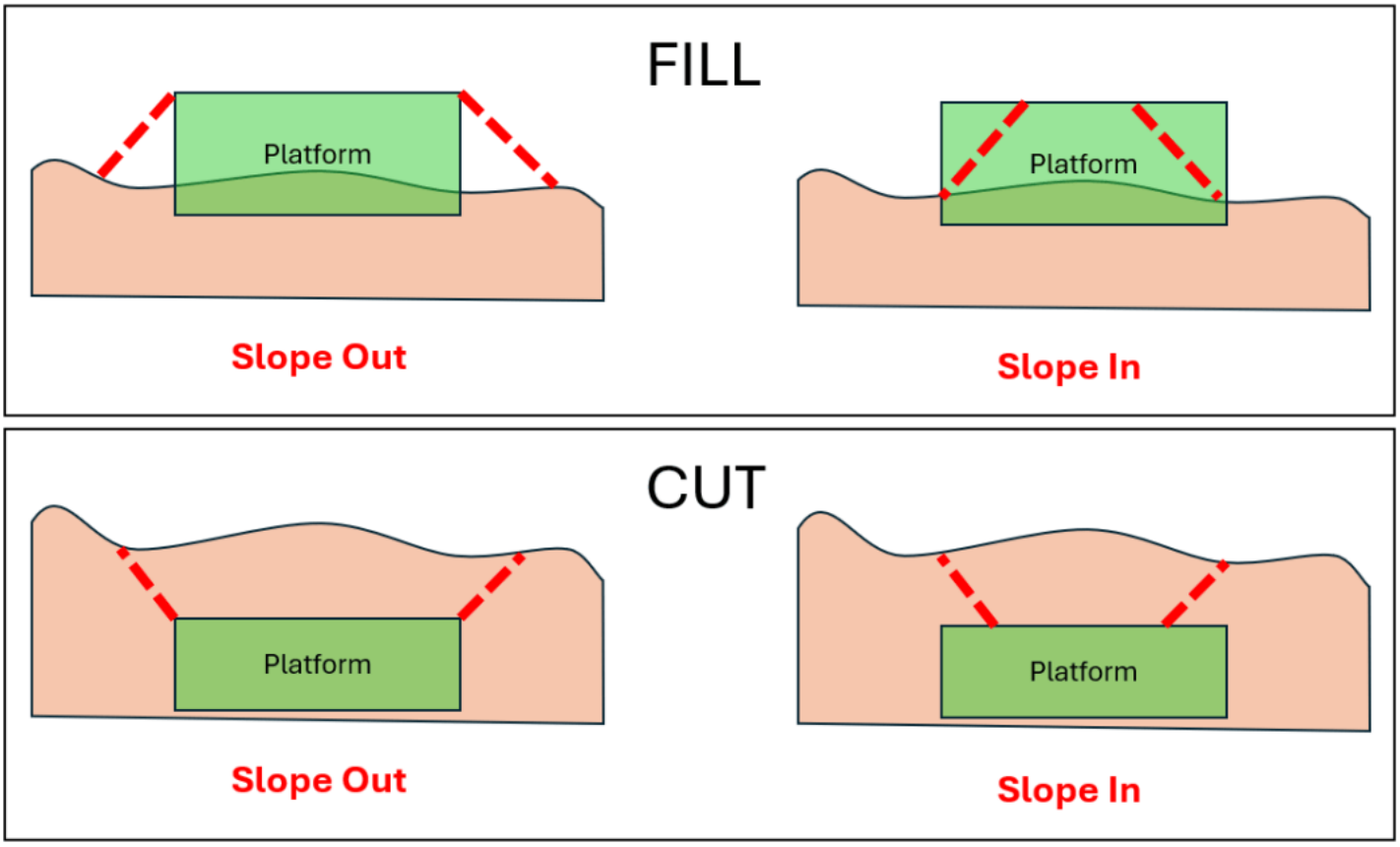
By allowing the presence of multiple ‘Point Group’, we can select different ‘Point Group’ to perform operations like DTM calculation. Within a ‘Point Group’, we can also have Subgroups, just for the purpose of having different appearance within one ‘Point Group’.

Platform

Platform is a level on top of the ground where it is the surface prepared before any structure is built. Platform is represented by 3D Polygon and each platform is made of at least three 3D Points.

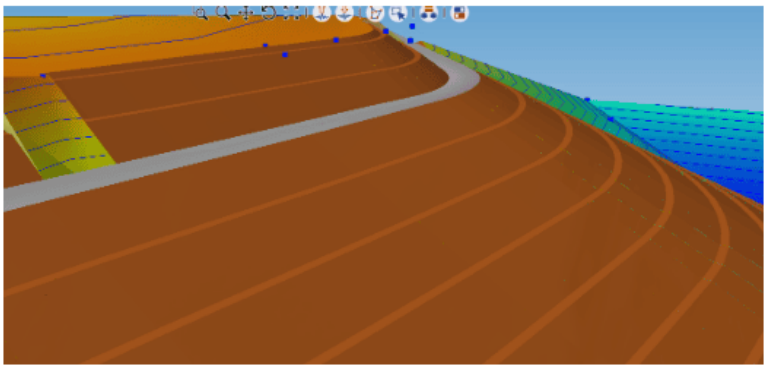
Slope

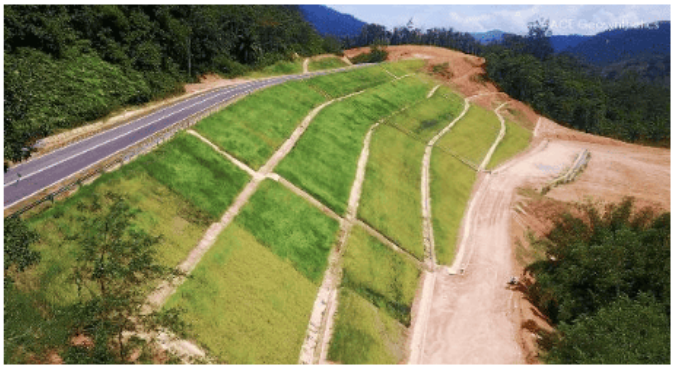
When platform and surveyor points are present, we can choose to ‘Generate Slope’ directly in MiTS. And the slopes can be generated in two directions (in or out). Users can also choose not to generate slopes (choose none for the slope direction).



We can have different configurations for each edge of a platform. For example, one edge can be ‘Slope In’, another can be ‘Slope Out’.

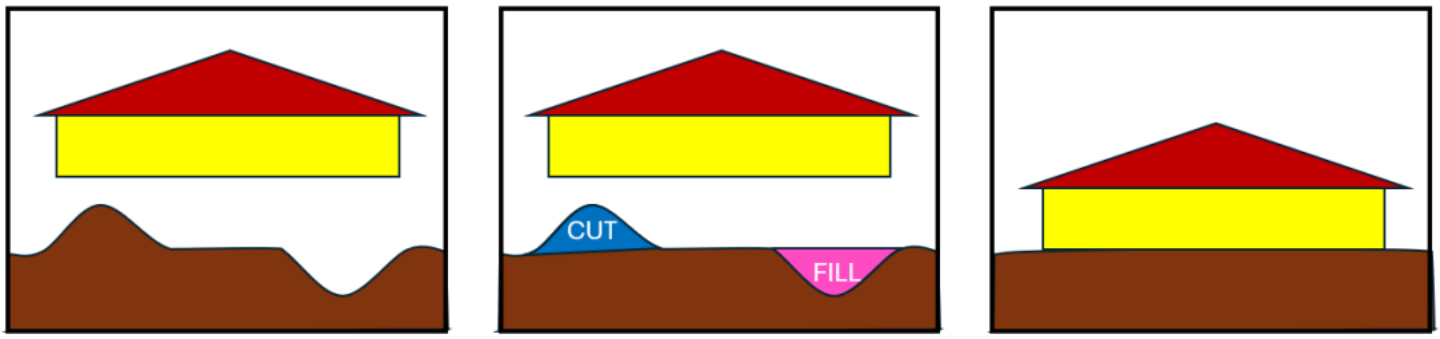
In addition to the direction, we can also specify how the slope should look like under the ‘Slope Template’ setting, as slopes can differ in terms of gradient, presence of berm or drains. For example, the default slopes in MiTS contain slope and berm (flat strips of land that act like steps).





Cut and Fill

Imagine you want to build a house on land where the ground goes **up and down** (not level).



In the **high areas**, we **cut** (remove soil) whereas in the **low areas**, we **fill** (add soil).

Basically, the goal is to make the whole area **level and even** for the house platform. Cut and fill helps save money and materials because we reuse the soil from the cut areas to fill the low spots.

Cut Section

'Cut Section' allows us to view the components (Ground Level, Platforms, Cut and Fill, etc) of a particular section of land. It's like slicing open a piece of cake and viewing the inner part. The following shows the Cut Section input and how the actual Cut Section view.

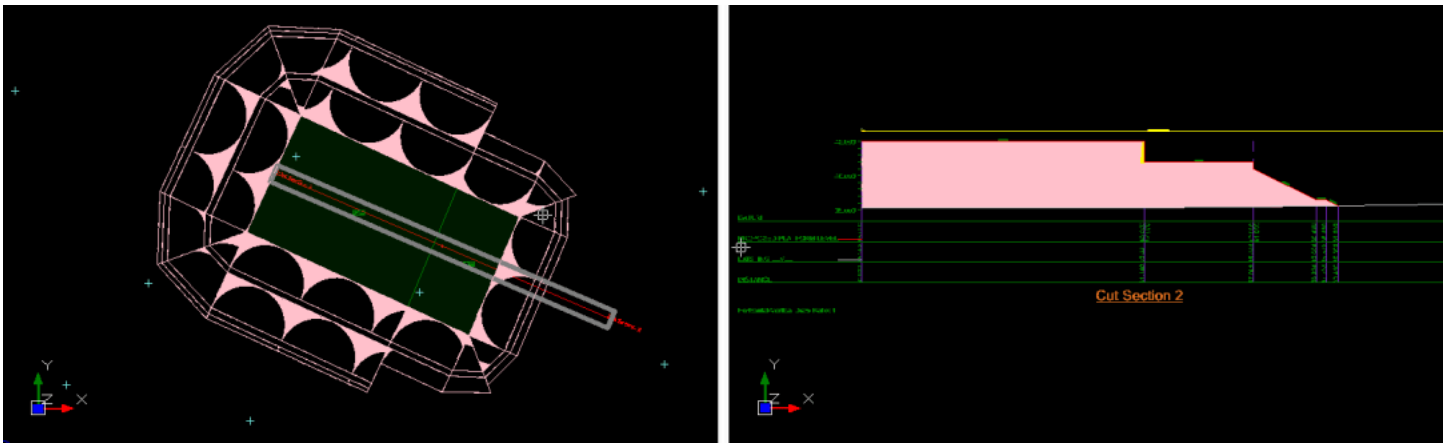


Image 1.2.3.1: On the left is the red line represent Cut Section and on the right is the Actual Cut Section view

DTM Volume

DTM Method can be used to calculate the Cut and Fill Volume between Platform and Ground Level. There're different methods in estimating the Cut and Fill Volume other than DTM Method (eg. Grid Method, End Area Method).

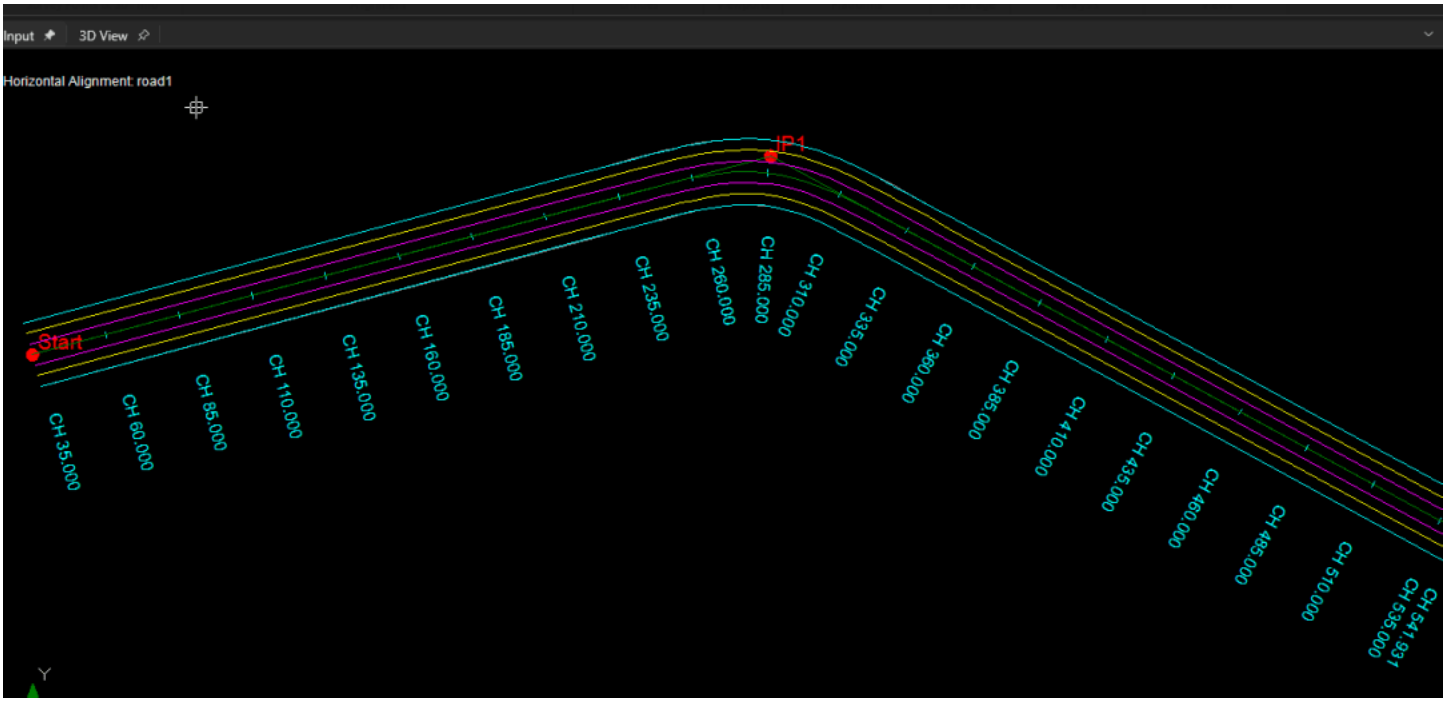
DTM can be used to compare different groups (a *Base* and a *Comparison*). For example, we can calculate the DTM between Platform (as comparison) against Survey Point group (as Base), or compare two Survey Point groups.

Road

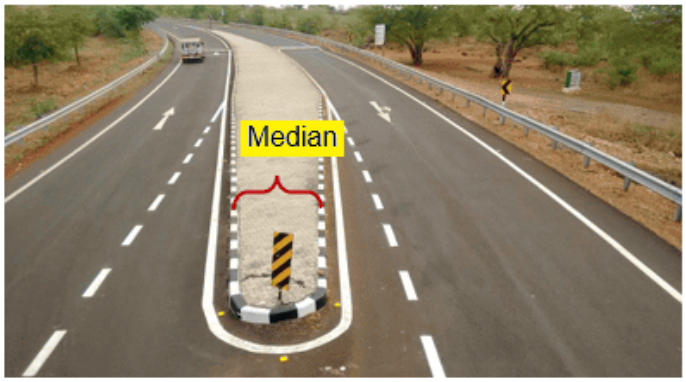
For roads, we have horizontal and vertical alignment. Horizontal is the plan view, where we input points to define how the Roads should be positioned and shaped while vertical point is to define the elevation of the road.

After forming a road, we can click on ‘Generate Platform’ and the generated platform is categorized as the Road Platform. Then, they can have the features of a regular platform in the sense that slopes can be generated, DTM volume can be computed, etc.

Road Width



A road offset item (road width entities) are not just one lane, and the lane can be different types, in addition to just regular “Road” (carriageway). For example, a road design can consist of entities like carriageway, median, shoulders, and other things like drains.







Each road offset item can have different widths and cross slopes. Cross slope is needed so that the lanes are slanted, and rain water won't pool on the surface.

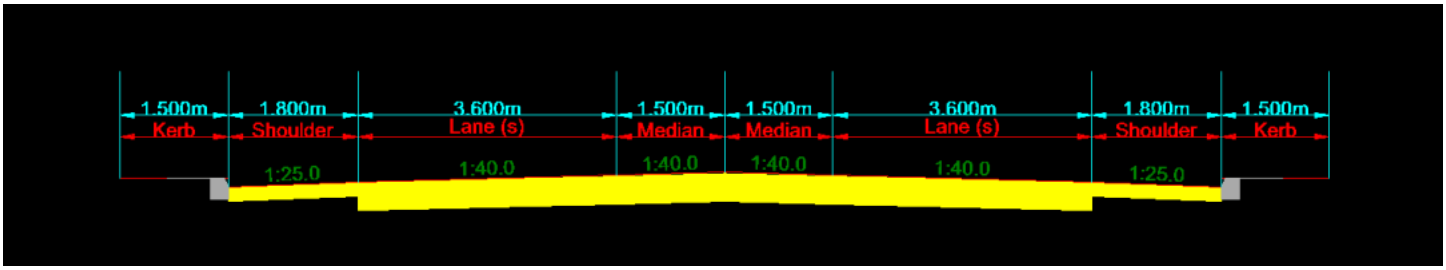


Image 2.1.1: Yellow part indicating the road width entities and they are slanted with center as the crown

Chainage

Chainage is the measurement of distance (with the same range) along the centerline of a road from a fixed starting point. As an example, there are CH25.00, CH50.00 and CH75.00 and so on in the next interval. The number show the distance of the road with range of 25 meter each.

The chainage does not always start with CH 0. For example, if a road designer is assigned the task to design just a particular section of the road (CH 35 – CH100), they set the road's **Start Chainage** to 35, so the chainage starts from a value other than zero.

Every chainage MiTS shows or asks for is then this real project chainage, the same number printed on the drawings. On a road that starts at CH 35, a point 15 m along the road is CH 50 in the drawings, in the input tables (vertical points, cross sections, viewports, slope schedule, excluded sections), in the property grids and in the reports. If the Start Chainage is changed later, everything on the road stays where it is and only its chainage numbers change.

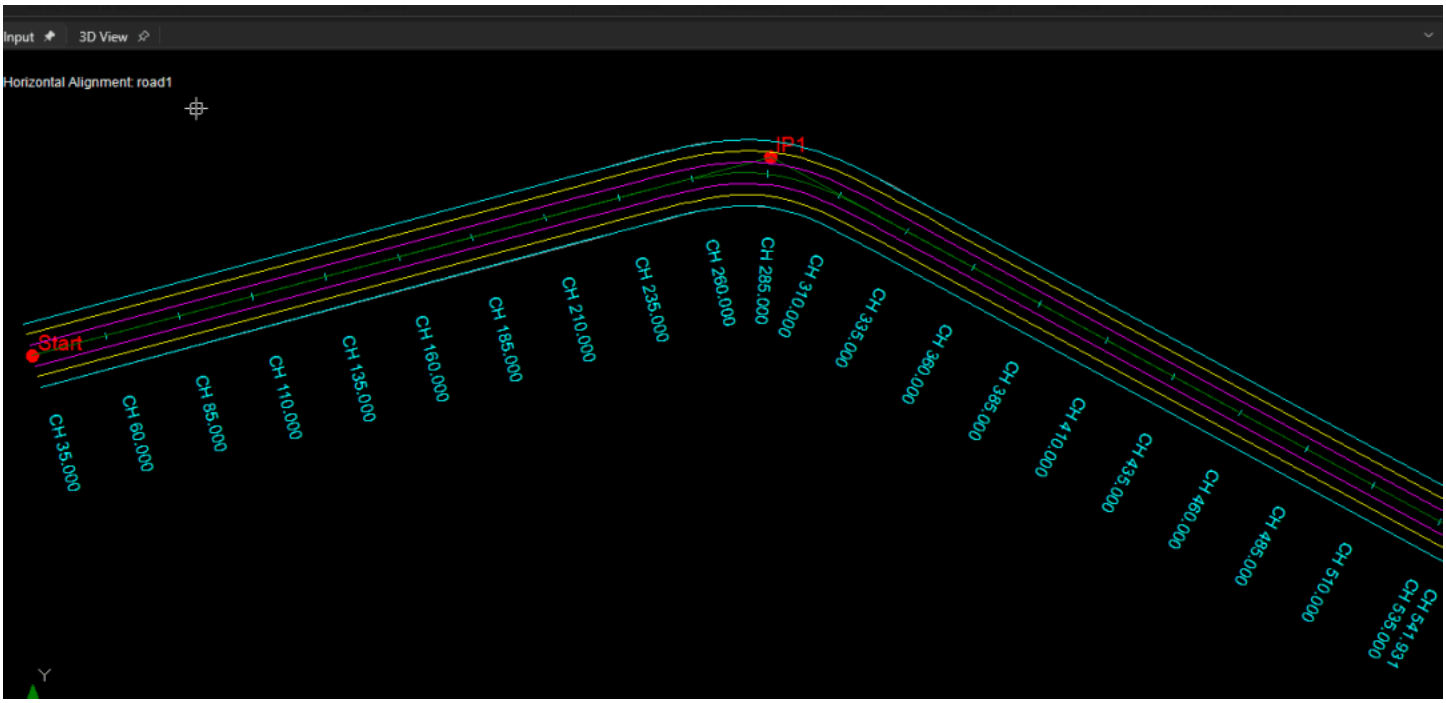
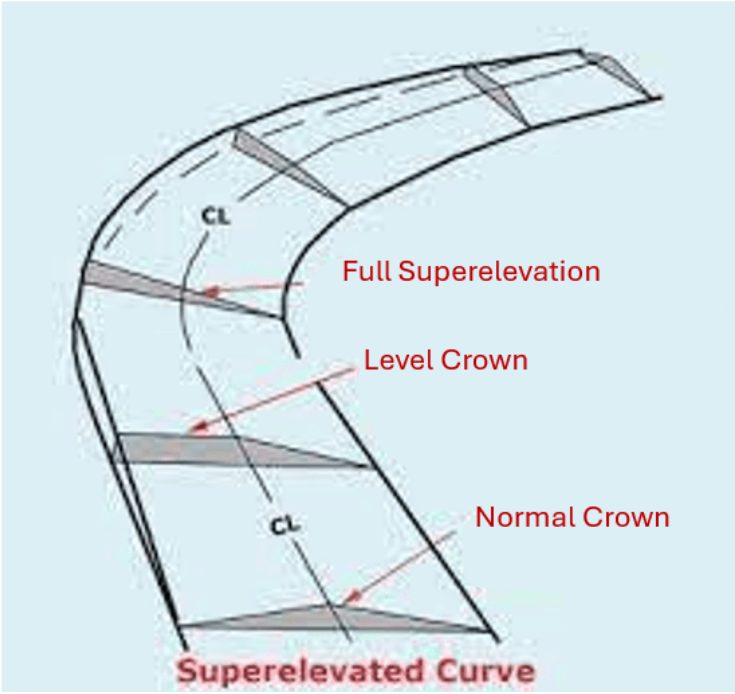


Image 2.2.1: Road with a Start Chainage of 35

Superelevation

Superelevation is needed on a curve, so that when making turns, the vehicle won't be thrown off from the road if they're moving too fast. A regular Superelevation contains main items like Normal Crown (NC), Level Crown(LC), Reverse Crown(RC), Full Superelevation.

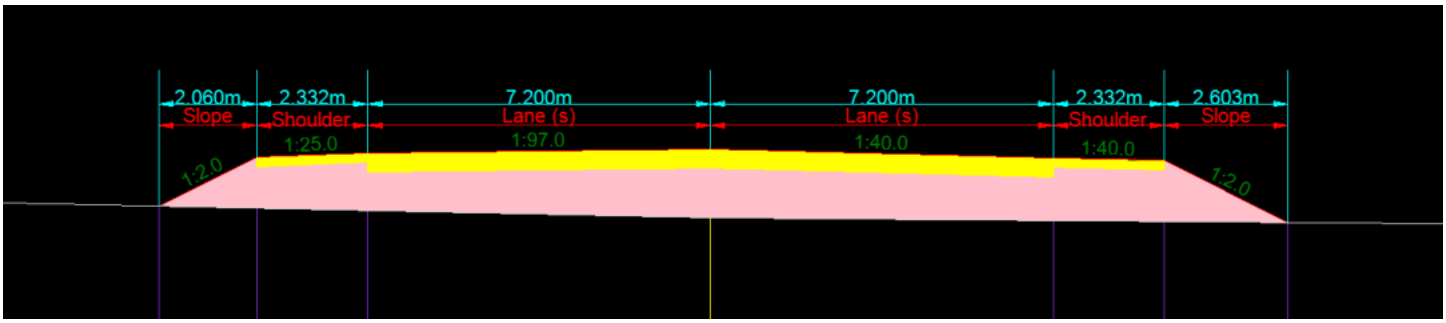




Cross Section

'Cross Section' in Road is just like the 'Cut Section' in Earthwork where we are slicing the road to view the profile. The 'Cross Section' can be created along the road with a certain interval, or input by the user at any chainage.

From the image below, the yellow color strip indicates the road entities with each section labeled and pink color indicates the fill slope.



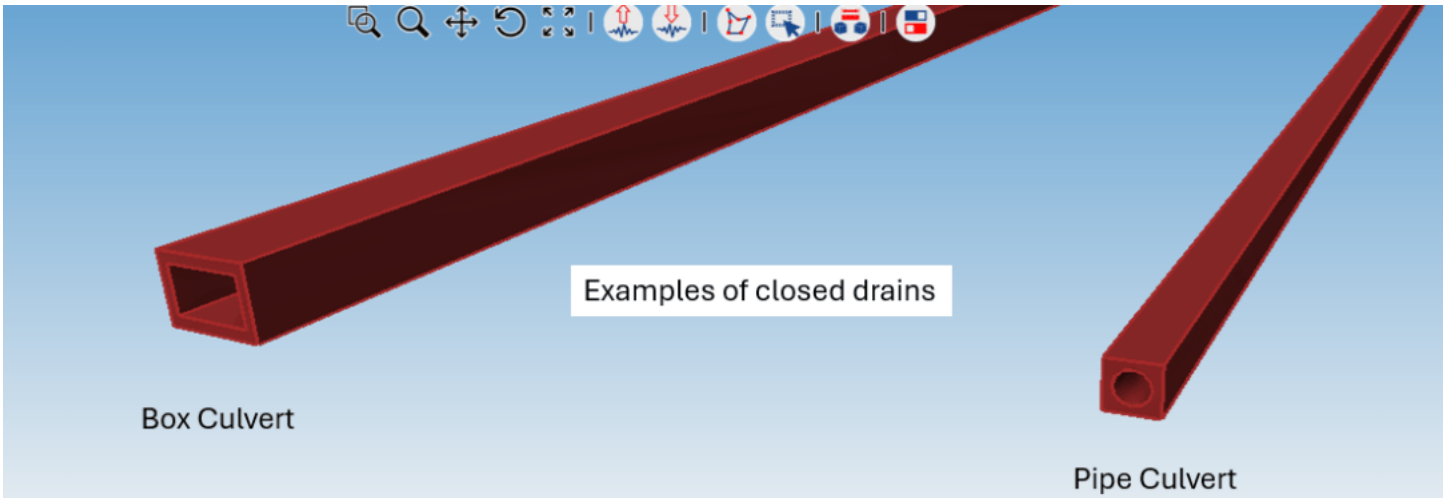
Utility

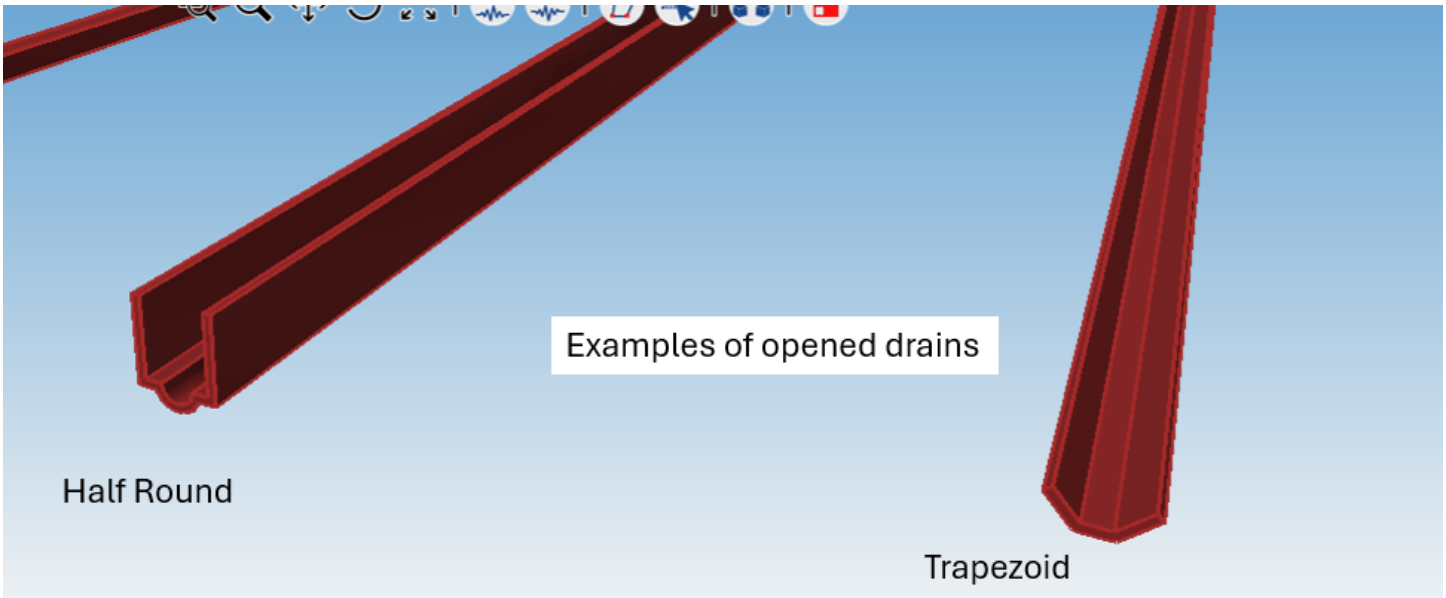
The concept behind Drainage / Sewerage / Water Reticulation is very similar so this section will only explain Drainage Module.

Basic Understanding on Drain, Node, IL, GL

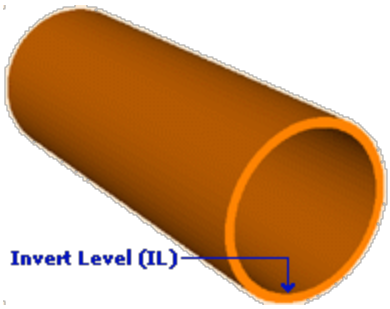
Each drain has a start node and an end node. Drain can be made of just two points (hence forming a straight line), or more than two points (hence forming a polyline). When it is a polyline, the first and last point will be the start node and end node respectively and the rest are the intermediate points.

Each Drain can have different shapes. Some examples are Half Round, Trapezoid, Box Culvert, etc.





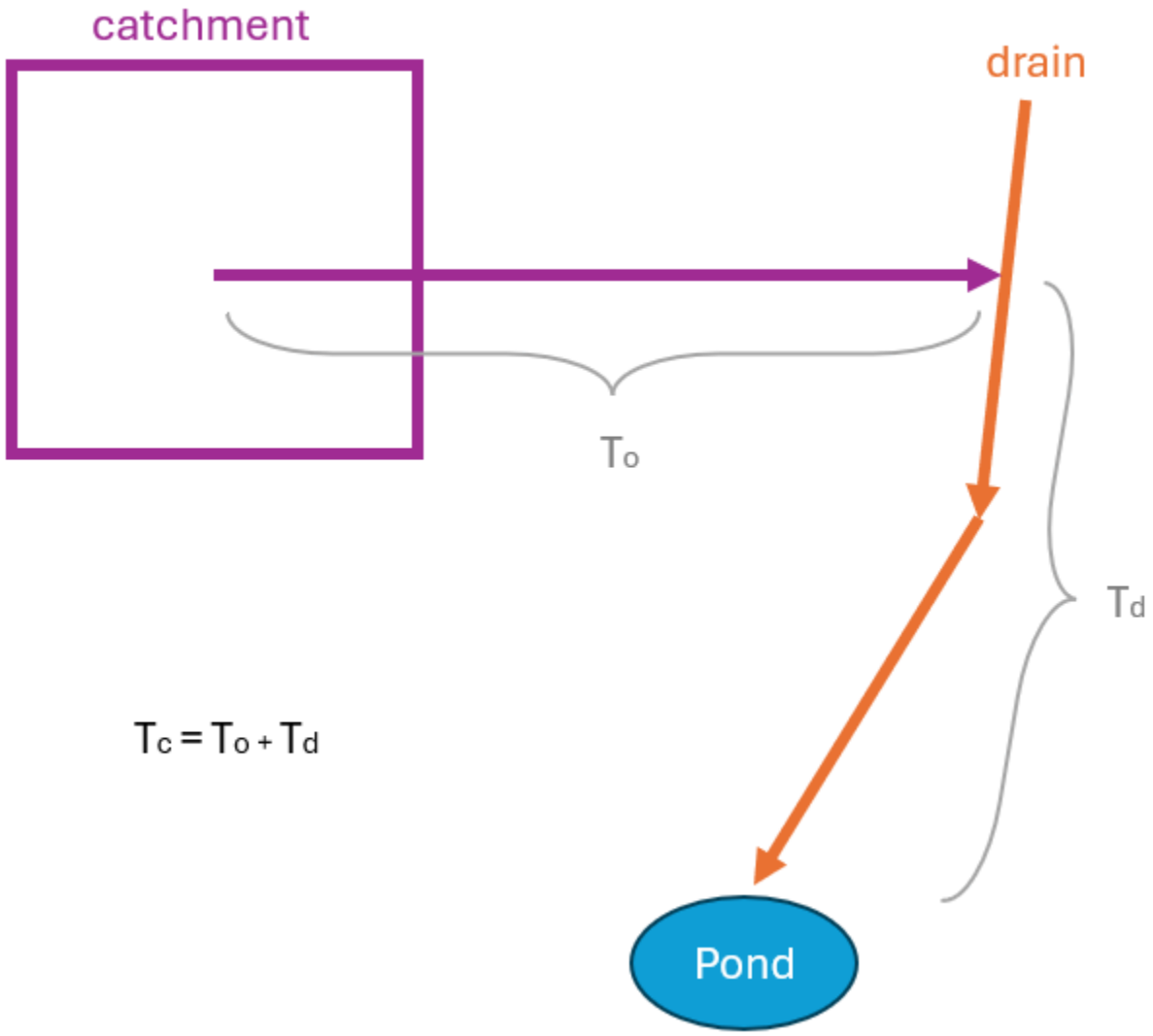
Invert Level (IL) refers to the level of the inner bottom of a drain. In a drain, the IL of the Start Node has to be higher than the IL of the End Node, so that the water can flow properly in the drain to avoid clogging.



Understanding Catchment and Time of Concentration (Tc) calculation

We have a drain, catchment and pond referring to the image below. Water will flow from the catchment to the drain and eventually to a pond. Catchment is the area that catches rain and we can assign catchment to drain, indicating that the water will flow into the particular drain.

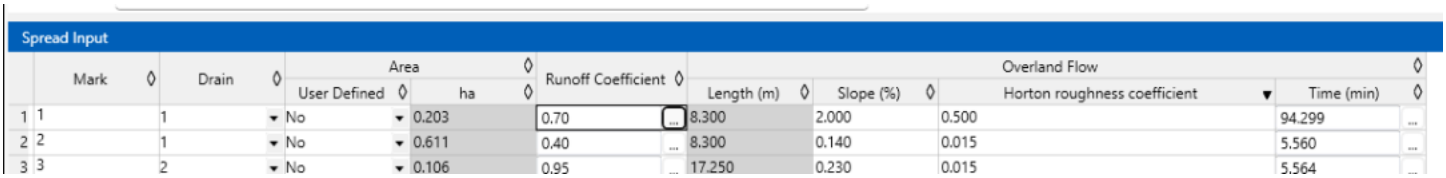
Tc = Td + To : Tc is the Time of Concentration, Td is the Drain Time, To is the Overland Flow Time.



Each catchment has a sloping value, so that water (which is usually referred as runoff) can flow. Realistically, slope should be a valid number. If the slope is infinite (conceptually vertical), that means To is equal to 0 and Tc=Td (water goes straight into the drain without spending a single second on the catchment). In this case, all runoff from the catchment contributes to the flow, and the discharge is calculated as, Q=CIA/360.

If the slope is 0 (it is flat), that means the water from the catchment is not going into the drain. So, the catchment shouldn't contribute to the flow and it shall be excluded from the Tc calculation.

Overland Flow Time (To) belongs to each catchment, and Td belongs to each drain. Below are the example properties of each catchment from MiTS.



Spread Input

	Mark	Drain	Area		Runoff Coefficient	Overland Flow			
			User Defined	ha		Length (m)	Slope (%)	Horton roughness coefficient	Time (min)
1	1	1	No	0.203	0.70	8.300	2.000	0.500	94.299
2	2	1	No	0.611	0.40	8.300	0.140	0.015	5.560
3	3	2	No	0.106	0.95	17.250	0.230	0.015	5.564

Each catchment can have Slope, Area, Runoff Coefficient and Time. Time is calculated from Slope and Horton Roughness Coefficient, but it can also be customized.

Tc of drain is equal to To plus Td and if a drain is attached to two catchments, the greater value will be considered for the To. Referring to the image above as an example, if the first two catchments are attached to "Drain1", then "Drain1" will consider 94.299 instead of 5.560 as the To.

If the subsequent "Drain2" (on the downstream of Drain1) is attached to any catchment, it will use To that is greater between previous Tc or To of current catchment. Below is the example calculation.

Catchment	Drain	T_d	Area	Coefficient	T_o	Slope
1	D1	0.770	0.275	0.3	20.850	
2			0.327	0.3	0 (Old)	Negative
-	D2	0.981	-	-	-	-
3	D3	0.970	0.120	0.3	24.648	
4	D4	1.054	0.124	0.3	24.830	
5			0.053	0.3	24.534	

Tc and Flow Calculation

Drain	Tc	**Flow = CIA / 360** **CIA is (Sum of CA)** x **I** * C is Coefficient, A is Area, I is Intensity **Then add the previous Flow**
D1	Tc = Max (To of C1, To of C2) + Td = Max (20.850, 0) + 0.770 = 21.620	[(0.3 x 0.275) + (0.3 x 0.327)] x 151.75 / 360 = 0.076
D2	Tc = Max (To, Previous Tc) + Td = Max (0, 21.620) + 0.981 = 22.601	(0) x 147.78 / 360 + 0.076 = 0.076
D3	Tc = Max (To, Previous Tc) + Td = Max (24.648, 22.601) + 0.970 = 25.618	(0.3 x 0.120) x 136.92 / 360 + 0.076 = 0.090
D4	Tc = Max (To, Previous Tc) + Td = Max (24.830, 25.618) + 1.054 = 26.672	[(0.3 x 0.124) + (0.3 x 0.053)] x 133.54 / 360 + 0.090 = 0.110

Related



Ngu Soon Hui

I'm the Benevolent Dictator for Life for MiTS Software cum Editor of this website. Read more here.

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