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| Tunnel Builder |
| Help Manual |

2.4.1

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Tunnel Builder

Tunnel Builder is a Rhino plugin purposely developed to facilitate modelling tunnel/underground excavations. The impetus of the plugin was to automate some of the pre-processing tasks for FLAC3D modelling. However, many commands have been implemented since. Hence, this document is created to detail the plugin and all the commands.

1. Version Control

Both this document and the plugin are version controlled (which means they will be updated from time to time to incorporate new functions and bug fixes). The user is encouraged to install the latest version of the plugin from [Public Drive](file:///\\VAS-PSM-FS\Public\Technical\Software_Engineering\Rhino\Rhino%206\Plugins\TunnelBuilder\TunnelBuilder\bin\Release\).

1. Installation and Update
   1. Installation

The easiest way to install the plugin is to double-click “TunnelBuilder.rhi” located in this [folder](file:///\\VAS-PSM-FS\Public\Technical\Software_Engineering\Rhino\Rhino%206\Plugins\TunnelBuilder\TunnelBuilder\bin\Release\) (W:\Technical\Software\_Engineering\Rhino\Rhino 6\Plugins\TunnelBuilder\TunnelBuilder\bin\Release). This plugin requires Rhino 6.17 or above, so please update Rhino (Help->Check for Updates) to the latest version before attempting to install.

To confirm the plugin has been successfully installed, type *PluginManager* in to the Rhino command bar. TunnelBuilder should show up in the installed plugins, make sure the *Enabled* checkbox is checked.

A screenshot of a social media post

Description automatically generated

Figure 1: Verify TunnelBuilder is enabled and loaded in the Rhino Plugin Manager.

* 1. Updates

The plugin will automatically check for updates every time Rhino starts. Please make sure the computer is connected to PSM network if you want the auto update function works correctly. Otherwise, users can always go to the folder mentioned in 2.1 to manually update the plugin.

1. Commands
   1. Tunnels
      1. BuildTunnel

Extrude tunnel profiles along a control line.

Inputs:

* 1. Supports
  2. Geology
  3. Miscellaneous

Table - Table caption sample

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1. Table Notes
2. Background Knowledge
   1. Setout

‘*PlaceTunnelProfiles*’ and ‘*GenerateProfilesFromSetoutTable*’ commands follow the conventions set out (pardon the pun) by the Rozelle Interchange Design Drawings.

* + 1. Chainage

Chainage is defined as the 2D offset on the control line from a given point.

* + 1. Cross Section Geometry

Two types of tunnel shape geometries are supported by TunnelBuilder:

* Double Radii Geometry (Figure 2)
* Single Radius Geometry (Figure 3)

A picture containing sky, map, text, boat

Description automatically generated

Figure : Double Radii Geometry

A picture containing sky, map, boat, man

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Figure : Single Radius Geometry

The geometry for an arbitrary cross section can be specified by a set of set-out parameters, namely:

* : The width of the C-Line
* : The horizontal distance between tunnel centre line and control line (+ve: control line is on the right hand side of the centre line, -ve: control line is on the left hand side of the centre line)
* : The horizontal distance between minor arc set out point (SOP) and tunnel centre line
* : The vertical distance between the crown of the major arc and major arc set out point (SOP).
* : The vertical distance between minor arc working point (WP) and major arc set out point.
* :The vertical distance between minor arc set out point and major arc set out point.
* : The vertical distance between the control level and major arc set out point (+ve: control level is above the SOP, -ve: control level is below the SOP).
* : The vertical distance between the control level and bottom left point of the tunnel invert (+ve: invert is above the control level, -ve: invert is below the control level).
* : The vertical distance between the control level and bottom right point of the tunnel invert (+ve: invert is above the control level, -ve: invert is below the control level).
  + 1. 3D Setout Conventions

The local Cartesian set out coordinate system (i.e. Setout Plane) is assumed to be vertical (i.e. dips 90 degrees) and has a normal vector that is pointing to the tangent vector of the control line.

Note: The set-out coordinate system is a left-handed coordinate system (Figure 4 (a)). In Rhino, the default coordinate system is right-handed (Figure 4 (b)), that is why the ‘flip’ should be checked for ‘*PlaceTunnelProfiles*’ command.

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| https://www.evl.uic.edu/ralph/508S98/gif/lefty.gif | https://www.evl.uic.edu/ralph/508S98/gif/righty.gif |
| (a) | (b) |

Figure : (a): Left-handed coordinate system used by setout plane and (b): right-handed coordinate system used by Rhino[[1]](#footnote-1).

For and on behalf of

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1. <https://www.evl.uic.edu/ralph/508S98/coordinates.html> [↑](#footnote-ref-1)