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Designer User Manual

Table of contents

1. [Before You Begin](#)
 - 1.1 [Introduction to Paramics](#)
 - 1.2 [Designer Functionality & Use](#)
 - 1.3 [PMX Model File Format Conventions](#)
2. [Main Window](#)
 - 2.1 [Main Window](#)
 - 2.2 [Display](#)
 - 2.3 [Left Mouse Button](#)
 - 2.4 [Middle Mouse Button](#)
 - 2.5 [Right Mouse Button](#)
3. [Side Control Window](#)
 - 3.1 [Side Control Window](#)
 - 3.2 [Position Controls](#)
 - 3.3 [Apply To](#)
 - 3.4 [XYZ Translation](#)
 - 3.5 [XYZ Limits](#)
 - 3.6 [XYZ Scale](#)
 - 3.7 [XYZ Rotation](#)
 - 3.8 [Material Controls](#)
 - 3.9 [Materials](#)
 - 3.10 [Colours](#)
 - 3.11 [Textures](#)
 - 3.12 [Object Controls](#)
 - 3.13 [Display Controls](#)
 - 3.14 [Units](#)
 - 3.15 [Background](#)
 - 3.16 [Grid](#)
 - 3.17 [Base Plane](#)
 - 3.18 [Target Area](#)
 - 3.19 [Axis](#)
 - 3.20 [Render Controls](#)
 - 3.21 [Lighting Detail](#)
 - 3.22 [Lights](#)
 - 3.23 [Culling](#)

4. [File Menu](#)

4.1 [File Menu](#)

4.2 [Open](#)

4.3 [Import](#)

4.4 [Reload](#)

4.5 [Save](#)

4.6 [Save As](#)

4.7 [Print](#)

4.8 [Print to File](#)

4.9 [Recent Files](#)

4.10 [Exit](#)

5. [Draw Options](#)

5.1 [Draw Options](#)

5.2 [3D](#)

5.3 [Front](#)

5.4 [Rear](#)

5.5 [Left](#)

5.6 [Right](#)

5.7 [Top](#)

5.8 [Bottom](#)

5.9 [Textured](#)

5.10 [Solid](#)

5.11 [Mesh](#)

5.12 [Points](#)

5.13 [Low Light Quality](#)

5.14 [Medium Light Quality](#)

5.15 [High Light Quality](#)

6. [How To](#)

6.1 [How To](#)

6.2 [Import Model](#)

6.3 [Align Model](#)

6.4 [Save Model](#)

1. Before You Begin

1.1 Introduction to Paramics

Paramics is a suite of high performance software tools used to model the movement and behaviour of individual vehicles on urban and highway road networks. The core Paramics tool set consists of Paramics Modeller, Paramics Processor, and Paramics Analyser. The background description of these modules is given below.

Paramics Modeller provides network build, simulation, and visualisation via a graphical user interface (GUI). Geographic and travel data is input to the program which then simulates the lane changing, gap acceptance and car following behaviour for each vehicle. Modeller also provides a statistical output capability. This basic module therefore allows users to study the performance of their network and to obtain the information required to carry out standard transportation studies.

Paramics Analyser reads output from the Paramics Modeller simulation and provides a GUI to select results for visualisation and easy comparison with observed data. Analyser is used to contrast and analyse different test results. This visual interface to model statistics gives the user a clear representation and understanding of output such as Level of Service, queue lengths, turning and link flows etc.

Paramics Processor sets up and runs the traffic simulation in batch mode without visualising the network and vehicles through the GUI. This procedure is used once the model build is complete, to set sensitivity parameters and then collect sets of model results. Running the model without visualising through the GUI, dramatically increases the simulation speed thereby making the statistical collection phase more efficient.

A number of additional models are provided including:

- Programmer: the developer API
- Monitor: the pollution interface
- Estimator: the OD estimation tool
- Designer: the 3D model-building tool

[\[TOP\]](#)

1.2 Designer Functionality & Use

Designer is a model conversion and editing tool for converting 3D Studio format model files (3DS) into Paramics model format files (PMX). PMX files are an in-house model file format for use by the Paramics suite of software tools. PMX files are a compact and efficient model format developed to provide Paramics customers with a means of adding large numbers of detailed 3D models to their networks with minimal work or reduction in performance.

In order to use a PMX model in a Paramics application a 3DS file must be imported into Designer and then saved to PMX format. The PMX format does not support all of the features of the 3DS format and is not intended to do so. Unlike 3DS files which can have multiple files for the model and its textures, PMX files store all data in a single file.

3D computer rendering is a complex subject and the aim of Designer is to allow the user to import 3DS models created elsewhere and perform a minimum of editing in order to convert these models to the PMX format. Some standard 3D model terminology will be used within this document but the aim is to provide the user with an application that can be used with little or no previous knowledge of 3D computer graphics design.

[\[TOP\]](#)

1.3 PMX Model File Format Conventions

Models are stored in files that describe the physical appearance of a solid shape. A model is built up of one or more objects and one or more materials. Each object is allocated a material but a material may be used by more than one object.

Objects are built up of vertices and faces. Vertices are points in 3D space and faces are triangles formed by a single plane joining three vertices. The outside surface of each object is made up of connected triangle faces.

Materials are defined by a list of colours describing how the material looks under differing lighting conditions. Materials can also have textures which are pre drawn patterns painted onto the surface of the object.

The appearance of an object material is dependant on the light illuminating the model. Lighting can vary from a single ambient light source to multiple lights producing shadows and highlights.

PMX models use a positioning convention to ensure that all models are correctly aligned. It is defined that the positive direction of the z-axis points up and the positive x-axis point forward. The ground, which can be marked with a base plane, is situated along the axis where $z=0$. When viewed from a Top view models should be in the centre of the screen and facing to the right.

[\[TOP\]](#)

2. Main Window

2.1 Main Window

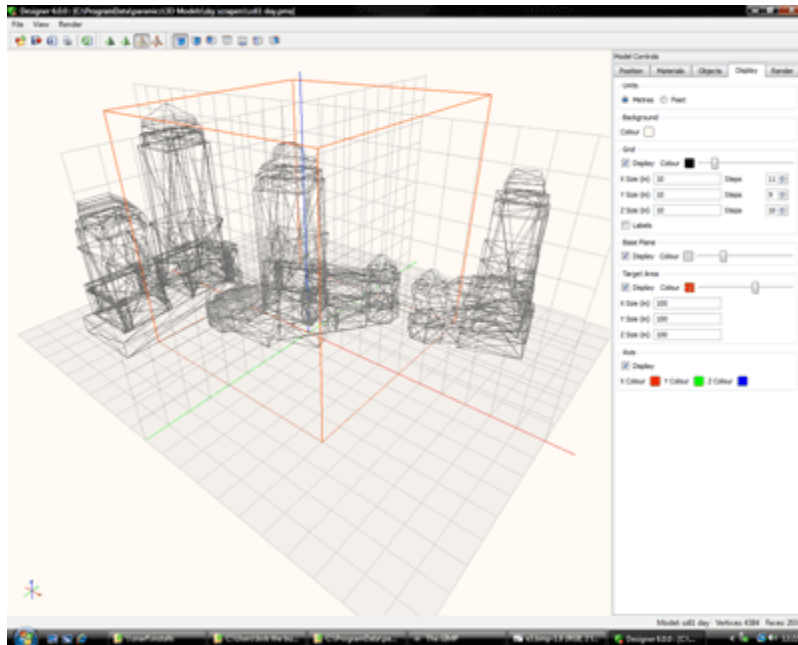


Figure 1 : Designer displaying a model in the main view window.

[TOP](#)

2.2 Display

The main display window shows the currently loaded model drawn in the style selected by the user.

In order to keep model presentation simple and intuitive the main window is kept as clear as possible. The model is displayed in the centre of the view window. If an imported model is not in the centre of the screen it should be repositioned. This may be required as publicly available 3D Studio models are rarely aligned or scaled to standard values by the original graphic artists.

Additional display components are provided to allow the user to accurately align and scale models.

Models can be displayed in a variety of styles, positions and light settings allowing the user to see how the model will look when in use.

[TOP](#)

2.3 Left Mouse Button

By dragging the view window with the left mouse button the view position can be rotated around the model. The model will move and rotate as if grabbed by the mouse pointer allowing the model to be rotated to any orientation. This option is only available when in 3D view mode.

[TOP](#)

2.4 Middle Mouse Button

By dragging the view window up or down with the middle mouse button the view window can be zoomed out or in respectively.

[\[TOP\]](#)

2.5 Right Mouse Button

Clicking the right mouse button pops up a small sub menu giving quick access to the commands of the View and Render Menus.

[\[TOP\]](#)

3. Side Control Window

3.1 Side Control Window

Model editing is performed through the side control window, a multi-panelled dialog window, which can be undocked from the main window and positioned anywhere on screen.

The commands are split into groups and positioned on separate panels selected by a row of tabs. Within each panel controls are further divided into sub groups of related commands.

[\[TOP\]](#)

3.2 Position Controls

When first imported models are rarely aligned in a way that will produce the results desired. Depending on the conventions used by the original model designer models may be too big, too small, facing in the wrong direction or not correctly positioned at the axis origin.

Position controls perform the desired translations, scales and rotations needed to correctly align models.

[\[TOP\]](#)

3.3 Apply To

A three state button that sets which parts of the model will be altered by any changes.

- **Model** : Apply all changes to the entire model;
- **Objects** : Apply changes only to selected objects highlighted in the Objects panel; and
- **Materials** : Apply changes only to the selected material highlighted in the Materials panel.

[\[TOP\]](#)

3.4 XYZ Translation

Move the selected elements of the model the distance given in the respective edit boxes. The model is moved directly by the amount given along the axis selected. Two buttons are provided for each axis allowing movement in either direction for each of the three axis.

[\[TOP\]](#)

3.5 XYZ Limits

Move the model to fit a desired position. Similar to Translation but the distance offset is calculated internally based on the desired new position and the structure and size of the model. The three buttons under Axis allow the user to select which axis the desired changes will take effect on.

- **Maximum:** The model is moved so that it lies to one side of the centre of the screen;
- **Average:** The model is moved so that the centre of the model is positioned in the centre of the screen; and
- **Minimum:** The model is moved so that it lies just to one side of the centre of the screen, in the opposite direction to Maximum.

[\[TOP\]](#)

3.6 XYZ Scale

Scale the model by the amount in the selected edit box. Three edit fields, each with a pair of buttons, give the user the option to scale the model by the ratio given. The two buttons for each ratio divide and multiply the scale respectively:

- **Apply All:** Checking forces each scaling operation to take effect on all three axis together;
- **Fit Target:** Similar to a scaling operation but the model is scaled to fit the target area displayed in the main view window; and
- **Apply All:** Checking forces fit target operations to be performed on all three axis together.

[\[TOP\]](#)

3.7 XYZ Rotation

Rotate the model around the selected axis by the distance given in the edit box.

Three edit fields, each with two buttons, rotate the model by the given angle in degrees. The model is rotated about the axis origin in the centre of the screen.

[\[TOP\]](#)

3.8 Material Controls

This panel provides commands to edit or delete materials within a model. When imported some materials may not be used or it may be necessary to alter the appearance of a material to get the desired effect.

[\[TOP\]](#)

3.9 Materials

A full list of all materials in the model is displayed. Highlighting an item in this list box selected this material for editing:

- **Name:** The material name can be edited. This does not affect the appearance of the model but may be useful when converting models with confusing material names;
- **Delete:** Remove the material and reassign any object that previously used this material; and
- **Mark Selected:** Checking alters the main view window so that all objects made up of the selected material are drawn and everything else is drawn semi transparent.

[\[TOP\]](#)

3.10 Colours

Four colour buttons are provided to change the colour properties of the material. When pressed a colour select dialog appears and allows the user to select the desired colour for this property.

Material appearance is a combination of these four colours. The final colour is calculated from these four material colours and the light illuminating the object:

- **Ambient:** The colour of the material when viewed under unfocussed white light. This represents the colour under soft background lighting;
- **Diffuse:** The colour of the material when viewed under a soft directed white light. This is the most general colour of the material;
- **Emissive:** The colour the material emits regardless of the lighting conditions. Unless there is a specific reason this should be left black;
- **Specular:** The colour of the specular highlights when under a directed sharp light. When a focussed light shines on a material it may reflect highlights on some of the surface. The specular component sets the desired colour and intensity of these highlights;
- **Shininess:** Specular lighting effects have a shininess rating to describe the level to which highlights are spread over the surface of the object or focussed on a small spot; and
- **Transparency:** Materials do not have to be opaque and can have a level of transparency. This option must be selected with a check box as transparency effects can reduce drawing speed significantly.

[\[TOP\]](#)

3.11 Textures

Some materials have a texture applied to their surface. Any material with a texture can have it altered to another image file.:

- **Texture Button:** If a material has a texture it will be displayed on a large button inside the texture group border. Pressing this button opens a file dialog that allows the user to select a new texture image file for the material. Setting a texture also requires several other internal models values to be set which is outside the scope of Designer. It is recommended that textures are changed only to similarly laid out textures or the final effect may not be exactly what is desired; and
- **Set Mask:** Textures can have a degree of transparency about them. Semi-transparent textures require a masking image to be supplied. A mask is an image similar to the texture image but in black and white to mark out which parts are opaque and which are transparent. It is recommended this option is only used when models are supplied with textures and the corresponding masks pre drawn.

[\[TOP\]](#)

3.12 Object Controls

This panel provides commands to edit or delete the objects within a model. When imported some objects may not be used or it may be necessary to alter the material assigned to the object.

A full list of all objects in the model is displayed. Selecting an item in this list will selected this object for editing:

- **Selection:** Sets whether a single or multiple objects can be selected. Multiple objects are selected by holding down shift or ctrl when selecting with the mouse;
- **Name:** The object name can be edited. This does not effect the appearance of the model but may be useful when converting models with confusing object names;
- **Delete:** Remove the object from the model; and
- **Mark Selected:** Checking alters the main view window so that all selected objects are drawn normally and everything else is draw semi-transparent.

[\[TOP\]](#)

3.13 Display Controls

A selection of additional controls is provided to aid the user in positioning end editing models.

[\[TOP\]](#)

3.14 Units

Set the units between Metres and Feet.

All sizes displayed in edit fields, on screen or used for positioning the model are in the selected unit size.

[\[TOP\]](#)

3.15 Background

A colour button allows the user to change the background colour of the main view window.

[\[TOP\]](#)

3.16 Grid

Sets a 3D grid along all three axis above the ground level with the given colour, transparency, step size and number of marked steps. Checking the draw labels box displays a text scale along the edge of the grid in the currently selected units.

[\[TOP\]](#)

3.17 Base Plane

Sets a flat base plane along the ground level of the model. The base plane has a colour and a transparency. The area is defined the the x and y ranges of the grid.

[\[TOP\]](#)

3.18 Target Area

The target area is a bounding box draw around the central base point of the model. The user selects a colour and the range along all three axis. This target bounding box is used by the XYZ scale commands in the Position panel.

[\[TOP\]](#)

3.19 Axis

Draw the three axis (x,y,z). Three colours buttons allow the colours for each axis to be selected separately. The axis will cross in the centre of the main window.

[\[TOP\]](#)

3.20 Render Controls

The Render panel provides ways to improve the drawing speed of models. By altering the level of detail and the number of model faces that will be drawn it is possible to alter greatly the drawing speed and quality.

[\[TOP\]](#)

3.21 Lighting Detail

Sets the level of lighting detail to be used when displaying the model in the main view window. This is for display purposes when editing as PMX model used in Paramics applications are drawn using all three lighting details depending on their distance to the viewer.

The greater the lighting detail the longer it will take to draw the model:

- **Low Lighting Quality:** Draws the model with no lighting effects at all. The model is drawn as if surrounded but a uniform unfocussed white light. A slider is provided as an additional control to darken or lighten the model. Low level will be used when models are in the far distance;
- **Medium Lighting Quality:** Draws the model with some lighting effects but ignoring specular highlights. Lighting is calculated in advance based on the number and position of the lights illuminating the model. Medium level will be used when drawing models in the middle distance; and
- **High Lighting Quality:** Draws the model with all lighting effects enabled. The lighting effects are calculated in real time and so give the best quality display. High level will be used for models very close to the viewer.

If a model has no lights set then it will always be drawn in low lighting quality in other Paramics applications.

[\[TOP\]](#)

3.22 Lights

Up to eight different lights can be used on the model and each given their own position and intensity:

- **Lights:** The light positions can be selected from a list of fourteen predefined placements evenly spread around the model and the intensities are set by sliders. All lights are white in colour and are drawn a distance away pointed at the centre of the model; and
- **Apply All:** Checking forces all changes to a light intensity slider to be replicated to all other lights in use.

[\[TOP\]](#)

3.23 Culling

When drawing a face on screen the three vertices will be positioned in either a clockwise or counter clockwise order when seen by the viewer. If all the faces have been correctly arranged in the original model it may be possible to draw only faces which are aligned in one of these two directions. This can improve the speed of drawing greatly by ignoring faces which are facing away from the viewer. By selecting one of these options the model is drawn with incorrectly aligned faces ignored.

Selecting None will always draw the model correctly and only one of Clockwise or Counter Clockwise will have the desired effect. If the faces have not been correctly aligned None should be selected and the performance boost from Culling will not be available.

If a culling option is selected and the faces are not correctly aligned it will be immediately obvious from the main view window as parts of the model will be invisible or appear to be drawn inside out.

[TOP](#)

4. File Menu

4.1 File Menu

A standard drop down File Menu provides file access and printing.

[\[TOP\]](#)

4.2 Open

A file open dialog allows the user to select a PMX model file that is then loaded and displayed on screen in the main viewer window.

[\[TOP\]](#)

4.3 Import

A file open dialog allows the user to select a 3DS model file that is then loaded, converted into a PMX model and displayed on screen in the main viewer window.

[\[TOP\]](#)

4.4 Reload

The currently loaded model is reloaded from file and any changes made so far since the last file save are lost.

[\[TOP\]](#)

4.5 Save

The currently loaded model is saved to the file it was loaded from. If the file was imported rather than loaded the a save as will be performed instead.

[\[TOP\]](#)

4.6 Save As

A file save dialog allows the user to select the output file PMX model will be save to.

[\[TOP\]](#)

4.7 Print

The contents of the main view window only will be printed to the selected printer.

[TOP](#)

4.8 Print to File

A file dialog allows the user to select the name of a JPG image file where a copy of the contents of the main view window will be saved.

[TOP](#)

4.9 Recent Files

Shortcuts for the 4 most recently viewed files are provided in a menu.

[TOP](#)

4.10 Exit

Exit the application, allowing the user to save any changes to the current model.

[TOP](#)

5. Draw Options

5.1 Draw Options

A range of draw options are provided to alter the display settings for models. These values can be set from the View Menu, Render Menu, Tool Bar or using the Right Mouse Button in the main display window.

Draw options do not alter the actual model but are provided so the user can view the model under a range of settings that will be used within other Paramics applications.

[\[TOP\]](#)

5.2 3D

The model is drawn with full perspective and the user is free to rotate the view point around the model with the mouse.

[\[TOP\]](#)

5.3 Front

View the model from a fixed position looking along the x-axis in the direction of $-x$.

[\[TOP\]](#)

5.4 Rear

View the model from a fixed position looking along the x-axis in the direction of $+x$.

[\[TOP\]](#)

5.5 Left

View the model from a fixed position looking along the y-axis in the direction of $-y$.

[\[TOP\]](#)

5.6 Right

View the model from a fixed position looking along the y-axis in the direction of $+y$.

[\[TOP\]](#)

5.7 Top

View the model from a fixed position looking along the z-axis in the direction of $-z$.

[TOP](#)

5.8 Bottom

View the model from a fixed position looking along the z-axis in the direction of +z.

[TOP](#)

5.9 Textured

Draw the model complete with all valid textures.

[TOP](#)

5.10 Solid

Draw the model complete but ignoring all textures.

[TOP](#)

5.11 Mesh

Draw the model as a wire frame outline. The surfaces of the model will be drawn as a collection of wire frame triangles outlining the object faces.

[TOP](#)

5.12 Points

Draw only the model vertices as single points.

[TOP](#)

5.13 Low Light Quality

Draw the model using low light quality.

[TOP](#)

5.14 Medium Light Quality

Draw the model using medium light quality.

[TOP](#)

5.15 High Light Quality

Draw the model using high light quality.

[TOP](#)

6. How To

6.1 How To

In order to understand the processes involved in converting a model the following steps explain the stages. This run through will only deal with the basics of converting a model and correctly positioning it. It does not deal with the more complex commands.

[\[TOP\]](#)

6.2 Import Model

- With the side control panel Display Controls switch on and adjust which on screen controls are required. It is recommend that the axis be switched on at all times. The base plane and target area will also be used in this example;
- Select import model either from the File Menu or the Tool Bar; and
- Select the desired model to be imported using the file open dialog.

[\[TOP\]](#)

6.3 Align Model

If the model cannot be seen on screen it is either too small or too large to be seen. In this case zoom in and out (using the middle mouse button) until the model can be seen;

- Rotate the model to the correct facing with the side control panel Position Controls XYZ Rotation. At this point the model may not be the correct scale or be positioned in the correct place in the centre of the screen. This is not important and will be fixed shortly. The desired alignment is for the model front to be facing along the axis towards the 'x'. The top of the model should be facing along the y axis towards the 'y';
- Position the model using the XYZ Translation controls. Select X-axis in XYZ limits and select Average, the model should move in one direction. Select Y-axis and Average and the model should move in a different direction. Viewed from above the model should now be positioned in the centre of the screen but may be at the wrong height. Select Z-axis and this time select Minimum. The model should now be correctly aligned and positioned. If not it may be necessary to further position the model manually with the XYZ Translation controls;
- Using the side control panel Display Controls switch on and set the target area to the desired size of the model. Only one of the three dimensions is needed; and
- With the Position Controls panel again, select the corresponding Fit Target button and the model will be scaled to fit inside the target area.

[\[TOP\]](#)

6.4 Save Model

- The model should now be correctly aligned and positioned for use within Paramics. The remaining commands in the application can now be used to further edit the model; and
- Save the model to PMX format with File Menu or Tool Bar Save As.

[\[TOP\]](#)