

Blender 2.8 Exporter for MSTS/OR

by

Wayne Campbell

Version 4.3

This is a script addon for the Blender 3D program. Use it to create .S shape files for Microsoft Train Simulator or Open Rails.

This version of the EXPORTER is for BLENDER 2.8 and above
Use V3.5 of the EXPORTER for PRIOR VERSIONS of BLENDER

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CONTACT

I am using the Blender forum at Elvas Tower for support and update announcements

<http://www.elvastower.com/forums/index.php?/forum/399-plugins-exporters-for-3d-modeling-software/>

Or you can reach me directly at:

wayneinbc@gmail.com

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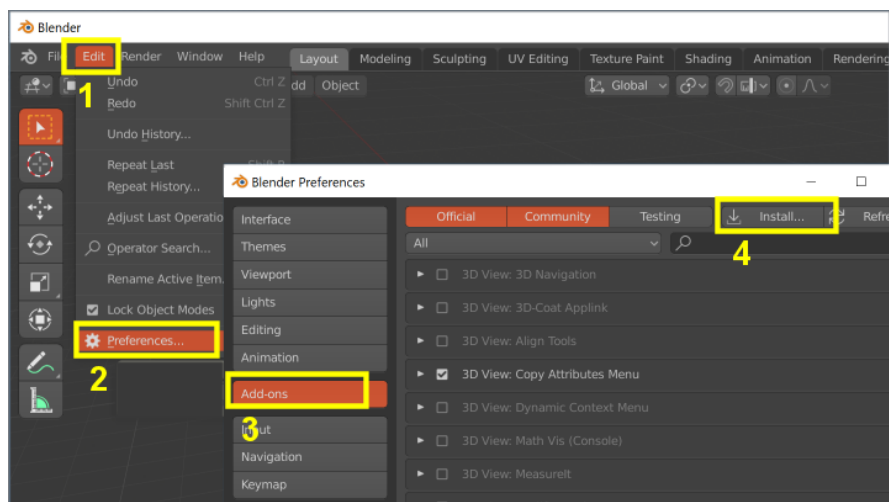
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1. INSTALLATION

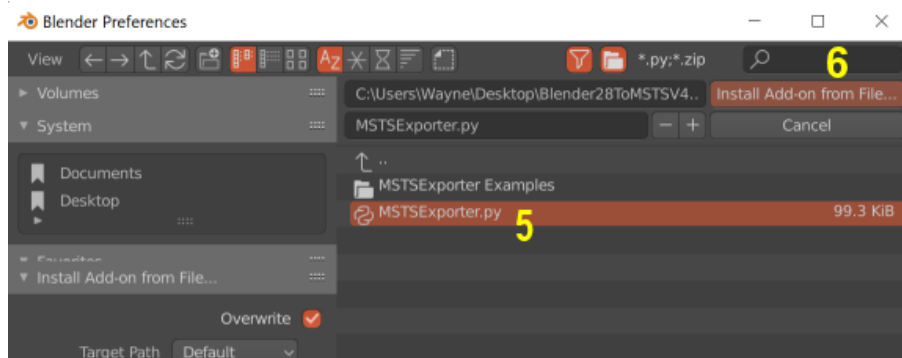
Open the downloaded zip file and drag the contents to your desktop or another convenient folder.

1. Press Edit in the menu bar.
2. Select Preferences
3. Choose the Add-ons tab.
4. Click on Install



Navigate to your desktop or where you extracted the download zip.

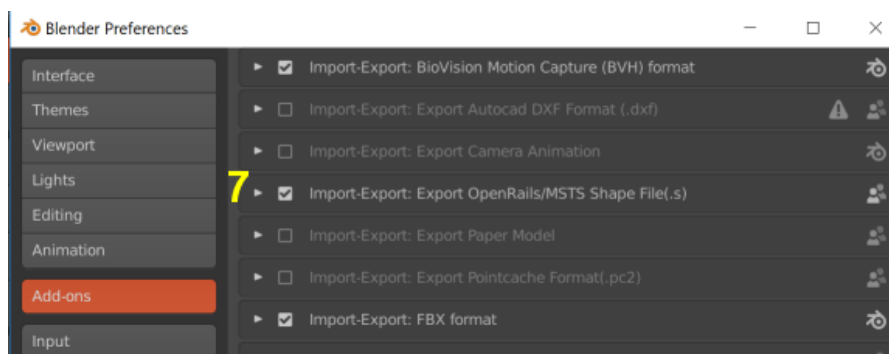
5. Select '*MSTSExporter.py*'
6. Click on 'Install Add-on from File'



Scroll down to the script:

Export OpenRails/MSTS ...

7. Check the box to enable it.



Note: to MANUALLY INSTALL the addon, copy *MSTSExporter.py* to your addons folder, usually located at:

C:\Users\{username}\AppData\Roaming\Blender Foundation\Blender\2.8x\scripts\addons

(where 2.8x represents the current version of Blender)

and RESTART BLENDER.

2. EXAMPLES

Included in the package are:

Building\UnionStop - an example of a simple model that uses two different textures.

Loco\L1 - a more complex example that includes animation and LOD levels.

Tutorial - contains texture file for use in the tutorial section of this document

3. WHAT'S CHANGED WITH THE 2.8 UPGRADE

The exporter now supports Blender 2.8's new Eevee rendering engine and materials.

Unfortunately however Blender has discontinued support for Blender Internal materials and face texture methods. This means that any models originally made in 2.79 must be retextured if they are brought into Blender 2.8.

Another change relates to LODs and part naming. The updated exporter uses Blender's new 'collections' feature to organize the LODs of a model. We no longer have a model named 'MAIN'. Instead we have a collection named MAIN that contains all the parts we want to export. More detail is provided later in the manual. Models originally made in 2.79 must be reorganized into collections when they are brought into Blender 2.8.

The DLEVEL, DMIN, DMAX method of assigning LODS is no longer supported in the exporter.

The Railworks style part naming is no longer supported in the exporter.

The exporter no longer exports particle systems or bezier curves directly. These must be converted to meshes before export.

The exporter is 4 times faster than the previous version (based on exporting L1 example file)

4. OVERVIEW

- look for the export script in Blender's File - Export menu.
- cloned objects and object modifiers are fully supported
- externally linked objects are fully supported
- if an object is not textured in Blender, the default texture, blank.ace, will be applied.

5. OPTIMIZATIONS

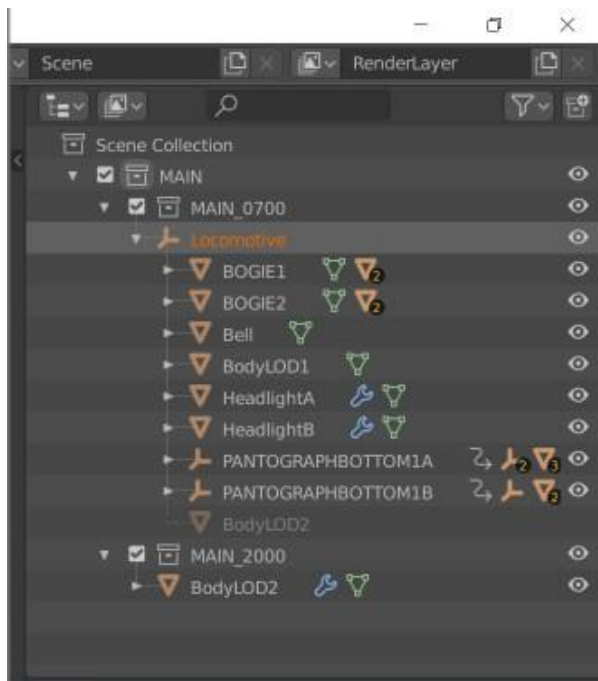
The script includes a number of optimizations for higher frame rates and better GPU and CPU usage including:

- Primitive consolidation which reduces batch calls by consolidating tris from different objects when they use the same material
- Large primitives, vertex_sets, and subobjects are split as needed to prevent them from exceeding MSTs's loading limits.
- Complex hierarchies are simplified and collapsed to prevent exceeding MSTs's hierarchy depth limits and to improve effectiveness of the primitive consolidation. However animated nodes are always retained. This includes ones where you have applied an animation in Blender, as well as the following named parts:

BOGIE1 BOGIE2 WHEELS11 WHEELS12 WHEELS13 WHEELS21 WHEELS22 WHEELS23

You can disable this optimization and force the exporter to retain all part names with an option in the exporter window. See section 8.

6. ARRANGING PARTS AND LODS IN THE OUTLINER



You must have a collection called MAIN in your scene. It must be attached directly to 'Scene Collection'

MAIN contains one or more sub collection for each LOD, in this example, MAIN_0700 and MAIN_2000.

These LOD collections contain all your parts.

You create parts and drag and drop them into whatever LOD you want. You can see in the example there is a BodyLOD1 in MAIN_0700 and a lower res BodyLOD2 in MAIN_2000. Note that BodyLOD2 also appears grayed out in MAIN_0700. This shows you where it is in the Locomotive hierarchy, but grayed out since it isn't part of that LOD collection.

Control what LOD is visible in your viewport with the checkboxes beside each LOD collection. Or you can create Render Layers that show one LOD or the other in a render.

Use standard MSTs part names such as BOGIE1, WHEEL11 for animated parts. (See Section 5 for a list of recognized parts) These key names must be in all capital letters to ensure they are retained in the exported shape file. Use lower case or mixed case names for all other parts.

The exporter supports objects linked to other blend files (File, Link). With the limitation that animation in those linked files will not be exported.

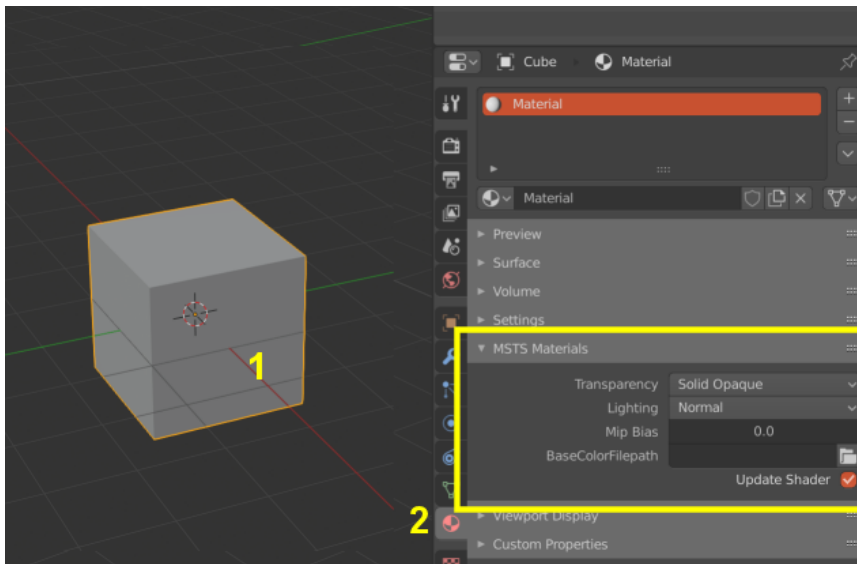
Dragging and dropping in the new outliner takes some learning. If you are moving a part from one LOD collection to another, just drag and drop. If you are moving it to a new level in the hierarchy, drag and Shift drop. If you want a part to be seen further out, add it to more than one LOD using Ctrl drop.

Instead of dragging and dropping, use the M key in the 3D viewport. Select an object, press M, and choose the target LOD collections. Or you can examine LOD collection assignment in the object tab of the properties panel.

TIP - if you use Blender primarily for MSTs models, why not add a MAIN and an empty LOD collection to your startup file then save it as the default with File, Defaults, Save Startup File.

7. MSTS MATERIALS PANEL

To access the panel, select an object (1), choose the materials tab (2), find this panel near the bottom.



Transparency: Controls the effect of the texture's alpha channel

Solid Opaque - Alpha channel is ignored, it has no effect.

Transparency On/Off - Transparent if alpha value below a threshold

Alpha Blended - Alpha value blends from transparent up to opaque

Alpha Sorted - Alpha blending with scene depth sort

Lighting: Selects one of MSTs's special shading modes

Normal - Sun facing surfaces are lit and opposite facing are shaded

Specular 25 - Strong specular highlight

Specular 750 - Small specular highlight

Full Bright - Shaded surfaces appear lit

Half Bright - Shaded surfaces appear partly lit

Dark - Sun facing surfaces appear fully shaded

Cruciform - Indirect ambient lighting only

Emissive - Surfaces emit light at night

MipMapLODBias: Controls sharpness of the applied textures. Values range from -8 to +8. Negative values sharpen the image, but can cause excessive moire patterns. Positive values result in texturing blurring, and less moire.

BaseColorFilepath: Select the texture image (usually a .tga or .bmp file) to apply to the model.

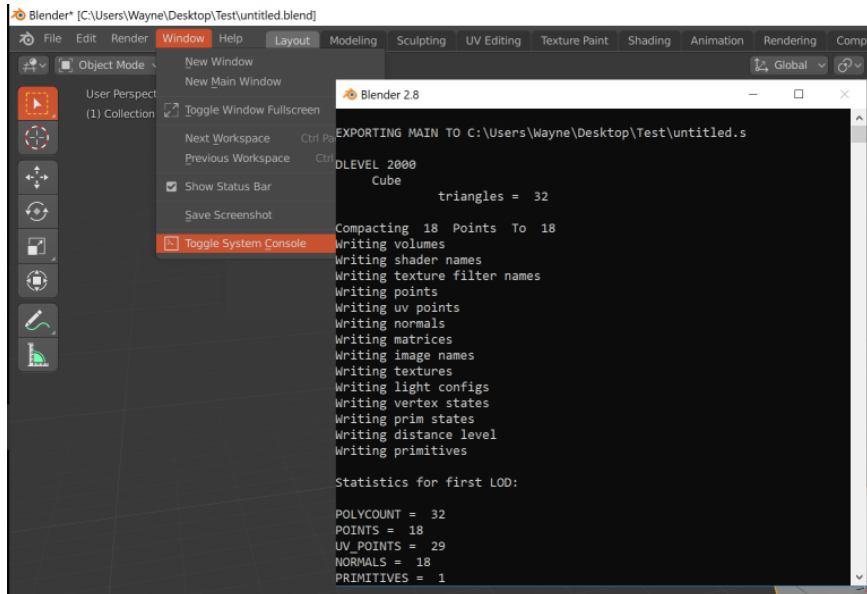
Update Shader: Normally when you change a setting on this panel, the Eevee material is changed to match.

Disable updates if you are an advanced user wanting to make your own custom Eevee shaders.

The Material name isn't used by MSTs or included in the exported .s file.

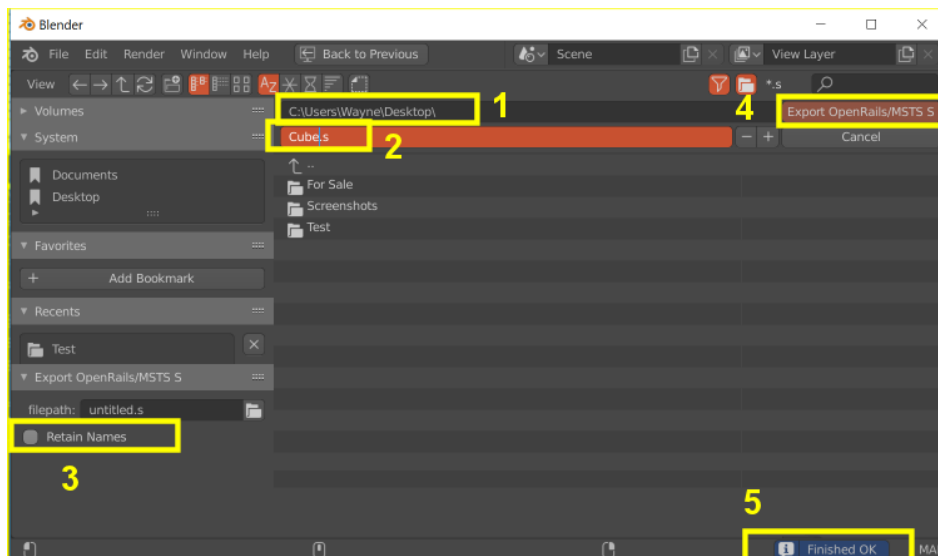
8. FILE EXPORT PANEL

NOTE: There is no progress bar (percent complete etc) so the program may appear to hang when exporting large files. Before you begin the export, toggle ON the system console (under the window menu) to see progress.



ENSURE YOU ARE NOT IN EDIT MODE WHEN YOU EXPORT!

To reach the Export Panel, on the top menu bar choose File, Export, OpenRails/MSTS(.s)

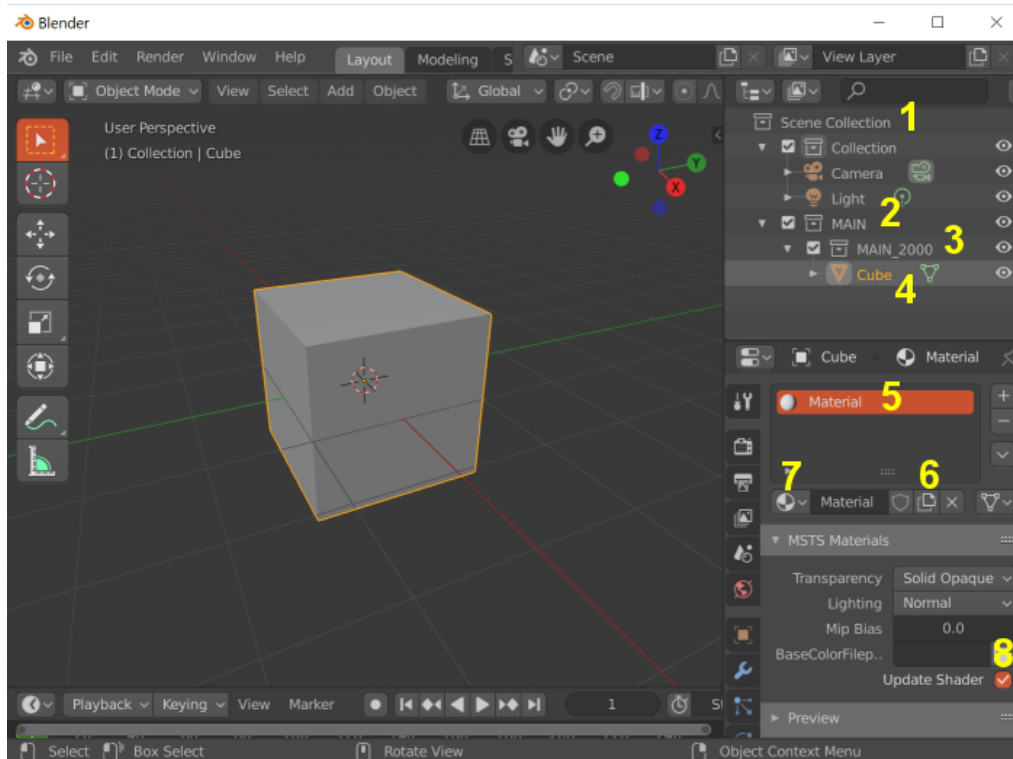


1. Enter the directory that contains your shape files, or use the panel to the left to navigate to a folder.
2. Enter the filename of the exported shape file.
3. RETAIN NAMES - This setting disables most of the optimizations. All object names and hierarchy are retained in the shape file for users wanting better compatibility with external utilities such as Polymaster.
4. Initiate the file export.
5. Results will appear on the status panel at the bottom of the screen.

9. TUTORIAL - EXPORTING A CRATE

This brief tutorial explains how to organize the parts in the outliner and then how to apply a texture to the cube. The final step is to export it to the MSTs .s shape format.

Open Blender to load the default cube.



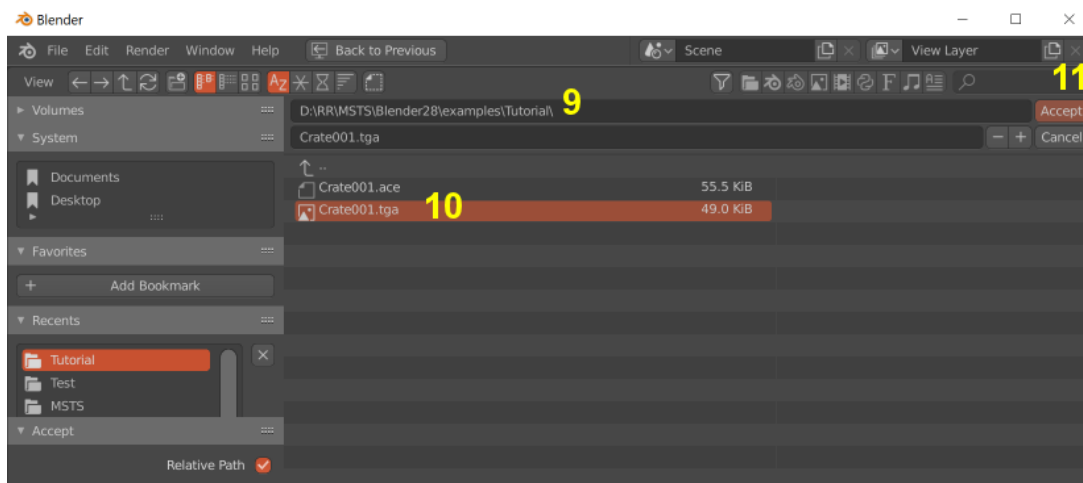
First set up the collection hierarchy.

1. In the outliner, right click on 'Scene Collection' and create a new collection
2. Ctrl click on the new collection and rename it to MAIN
 - right click on MAIN and attach a new collection to it
3. Ctrl click on this one and rename it to MAIN_2000
 - left click (and release) to select the default Cube
4. drag it to the MAIN_2000 collection to assign it to that LOD

Next we will texture the cube to look like a crate.

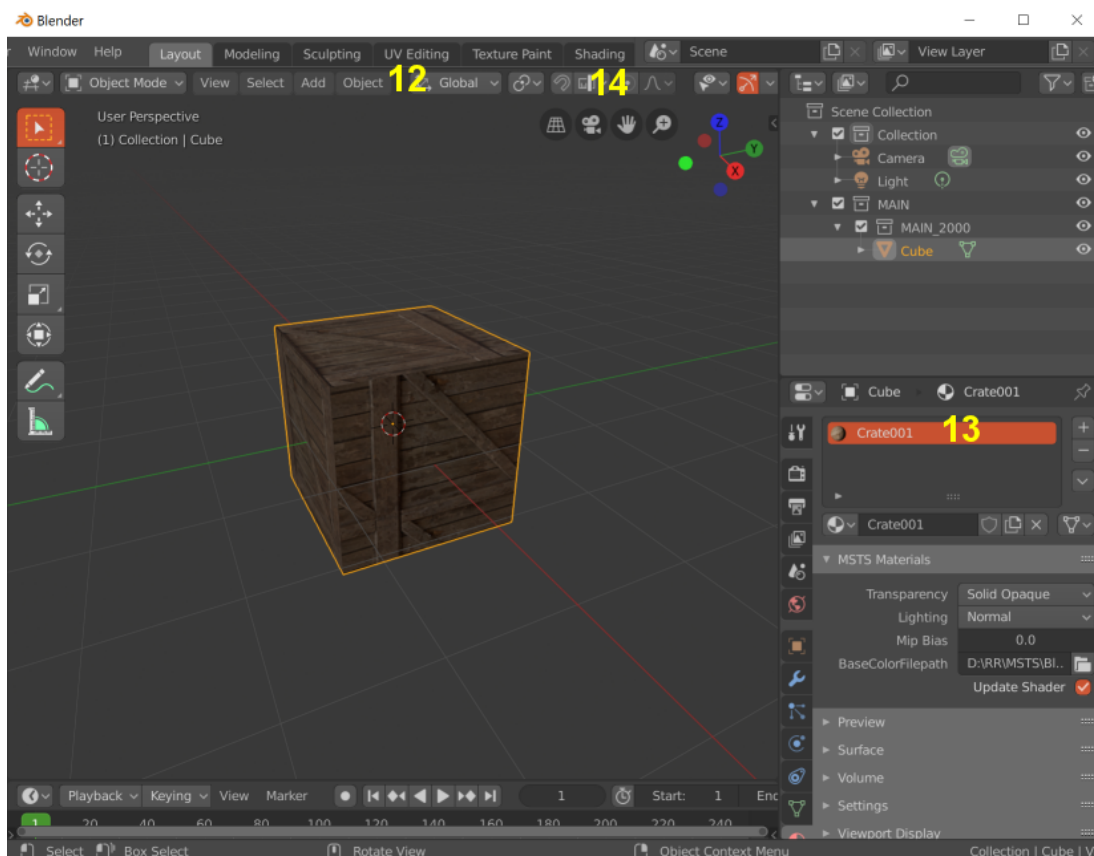
We will use the default material (5) that is already applied to the Cube,
But otherwise you could have created a new material with (6),
or selected from an existing material with (7).

8. Click the file folder icon in the MSTs Materials panel to assign a texture to the default Material



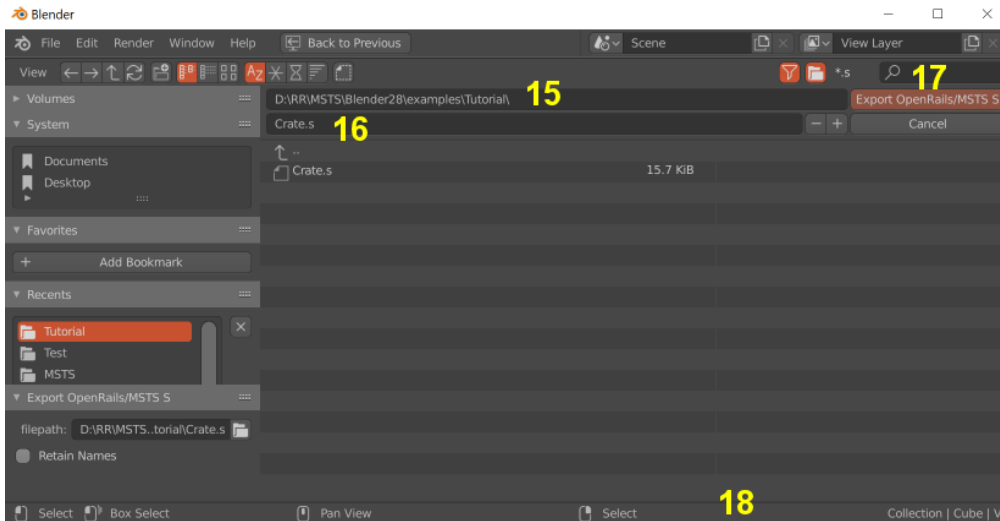
I provided a Crate001.tga texture file in the download package with this script.

9. Enter a path to where you unzipped the Tutorial files or use the shortcuts on the left.
10. Choose the Crate001.tga texture file.
11. Press Accept.



Your cube will be textured. You can use your UV Editing (12) screen to adjust the texture mapping. Notice that the default Material was renamed to Crate001 (13). The MSTs Materials panel will do this so long as there isn't already a material with that name. Also, in the background, the panel has created a full Eevee shader. You can see it on the Shading (14) screen.

Next, open the Export Panel from the top menu bar choose File, Export, OpenRails/MSTS(.s)



15. Enter a path to the Tutorial folder or use the shortcuts on the left.

16. Export as Crate.S

17 Click on Export OpenRails/MSTS.

18. Look for 'Finished OK' in the status bar.

NOTE: The exporter creates the .S file only. All other related files must be created manually by other programs. For example:

- for scenery objects, you must create the .SD file and add an entry to the .REF file.
- for rolling stock you must create the .ENG or .WAG file
- you must convert the texture images to .ACE files and place them in the correct directory.

10. OPTIMIZING MODEL PERFORMANCE

The console window can help with optimizing your model's performance. Modern graphics cards can draw millions of triangles per second using multiple GPU processors. The real limitation usually come in setting up for the draw. Each change of texture image or material settings causes the GPU to halt drawing to reconfigure and restart. A key objective for performance should be to **minimize the number of Draw calls** to the GPU.

At the end of the report (1), it tells you how many triangles are drawn for each LOD level and more importantly how many Draws were issued to the GPU.

To understand what triggers these Draws you can look to the top section of the report.

The Headlight object triggers the first Draw (2) using the L1.ace texture with the material settings shown.

The Bell (3) does not trigger a Draw because it uses the same texture and material as HeadlightB and so it was added to that Draw. Same for HeadlightA. We basically get these parts for free so it should be our objective to **use the same texture and material on as many parts as possible**.

The BodyLOD1 object has some faces textured with 'chainlink.ace'. So this triggered a new Draw for that (4); same for 'diamondplate.ace'.

BodyLOD1 also uses 'L1.ace' So far all of those faces are being added to the previous Draw (2).

But item (5) shows a new Draw set up for 'l1.ace'. This is because these faces have a material transparency set to ALPHA instead of CLIP. That triggers a new Draw for that setup. These are for the windows on the loco, so we will need to keep that extra draw.

The next Draw at (6) uses the same texture and material as the one at (2). So you can assume it was triggered because the first Draw (2) was filled up. MSTs has a maximum number of triangles that it allows in a Draw (MSTs calls it a primitive). So when we reach that limit, the exporter starts a new Draw. That's the same for Draw (7). There is not much we can do to reduce these Draws except to **trim out excess mesh triangles**.

The next Draw (8) is for PANTOGRAPHBOTTOM1B. It uses the same texture and material settings as the previous one at (7), but it can't be added to that Draw because this part is animated. Any animated node triggers a new Draw. That includes both ones animated in Blender, like PANTOGRAPHBOTTOM1B, as well as the automatically animated ones like BOGIEs and WHEELSxx. So it's quite important to **organize your animated parts to use only one texture and material settings per node**, otherwise you could trigger multiple Draws for each animated part.

The second LOD level is shown at (9). It has just a single Draw. There are big performance benefits to **organize your distant LODs to use a single Draw**.

```
EXPORTING MAIN TO D:\RR\MSTS\Blender28\Tests\MSTS\lps-11.s
DLEVEL 700
  HeadlightB
    triangles = 174
    Draw l1.ace CLIP NORMAL MipBias= 0.0 2
  Bell
    triangles = 528 3
  HeadlightA
    triangles = 174
  BodyLOD1
    triangles = 5010
    Draw chainlink.ace CLIP NORMAL MipBias= 0.0 4
    Draw l1.ace ALPHA NORMAL MipBias= 0.0 5
    Draw diamondplate.ace OPAQUE NORMAL MipBias= 0.0 6
    Draw l1.ace CLIP NORMAL MipBias= 0.0 7
  PANTOGRAPHBOTTOM1B
    Mesh.017
      triangles = 128
      Draw l1.ace CLIP NORMAL MipBias= 0.0 8
  PANTOGRAPHMIDDLE1B
    Mesh.018
      triangles = 84
      Draw l1.ace CLIP NORMAL MipBias= 0.0
  PANTOGRAPHBOTTOM1A
    Mesh.014
      triangles = 128
      Draw l1.ace CLIP NORMAL MipBias= 0.0
  PANTOGRAPHMIDDLE1A
    Mesh.015
      triangles = 84
      Draw l1.ace CLIP NORMAL MipBias= 0.0
  PANTOGRAPHTOP1A
    Mesh.016
      triangles = 80
      Draw l1.ace CLIP NORMAL MipBias= 0.0
  BOGIE2
    triangles = 196
    Draw l1.ace CLIP NORMAL MipBias= 0.0
  WHEELS21
    triangles = 248
    Draw l1.ace CLIP NORMAL MipBias= 0.0
  WHEELS22
    triangles = 248
    Draw l1.ace CLIP NORMAL MipBias= 0.0
  BOGIE1
    triangles = 196
    Draw l1.ace CLIP NORMAL MipBias= 0.0
  WHEELS11
    triangles = 248
    Draw l1.ace CLIP NORMAL MipBias= 0.0
  WHEELS12
    triangles = 248
    Draw l1.ace CLIP NORMAL MipBias= 0.0
DLEVEL 2000
  BodyLOD2
    triangles = 48
    Draw l1.ace OPAQUE NORMAL MipBias= 0.0 9
Compacting 9574 Points To 5265
Writing volumes
Writing shader names
Writing texture filter names
Writing points
Writing uv points
Writing normals
Writing matrices
Writing image names
Writing textures
Writing light configs
Writing vertex states
Writing prim states
Writing distance level
Writing primitives
Writing primitives
Writing primitives
Writing primitives
Writing primitives
Writing primitives
Writing primitives
Writing primitives
Writing primitives
Writing primitives
Writing distance level
Writing primitives
LOD: 700
  Triangles = 7774
  Draw Calls = 17 1
LOD: 2000
  Triangles = 48
  Draw Calls = 1
IMAGES:
  l1.ace
  diamondplate.ace
  chainlink.ace
FINISHED OK
```

11. UPGRADING MODELS FROM BLENDER 2.79

Version 2.8 is a 'breaking' change to Blender. This is not just an issue with MSTs files but affects all files made in previous versions of Blender. Blender has introduced the new Eevee render engine and associated material system and has discontinued the legacy 'Blender Internal' and 'Face Texture' system.

This means when you load an older version blend file that uses legacy materials, it will come into Blender 2.8 untextured and with empty material slots. However the UV mapping is retained at least which helps. For MSTs models you can use the new MSTs Materials panel to easily create the needed materials and shaders. If you have multiple textures on one mesh, you will use the 'Assign' tool to apply the new materials to the correct part of the mesh.

The other change relates to the method of assigning parts to LODs. The previous method, using custom Object Properties like DLEVEL, DMIN, DMAX etc has always been awkward to use. This seems like a good time to replace it with something better. Section 6 of this document explains how the custom properties will be replaced with Blender 2.8's new 'collections' feature.

Some of the advantages of collections over our previous method are:

- + easy to assign LODs by dragging parts around or using the M key to assign collections
- + easy to change distance level settings by editing LOD collection name, eg rename MAIN_0700 to MAIN_0500
- + good visibility of settings -all your LOD assignments show in the outline panel
- + and the LOD assignments are also clearly shown in the object's 'Collection' panel
- + you don't need the MSTs 'dlevel' control panel, choose LODs using the check boxes in the outliner
- + future support for multiple LOD controllers, ie main has lods at 700 and 2000, but wheels have 100, 200 and 500.
- + a part can be assigned to more than one LOD
- + render in Cycles or Eevee, you can select which LOD appears in your render
- + it uses standard Blender features - there's no hidden properties

TODO FINISH THIS SECTION WHEN BLENDER PROVIDES UPDATE PATH FOR 2.79 FILES

In Blender 2.79 set Distance Level Selection to OFF and resave file.

- this ensures all parts are in the visible state.

In Blender 2.8, File Open with Load UI disabled

Comes in without any texturing.

Create MAIN collection

Look at MAIN properties to determine DLEVEL's needed for LOD Collections

Create LOD Collections in MAIN

Remove DLEVELS properties from MAIN

Use DMAX and DMIN properties on each object to assign it to the correct LOD Collection

Remove DMAX and DMIN Properties from all objects.

Create and apply materials.

UV Mapping should be OK

Set Current Frame to 0 in Animation panel

END OF DOCUMENT