AS500048

3D Modeling with the Best, AutoCAD!

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Learning Objectives

- Learn how to create 3D Solid, Surface, and Mesh objects using various tools.
- Learn how to edit the objects using tools such as Union, Slice, Extrude Face, Fillet, and so on.
- Learn how to apply texturing and materials to 3D objects.

Description

In this instructional demo, you'll learn how to create 3D geometry using AutoCAD solid, surface, and mesh tools. Create 3D assets for Revit families, Civil 3D and InfraWorks models, Inventor software, game engines, and other software environments. Edit the 3D objects using various editing tools, such as Union, Slice, Extrude Face, Fillet, and so on. Export the 3D objects. This class is designed to expand your AutoCAD 3D modeling knowledge.

Speaker(s)

Vince has been using Autodesk products since 1992. He has been working in the GIS, Civil Engineering and Surveying field since 1995. He currently serves as Sr. Designer for a civil engineering consulting firm located in Richmond, Virginia. He is also a Design Specialist and Blogger on the site Poly In 3D where he writes tutorials and how to tips for Autodesk products. Vince has also been 3D modeling and rendering for over 15 years using a verity of Autodesk® products and other non-Autodesk® products. Autodesk University 2012 lab speaker on Civil 3D 2013, Civil View 2013 and 3ds Max Design 2013. Autodesk University 2015 lab speaker on Vehicle Tracking 2016, Autodesk University 2017 on Autodesk Stingray and Autodesk University 2019 & 2020 on 3D modeling with AutoCAD.

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Poly In 3D Blog

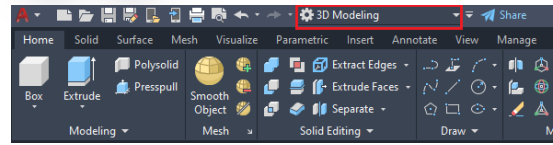Vincent Sheehan (@vlsheehan) | Twitter

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Launch AutoCAD 2022

3D Modeling Workspace
Set the workspace to "3D Modeling". This will have all the necessary tools to create 3D assets and 3D environments.
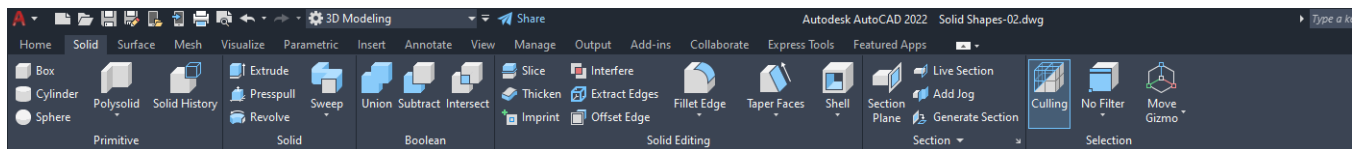

Home Tab:

Home tab has various command for 3D modeling and other drafting.
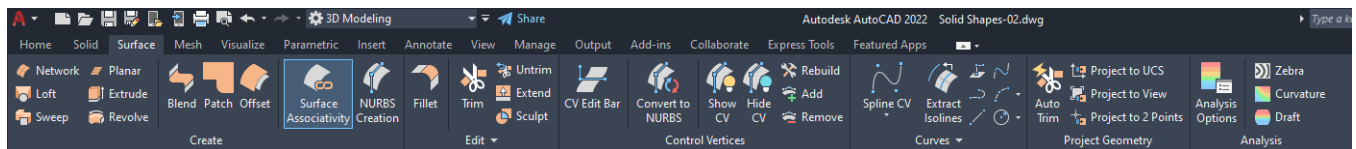
3D Modeling Ribbon Menus
Below are the 3D modeling types used in this exercise. 3D Solid, 3D Surface, 3D Mesh and 3D Face.

Solid Tab:

3D Solid objects consist of primitive shapes and extruded profile. Solids contain volume/mass properties.

Surface Tab:

3D Surface creation tools are similar to the 3D Solid tools such as sweeping, lofting, extruding, and revolving. 3D Surfaces can also be created by blending, patching, offsetting, filleting, and extending other surfaces. They do not contain volume/mass properties.

Mesh Tab:
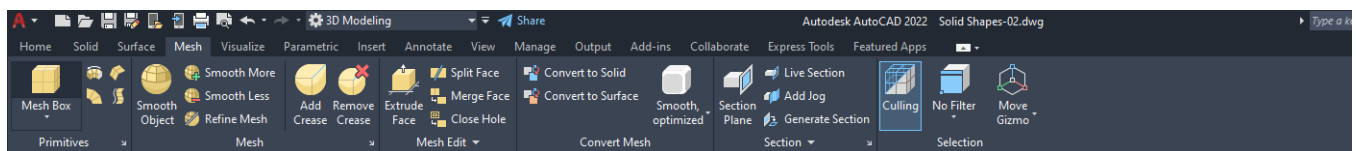
3D Mesh is similar to 3D Surfaces. They contain vertices, edges, and faces that use polygonal representation. They also do not contain volume/mass properties.

Coordinates/UCS, Commands, Views, Visual Styles and Draw/System Variables

Adjusting the UCS:
Click the Home Tab, Coordinates panel.
Default UCS is World coordinates. Adjust the Z-Axis by click the Z button. Select and object face or object intersection the drag the mouse in the direction to establish the Z-Axis.

Dynamic UCS:
Located in the Status bar. When creating an object, Dynamic UCS temporarily aligns the XY plane of the UCS to a planar face on objects such as 3D solids and planar mesh elements.
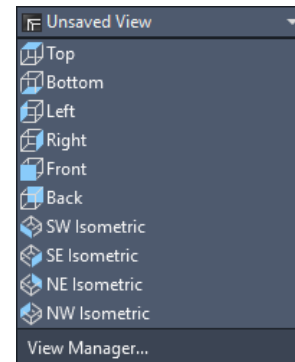
Views:
Click the Home tab, View panel or click View Controls on the upper left of the workspace.
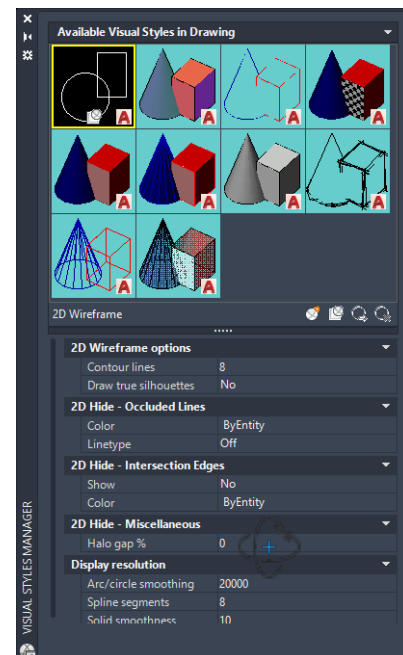**[-][SW Isometric][2D Wireframe]**
(The command to turn on the Viewport Controls is **VPCONTROL**.)

Visual Styles:
Click the View tab, Palettes panel or click Visual Style Controls on the upper left of the workspace.
[-][SW Isometric][2D Wireframe]

3D Osnap:
Snaps the cursor to 3D solids, surfaces, and point cloud segments.

Facetres (System Variable):
Facetres adjust the smoothness of rendered objects and shadows.
Initial calue: 0.5000
Valid values are from 0.01 to 10.0.

Viewres (Command):
Controls the sharpness of circles, arcs, splines, and arced polylines using short vectors.

Surftab1 & 2 (System Variables):
Sets the mesh density in the M and N direction for the REVSURF and EDGESURF commands.

3D Orbit:
Rotate/Orbit the view in the current viewport. Drag the cursor horizontally, the camera moves parallel to the XY plane. Drag the cursor vertically, the camera moves along the Z axis.

3D Rotate:
Rotate an object along the X, Y, Z axis using the Rotate Gizmo.

3D Scale:
Scale an object as a whole or along the X, Y, Z axis using the Scale Gizmo.

3D Move:
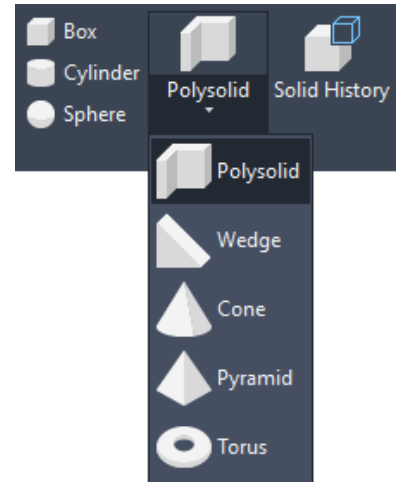Move an object along the X, Y, Z axis using the Move Gizmo.

Create Primitive Objects

Primitive objects are basic 3D shapes made of solid or mesh objects.

1. **Solid Primitive Objects. Solid tab, Primitive panel.**

    a. Box
    b. Cylinder
    c. Sphere
    d. Polysolid
    e. Wedge
    f. Cone
    g. Pyramid
    h. Torus
    i. Show History (Records the history of the solid objects).

2. **Mesh Primitive Objects. Mesh tab, Primitive panel.**

    a. Mesh Box
    b. Mesh Cone
    c. Mesh Cylinder
    d. Mesh Pyramid
    e. Mesh Sphere
    f. Mesh Wedge
    g. Mesh Torus
    h. REVSURF (Revolve Surface)
    i. EDGESURF (Edge Surface)
    j. RULESURF (Ruled Surface)
    k. TABSURF (Tabulated Surface)

3. **Drawing Objects. Home tab, Draw panel.**

    a. Line
    b. Polyline
    c. 3D Polyline
    d. Spline
    e. Helix
    f. Circle
    g. Polygon
    h. Rectabgle
    i. Ellipse
    j. Region
    k. 3DFace

<u>Creating Solid Objects</u>

1. Solid objects can be created by several different methods.
  a. Open "C:\DATASETS\AS500048 - 3D Modeling with the Best, AutoCAD\DWG\Solid Shapes-01.dwg".
  b. Click Solid tab, Solid panel.
  c. Click **Extrude**. Select the yellow shapes. Specify height of extrusion of 5 then press **Enter**.
  d. Click **Presspull**. Select a face on the blue Solid object then move the mouse to either side.
  e. Click **Revolve**. Select the red half lamp shape objects. Snap Endpoint to the bottom left #1 then upper left #2. Type 360 then press press **Enter**.
  f. Click **Sweep**. Select the cyan circle. Click **Alignment** in the command line then select the cyan polyline.
  g. Click **Loft** (below Sweep). Select the series of magenta circles then press **Enter** twice..
  h. Click **Thicken**. Select the green surface object. Type the specifed thickness of 5 then press **Enter**.

<u>Creating Surface Objects</u>

1. Surface objects can be created by several different methods.
  a. Open "C:\DATASETS\AS500048 - 3D Modeling with the Best, AutoCAD\DWG\Surface Shapes-01.dwg".
  b. Click Surface tab, Create panel.
  c. Click **Network**. Select the red polylines 1, 2, & 3 then press **Enter**. Select polylines 4 & 5 then press **Enter**.
  d. Click **Loft**. Select the series of magenta circles then press **Enter** twice.
  e. Click **Sweep**. Select the cyan circle. Click **Alignment** in the command line then select the cyan polyline.
  f. Click **Planar**. Select the green polygon.
  g. Click **Extrude** then select the yellow polygons. Specify height of extrusion of 5 then **Enter**.
  h. Click **Revolve**. Select the red half lamp shape objects. Snap Endpoint to the bottom left #1 then upper left #2. Type 360 then press **Enter**.
  i. Click **Blend.** Select the green surface circle edge #1 then press **Enter**. Select the green surface circle edge #2 then press **Enter**. Click the List Icon then select G0, G1 or G2.
  j. Click **Patch**. Select the top edge of a blue shape then press **Enter**. Select the List Icon then select G0, G1 or G2 to change it's shape.
  k. Click **Offset**. Select the top edge of an orange shape. Type 0.5 then press **Enter**.
  l. Click Trim

<u>Creating Mesh Objects</u>

1. Mesh objects can be created by several different methods.
  a. Open "C:\DATASETS\AS500048 - 3D Modeling with the Best, AutoCAD\DWG\Mesh Shapes-01.dwg".
  b. Click **EDGESURF**. Select the yellow polylines 1, 2, 3 & 4.
  c. Click **REVSURF**. Select the green polyline then select the yellow polylines axis then press **Enter** for angle and **Enter** to revolve the object 360 degrees.
  d. Repeat step **C** for the other parts of the lamp.
  e. Click **RULESURF**. Select the red polyline then the yellow polyline.
  f. Repeat step **E** then select the red polyline and green polylines.
  g. Click **TABSURF**. Select the green polyline then the yellow polyline.

Editing 3D Objects
1. **Editing 3D Solid objects can be achieved by several different methods.**
   a. Open "C:\DATASETS\AS500048 - 3D Modeling with the Best, AutoCAD\DWG\Solid Shapes-01.dwg".
   b. Click the Solid Tab on the Ribbon.

   Union
   a. Click the **Union** button on the Boolean panel.
   b. Select the two red spheres to join together.

   Subtract
   a. Click the **Subtract** button on the Boolean panel.
   b. Select the two yellow spheres to subtract one object from another.

   Intersect
   a. Click the **Intersect** button on the Boolean panel.
   b. Select the two cyan spheres to join the objects where they intersect.

   Fillet Edge
   a. Click **Fillet Edge** button on the Solid Editing panel.
   b. Select an edge marked #1 on the red cube.

   Chamfer Edge
   a. Click the **Chamfer Edge** button under the Fillet Edge button on the Solid Editing panel.
   b. Select an edge marked #1 on the yellow cube.

   Taper Face
   a. Click **Taper Face** button on the Solid Editing panel.
   b. Select the face marked #1 on the green cube.
   c. Snap endpoint to #2 then #3.
   d. Type 15 to taper the face 15 degrees.

   Extrude Faces
   a. Click **Extrude Faces** button on the Solid Editing panel.
   b. Select a face marked #1 on the cyan cube, type a distance of 1 then press **Enter**.

   Offset Faces
   a. Click **Offset Faces** button on the Solid Editing panel.
   b. Select a face marked #1 on the blue cube, type a distance of 1 then press **Enter**.

   Shell
   a. Click **Shell** button on the Solid Editing panel.
   b. Select the magenta cube, type a distance of 0.5 then press **Enter**.

2. **Editing 3D Surface objects can be achieved by several different methods.**
   a. Open "C:\DATASETS\AS500048 - 3D Modeling with the Best, AutoCAD\DWG\Surface Shapes-01.dwg".
   b. Click the Surface Tab on the Ribbon.

   Fillet
   a. Click the **Fillet** button on the Edit panel.
   b. Select a blue surface then select the green surface.
   c. Click the Radius in the command line, type 0.5 then press **Enter**.

   Trim
   a. Click the **Trim** button on the Edit panel.
   b. Select the green surface then press **Enter**.
   c. Select the blue circle then press **Enter**.
   d. Click inside the circle then press **Enter**. The **Untrim** command will untrim the area.

3D Sign

1. **Constructing the Sign Footer.**
   a. Open "C:\DATASETS\AS500048 - 3D Modeling with the Best, AutoCAD\DWG\The Trails Sign.dwg". (Outlines of the sign are already in the drawing on the layer "*-GUIDELINES".)
   b. Isolate layer SIGN-FOOTING-GUIDELINES.
   c. Turn on and set SIGN-FOOTING layer current.
   d. Click the **Extrude** button on the Solid tab, Solid panel.
   e. Click **Mode** in the command line.
   f. Click **Solid**.
   g. Select the gray color square then press **Enter**.
   h. Click **Path** in the command line then select the magenta 3D polyline.
   i. Repeat steps c. - g. for the second gray square.

2. **Constructing the Sign Base.**
   a. Isolate layer SIGN-BASE-GUIDELINES.
   b. Turn on and set SIGN-BASE layer current.
   c. Click the **Extrude** button on the Solid tab, Solid panel.
   d. Select the gray color square then press **Enter**.
   e. Click **Path** in the command line then select the magenta 3D polyline.

3. **Constructing the Sign Trim.**
   a. Isolate layer SIGN-BODY-TRIM-GUIDELINES.
   b. Turn on and set SIGN-BODY-TRIM layer current.
   c. Click the **Extrude** button on the Solid tab, Solid panel.
   d. Select the white color square then press **Enter**.
   e. Click **Path** in the command line then select the magenta 3D polyline.
   f. Repeat steps c. - e. for the two additional white squares.
   g. Click the **Extrude** button on the Solid tab, Solid panel.
   h. Select a white corner shape polyline then press **Enter**.
   i. Click **Path** in the command line then select the yellow 3D polyline next to the selected white corner shape polyline.
   j. Repeat steps g. - i. for the two additional corners.
   k. Click the **Extrude** button on the Solid tab, Solid panel.
   l. Select the red trim shape then press **Enter**.
   m. Click **Path** in the command line then select the cyan square polyline.
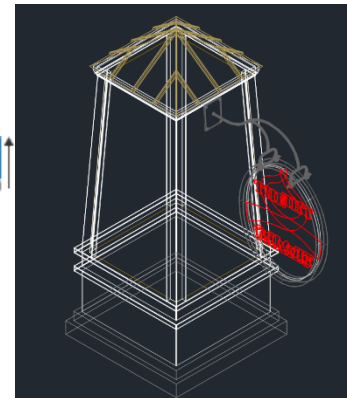
4. **Constructing the Sign Body.**
   a. Isolate layer SIGN-BODY-GUIDELINES.
   b. Turn on and set SIGN-BODY layer current.
   c. Click the **Loft** button on the Surface tab, Create panel.
   d. Click **Mode** in the command line.
   e. Click **Solid**.
   f. Select the bottom blue square then the top blue square then press **Enter** twice.

5. **Constructing the Sign Roof.**
   a. Isolate layer SIGN-ROOF-GUIDELINES.
   b. Turn on and set SIGN-ROOF layer current.
   c. Click the **Extrude** button on the Solid tab, Solid panel.
   d. Select the yellow polyline shape.
   e. Type 24 then press **Enter**.
   f. Click the **Extrude** button on the Solid tab, Solid panel.
   g. Select the brown color polyline then press **Enter**.
   h. Click **Path** in the command line then select the magenta 3D polyline.
   i. Click **Subtract** button on the Solid tab, Boolean panel.
   j. Select the newly created roof panel then press **Enter**.
   k. Select the brown multisided solid shape then press **Enter**.
   l. **Polar Array** the triangle roof panel around 0,0 with 4 items.

6. **Constructing the Sign Hanger.**
   a. Isolate layer SIGN-IRON-GUIDELINES.
   b. Turn on and set SIGN-IRON layer current.
   c. Click the **Extrude** button on the Solid tab, Solid panel.
   d. Select a gray circle then press **Enter**.
   e. Click Path in the command line then select the yellow polyline.
   f. Repeat steps d. - e. for the additional circles.
   g. Click the **Extrude** button on the Solid tab, Solid panel.
   h. Select a gray rectangle then press **Enter**.
   i. Type 3/4 then press **Enter**.
   j. Click the **Extrude** button on the Solid tab, Solid panel.
   k. Select all the blue loop shapes.
   l. Type 3/4 then press **Enter**.
   m. Click **Subtract** button on the Solid tab, Boolean panel.
   n. Select the outer solid loop then press **Enter**.
   o. Select the inner solid loop then press **Enter**.
   p. Repeat steps m. - n. for the additional loops.
   q. Fillet all the edges of the loops with a radii of 1/4.
   r. Click the **Spheer** button on the Solid tab, Primitive panel.
   s. Place a spheer in the center of each green circle with a radii of 1/2.
   t. Click the **Extrude** button on the Solid tab, Solid panel.
   u. Select the two red circles then press **Enter**.
   v. Click **Path** in the command line then select the magenta polyline.
   w. Fillet all the edges of the shafts with a radii of 1/8.

7. **Constructing the Oval Sign.**
   a. Isolate layer SIGN-SIGN-GUIDELINES.
   b. Turn on and set SIGN-SIGN layer current.
   c. Click the **Extrude** button on the Solid tab, Solid panel.
   d. Select the white ellipse then press **Enter**.
   e. Click **Path** in the command line then select the magenta polyline.

8. **Constructing the Oval Sign Logo.**
   a. Isolate layer SIGN-SIGN-LOGO-GUIDELINES.
   b. Turn on and set SIGN-SIGN-LOGO layer current.
   c. Click the **Extrude** button on the Solid tab, Solid panel.
   d. Select the red polylines then press Enter.
   e. Click **Path** in the command line then select the magenta polyline.
   f. (Note: I used the Express Tools, Explode Text (txtexp) command to create the text outline.)
   g. Click **Subtract** button on the Solid tab, Boolean panel.
   h. Select the letter R outer solid then press **Enter**.
   i. Select the letter R inner solid then press **Enter**.
   j. Repeat the solid subtraction for the letter A.
   k. **Polar Array** the red logo around the midpoint of the yellow line with 2 items.

9. **Constructing the Oval Sign Trim.**
   a. Isolate layer SIGN-SIGN-TRIM-GUIDELINES.
   b. Turn on and set SIGN-SIGN-TRIM layer current.
   c. Click the **Extrude** button on the Solid tab, Solid panel.
   d. Select the two gray ellipses then press **Enter**.
   e. Click **Path** in the command line then select the magenta polyline.
   f. Click **Subtract** button on the Solid tab, Boolean panel.
   g. Select the outer oval solid then press **Enter**.
   h. Select the inner oval solid then press **Enter**.

3D Car Wheel

1. **Constructing the 3D wheel.**
    a. Open "C:\DATASETS\AS500048 - 3D Modeling with the Best, AutoCAD\DWG\Car Wheel.dwg". (Outlines of the wheel are already in the drawing on the layer "GUIDELINES".)
    b. Click the Solid Tab on the Ribbon.
    c. Set layer **3DWHEEL** current.
    d. Click the **Revolve** button on the Solid panel.
    e. Click **Mode** in the command line then select **Solid**.
    f. Select the two green polygons then press **Enter**.
    g. Specify Axis Start Point. Snap Endpoint to one end of the red centerline then Snap Endpoint to the other end of the red centerline.
   h. Type 360 at the command line then press **Enter**.

2. **Constructing the lug bolt holes.**
    a. Set layer 3DWHEEL-HOLES current.
    b. Click the **Revolve** button on the Solid panel.
    c. Click **Mode** in the command line then select **Solid**.
    d. Select the blue polygon then press **Enter**.
    e. Specify Axis Start Point. Snap Endpoint to one end of the yellow centerline then Snap Endpoint to the other end of the yellow centerline.
    f. Type 360 at the command line then press **Enter**.
    g. Array the newly created cylinder by typing **3DArray** at the command line then press **Enter**.
    h. Select the newly created cylinder.
    i. Click **Polar** in the command line then press **Enter**.
    j. Click **Axis** of rotation in the command then press **Enter**.
    k. Snap Endpoint to one end of the red centerline then Snap Endpoint to the other end of the red centerline.
    l. Click **Items** in the command, type 5 then press **Enter** twice.
    m. Click the Solid Tab on the Ribbon.
    n. Click the **Subtract** button on the Boolean panel.
    o. Select the newly created cylinder then press **Enter**.
    p. Select the center section of the wheel then press **Enter**.

3. **Constructing the 3D wheel spokes.**
   a. Set layer 3DWHEEL SPOKES current.
   b. Click the Solid Tab on the Ribbon.
   c. Click the **Loft** button on the Solids panel. (Located below the Sweep button.)
   d. Select the two white rectangles then press **Enter**
   e. Click **Path** in the command line, select the cyan polyline then press **Enter**.
   f. Repeat steps c – e for split spoke.
   g. Array the newly created cylinder by typing **3DArray** at the command line then press **Enter**.
   h. Select the newly created cylinder.
   i. Click **Polar** in the command line then press **Enter**.
   j. Click **Axis** of rotation in the command then press **Enter**.
   k. Snap Endpoint to one end of the red centerline then Snap Endpoint to the other end of the red centerline.
   l. Click **Items** in the command, type 5 then press **Enter** twice.
   m. Apply a material to the objects. (Directions shown on page 15)
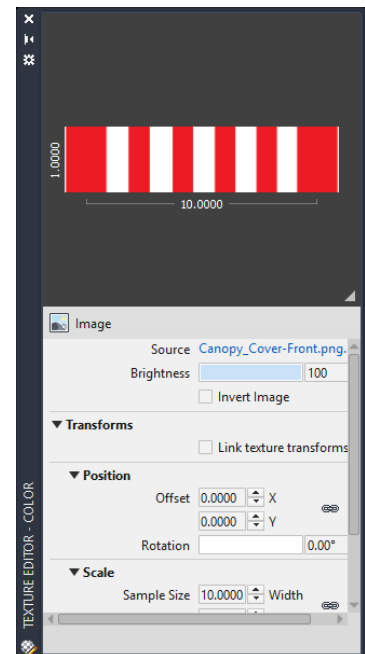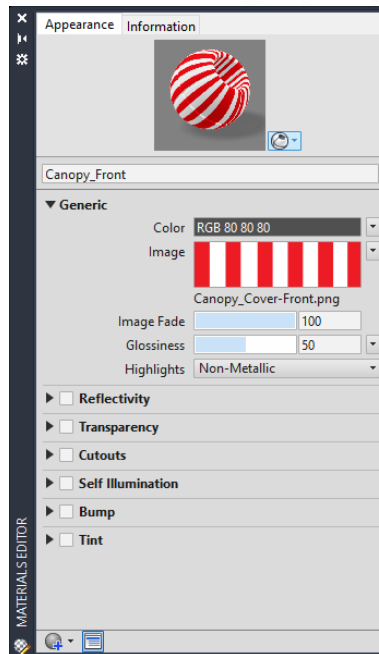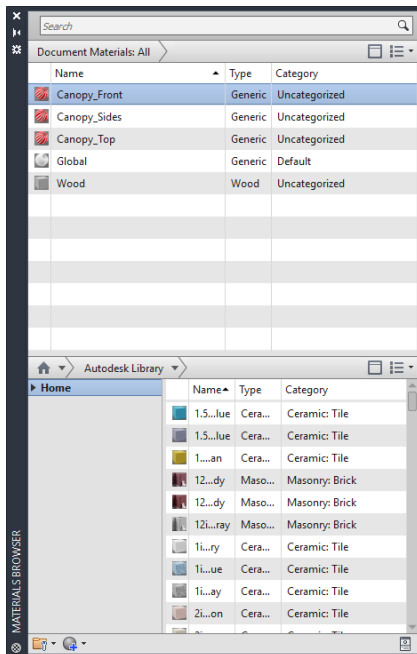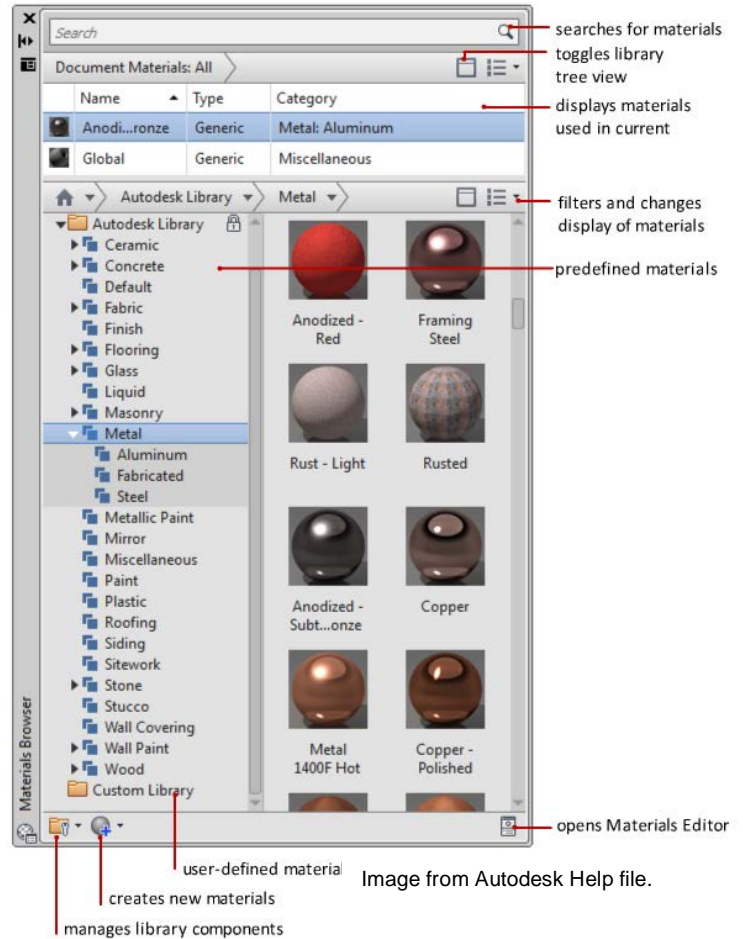
AUTODESK UNIVERSITY
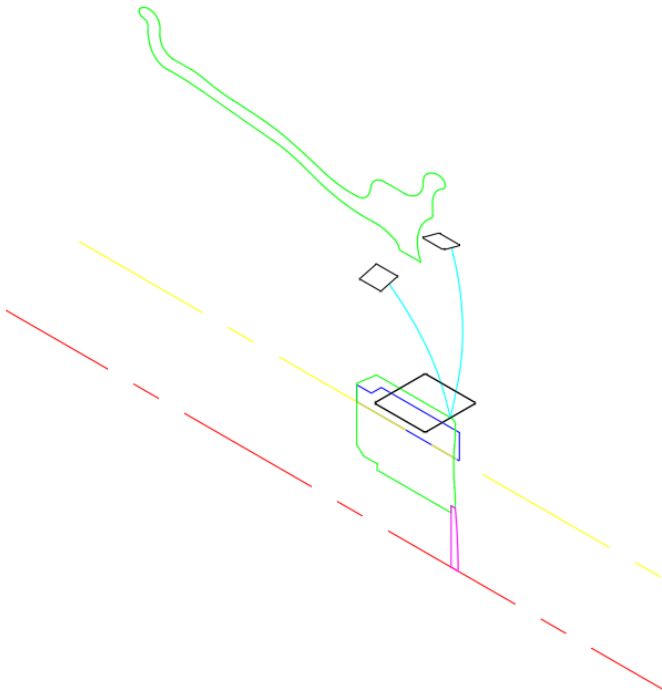
3D Street Light

1. Construct the 3D streetlight with the tools solid learned in this handout.
   a. Open "C:\DATASETS\AS500048 - 3D Modeling with the Best, AutoCAD\DWG\Light_Pole.dwg".
   b. (Outlines of the light pole are already in the drawing on the layer "GUIDELINES".)
   c. Set the LIGHTPOLE-BASE layer current.
   d. Click the **Loft** button on the Solids panel. (Located below the Sweep button.)
   e. Select each magenta closed polylines starting at the bottom to create the base.
   f. Set the LIGHTPOLE-POLE layer current.
   g. Click the **Extrude** button on the Solids panel.
   h. Select the red circle then press **Enter.**
   i. Click **Path** in the command line, select the cyan polyline then press **Enter**.
   j. Set the LIGHTPOLE-HOUSING layer current.
   k. Click the **Extrude** button on the Solids panel.
   l. Select the outer green rectangle then press **Enter.**
   m. Type a height of 5.0 then press **Enter.**
   n. Click the **Extrude** button on the Solids panel.
   o. Select the inner green rectangle then press **Enter.**
   p. Type a height of 4.5 then press **Enter.**
   q. Layer isolate the LIGHTPOLE-HOUSING layer.
   r. **Solid Subtract** the inner solid from the outer solid.
   s. Turn all layers on.
   t. Set the LIGHTPOLE-LENS layer current.
   u. Click the **Extrude** button on the Solids panel.
   v. Select the yellow rectangle then press **Enter.**
   w. Type a height of 0.4 then press **Enter.**
   x. Apply a material to the objects. (Directions shown on page 15)
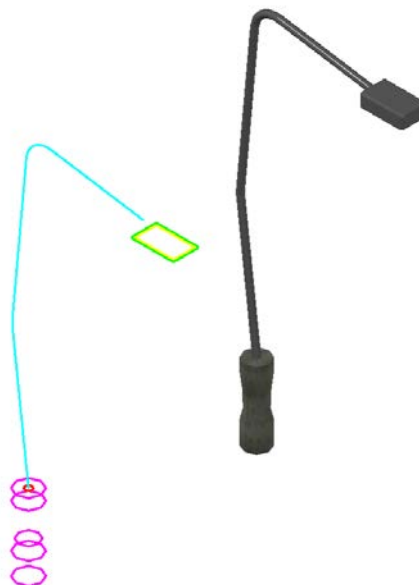
Assigning Textures and Materials.

    a. Open "C:\DATASETS\AS500048 - 3D Modeling with the Best, AutoCAD\DWG\Dropbox.dwg".

    b. Isolate layer "DROPBOX".

    c. Click the **Material Browser** button under the Visualize tab, Materials panel.

    d. Click the Create New Material button the select New Generic Material. (The Materials Editor will open)

    e. Rename the material name to "Dropbox_Color".

    f. Click the white image box then select Dropbox_Color.png from the "IMG" folder.

    g. Close the Texture Editor and Materials Editor.

    h. Set the Visual Style to "Realistic" to see the materials.

    i. To adjust the material mapping, click the **Material Mapping** button under the Visualize tab, Materials panel then while holding the "Control" (ctrl) key, pick the side of the drop box.

    j. Repeat for additional materials.

Image from Autodesk Help file.

<u>NOTES</u>