Photo matching by hand

Sometimes model geometry is incomplete or the photo has no discernible points to auto match.

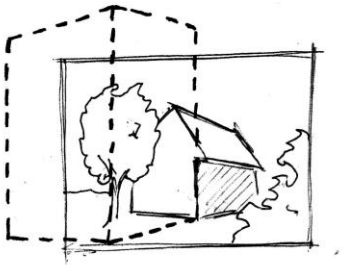
With a little careful rigging, the vanishing points most photos have can be used to calculate the camera position and align the photo with the model.

With some unexpected advantages over the automated tool..

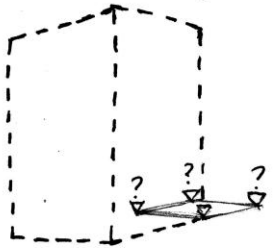
Problems

Usually the photos to hand are those taken while the photographer was wandering around site, framing existing objects - not the space of a proposed structure.

The photographer usually didn't note much about the camera angle, zoom, or even where he was standing.

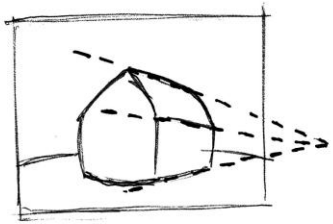


The modeller may have limited information and not all model geometry is accurate, or geometry simply hasn't enough corresponding points to match with the photo.



The existing photo match tool does not take into account barrel distortion of the photo, so photo points used to match geometry often miscalculate.

Once photo matched, you cannot zoom or rotate your view to better frame the geometry.



You cannot achieve foreground masking, or background replacement without resorting to a photo editing software.

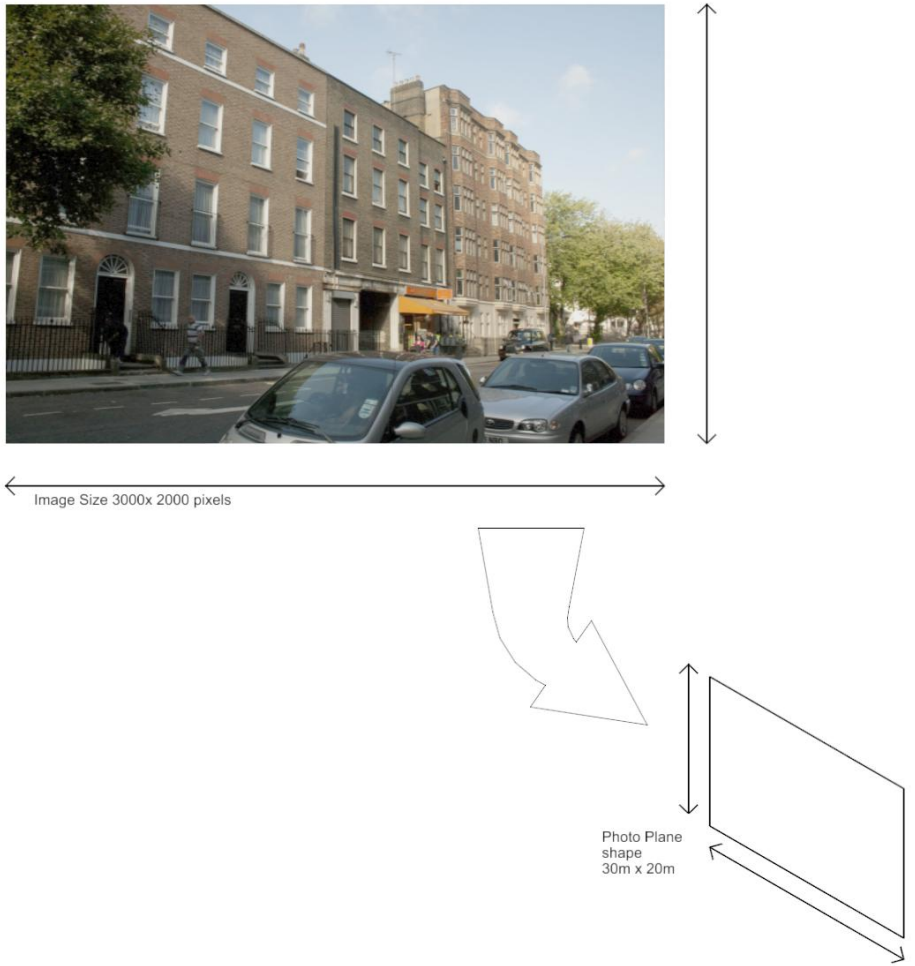
Technique requirements

1. A "Model" file containing your 3D Geometry
2. An unedited photo
3. An empty 3D "Photo Rig" file

In the 3D Photo Rig File:

Create a rectangular 2D "Photo Plane" shape.
It should be,

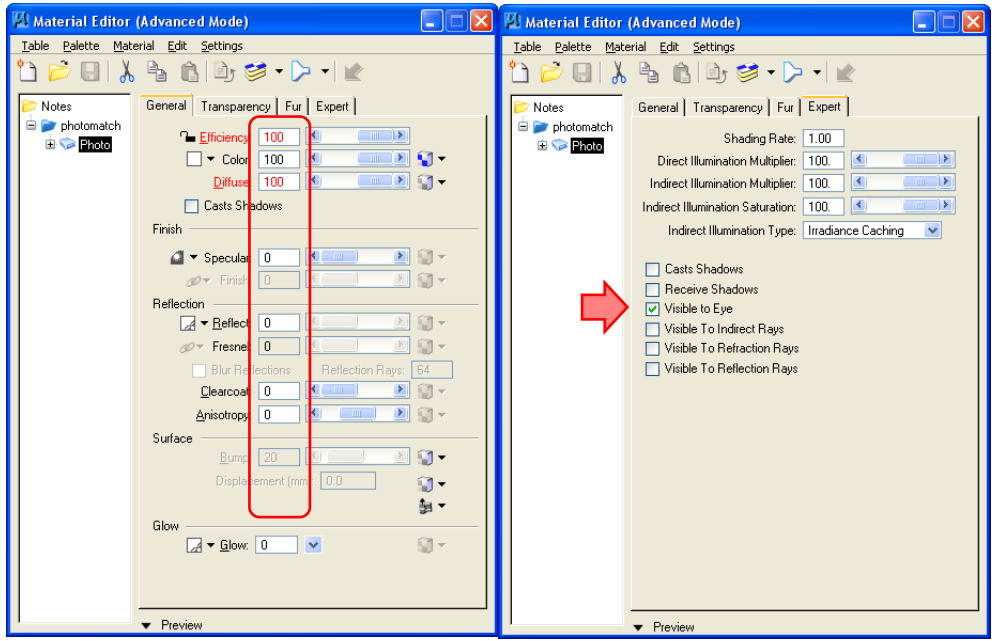
- aligned with Front View,
- with the same aspect ratio as the photograph,
- at a scale large enough to act as a back-plate to the 3D model.

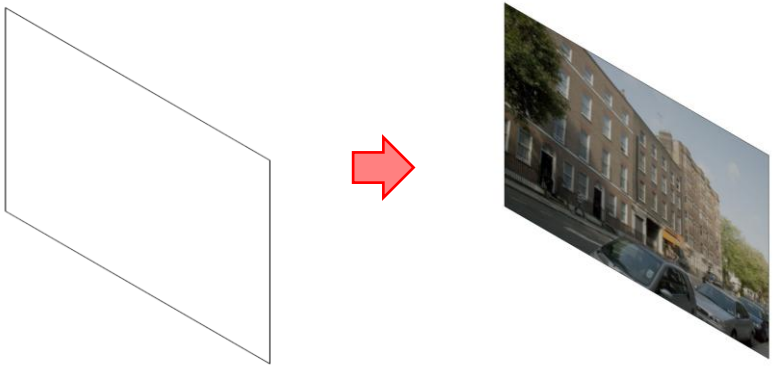


In the 3D Photo Rig File:

Create a material using the photograph as a texture map and apply to the plane.

The texture should set up to visible to eye only and not be affected by environmental or other lighting.





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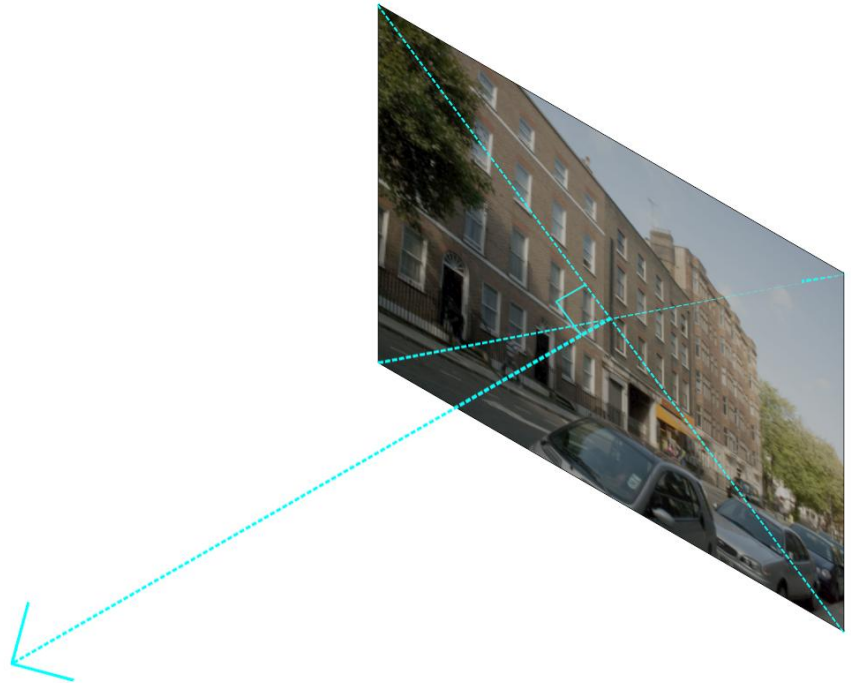
In the 3D Photo Rig File:

Draw an "Eye line“,

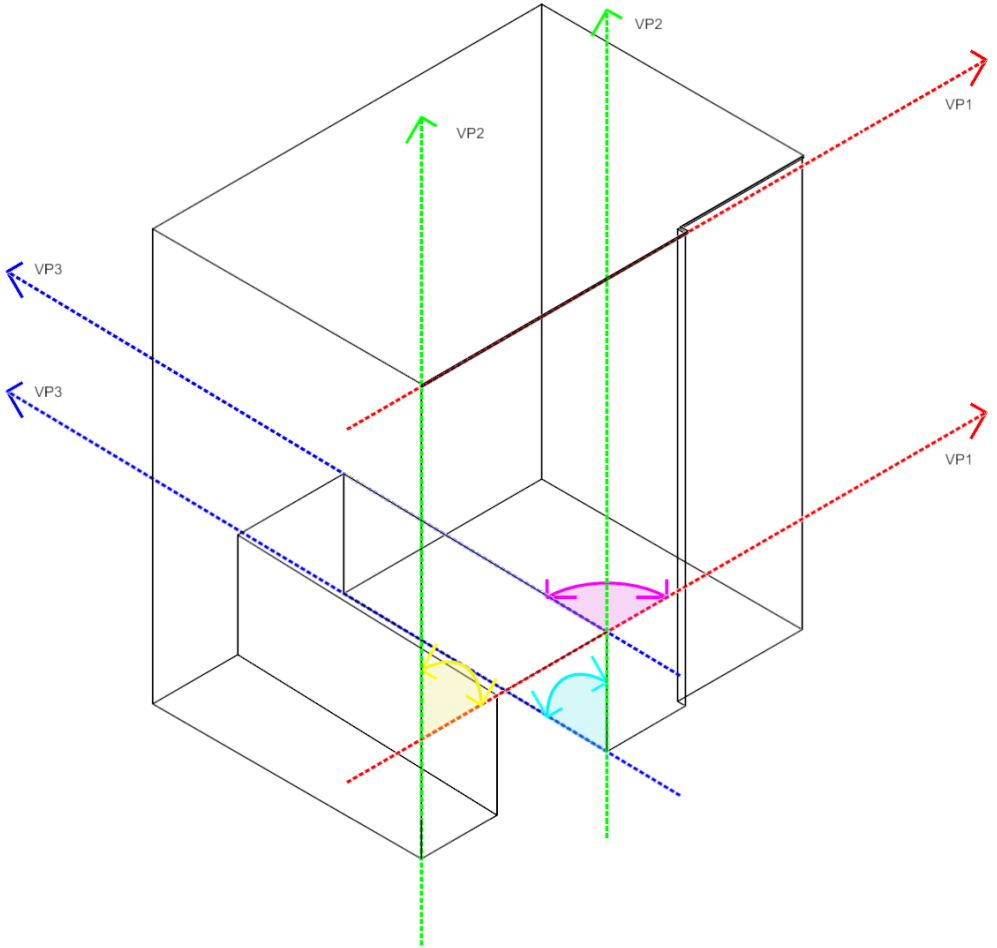
- from the centroid of the Photo Plane,
- normal to that Plane (i.e. 90° to the shape)



In the Model file

Identify the faces of the 3D geometry that are displayed in the photograph, and the parallel lines in the 3D Model geometry that are common to the Vanishing Points calculated on the 3D Photo Rig.

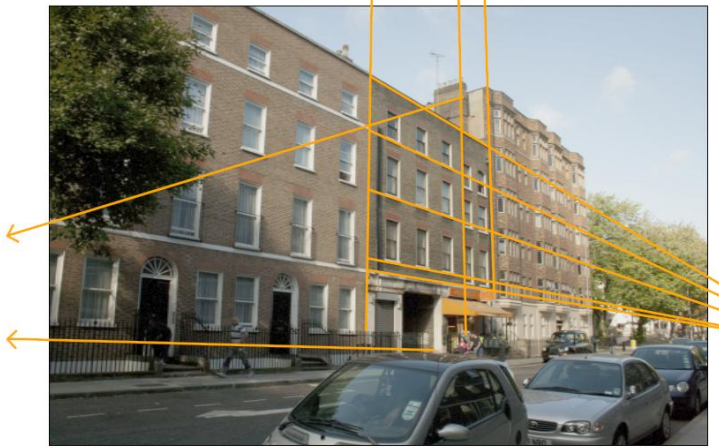
Note the angles between these lines of 3D geometry. Lines that are 90˚ to each other are easiest to calculate, but it should be possible to work out any angle.

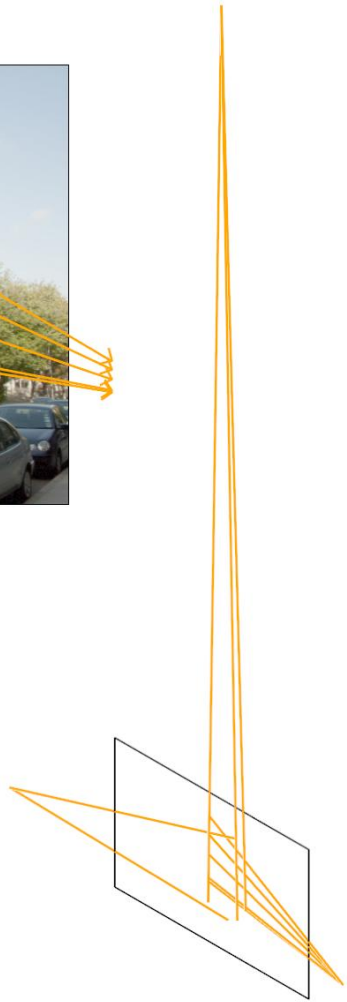


Calculate vanishing points

On the Photo Plane draw and adjust line work to calculate the Vanishing Points.

First roughly trace the edges on the photo, then use the trim tools to find a rough vanishing point. This rough point can be adjusted using the handle tools to better fit all the edges.



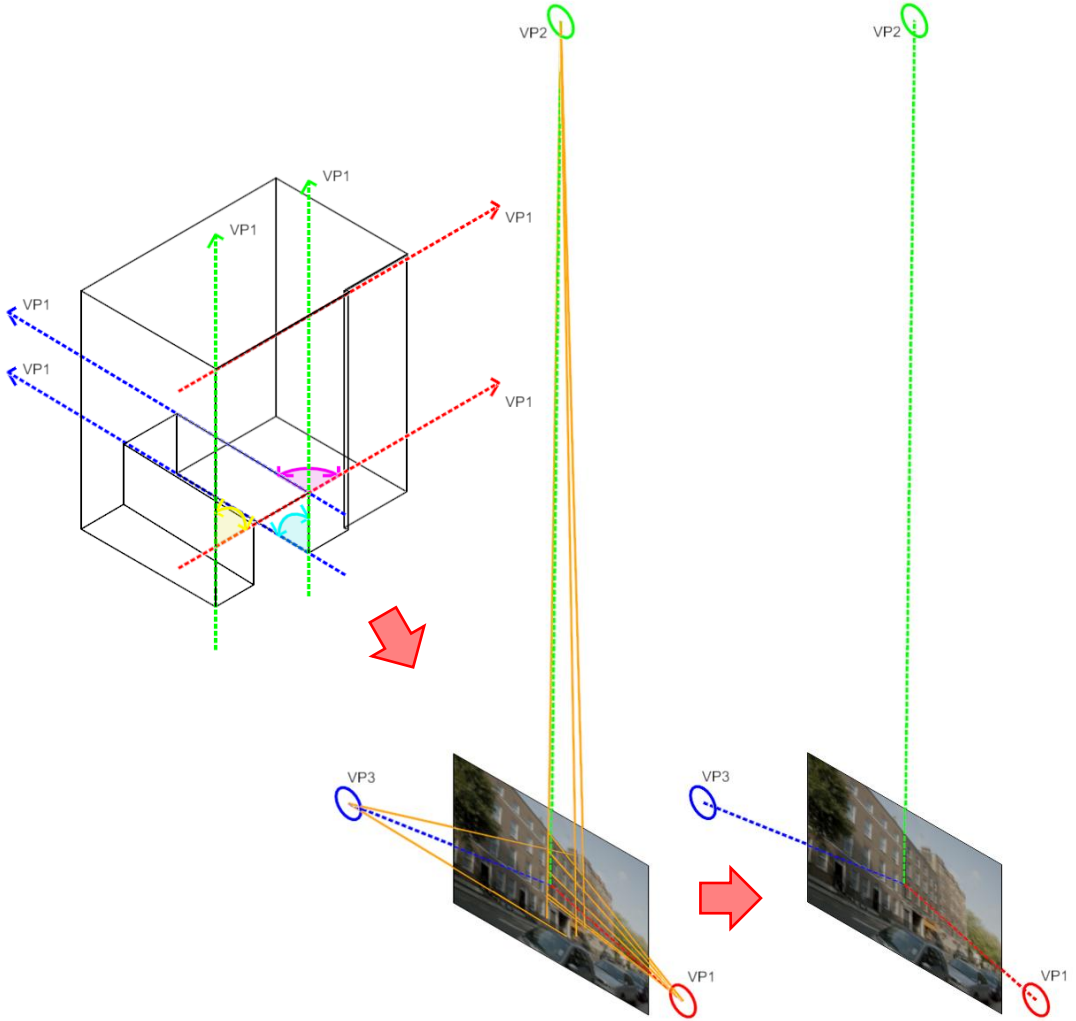


Calculate vanishing points

Edges of planes in the Model file that are parallel to each other will all share a common vanishing point - try find the vanishing points on the Photo Plane of the faces of your 3d Model you wish to view.

As the photograph is unedited it will automatically be a 3 point perspective. Finding 3 vanishing points relating to 3 model planes will result in the best outcome, but you can get away with just fining 2.

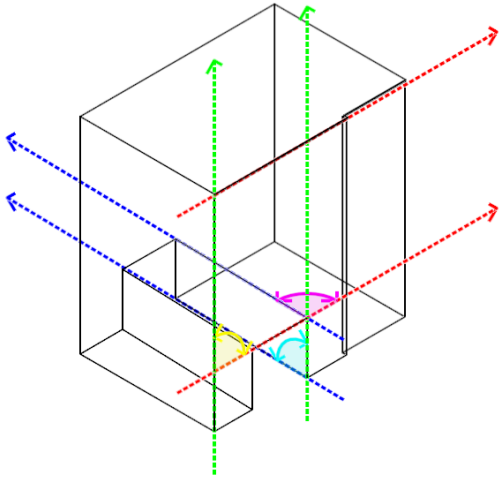
This technique averages out the error caused by picking points on blurry or barrel vaulted photos. It is also possible to estimate vanishing points even if there are no hard points to snap to, as long as the planar / parallel edge – common vanishing point relationship is honoured.

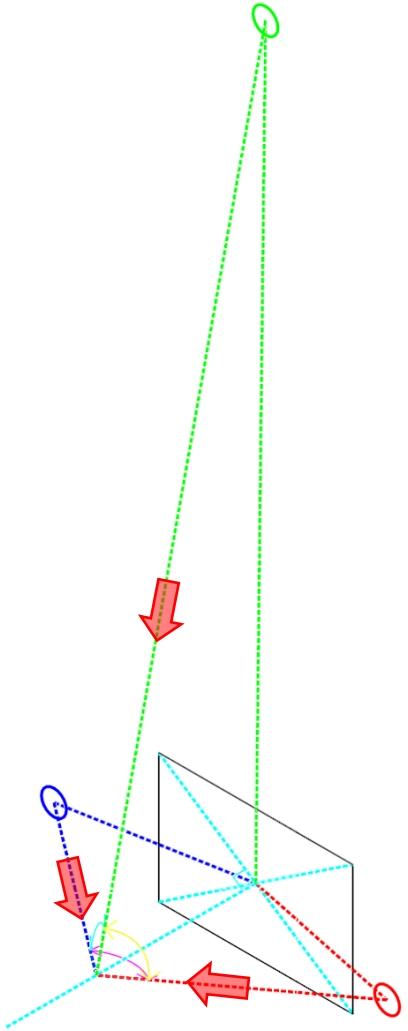


Find Camera position

From the Photo Planes Vanishing Points, draw "Alignment Lines“ to a single point on the Eye Line.

To determine the correct position along the Eye Line, the Alignment Lines will form the same angles as the 3D geometry edges in the 3D model.



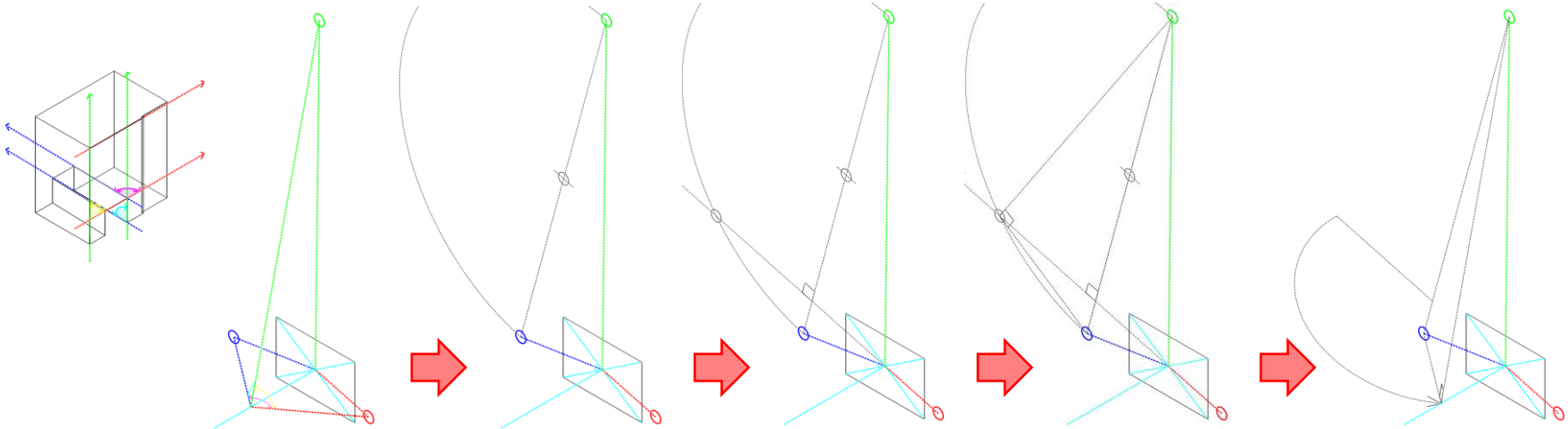


Find Camera position

For many buildings the planar edges form 90° and can be accurately replicated in the photo rig.

a) drawing a semi-circle drawn between two Vanishing Points
b) drawing a line from the centre of the photo plane, perpendicular to the line between those Vanishing Points.
c) the intersection of the semi-circle and the line define the position of the 90° angle.
d) this 90° can then be folded around the line of the Vanishing Points until it meets the Eye line.

Alternative Geometry or Trigonometry is required to calculate angles other than 90°.



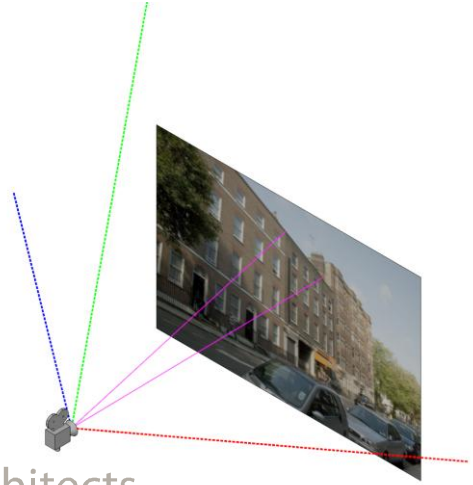
Positioning the Model

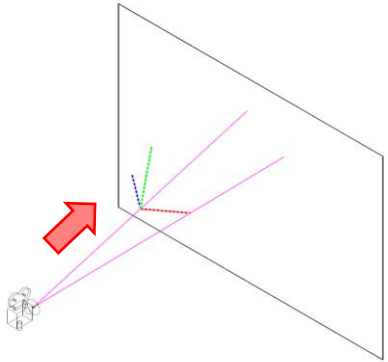
From the Camera Point draw at least two “Sight Lines” to points on the Photo Plane that correspond to points on a common edge in the Model.

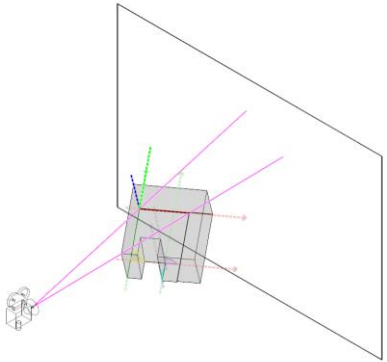
Copy the Alignment Lines to some point along one of the sightlines.

One of these copies will intersect with the second sight line because they represent the same edge.

You can use this information to move, scale and rotate the Photo Rig file when you reference it into the Model file



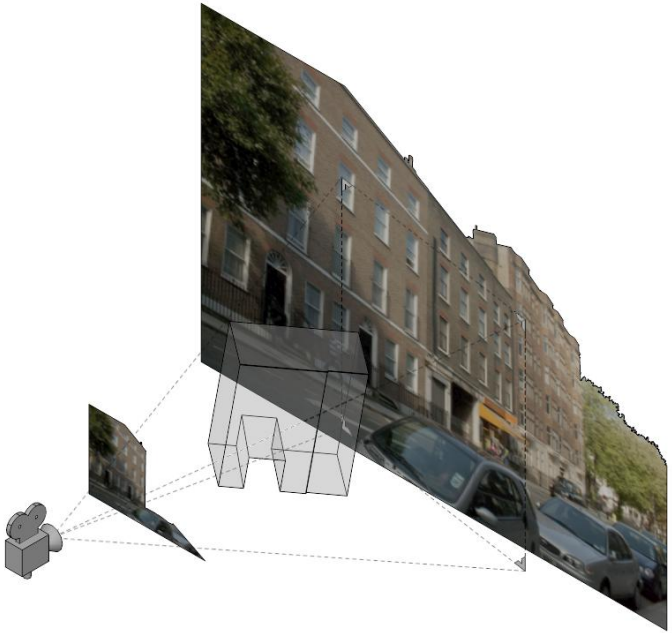




Masking and Background Cut outs

A copy of the Photo Plane can be scaled down and its distance to the camera similarly scaled so that it would form a foreground image. Its shape can then be edited to form a foreground mask.

The original Photo plane can also be edited to remove unwanted sky, and any number of intermediate "Billboard" items can be placed in front or behind the Model to form a 3D composite. Eg. Trees or people.



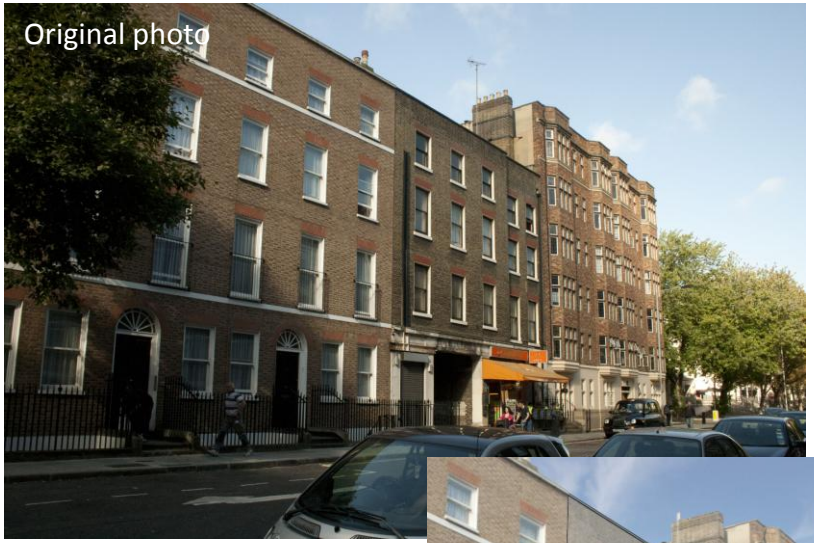
Independent View Zoom and Size

As long as the Camera position is not moved,

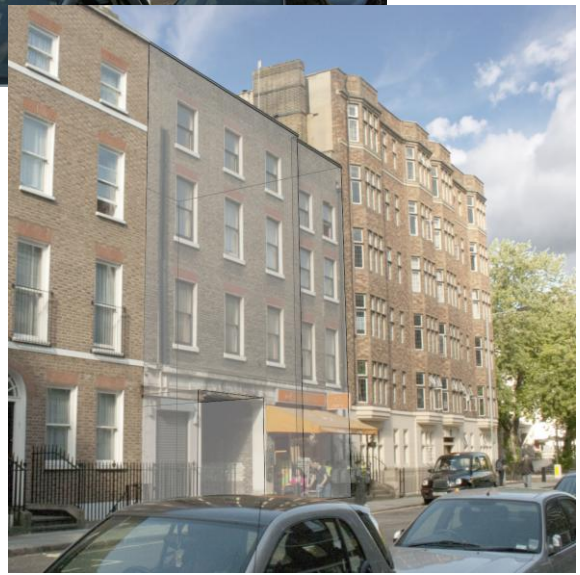
- the camera target can be panned across the image without losing perspective.
- he view port can also be resized without destroying the perspective.

This allows you to frame and crop the view to better suite the model, rather than a badly framed photo.

Assuming multiple photos were taken from the same lens nodal point, several Photo Rigs could be used to alight photos into a panoramic view.



Resized view port showing "live" compositing of foreground mask, proposed geometry, cut away back plate, and alternate sky background



Regards

Robert