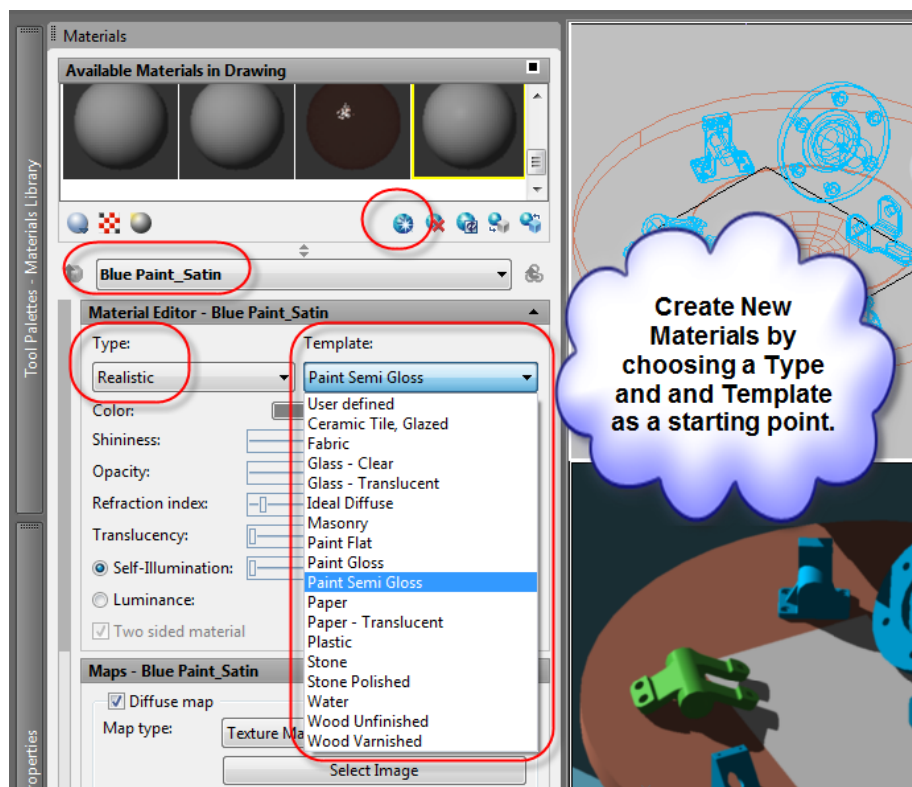


AGENDA:

1. Custom Color Materials
2. Custom Texture Mapped Materials

Custom Color Materials

The Material Editor allows us to create new, custom materials as well as edit the properties of existing materials from the default material libraries. A material is defined by a number of qualities. The available options depend on the material template.



There are four material Types: *Realistic*, *Realistic Metal*, *Advanced* and *Advanced Metal*. The realistic types use only a diffuse color while the Advanced Types let you choose colors for the Ambient and Specular components as well as Diffuse. The advanced material types have more options including properties that can be used to create special effects and simulated reflections.

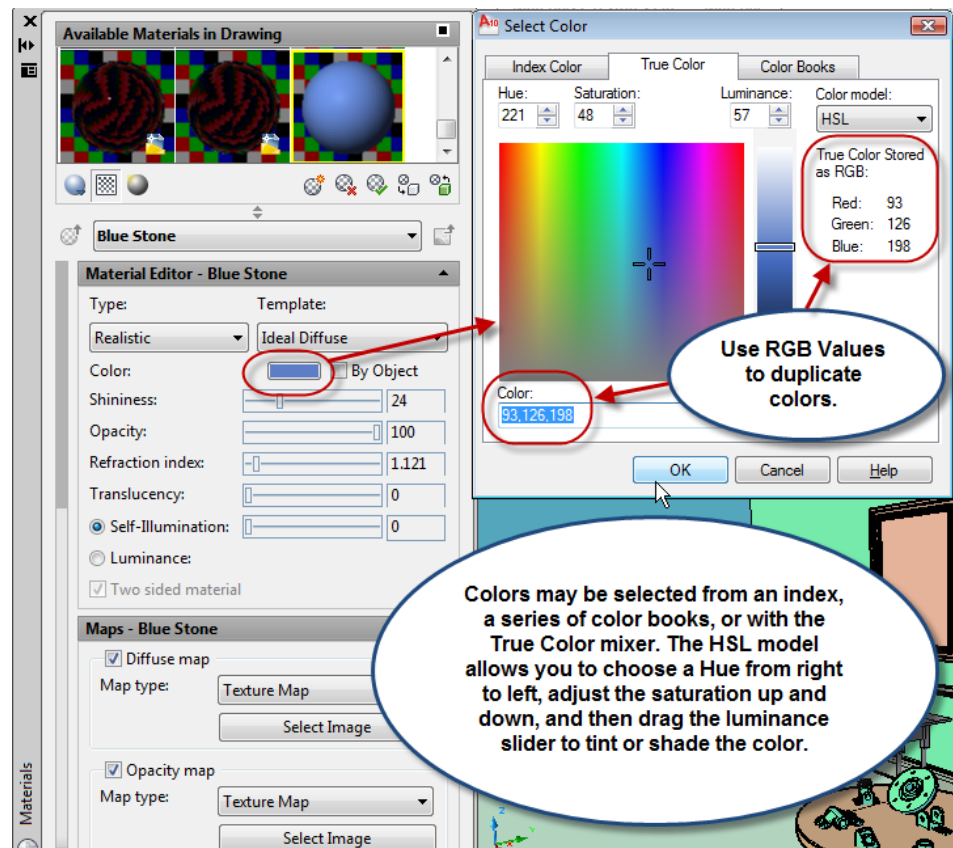
LECTURE NOTES: CLASS 08

In addition to the Four Material types, which control the available material options, there are 22 templates which are based on the Realistic and Realistic Metal types. These templates simply preset the material properties such as shininess and opacity to reasonable starting values for a particular material.

Several of the templates have the exact same preset properties. For example, Ideal Diffuse, Fabric, Masonry, Paint Flat, Stone, Wood Unfinished and Paper all set the same starting values for the material properties. These materials are all opaque and all have a very low shininess. The Ceramic Tile Glazed template also has exactly the same starting values for shininess and refraction as the Plastic Template.

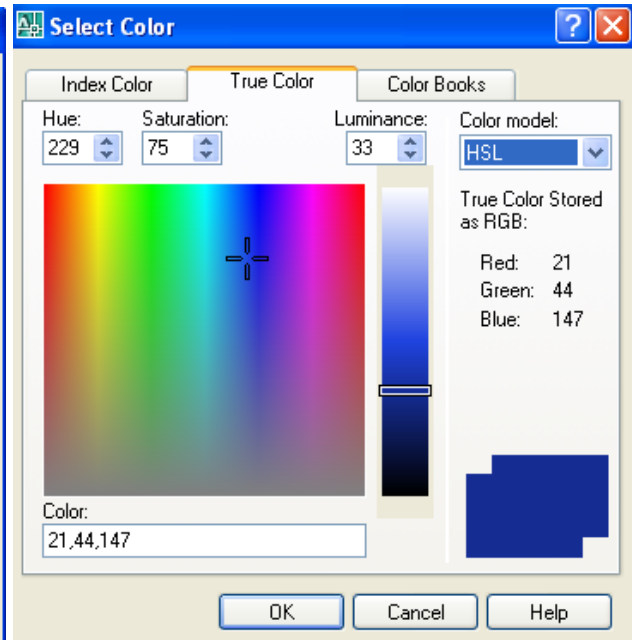
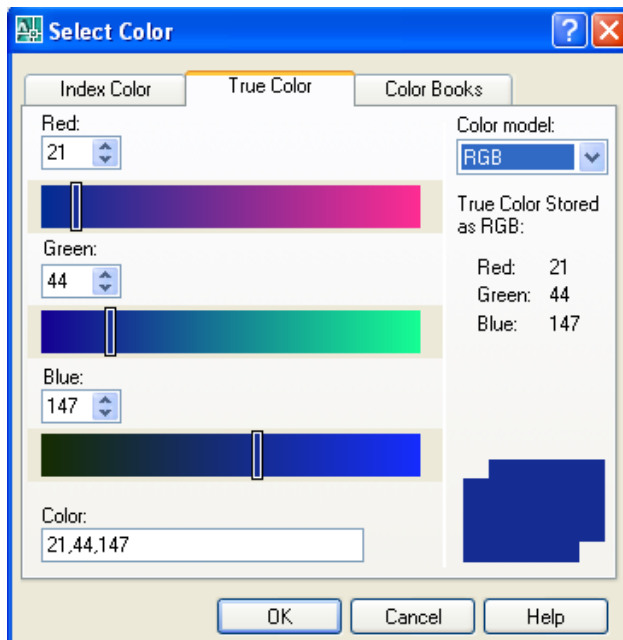
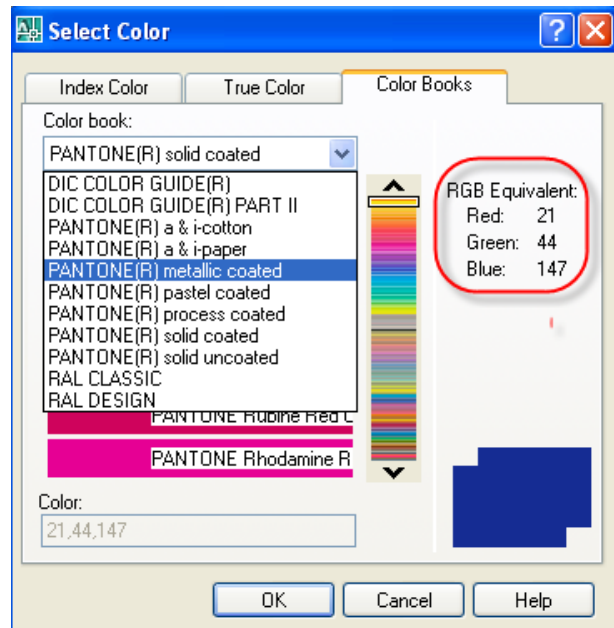
It is not necessary to start a custom material with a template that bears its name. For example you can start to create a custom plastic material or a custom grass material and base either of them on the basic, Realistic material type at the top of the template list. You can then adjust the shininess, refraction, translucency, etc. to create any material.

Materials may be defined with colors, images, or a mixture of both as their base Diffuse property. The simplest type of material uses no images but is based solely on a single color and a set of properties defining how the material interacts with light rays.



When you choose the Diffuse color Swatch, a Select Color dialog box opens in which you can select or create any color. The Color Index supplies the standard AutoCAD Color Index of 255 colors. The Color Books tab lets you select a predefined color from a series of recognized Design Colors including metallic coatings, pastel colors, and process coated colors.

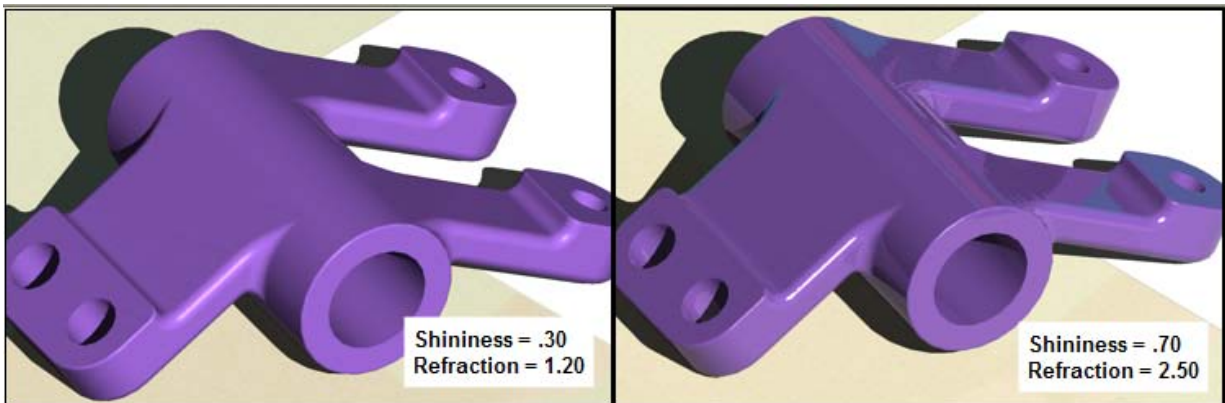
The True Color tab allows you to create a custom color with one of two Color Models, RGB or HSL.



RGB stands for Red, Green, and Blue and any color can be created by setting values for these colors in a range of 0 to 255. An RGB color is always described with three numbers. RGB of 0,0,0 is pure black and RGB of 255,255,255 is pure white. The HSL Model defines a color with a Hue, Saturation, and Luminance. The Hue is the color, the Saturation defines how pure the color is, and the Luminance lets you add black or white to the color to create a tint (lighter) or a shade (darker).

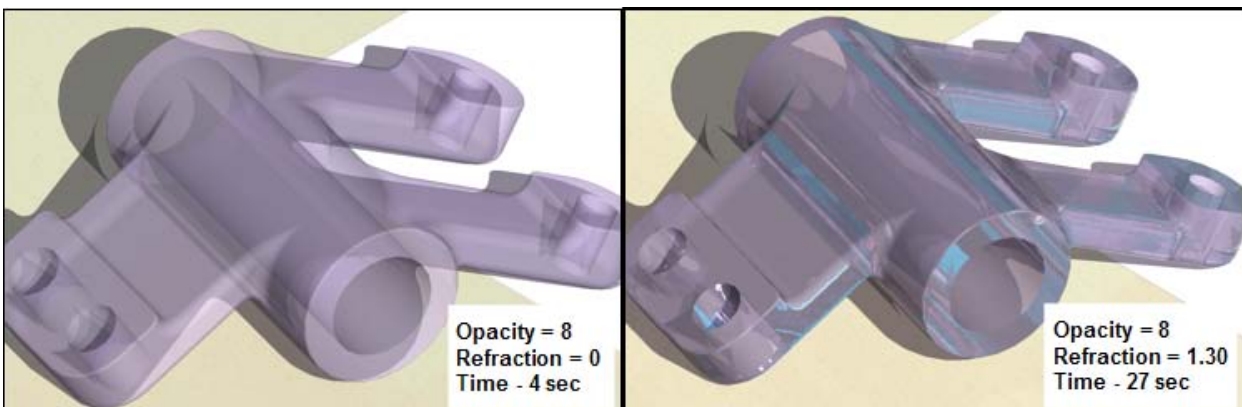
LECTURE NOTES: CLASS 08

After you choose the Diffuse color for your material you may wish to fine tune the finish by adjusting the shininess and refraction values. As you increase the Shininess, the material will look harder and smoother. As you increase the Refraction, the material will bend light if it is transparent and become Reflective if it is opaque.



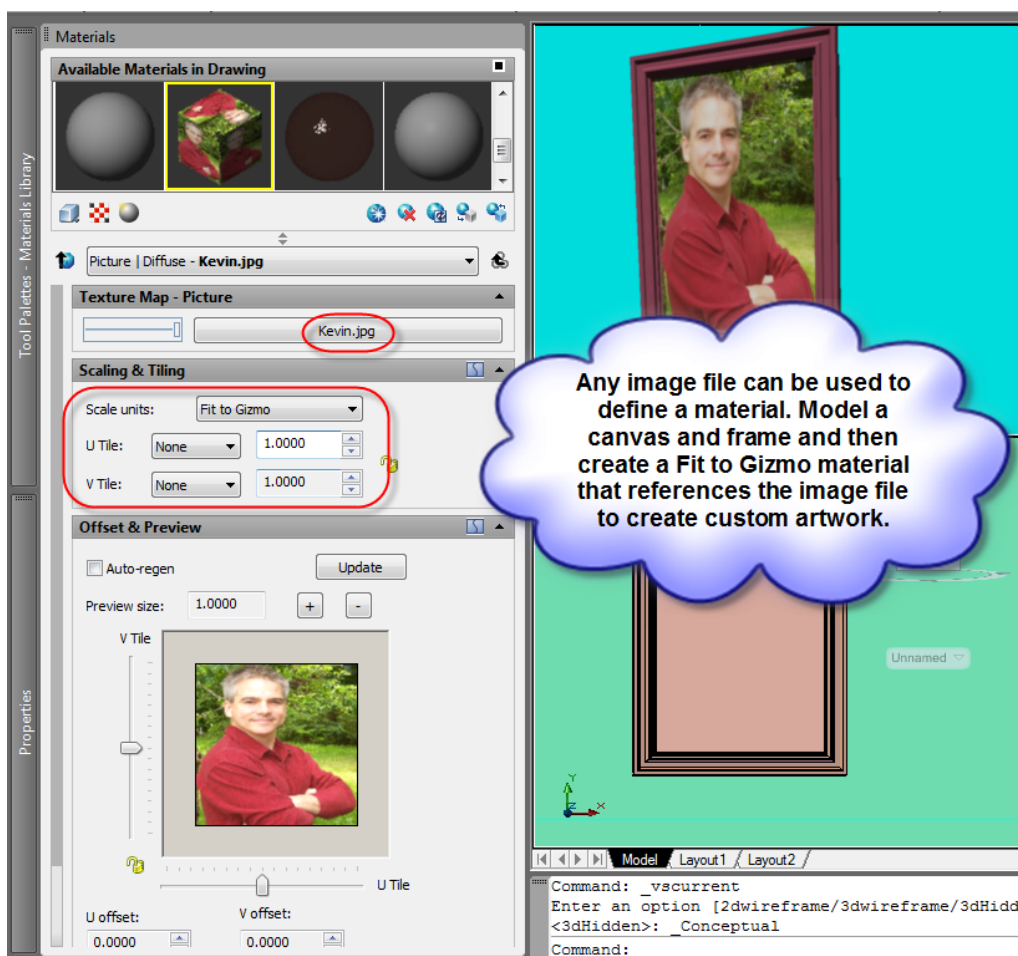
Refraction combined with Opacity values of less than 100 can have a huge impact on both realism and render times. If an object to be rendered is small, secondary in importance, or located at the periphery of a scene, you may wish to set Refraction to zero to increase render performance.

Opacity, Translucency, and Refraction all relate to the rate and manner in which light passes through a material. Opacity is the opposite of Transparency which refers to light passing directly through an object. Translucent objects also allow light to pass through an object, but the light rays are scattered as they do so. A translucent object is not necessarily transparent as well.



Custom Texture Mapped Materials

A material that uses an image as the basis for its Diffuse color component is referred to as a Texture Mapped Material. Any standard image file can be used as the basis for a custom texture mapped material, but there are certain requirements that must be met depending on where the image will be used and whether or not the material will be tiled or cropped. A tiled material repeats the image and a cropped material uses one image.



A Cropped material can use any image. A typical example of a cropped material is a picture or a painting to hang on your wall. Images used as signs or billboards are also created as cropped materials that will reference a single image.

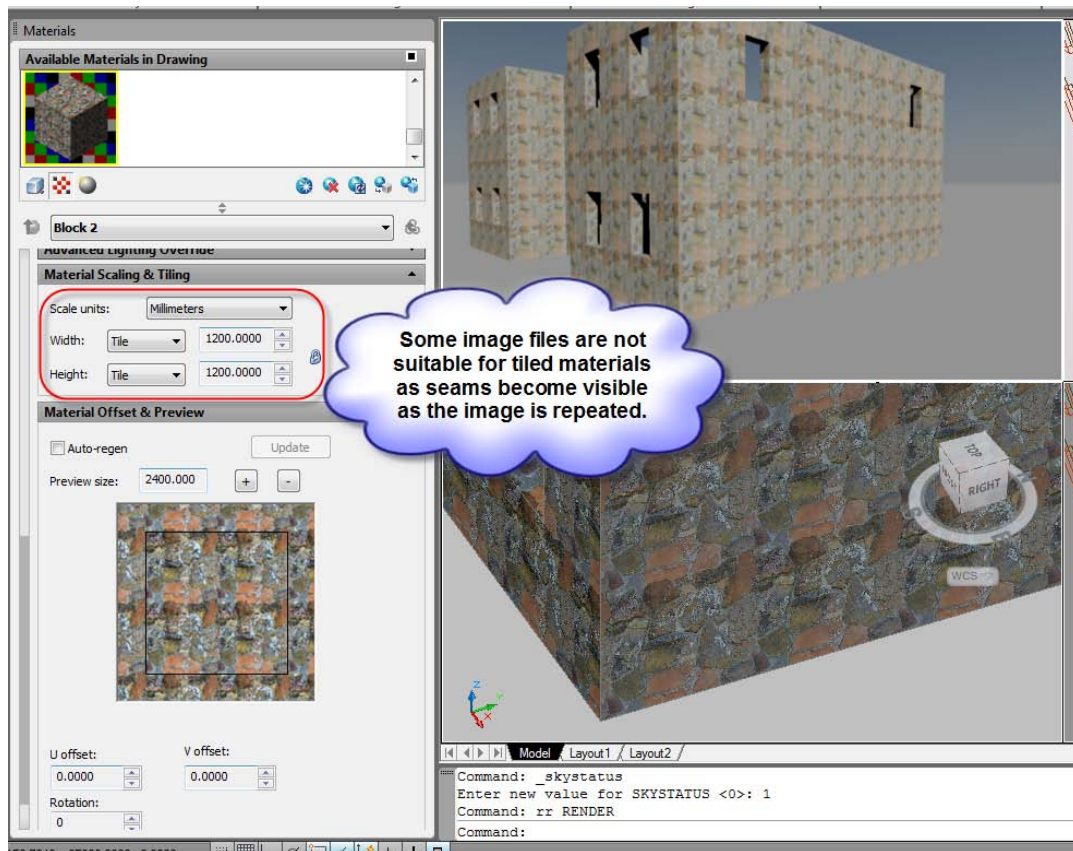
When you use the Fit to Gizmo mapping style, and set the Tile values to 1 or the Tile setting to None, the image will be stretched to fit the available geometry. This means the image will be distorted if the canvas and the image have different aspect ratios. One solution would be to match the dimensions of the canvas to the dimensions of the image.

A second option is to use a Fixed Scale material. Set the dimensions of the material to match the aspect ratio of the image and then increase the size until the smallest dimension of the material is larger than the smallest dimension of the canvas. Use mapping to position the image as required.

The most common type of texture mapped material is the Fixed Scale, tiled material that we typically use for a wide variety of architectural materials. Floor finishes such as tiles, wood, terrazzo, etc., wall finishes such as bricks, stone, siding, wall paper, stucco, and Roof finishes such as shingles are all defined with Fixed Scale, tiled materials.

Although it is possible to take a picture of a brick wall and then use the image file to define a brick material, the material will not look good unless it is used in a very small area. If the image tiles or repeats, it will show noticeable seams and the material will clearly display a checkerboard pattern of rows and columns.

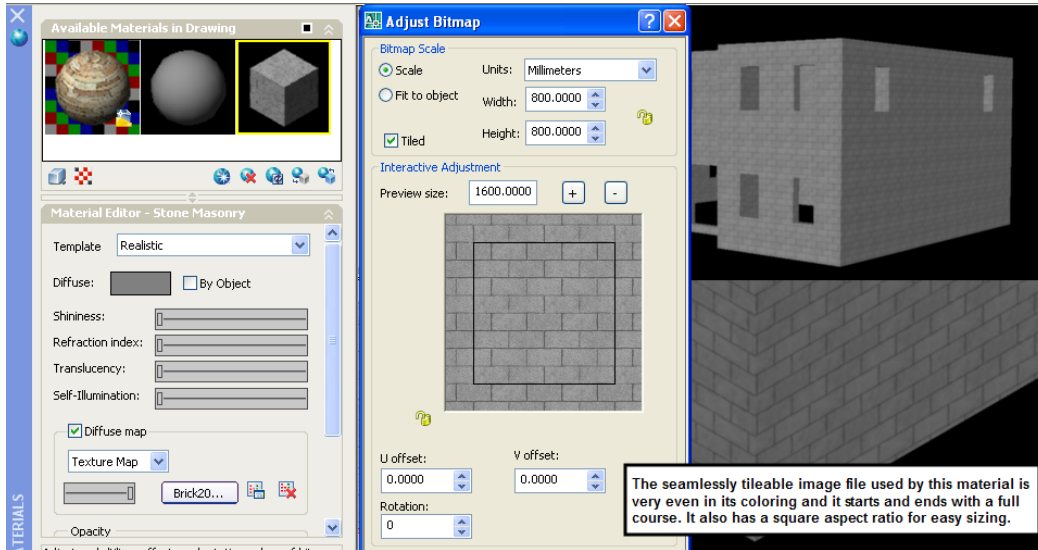
Images that are used as tiled material maps should be mirrored and manipulated in an image editing program so that when the image repeats, the rows and columns are not visible. This type of image is referred to as being “seamlessly tileable”.



The texture map used for the stone material in the image above has two big problems. The variation in color from the center to the edges is causing the vertical stripes. A tileable image can not contain any very distinctive sets of colored pixels. A leaf on a square of grass or a white stain on a single brick in an image of 20 bricks would both be very noticeable when the image repeats in a number of rows and columns.

The horizontal stripe comes from a partial block course at the top. If there is a portion of a course at the top, the corresponding portion of the course needs to be included at the bottom so that when the image is repeated, the two portions create a full course. The best images usually start and finish with a full course.

The image file used in the material shown below is seamlessly tileable. It is almost impossible to see the seams where the image repeats on the wall.



The image above had a set of pixel dimensions of 1000 x 1000. A square image is the easiest to size because once you estimate the size of the material in one direction, you know the second as well.

Understanding how to size a map with regards to its real world dimensions is crucial to creating materials with maps. A common error when creating custom mapped materials is to leave the scale at its default value of 1x1. This would indicate that the image would be displayed in an area only 1 drawing unit square. The next most common error is to set the scale with the Pixel dimensions instead of estimating the true dimensions of the material displayed in the image.

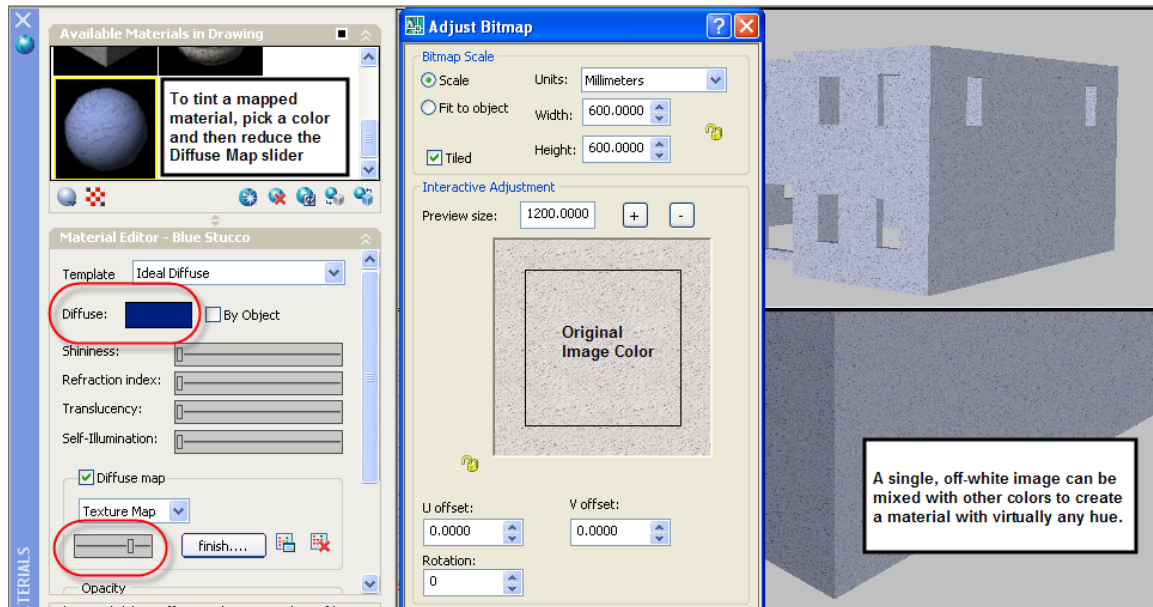
To estimate the real world dimensions look for a unit in the image for which you know the true size (1 tile, 1 brick etc,) and multiply by the number of units displayed in that direction. If a unit does not exist, such as in a picture of grass, sand, or fabric, simply make your best guess and test render until it looks good.

When you are using a custom image file on which to base a material, you should know 2 set of dimensions, one for the pixels of the image and one for the real dimensions of the object being depicted. For example, your image file is 512 pixels x 512 pixels and displays 9 rows of brick that are 3 bricks long. The pixels are 512x512 but the real world dimensions of 3 bricks long = 600mm or 24 inches. The scale of the image as specified in the material would be U=600 and V=600 (or 24 and 24 depending on your units).

The pixel dimensions are especially useful when using an image that is not square. The pixels can be used to calculate the aspect ratio which can then be locked as you set the dimensions of the material. This ensures that the image will not be distorted. For example, your image file is 512 x 330 and displays 6 courses of shingles x 5 shingles long. If you create a new material and select this image file, AutoCAD will set the U and V tile values to 1 and 1.5515 (512/330). (*Note - You need to reverse the U and V values at the time of this writing.) If you lock the aspect ratio, you only need to estimate the material dimensions in one direction. 6 courses of shingles at 200mm per course means the V distance is 1200mm. Enter 1200 and the horizontal distance will be calculated and set correctly as 1861.8

Texture maps may be tinted with other colors by mixing the Diffuse color component with the Diffuse map component. When you reduce the Diffuse map slider by a certain percentage, the same percentage of Diffuse color is mixed in. If your map slider is at 80, then 20% of the final material comes from the Diffuse color.

If you lower the Diffuse map slider to a very low value (<20%), you may not be able to see the details of the original texture map. This technique works best with light colored maps. For example, if you have an image of white stucco, but would like to use a light blue stucco in your project, you could create a material based 80% on the white stucco image and 20% on a dark blue Diffuse color.



If you use black or white in the diffuse color, and mix it in with a color map, it will create a lighter or darker version of the map. These types of color modifications can also be applied directly to the image file with an image editing program.

Exercise Notes

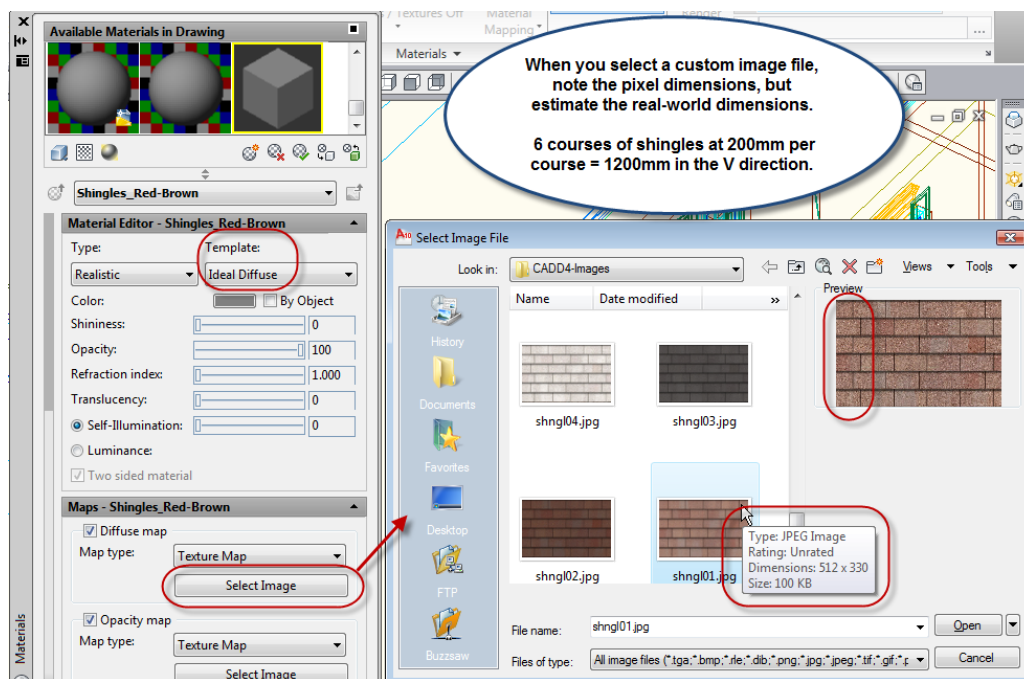
In the following exercises you will how to create your own custom materials using colors, image files, and material templates.

1. Start AutoCAD and open your House drawing. At this point you should have a material on all visible layers. You have created Sunlight systems, as well as a series of Distant lights, Point Lights and Spotlights that can be used in both Daytime and Night renderings. The default materials that are available are a good starting point but you may find that you would like more choices in paint colors or finishes, or in the texture maps that are available.
2. Unload all Xrefs. Turn off all lights except a Distant light or Sun and the Subfill. Switch to an Isometric view and then zoom in on a corner of the roof and rotate the view so you can see the crown.

3. We'll begin with a custom color material to use as a new trim color. Open the Material Palette and pick the Create New Material Icon. Name the material Paint_Deep Brown_Satin.
4. To set the color for this material will choose a standard color from a Color Book. Choose the Diffuse color swatch to open the color selector dialog. Select the Color Books Tab and then pick the DIC Color Guide Part II. The available color books are based on standard internationally recognized colors. The DIC color guide was first developed by the Dainippon Ink and Chemical company in Japan in 1968. The guide now contains over 3600 colors. If you select a band of color from the narrow strip on the right side, you are selecting a range of similar colors or a chapter in the book. Select a color from the main section of preview strips. Select a chapter of Browns and look for DIC2259. Select the color band and pick OK.
5. When you create a new material, the default template that is used to define the properties of the material is "Realistic". This template simply sets the Shininess at 50% and leaves the other properties at their default values. From the template pulldown, choose Ideal Diffuse which will change the Shininess to 0%. Change the template to Masonry and view the properties. Change the template to Fabric and view the properties. Change the template to Paint Flat. All four templates use the same properties.
6. Change the template to Paint Gloss. This time the Shininess increases to 50% and the Refraction changes to 1.25. Change to Semi-Gloss and the Specular reflection disappears. If the preset templates are not producing the finish you want, set the properties yourself. Pick the Realistic template again. Drag the Refraction slider to 1.25 and the preview will be identical to the Paint Gloss template. Drag the Shininess slider to 80% to see the effect on the preview and then reduce it to 30%. Reduce the Refraction to 1.0 to produce a soft highlight while eliminating any unwanted reflections. This is our Satin finish. ☺
7. Assign the material to the Crown, Eaves, and Fascia. Test render your new material. If you like it, keep it, but if you don't, change it or delete it. This exercise is simply meant to show you the method used in creating a new material.

LECTURE NOTES: CLASS 08

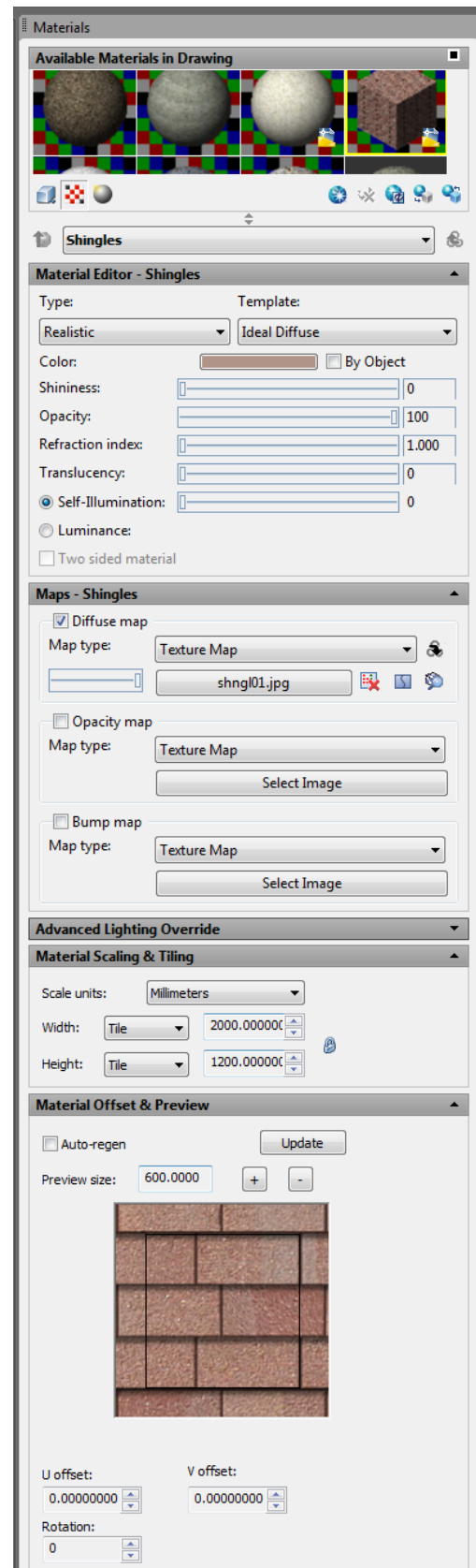
8. Switch to an isometric view and isolate your roof layer. Test render the view and you will probably be able to see the seams between the rows and columns. Depending upon which roof material you selected, the checkerboard effect may be very strong. All of AutoCAD's predefined shingles show seams. With the right images, these seams can be eliminated.
9. Open your Material Palette and create a New Material called Shingles_Red-Brown. Set the template to Ideal Diffuse or leave it at Realistic and reduce the Shininess to 0. Both will have the same effect.
10. In the Diffuse Map area, choose the Select Image button and browse to the Textures directory on your CD. This folder contains a few examples of images that can be used to create custom materials including a better roof material. Browse and select the image file, shngl01.jpg.



11. When you select a custom map, note the pixel dimensions and then estimate the real world dimensions of the image being displayed. If the image has measurable units, estimate the size by multiplying the number of units by the dimension of a single unit. For example in the image above there are 6 horizontal rows or courses of shingles in the image. If each row is 200mm in height, the overall height will be 1200mm.

LECTURE NOTES: CLASS 08

12. Pick open to select the shngl01 image file. In the material preview, change the shape of the preview primitive to a cube to make it easier to distinguish the material.
13. Open the Material Scaling and Tiling section at the bottom of the material editor. Here we can specify the true scale of the image. When you create a custom mapped material, you should maintain the aspect ratio of the image so the material will not appear distorted. The aspect ratio of an image can be calculated by dividing the pixel width by the pixel height. Our Shingle image is 512x330 pixels so we can calculate the aspect ratio as $512/330=1.5515$
14. In the Material Scaling & Tiling area, you will see this value appear in the V-Tile field under the Bitmap scale area. This indicates that the image would have to repeat 1.55 times in the vertical direction to fill a square. Change the units to Millimeters. The U and V Tile fields change to Width and Height respectively but the values remain at 1 and 1.5515. Now reverse the values for the Width and Height and you will be describing the true aspect ratio. Remember, the U value is the width and the V value is the height. Our image is wider than it is high, so it makes sense that the U Scale must be larger than the V scale.

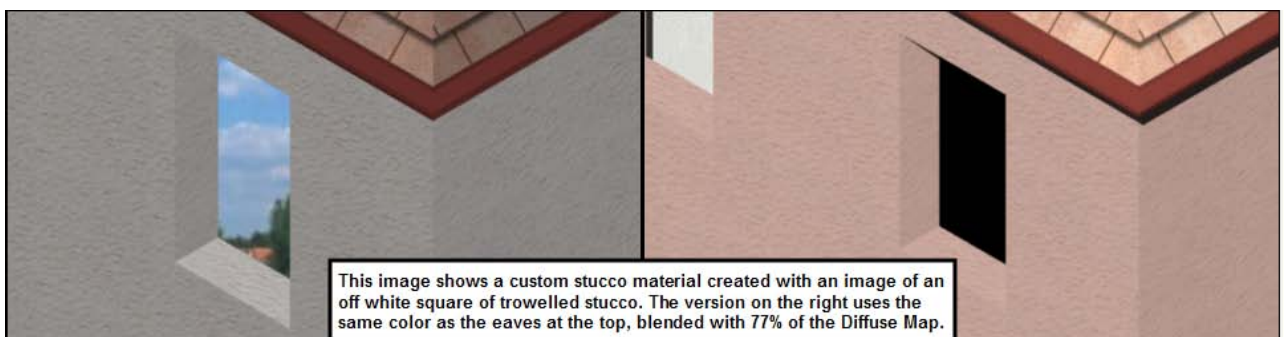


LECTURE NOTES: CLASS 08

15. With the Width at 1.5515 and the Height set to 1.00, pick the lock icon beside the fields to lock in the aspect ratio so when we change one value the other will change as well. We calculated the true height of the image at 1200. Set the height to 1200 and the width will automatically change to 1861.79. Change the preview size to 600 and you will see 3 courses displayed vertically. Close the dialog and the material editor.
16. Test render your new roof material to see how it looks. There are six different shingle textures in the Sample Textures folder on your DVD. Choose the color that works best to complement your wall material's color.



17. Create a new material called Red Brown Stucco. Use the Ideal Diffuse template. Set the diffuse color to DIC2259. Using standard colors makes it easy to duplicate colors between materials. (Any color may be duplicated by copying the RGB values of the original.)



18. In the Diffuse map section, select the image, stucco.3.trowelled.jpg from the Samples texture folder. Adjust the bitmap and set the units to millimeters with a scale of 800x800. Finally, reduce the Diffuse map slider to 75-80% to blend the Diffuse color in and tint the white map.

19. Assign the new custom tinted stucco material to your house wall and Test render.

Assignment #2 – 20% - Due in Class #9

Continue to work on the day and night renderings for the second assignment. Create at least one custom material using the roof example in today's exercise. If you wish to create more or even all of your materials with custom colors and maps, please do so.

Make sure you have materials on all layers. Make sure you are generating shadows with at least some of your lights. Use appropriate background images and ensure they are scaled properly for the required output resolution. (minimum 1024x768)

Submit the images for evaluation at the end of class #9. Maximum 4 images. Minimum 2.