EN1740 Computer Aided Visualization and Design

Spring 2012

5/10/2012

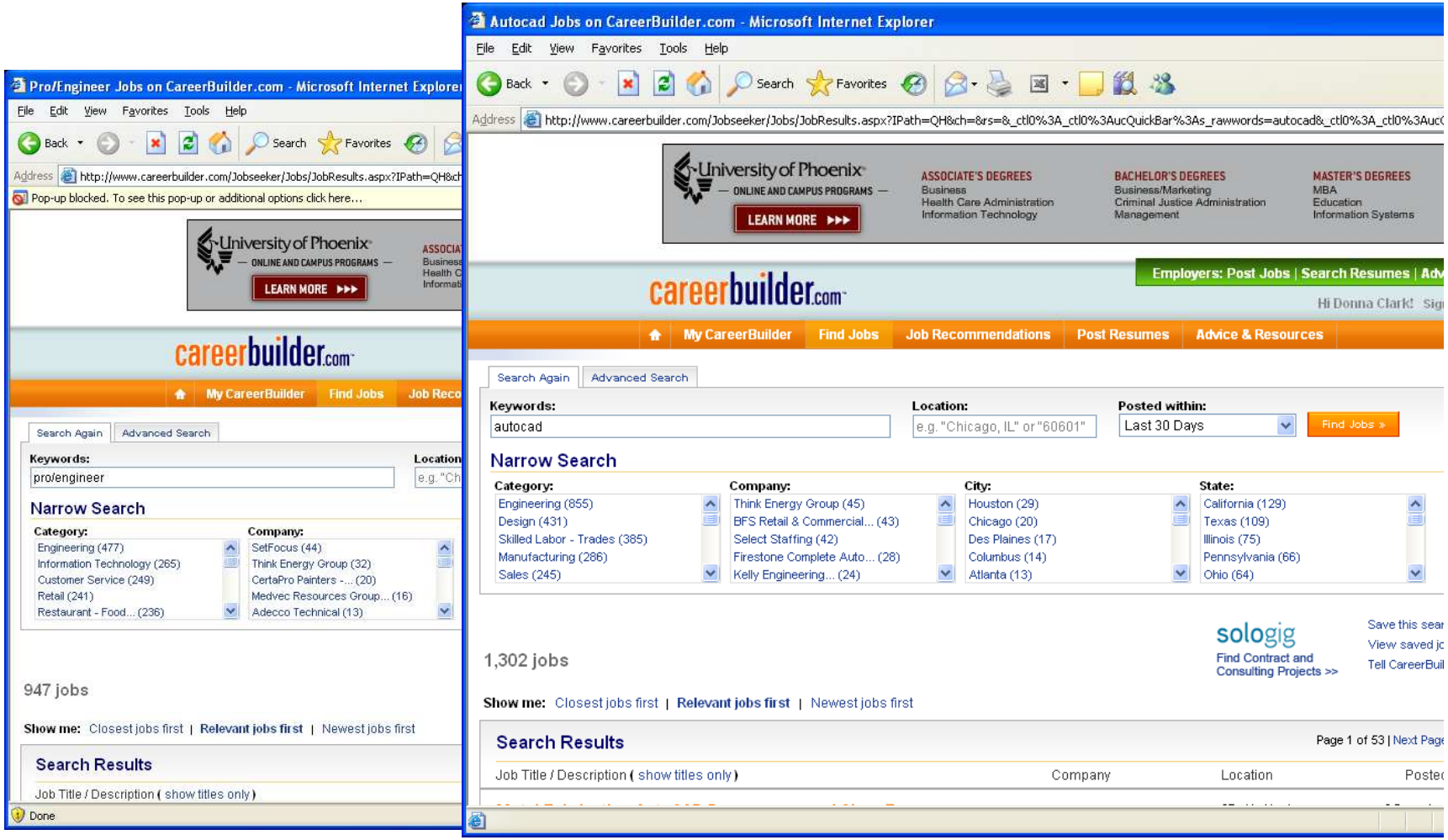
Brian C. P. Burke

Tonight:

- Introduction to AutoCAD

AutoCAD

Still relevant? Definitely.



2D vs. 3D CAD

Fundamentally different

2D

- Geometry is constructed from line entities
- To completely define real entity, multiple views are required as well as sections
- This type of visualization is an extension of drawing-board days
    - "Electronic pencil"

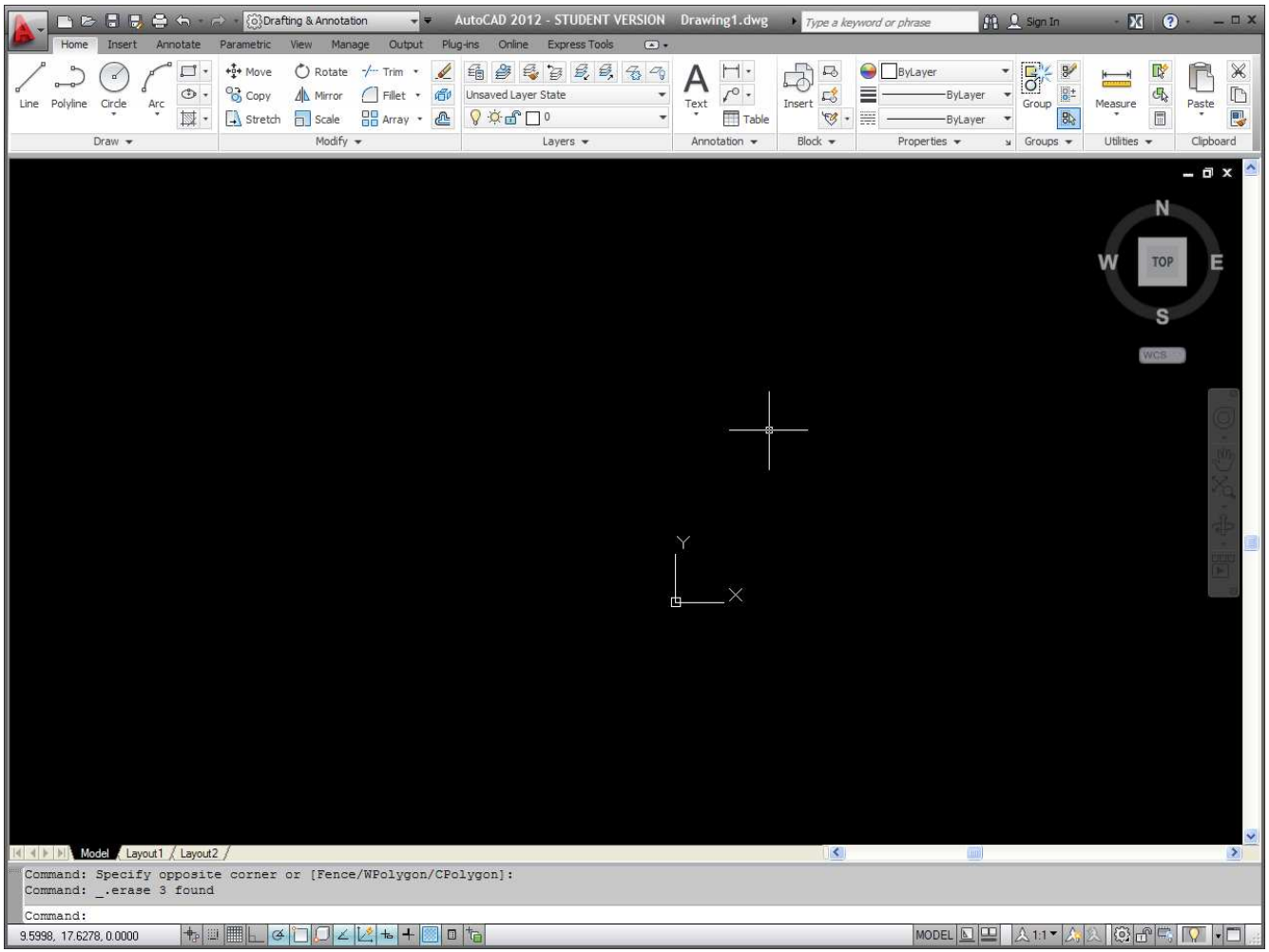
3D

- Construct parametric geometry
- Component features match CAD features
- Virtual parts correspond to real parts in terms of volume, as well as size and location of features

AutoCAD

Let's get the basics…

- Layout is very similar to PP2007, 2010

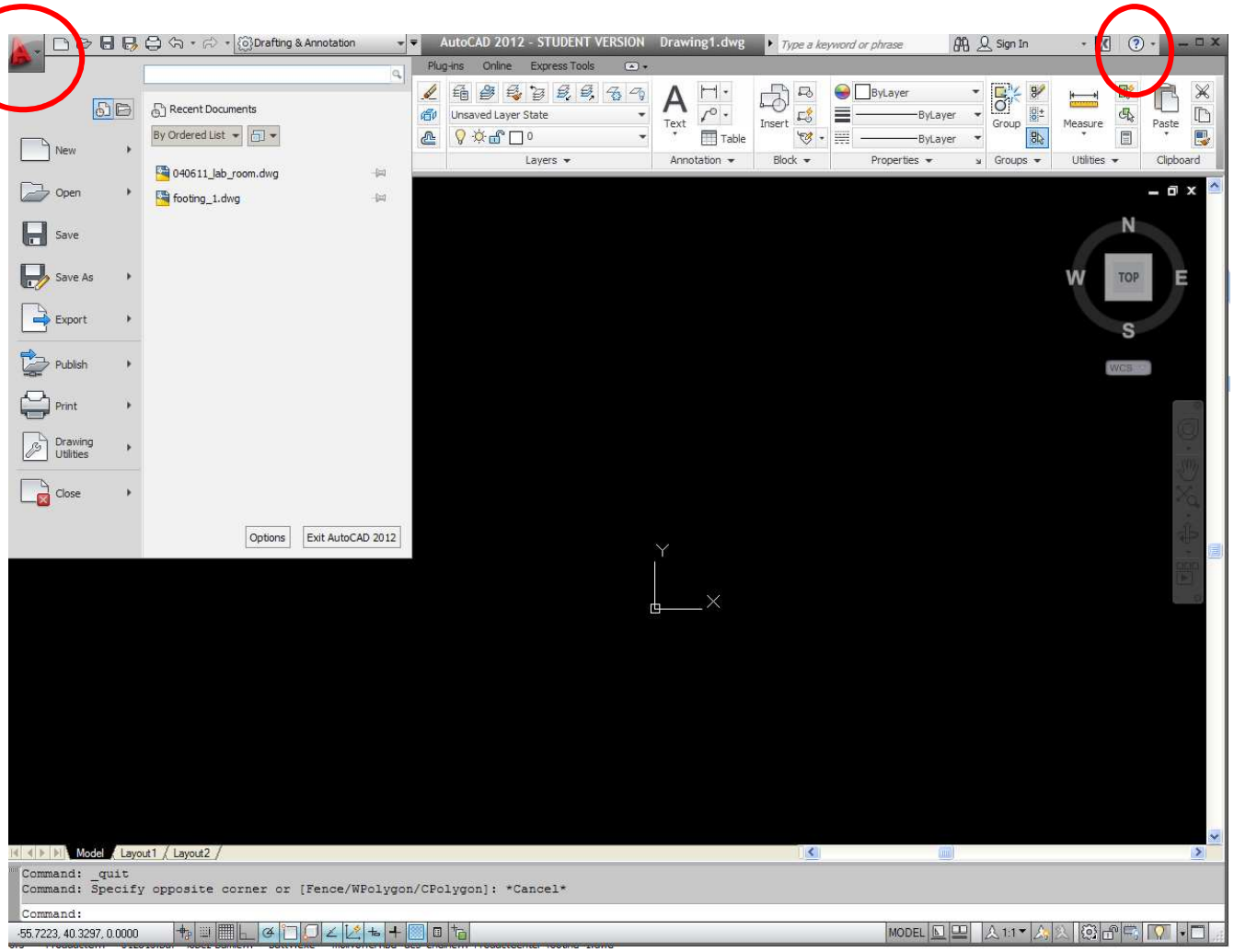


AutoCAD

Let's get the basics…

- File and System stuff is under the AutoCAD "A"

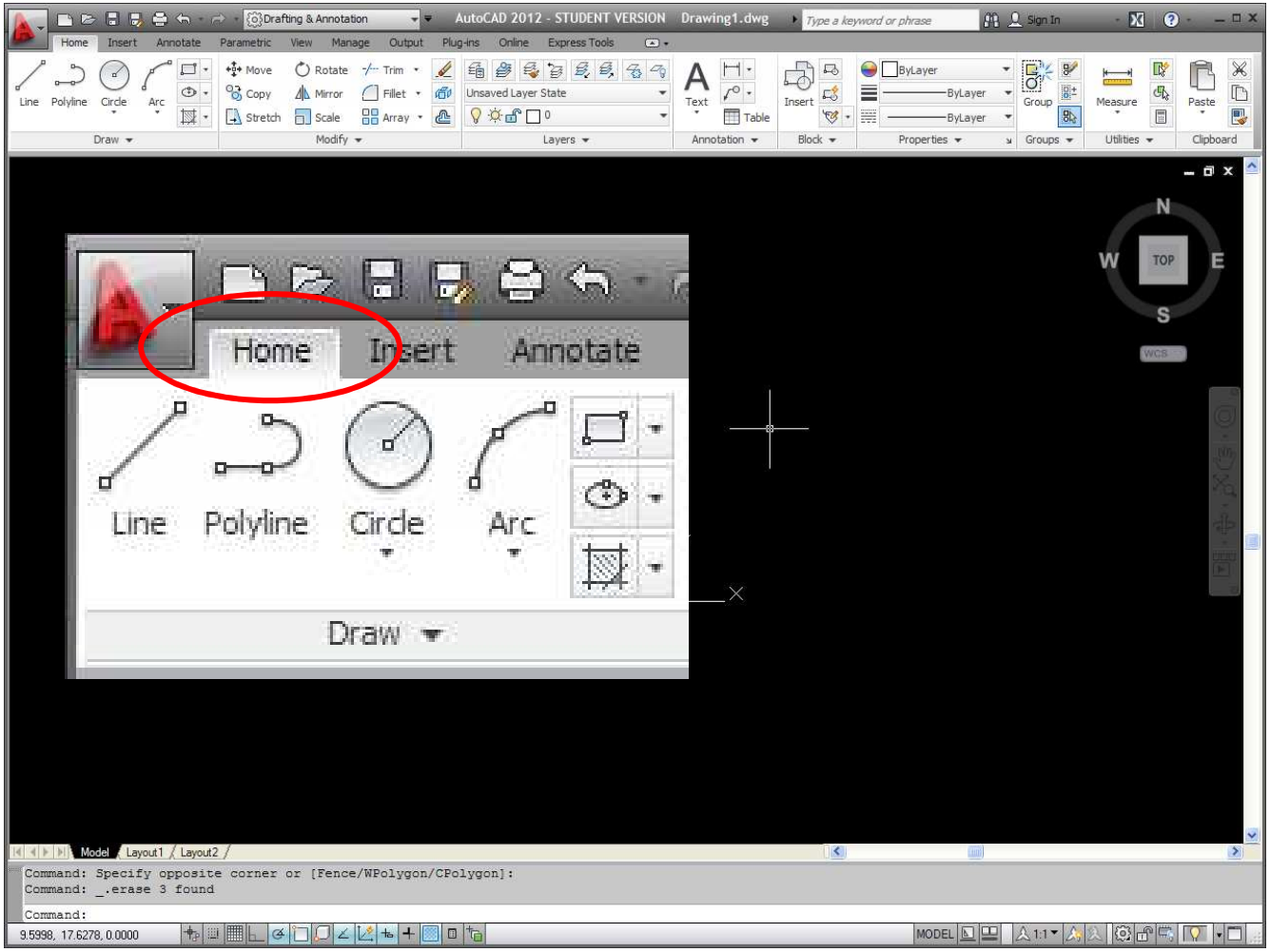
- Help is launched from the lonely question mark out on the end



AutoCAD

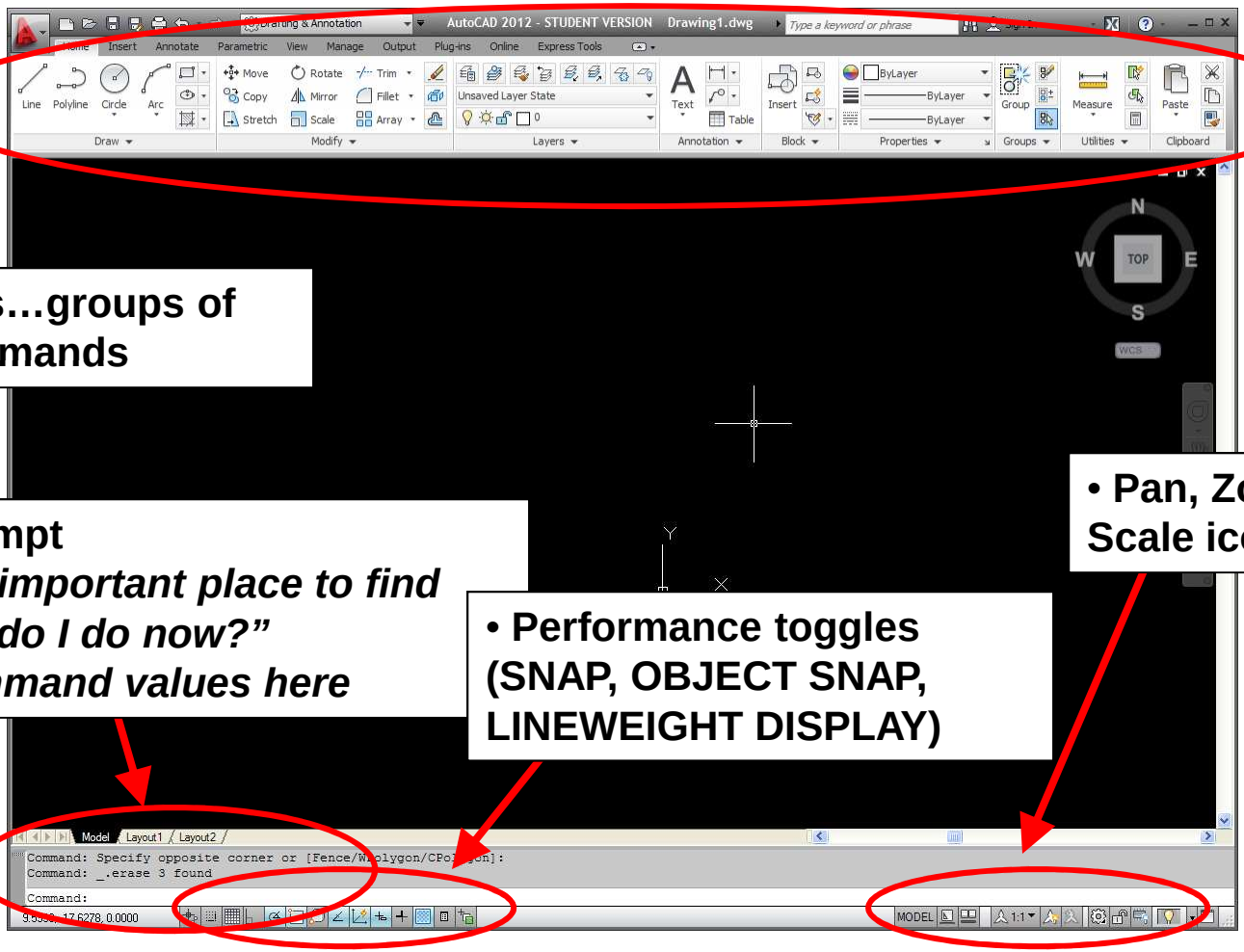
Let's get the basics…

- Most frequently used commands are found under the Home tab
- ***You could almost survive with just what's in the Home menu***



AutoCAD

General Layout – The essentials

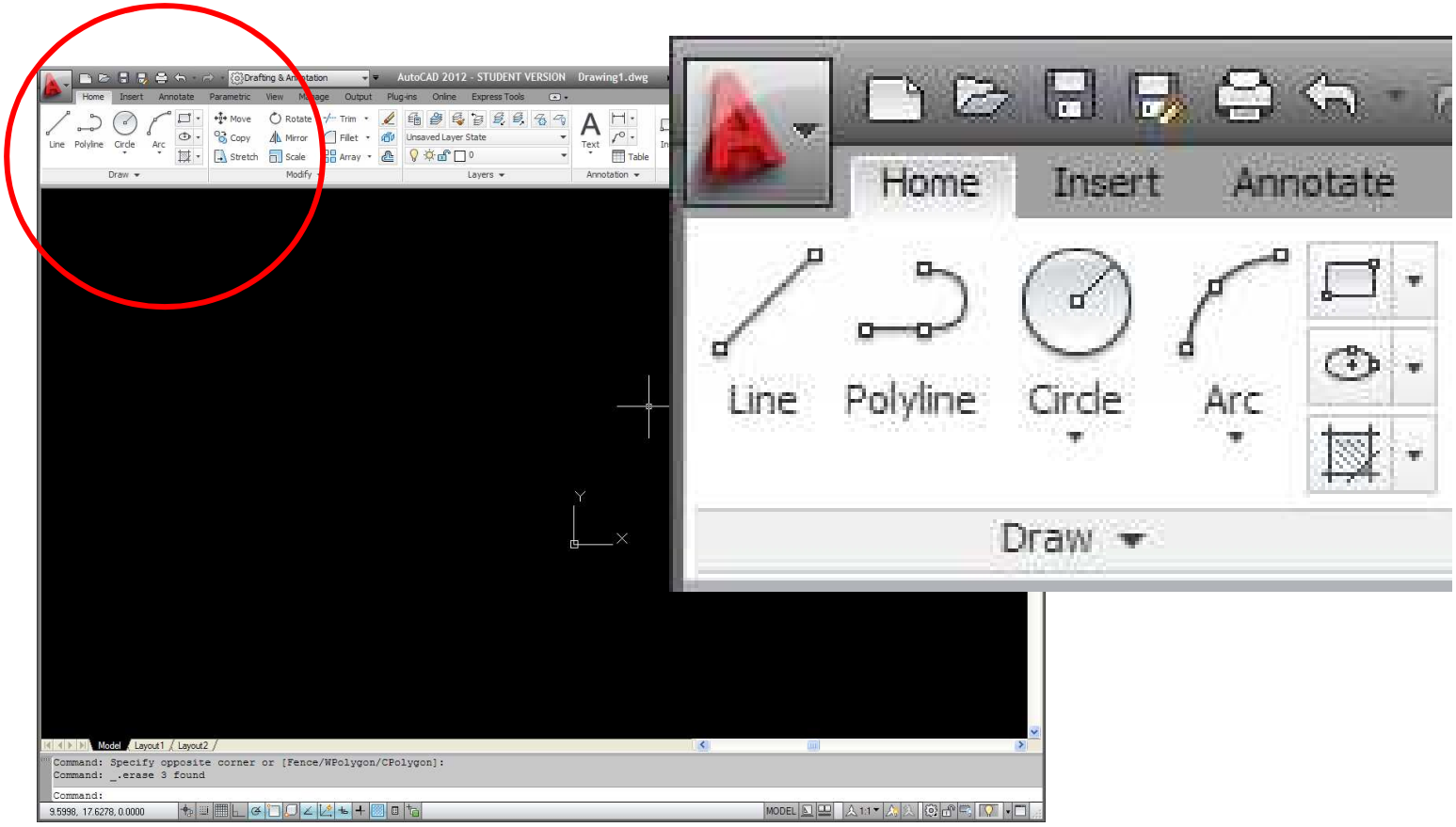


- **Menu panels…groups of common commands**
- **Command prompt**
  - ***The most important place to find out, "What do I do now?"***
  - ***Enter command values here***
- **Performance toggles (SNAP, OBJECT SNAP, LINEWEIGHT DISPLAY)**
- **Pan, Zoom, Scale icons**

AutoCAD

Typical menu layout

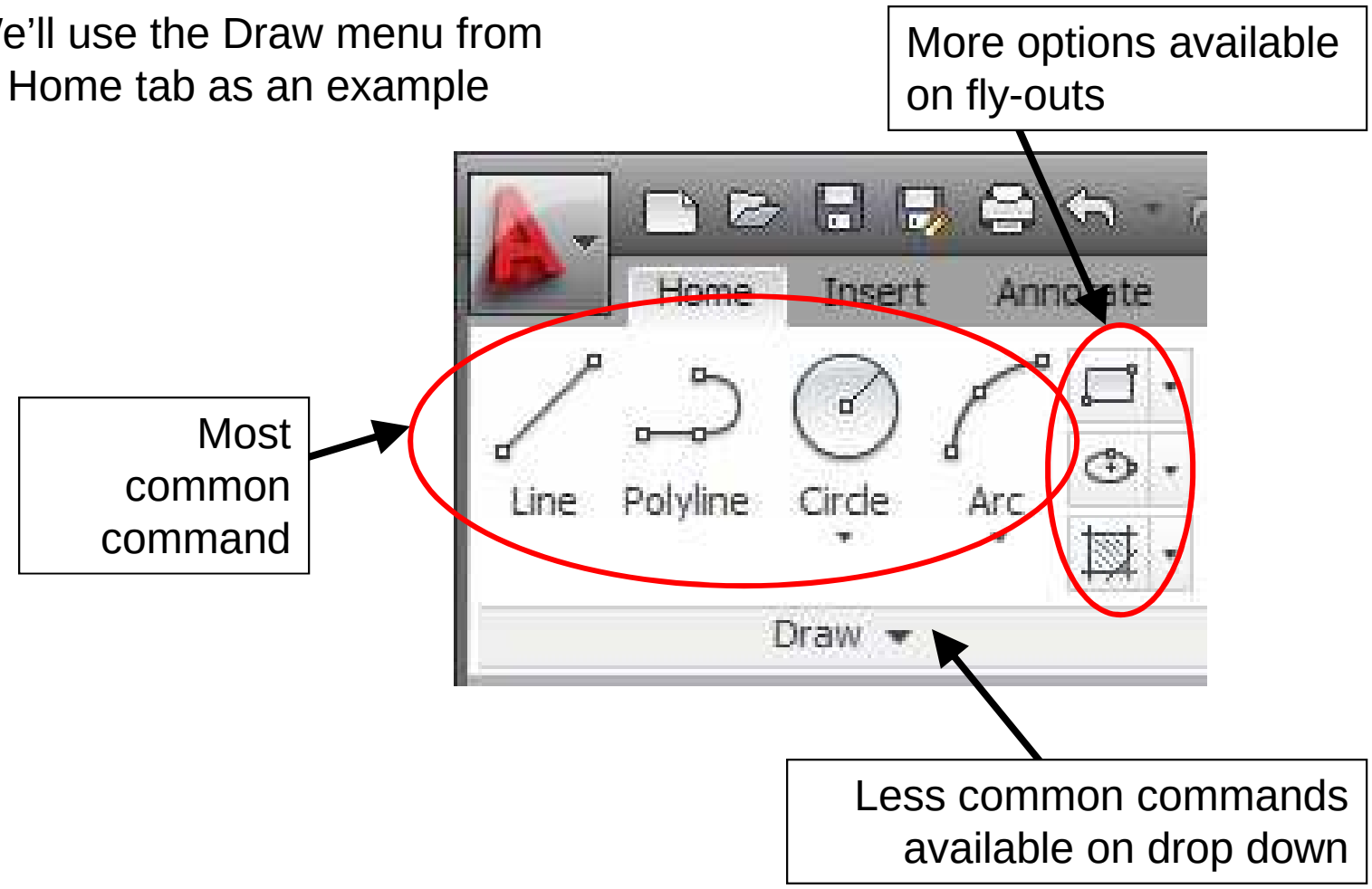
- We'll use the Draw menu from the Home tab as an example



AutoCAD

Typical menu layout

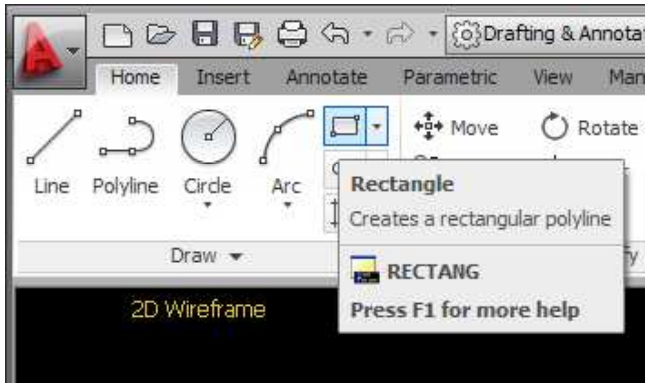
• We'll use the Draw menu from the Home tab as an example



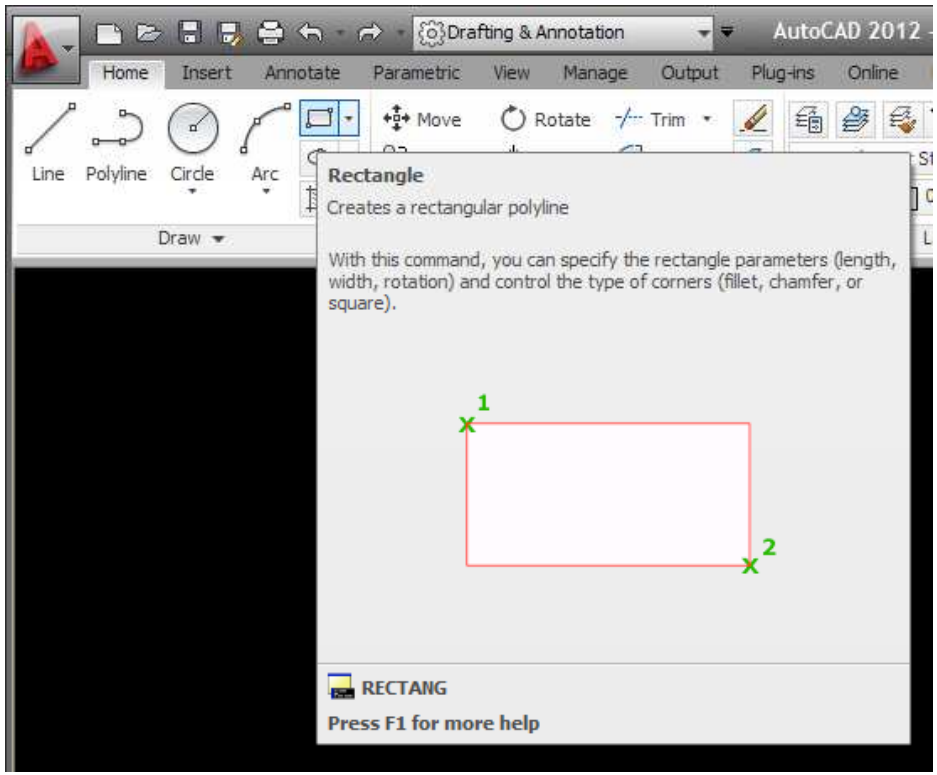
AutoCAD

Fairly detailed help available by hovering pointer over icons

Wait a little while…



Wait a little while longer…



AutoCAD

Default mouse button assignments

- LMB – Selection
- RMB – Pop-up
- Scroll wheel – Zoom
- Click and hold wheel – Pan

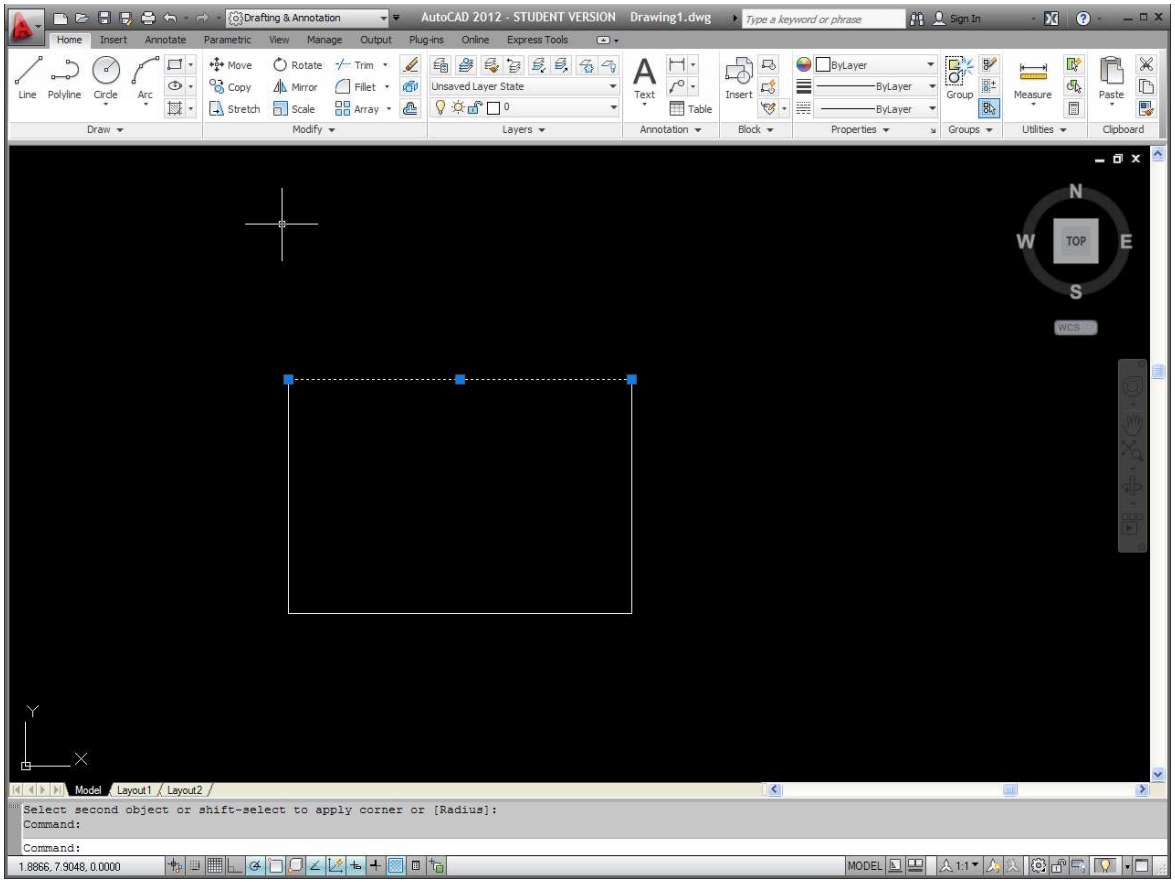
AutoCAD mouse buttons are highly customizable

RMB > Options to customize AutoCAD

AutoCAD

Selection

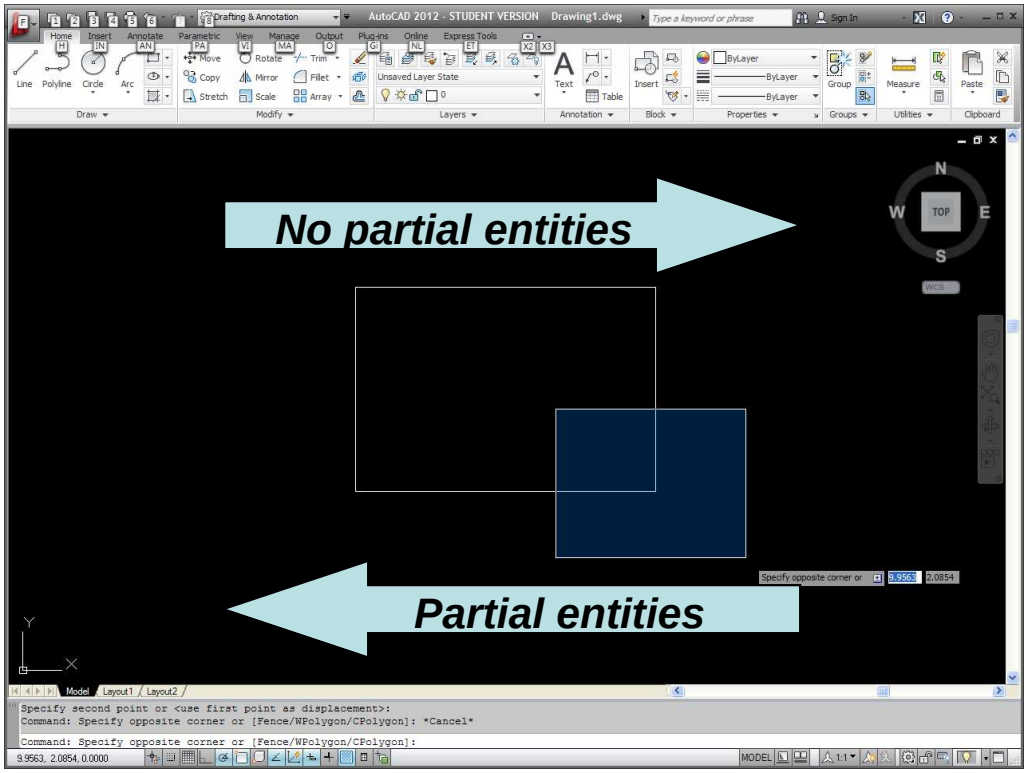
- Select with LMB
- Unselect individual entities with Shift + LMB
- Unselect all entities with Esc key



AutoCAD

Window select – Huge time saver

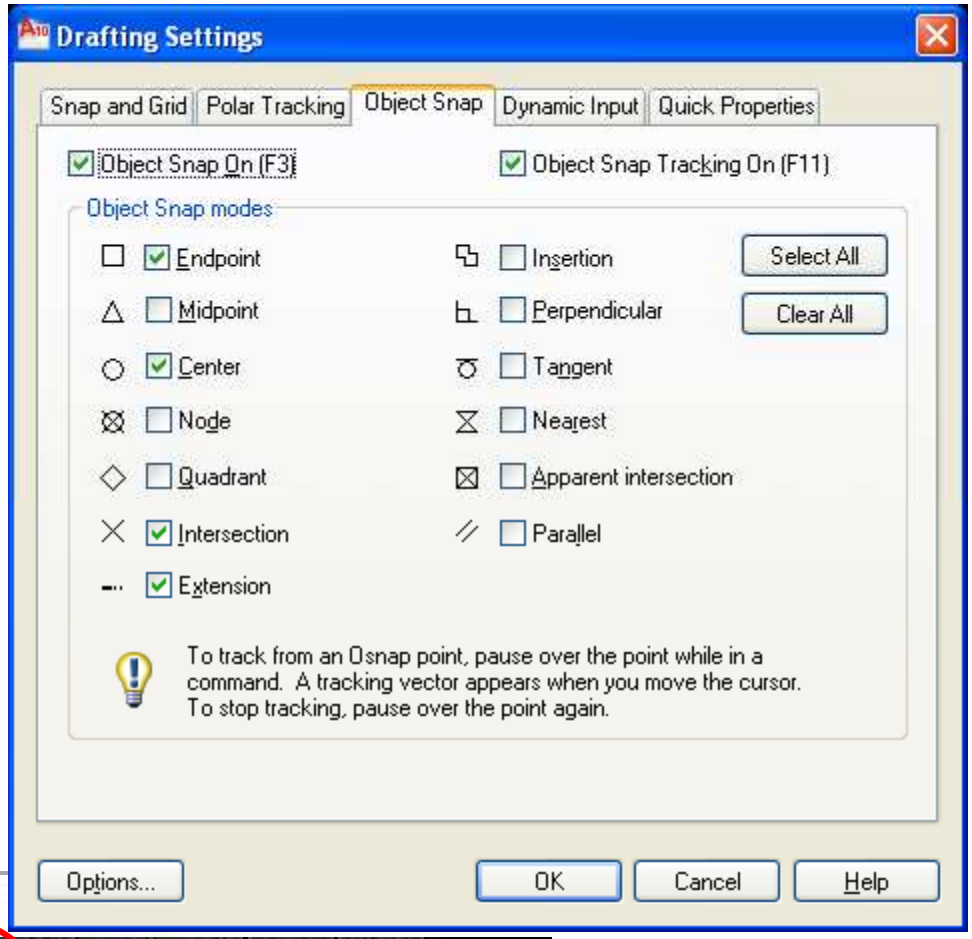
- Entities can be selected with a window
- Depending on which direction the window is drawn, partially enclosed entities are either included or not included
  - Left to right > Partial entities are not included
  - Right to left > Partial entities are included

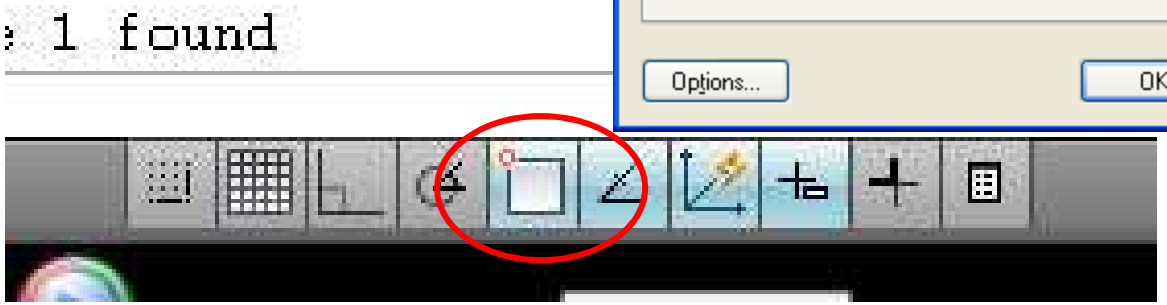


AutoCAD

Object Snap (OSNAP)

- Forces pointer to “snap” to certain types of drafting objects
- Turn on and off with the OSNAP icon along the bottom
- Access the settings by RMB on OSNAP icon > Settings…

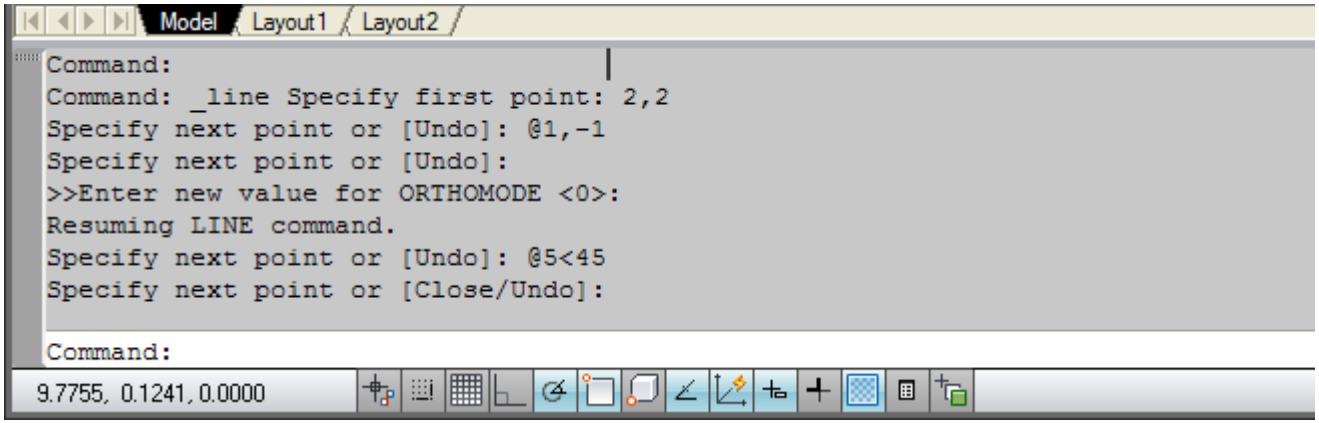




AutoCAD

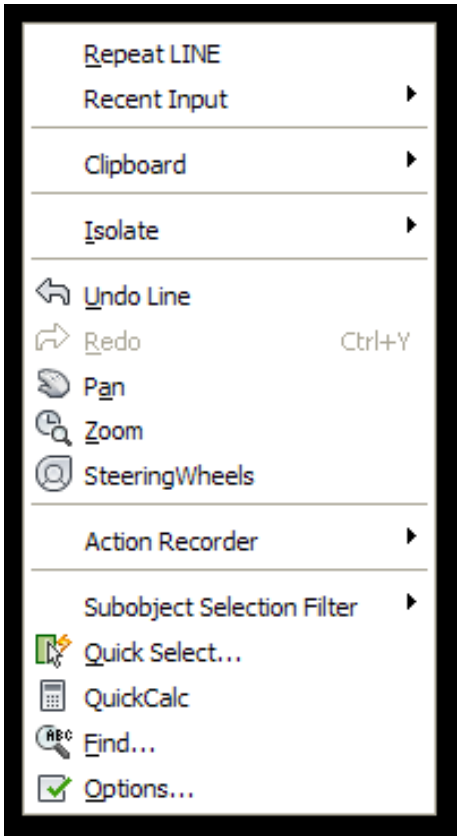
Points define line segments – There are several ways to specify

- Absolute coordinates – Give x, y location relative to coordinate system, e.g. 2,2
- Relative to last point – Key in the "@" symbol followed by relative displacement from last vertex, e.g. @1, -1
- Polar – Give distance and degree relative to last coordinate separated by "<" symbol, e.g. 5<45
- All coordinates get keyed at Command Prompt or in Graphics Window (new to AutoCAD)

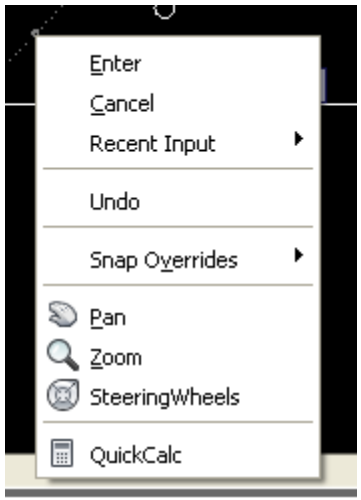


AutoCAD

Right Mouse Button – There's a lot there



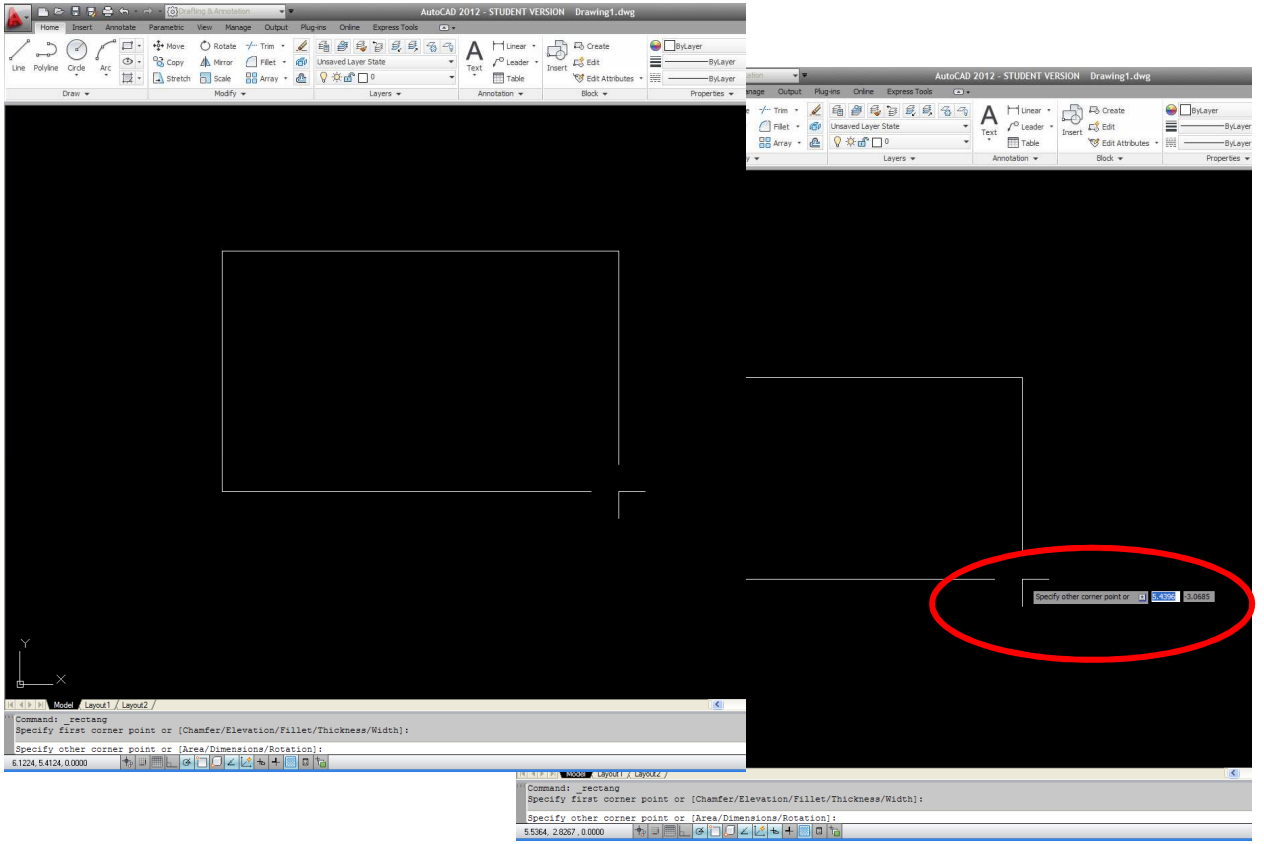
Outside a command there are frequently used commands and short-cuts

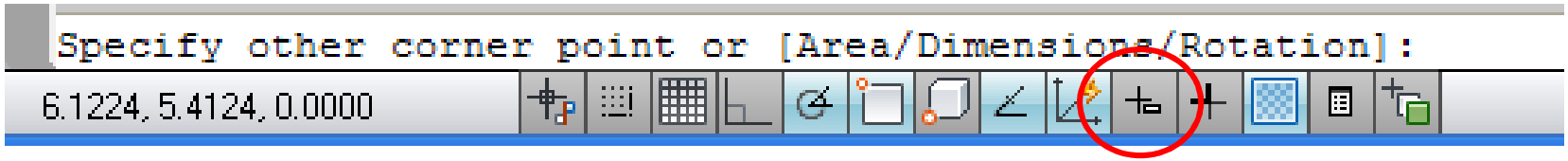


Inside a command, it can be used to enter a selection or cancel one

Turn off Dynamic Input!!

- Provides method for entering dimensions near prompt
- Comes with some assumptions
- Check help if interested

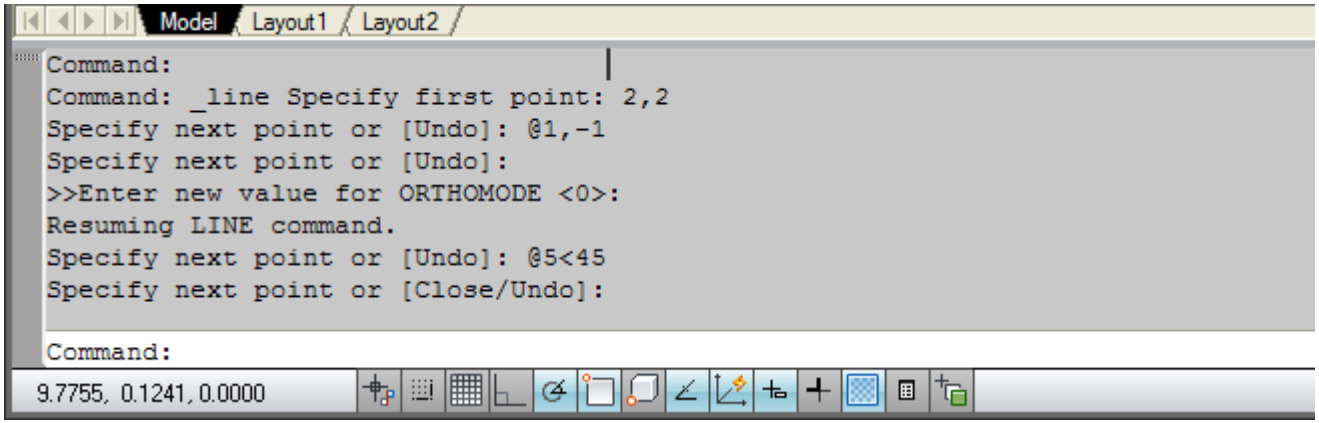




AutoCAD - *Reminder*

Points define line segments – There are several ways to specify

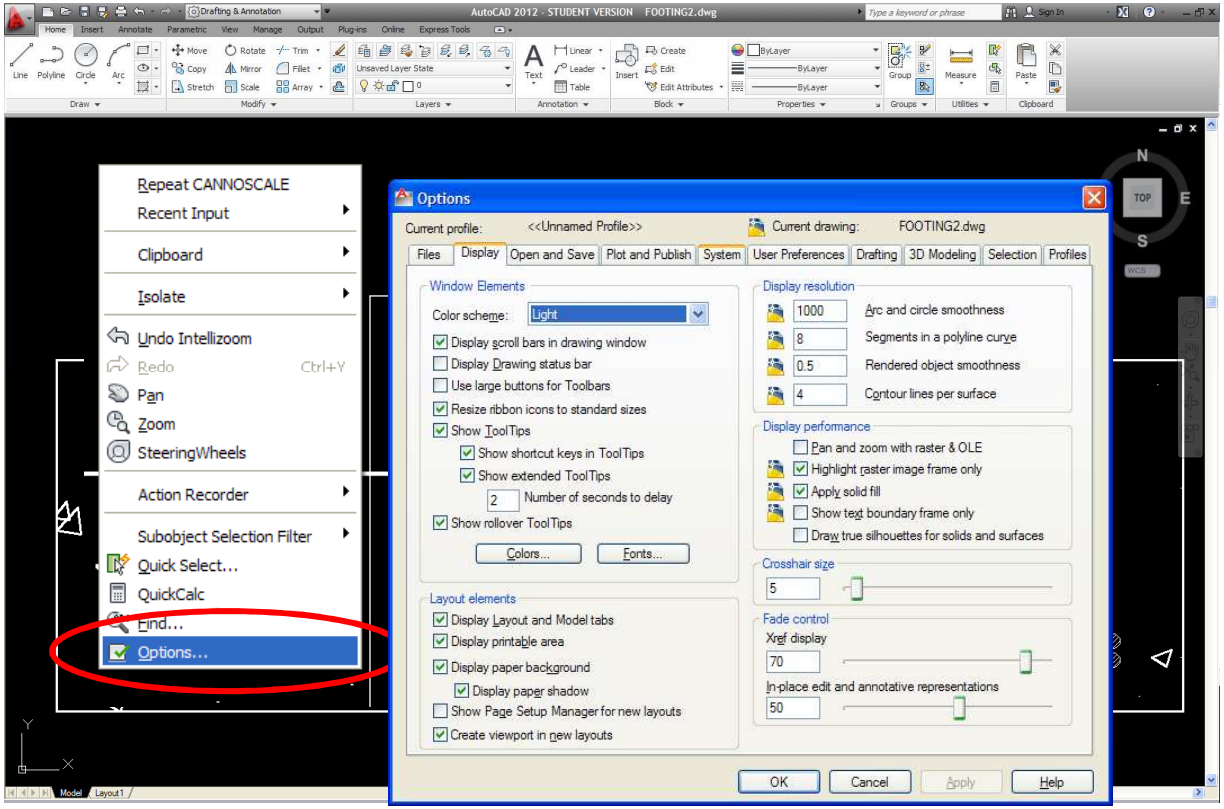
- Absolute coordinates – Give x, y location relative to coordinate system, e.g. 2,2
- Relative to last point – Key in the "@" symbol followed by relative displacement from last vertex, e.g. @1, -1
- Polar – Give distance and degree relative to last coordinate separated by "<" symbol, e.g. 5<45
- All coordinates get keyed at Command Prompt or in Graphics Window (new to AutoCAD)



Options

AutoCAD has a lot of options that can be customized

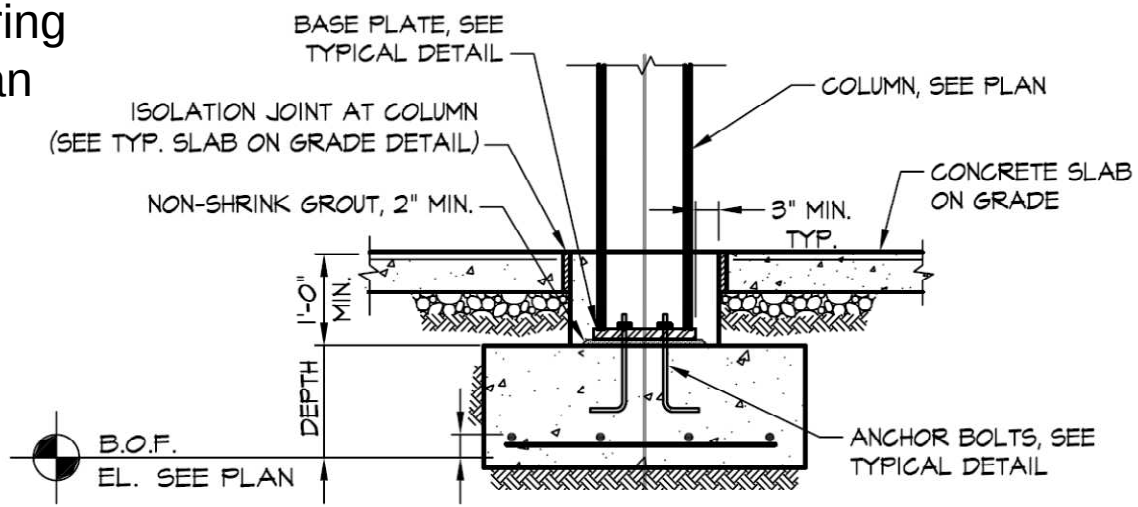
- RMB > Options… to bring up dialog box
- There's an option for everything, but may need look around a bit



EXERCISE - AutoCAD

Let's re-create a detailed view from set of construction plans

• Typical example of a 2D CAD application in Civil Engineering => Submission of plans to an inspector



NOTES:

1. FOOTINGS SHALL BEAR ON FIRM UNDISURBED SOIL WITH A MINIMUM BEARING CAPACITY AS SPECIFIED IN THE GENERAL NOTES.
2. FOR SIZE, DEPTH AND REINFORCING SEE FOOTING SCHEDULE.

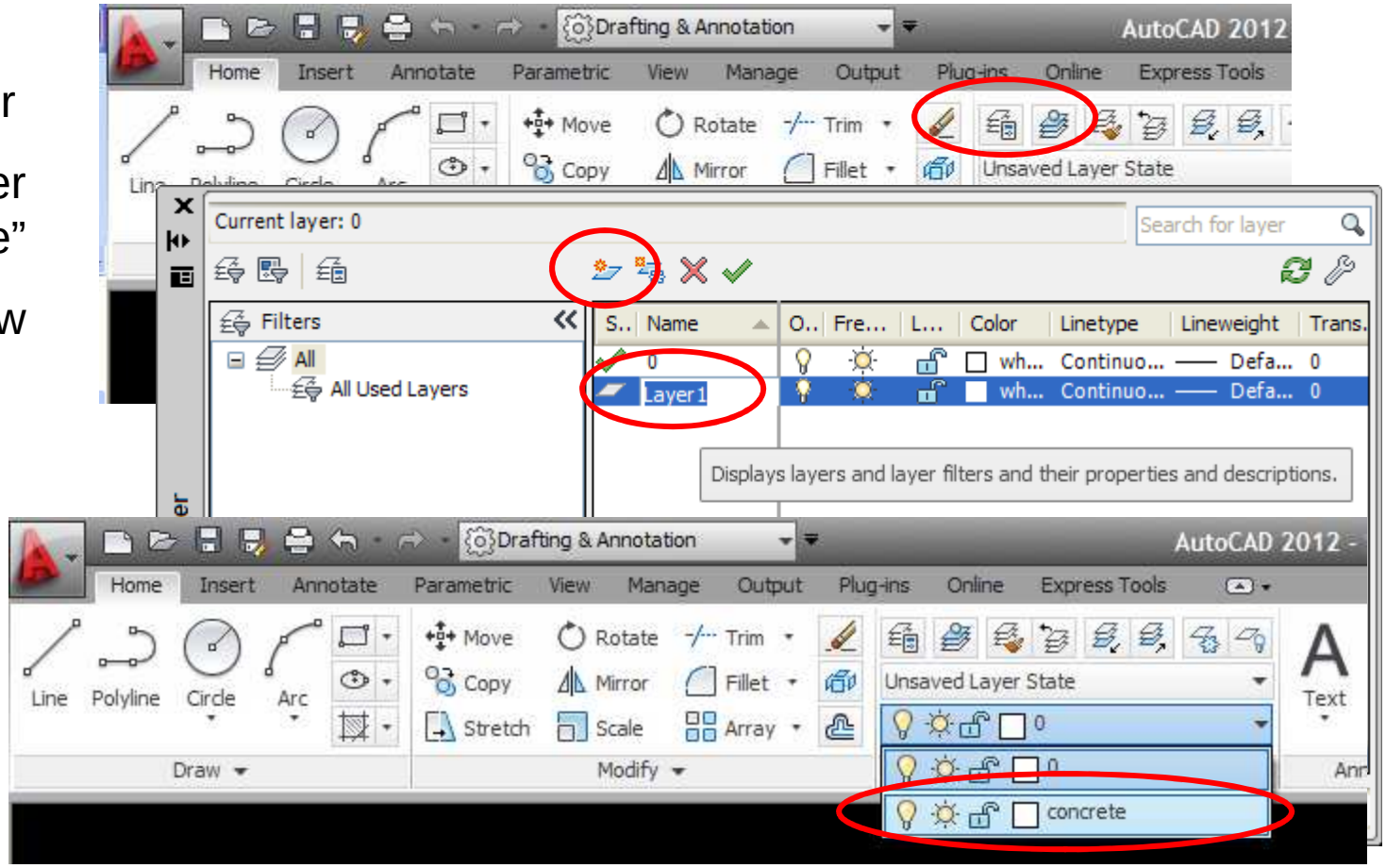
TYPICAL DETAIL STEEL COLUMN ON CONCRETE FOOTING

(Creative Arts Center Drawings, Brown University, Jan. 21, 2009)

EXERCISE - AutoCAD

Define a new layer for concrete sections

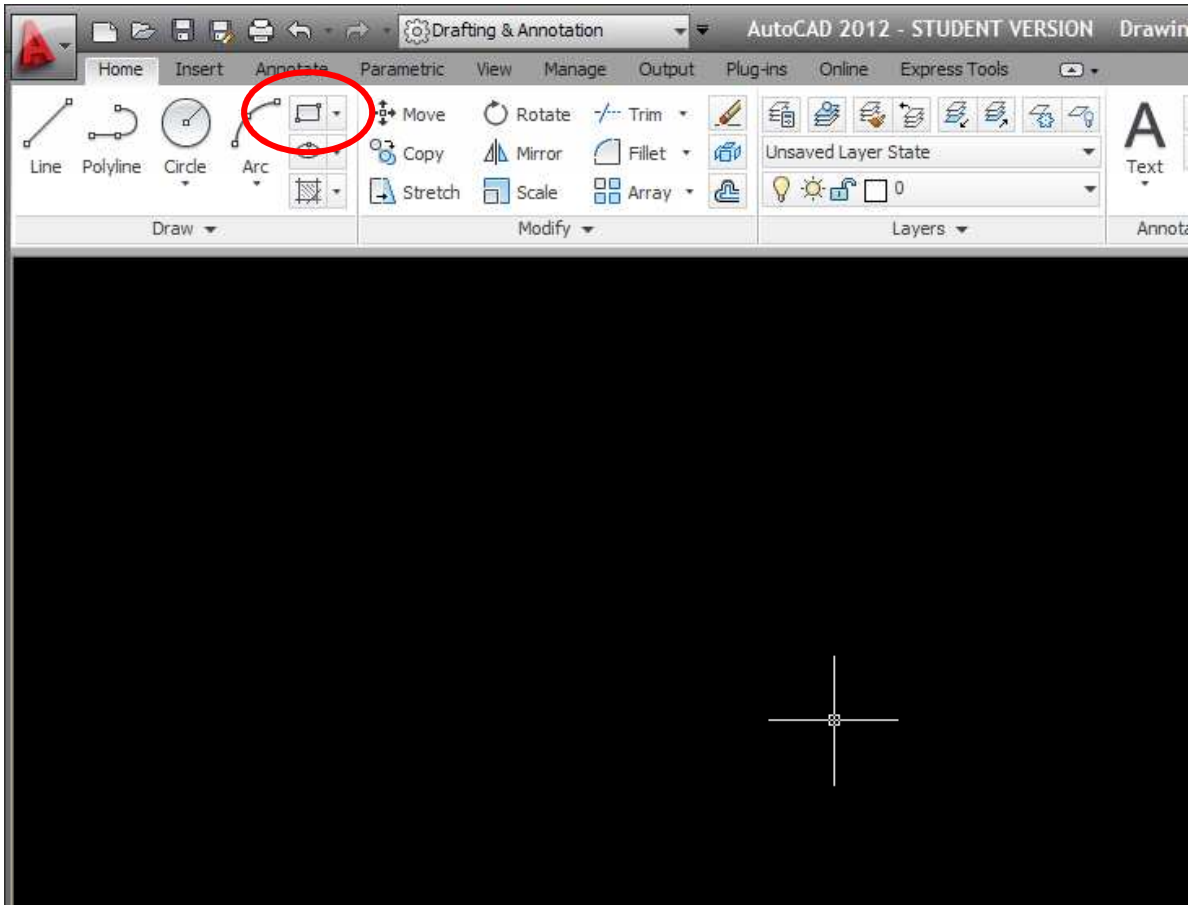
- Launch Layer Properties Manager
- Create a new layer and call it “concrete”
- From main window select that layer as current



EXERCISE - AutoCAD

Sketch a rectangle for the footing

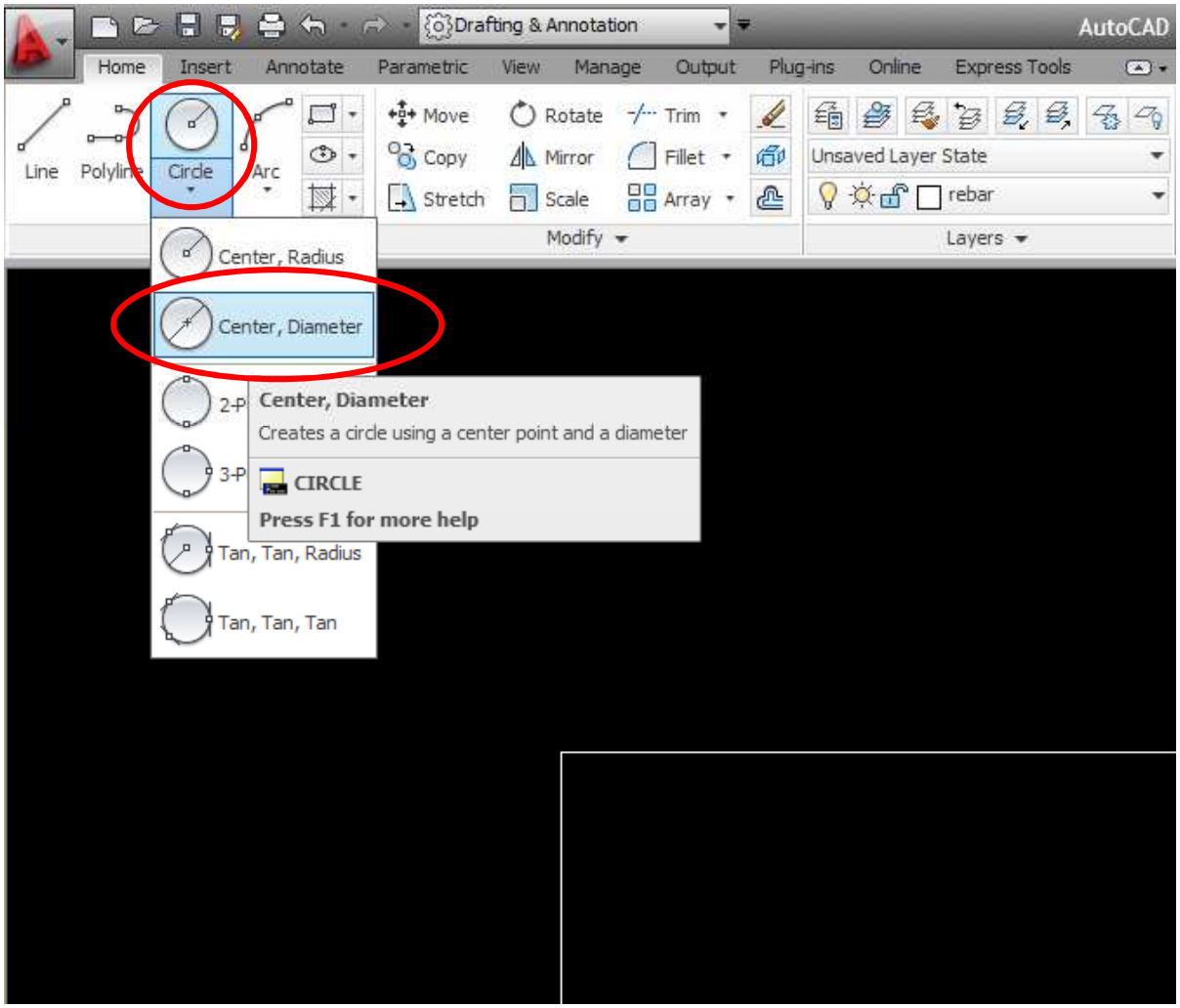
- Select Rectangle tool
- In command prompt, key in -2, -1.25 then 2, 0
    - This created a 4ft X 1.25ft rectangle whose bottom left coordinate is (-2, -1.25)



EXERCISE - AutoCAD

Draw rebar in footing

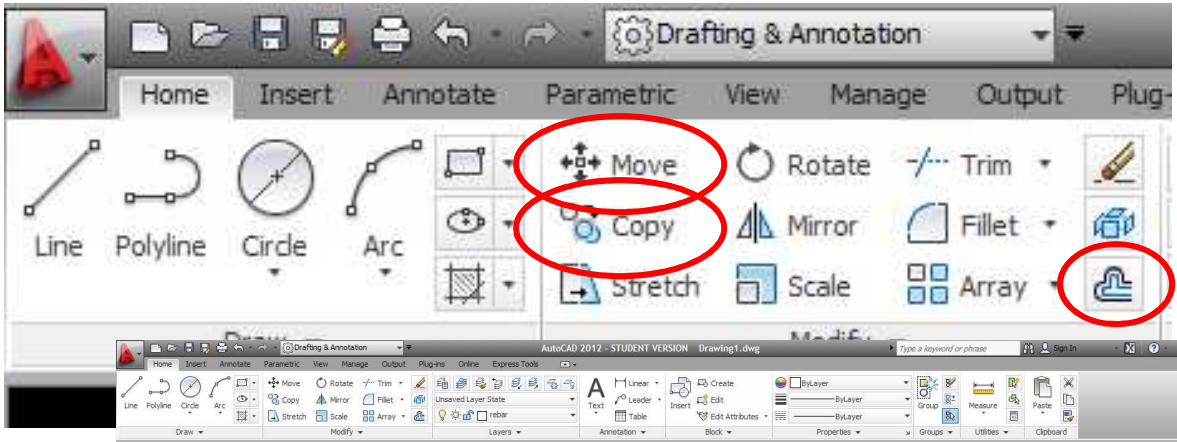
- Create a layer for rebar and set as active layer
- Use center diameter tool
- Sketch a circle anywhere in viewport with diameter .052ft (5/8in)

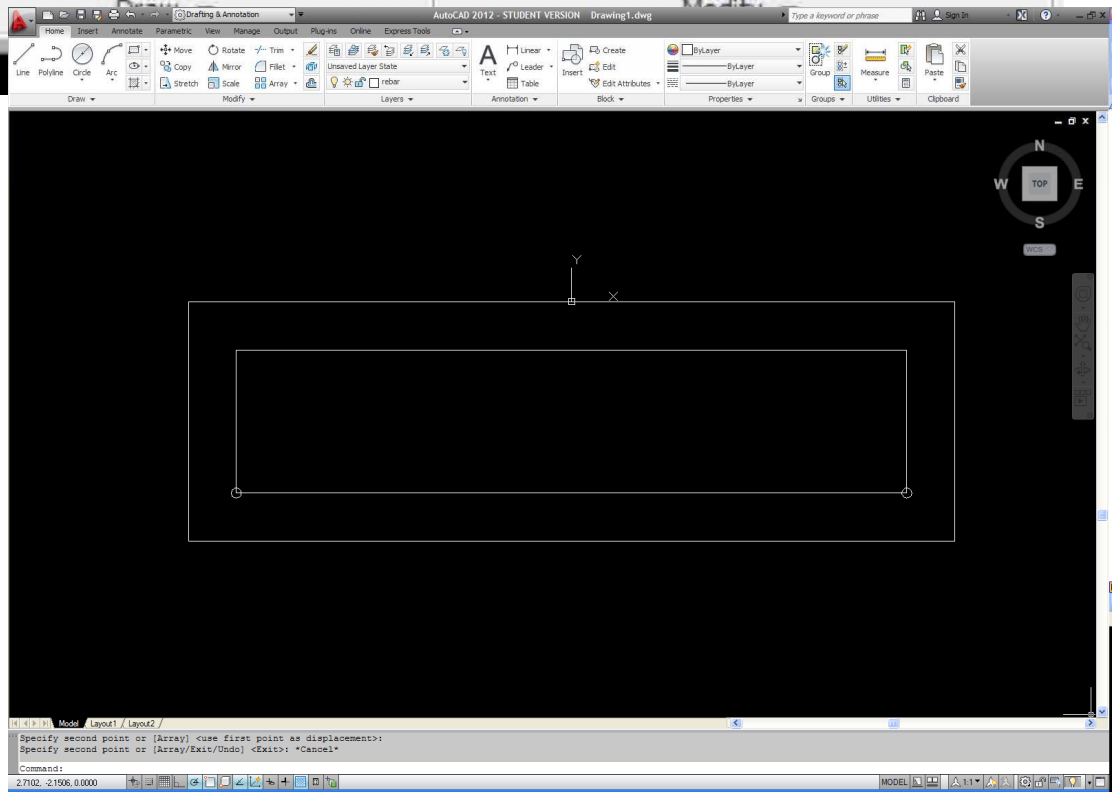


EXERCISE - AutoCAD

Draw rebar in footing

- Offset sides of footing IN by 3in (key 3/12)
- Move circle to bottom corner of offset
    - Click Move tool
    - Select circle > RMB
    - Select center
    - Select corner
    - RMB done
- Copy circle to opposite corner
    - Inputs correspond to Move

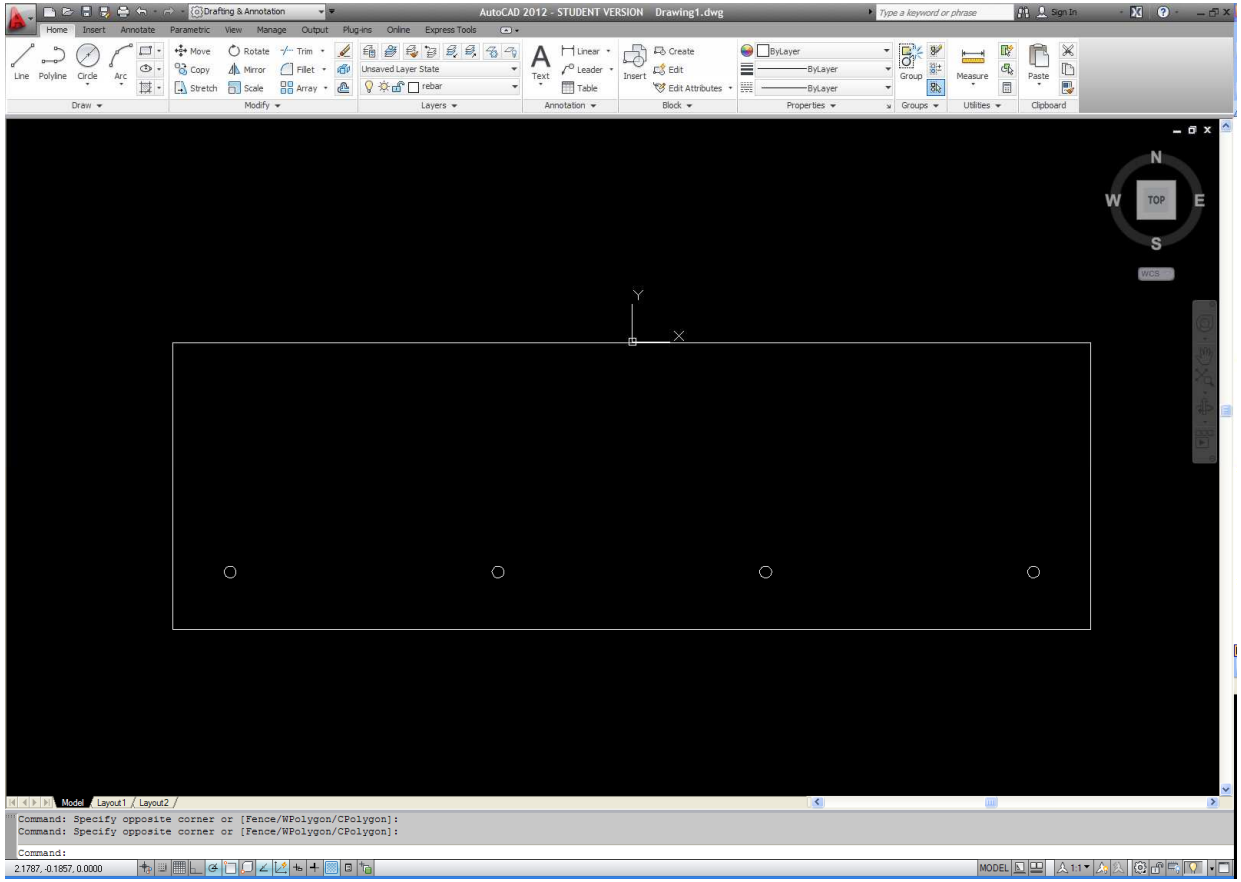




EXERCISE - AutoCAD

Draw rebar in footing

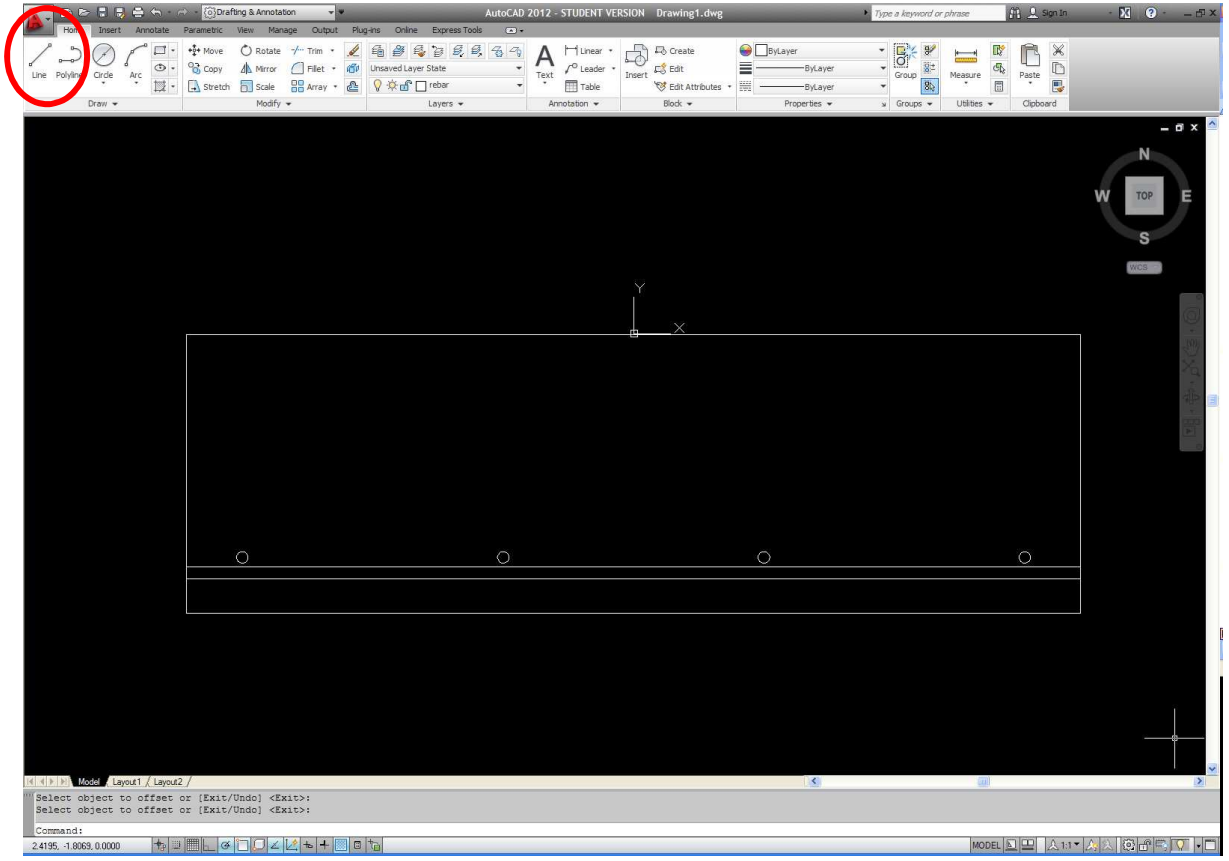
- Copy two more circles creating an even 14” spacing between them
  - Copy
  - Select Object > RMB
  - Select Center
  - Key *RELATIVE* offset (14/12 ft.)
  - RMB done
- Delete original Offset of footing outline



EXERCISE - AutoCAD

Draw long rebar piece under 4 cross-sections

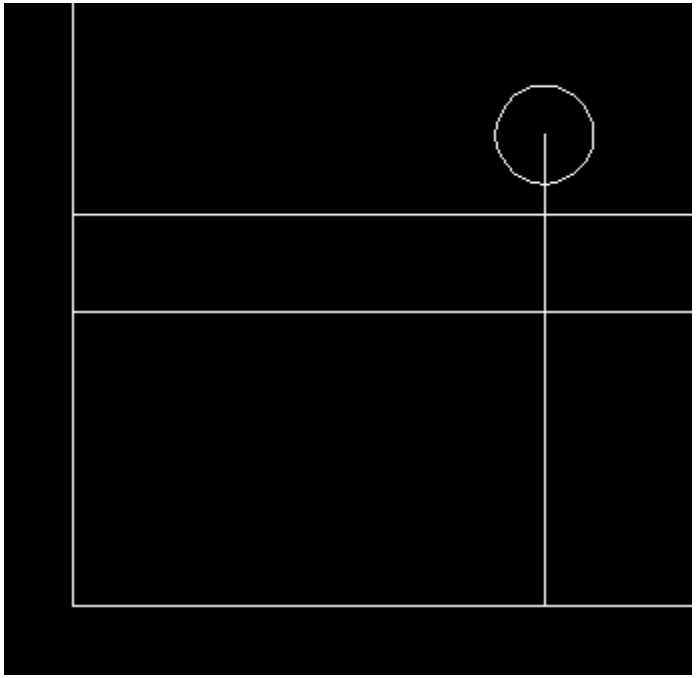
- Draw line along footing bottom
- Move line .208ft up
- Offset new line .052ft down
    - Select Offset tool
    - Enter distance
    - Select object > RMB
    - Select side to offset
    - RMB done.



EXERCISE - AutoCAD

Draw long rebar piece under 4 cross-sections

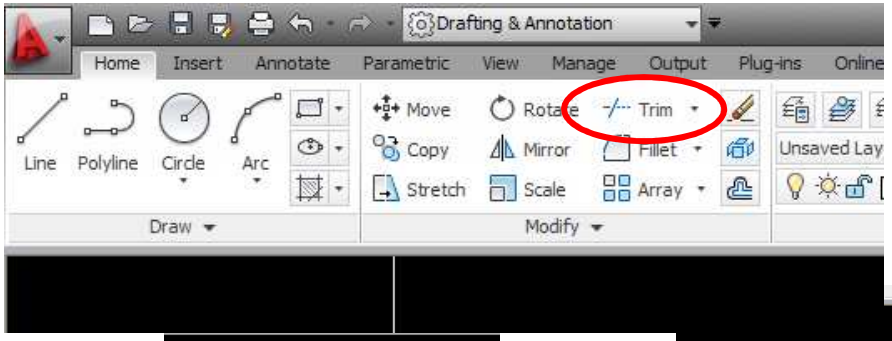
- Draw line from center of outer two circles down

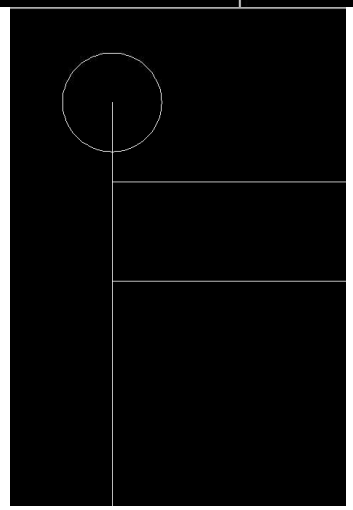


EXERCISE - AutoCAD

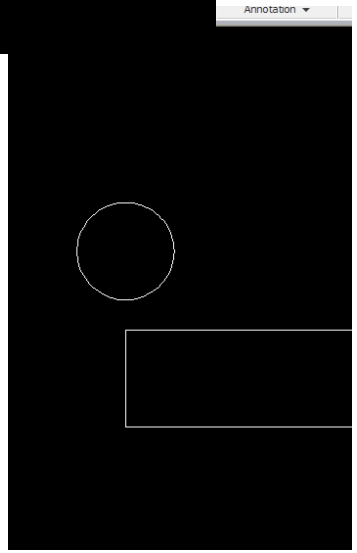
Draw long rebar piece under 4 cross-sections

- Use Trim to have extra horizontal length
  - Select Trim
  - Select objects that define boundaries (“cutting edges”) > RMB
  - Select objects to trim (the part of the object selected will be deleted)
  - RMB done
- Repeat to clip vertical guideline
- Repeat trim operations on other side





Step 1 – Trim horizontal ends

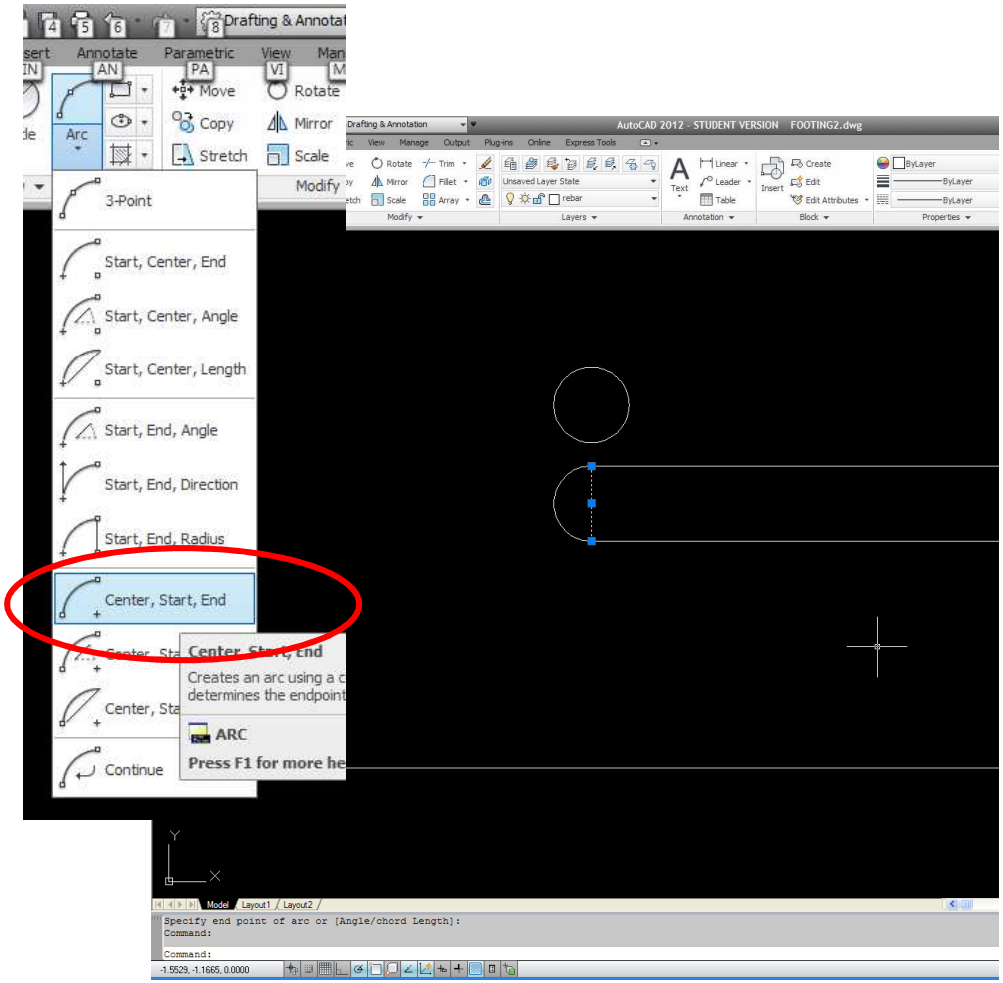


Step 2 – Trim vertical guide line

EXERCISE - AutoCAD

Draw long rebar piece under 4 cross-sections

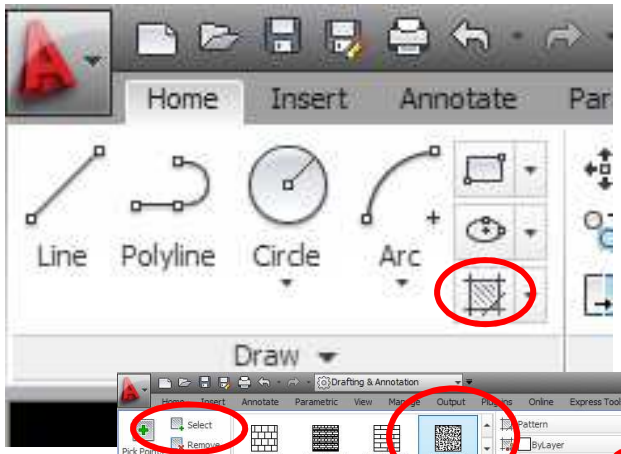
- Create a Center, Start, End arc to round each end of the in-plane rod
  - Select CSE Arc tool
  - Select mid-point
  - Select top corner
  - Select bottom corner
  - *If necessary adjust OSNAP settings*
- Repeat for other end
- Delete vertical line segments (shown selected here)

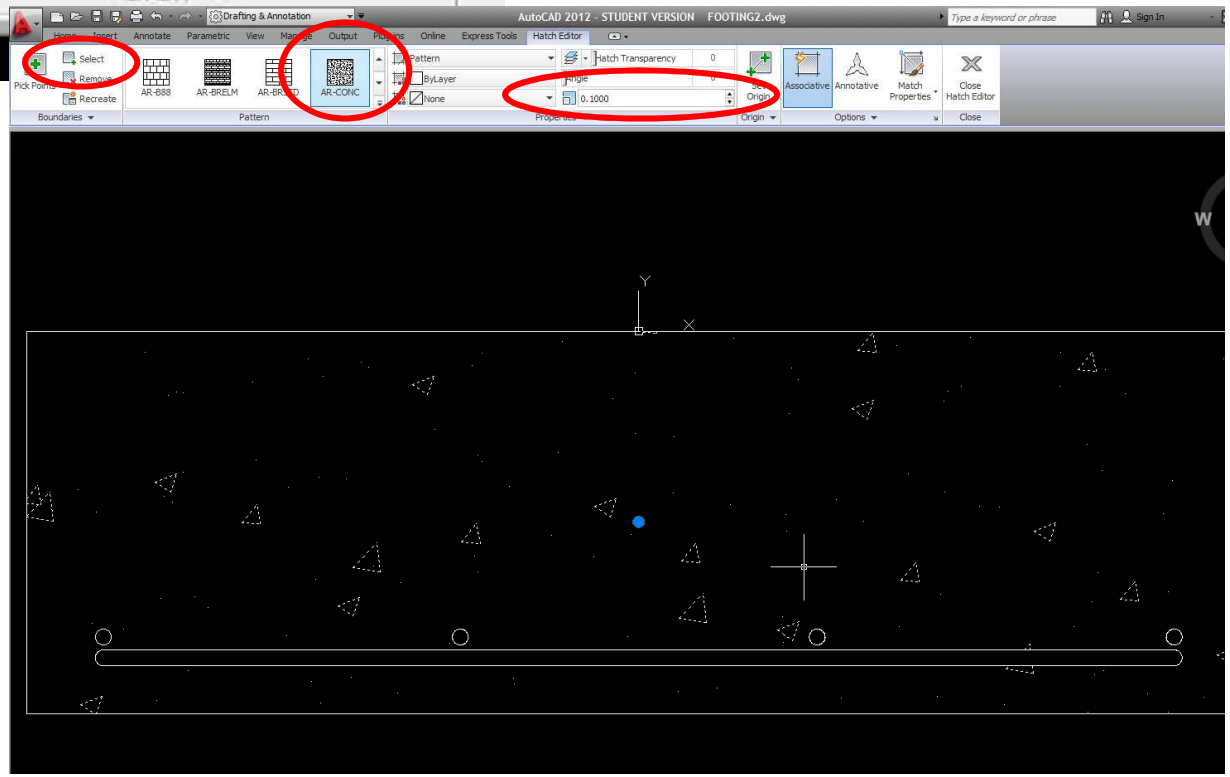


EXERCISE - AutoCAD

Hatch footing

- Select Hatch tool
- Hatch and Gradient dialog launches
- Select the AR-CONC pattern for concrete
- Click Add Select Objects
  - Select footing outline and rebar parts holding Shift key
- Adjust scale to .1

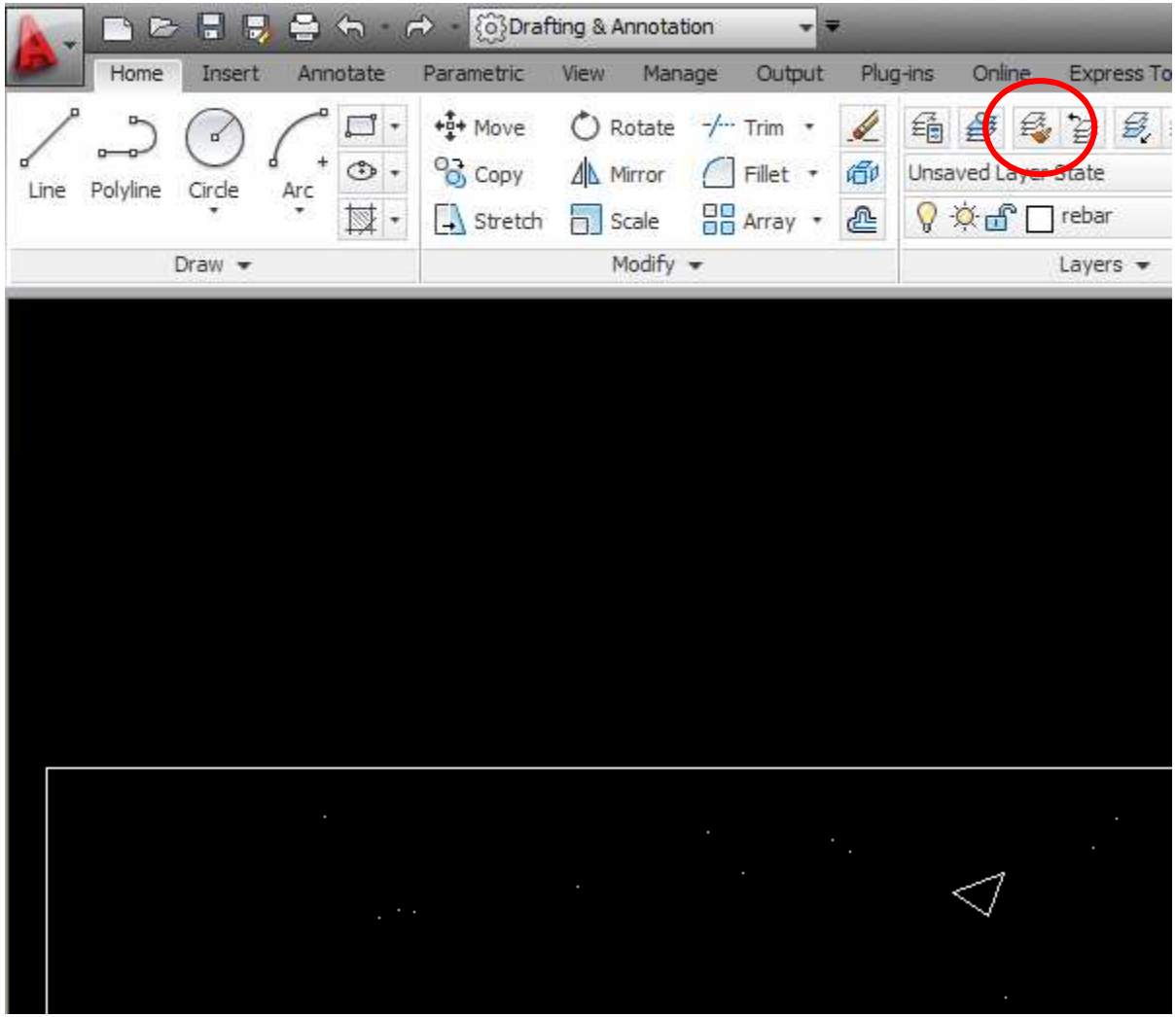




EXERCISE - AutoCAD

Hatch footing

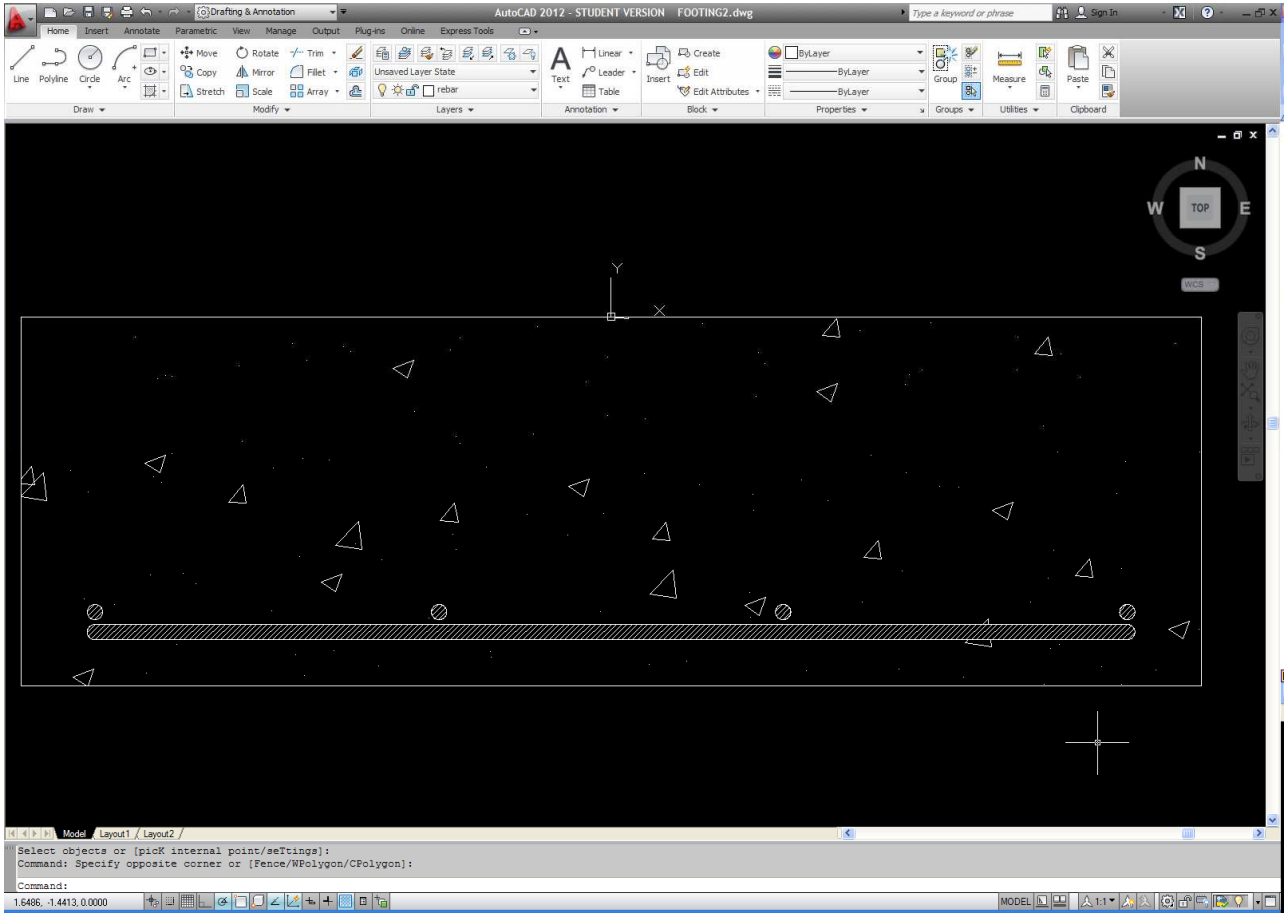
- Change hatch to concrete layer
  - Select Match layer tool
  - Select concrete hatch > RMB
  - Select footing outline (on concrete layer) > RMB
- *Check by blanking layer*



EXERCISE - AutoCAD

Hatch rebar

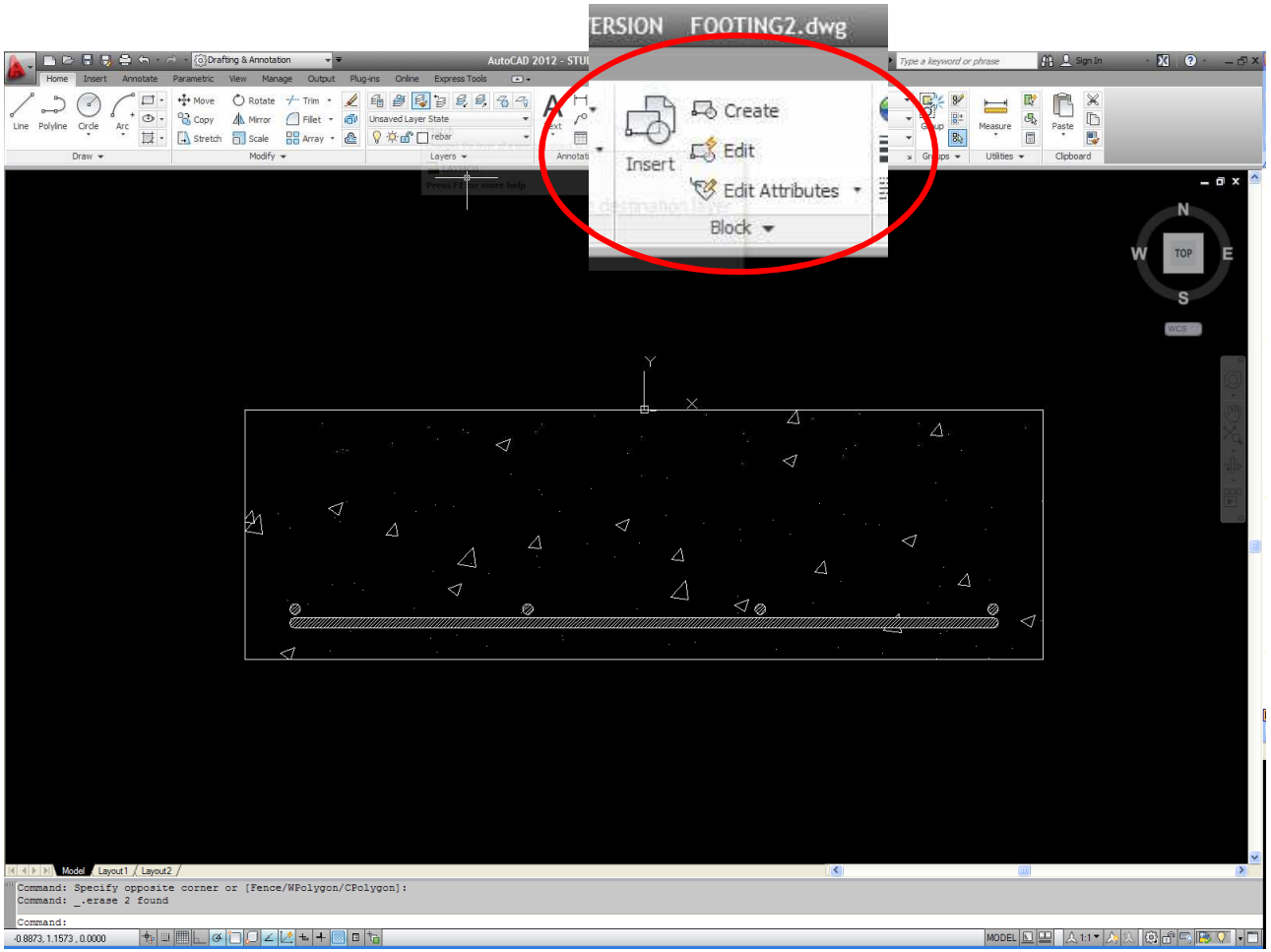
- Follow same steps to hatch rebar
  - Use standard cross hatch
  - Scale to .01
  - Select all rods in footing
- Assign rebar hatch to rebar layer



AutoCAD

Blocks

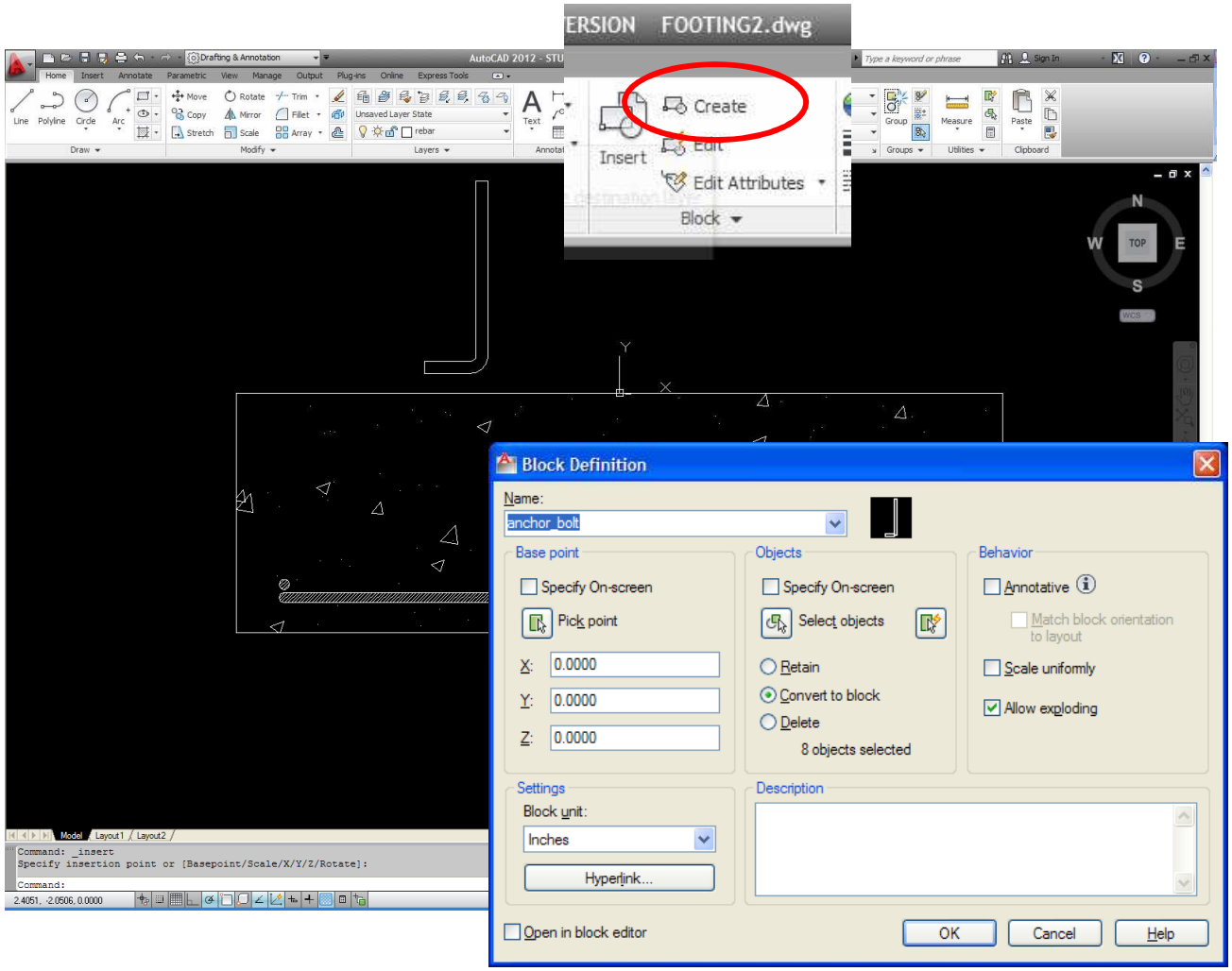
- Blocks are groups of entities that packaged as one
  - Makes creating multiple version of same geometry easy
  - Blocks can be moved, copied, mirror and inserted



AutoCAD

Blocks

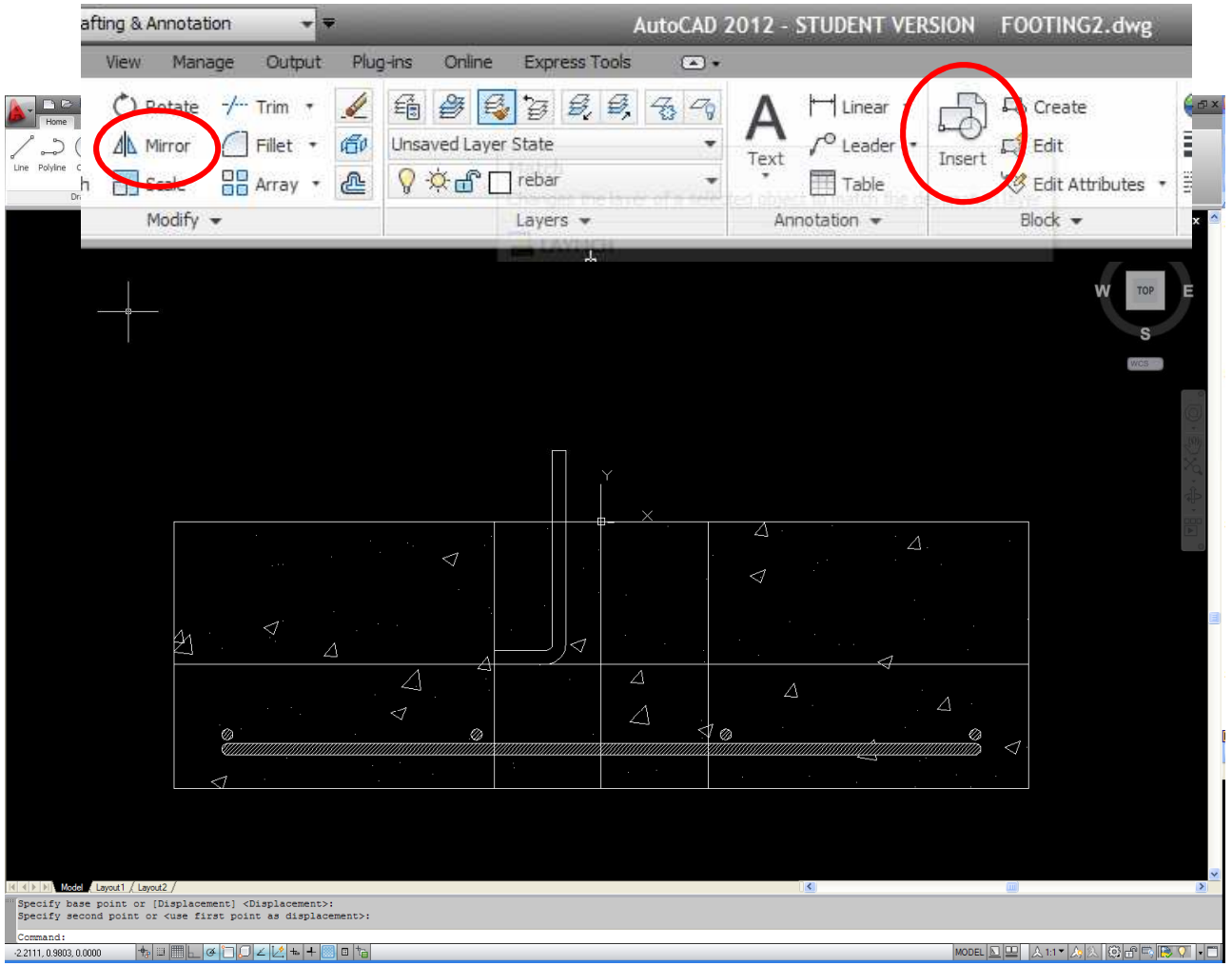
- Create the anchor bolt block (“L” shaped, 4” X 12” X ¾” dia.)
- Select the entities in the anchor bolt
- Click Create from the Block menu
- Name the Block “anchor_bolt”
- Click OK



AutoCAD

Blocks

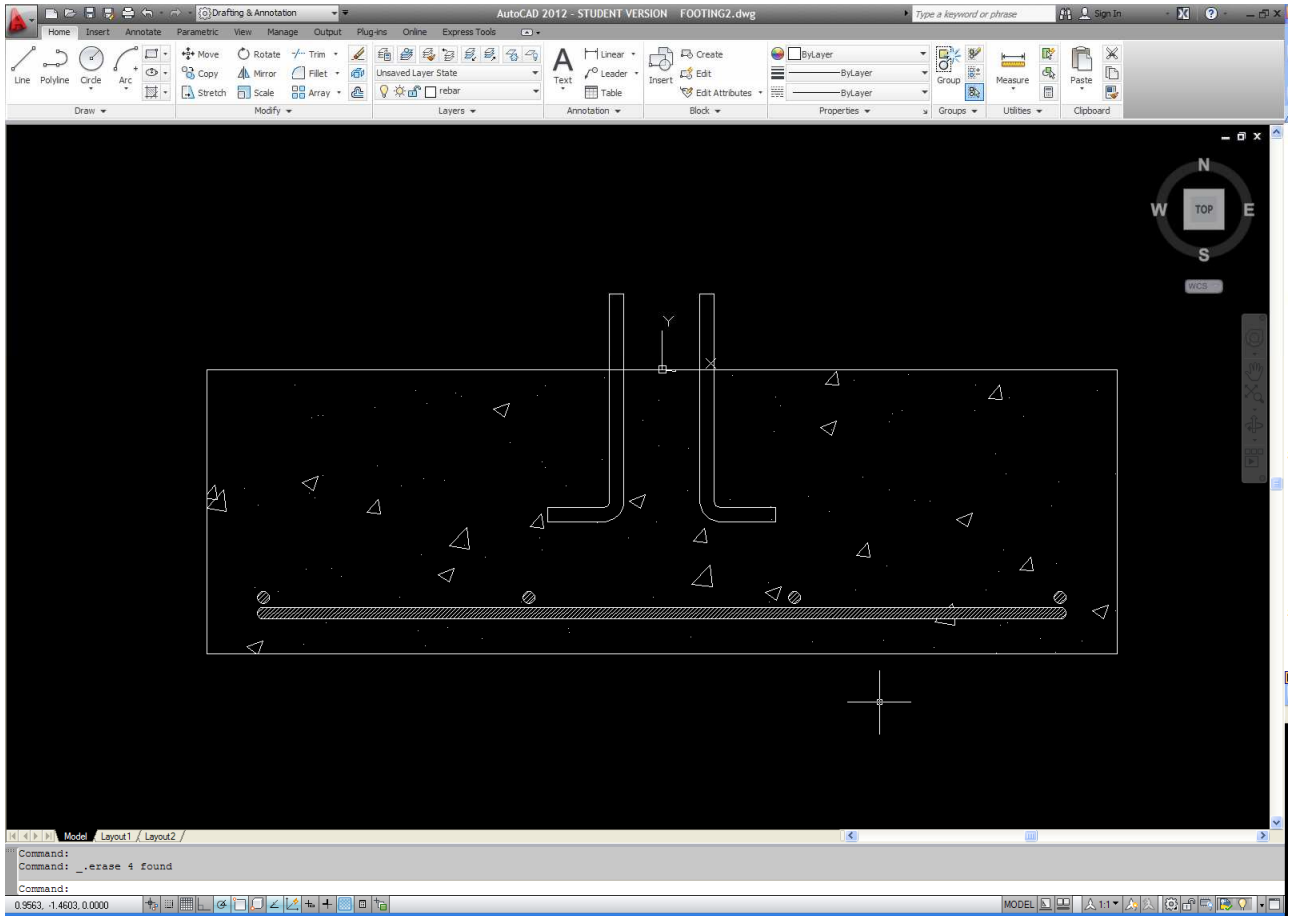
- Draw some guide-lines to position the anchor bolts 8in. down and 6in. over from the center
- Move the first Block into place
- Insert a second anchor_bolt
- Position the block and then use Mirror to orient



AutoCAD

Blocks

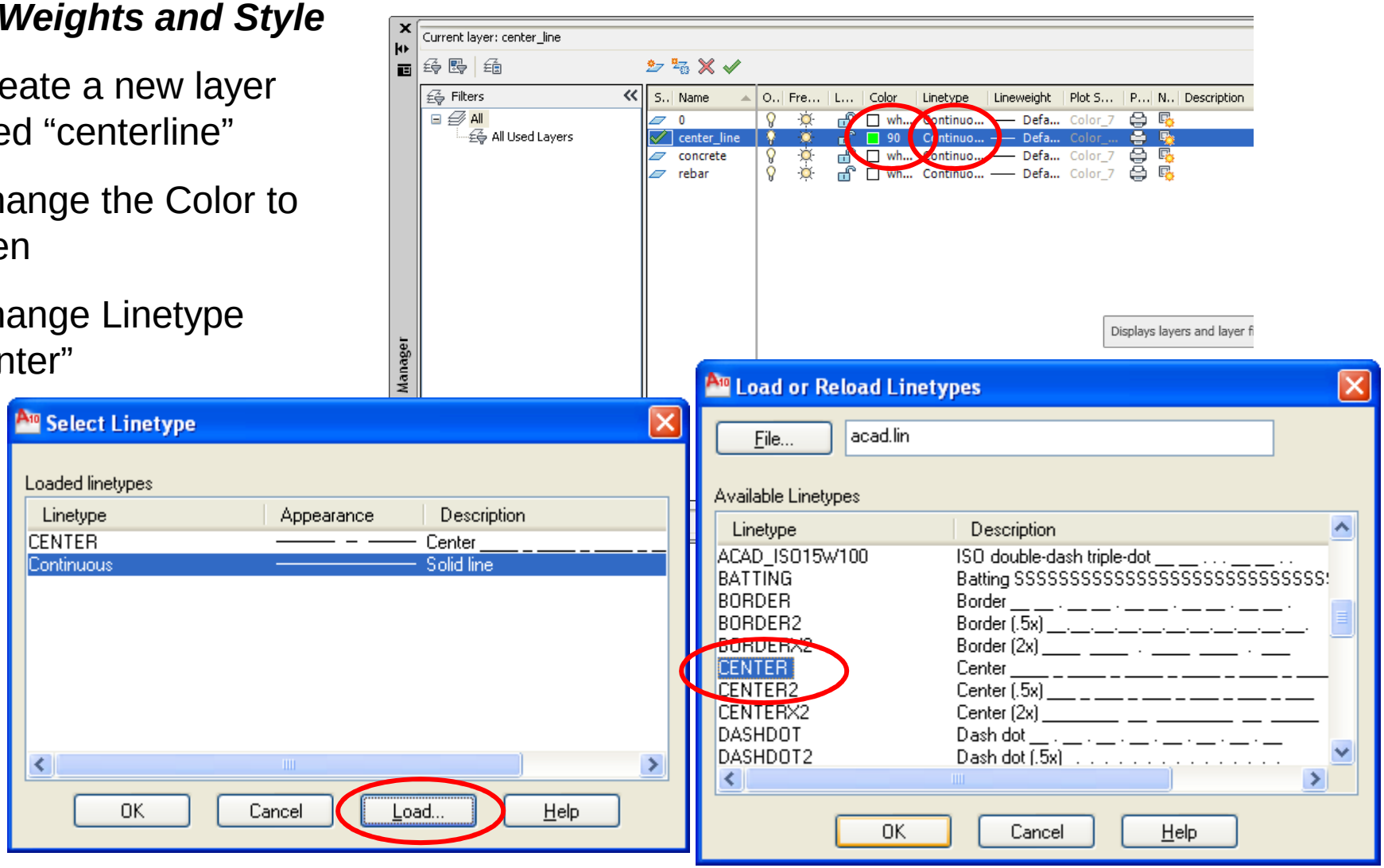
- Delete the guidelines
- Things should look like this



AutoCAD

Line Weights and Style

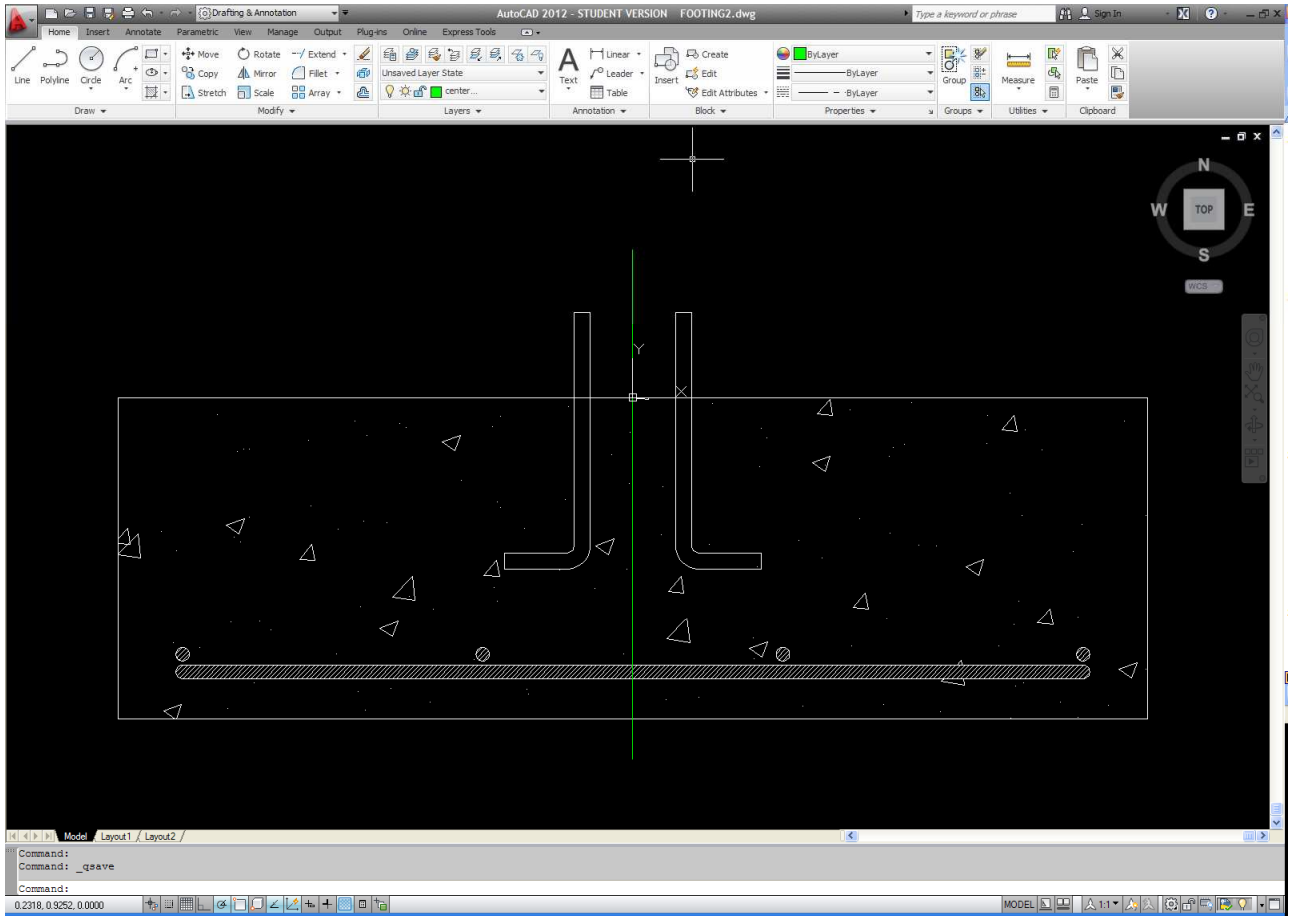
- Create a new layer called “centerline”
- Change the Color to green
- Change Linetype “Center”



AutoCAD

Line Weights and Style

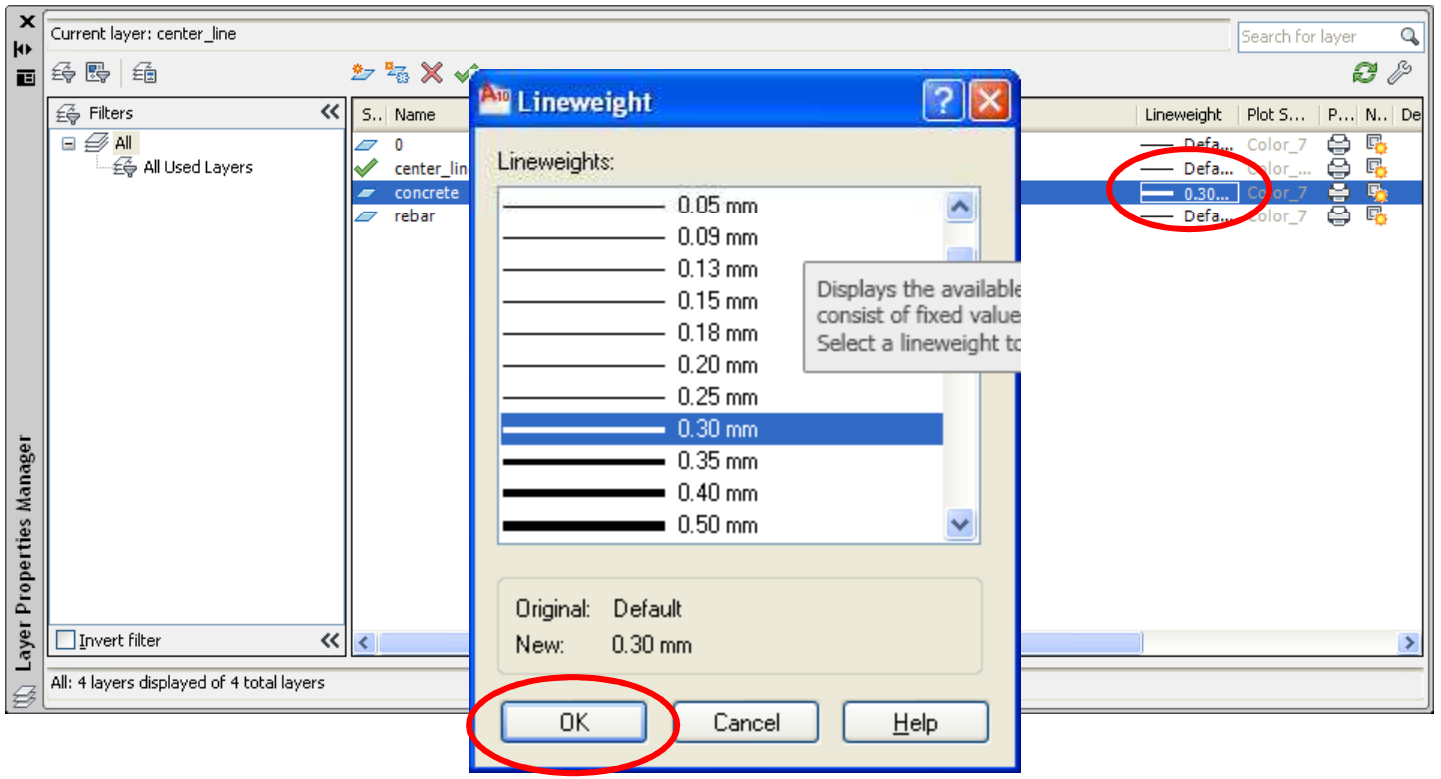
- Sketch a centerline on the centerline layer



AutoCAD

Line Weights and Style

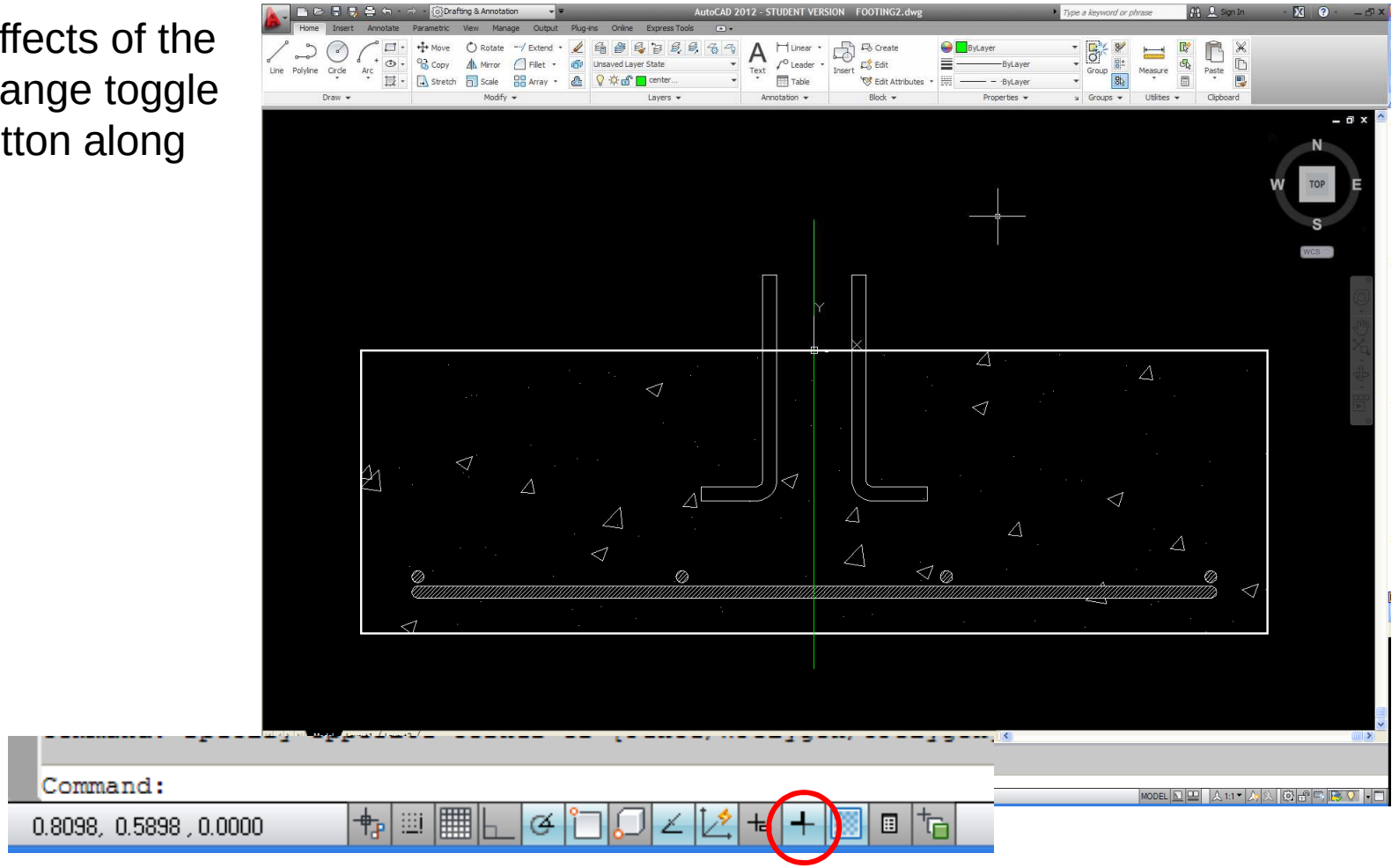
- Change the lineweight of the concrete layer to .30mm



AutoCAD

Line Weights and Style

- To see the effects of the line weight change toggle line weight button along bottom



AutoCAD

Model Space vs. Paper Space

Model Space:

- **Used to Model system, component, assembly**
- **Model is actual dimensions**
- **Multiple models, views, sketches, etc.**
- **Some parts may never be seen by anyone else**

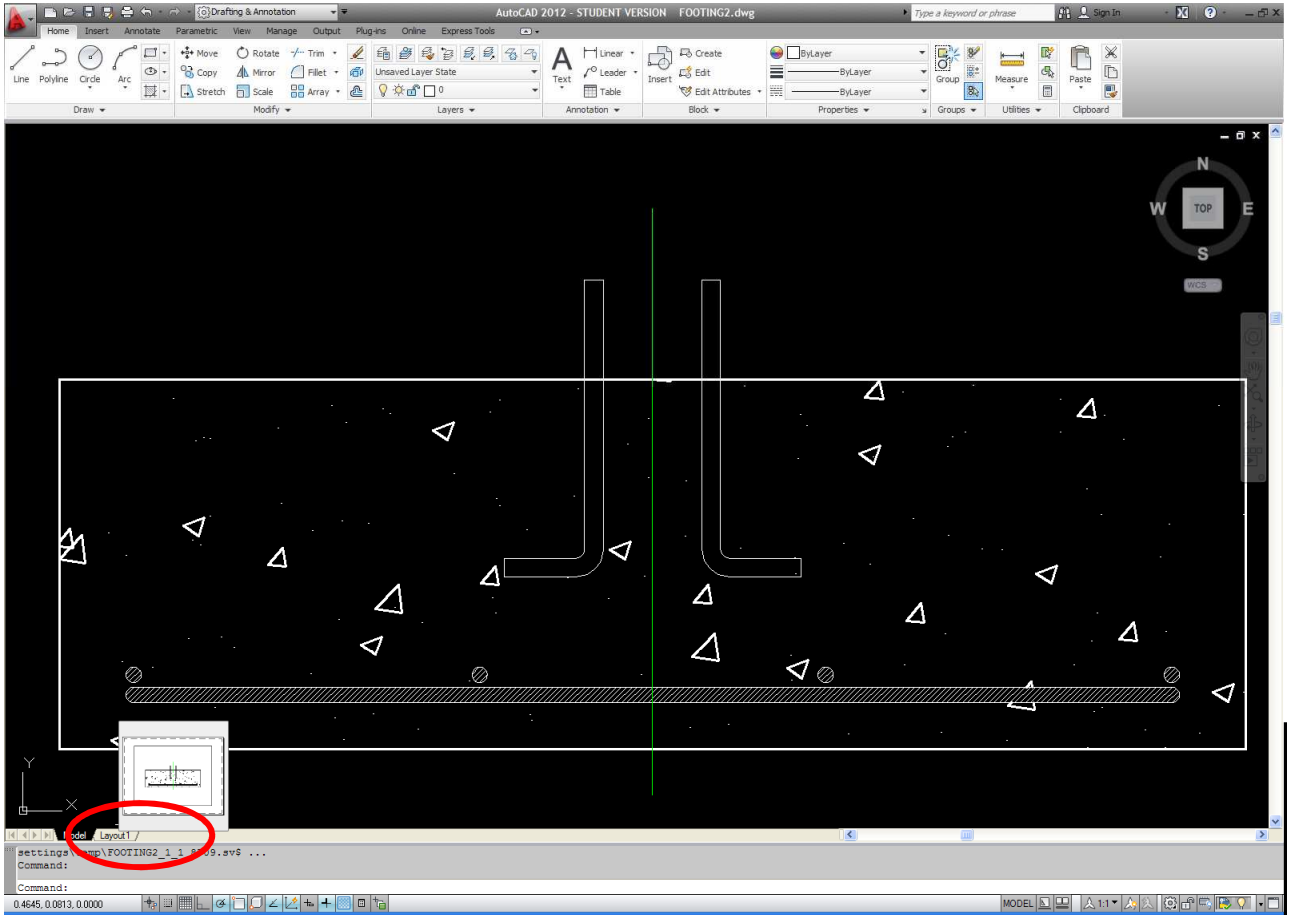
Paper Space (Layouts):

- **Parts, plan views, etc. are scaled to fit paper**
- **Models are scaled to fit**
- **Only sections of Model Space are shown here**
- **May be several Layouts for each Model**

AutoCAD

Transfer to Paper Space (Layouts)

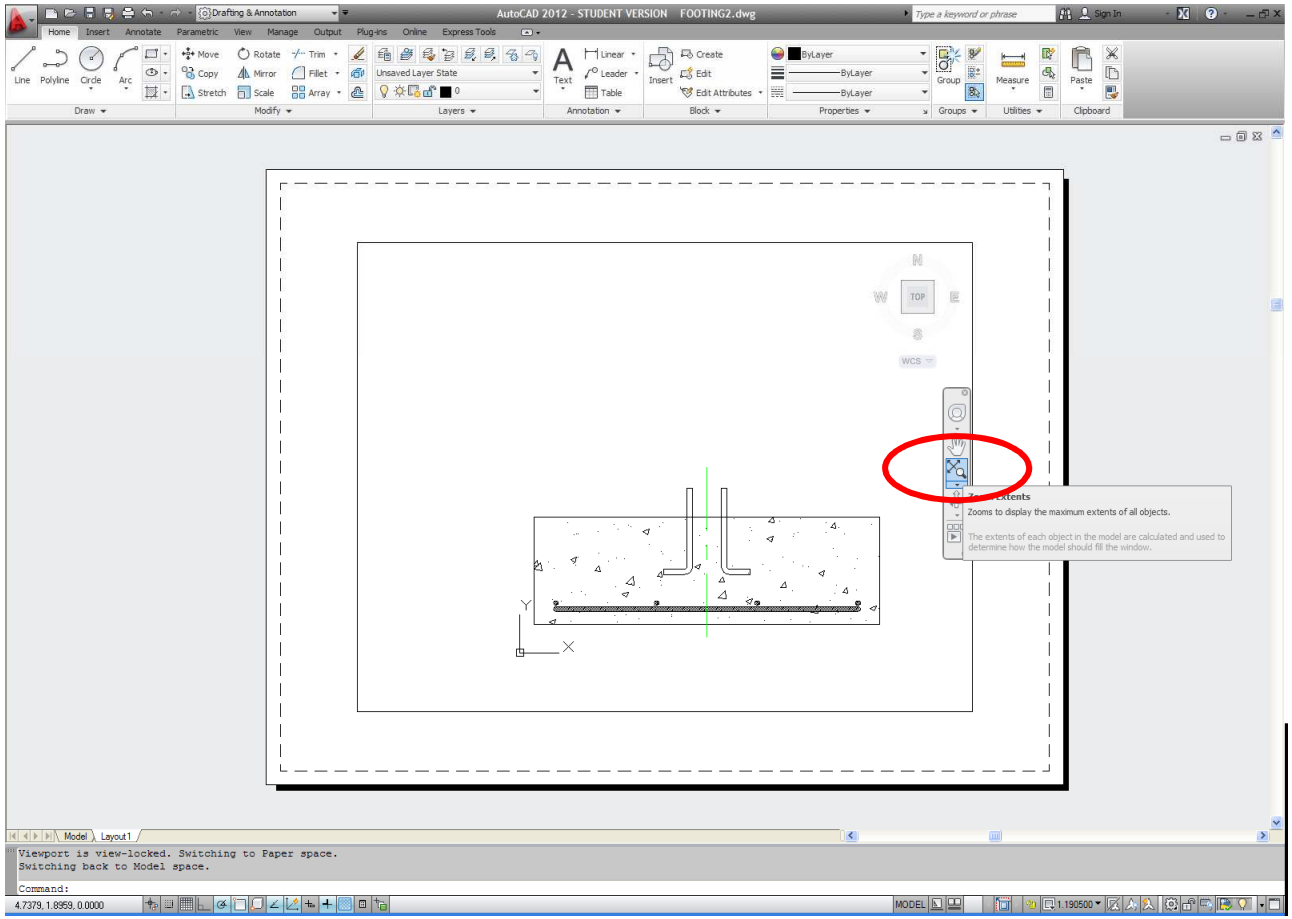
- Click on the Layout tab on the bottom of window



AutoCAD

Transfer to Paper Space (Layouts)

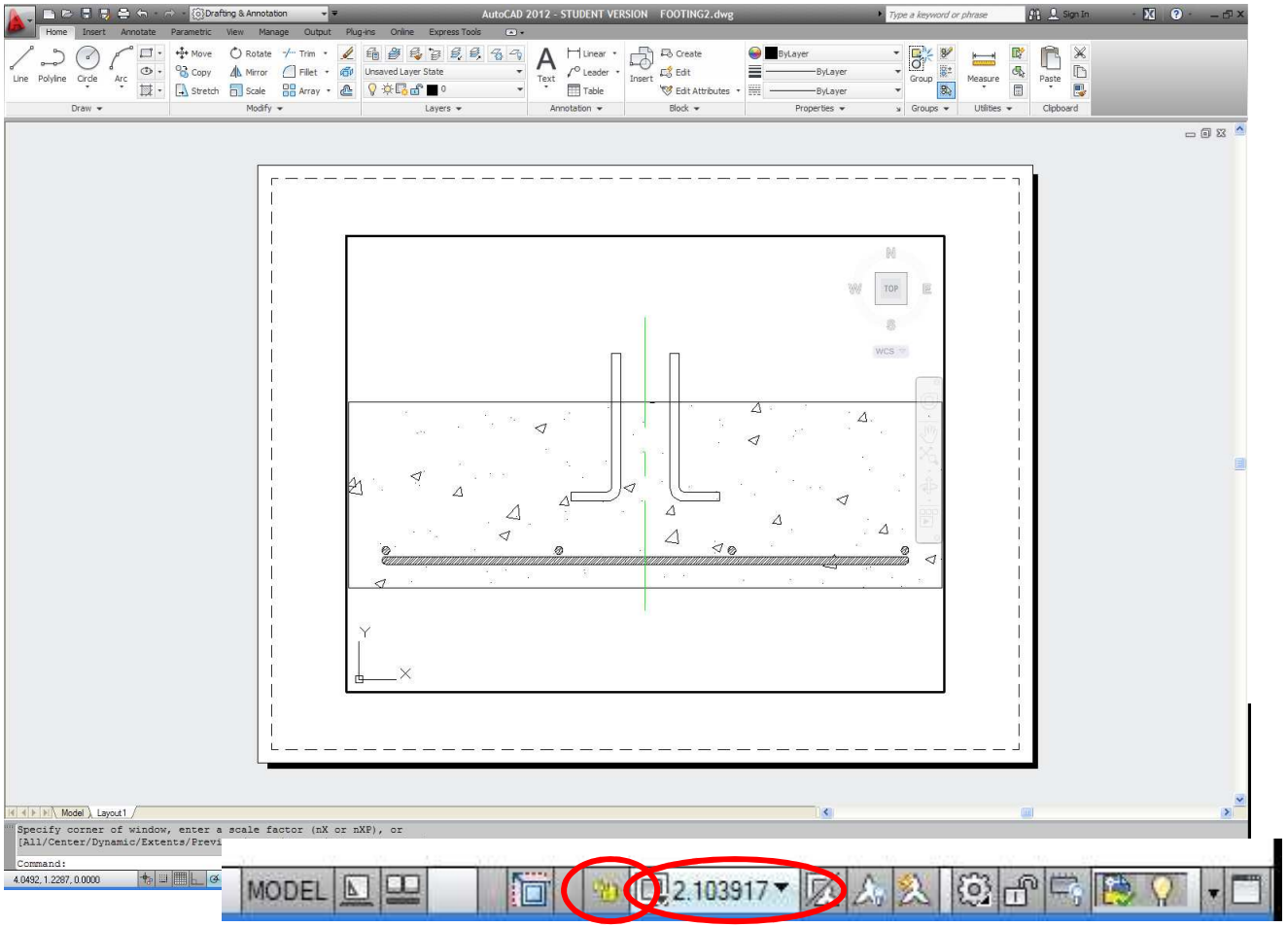
- We've now entered Paper Space > This is what will be set as our engineering drawing
- Click View Extents to maximize the viewport space



AutoCAD

Transfer to Paper Space (Layouts)

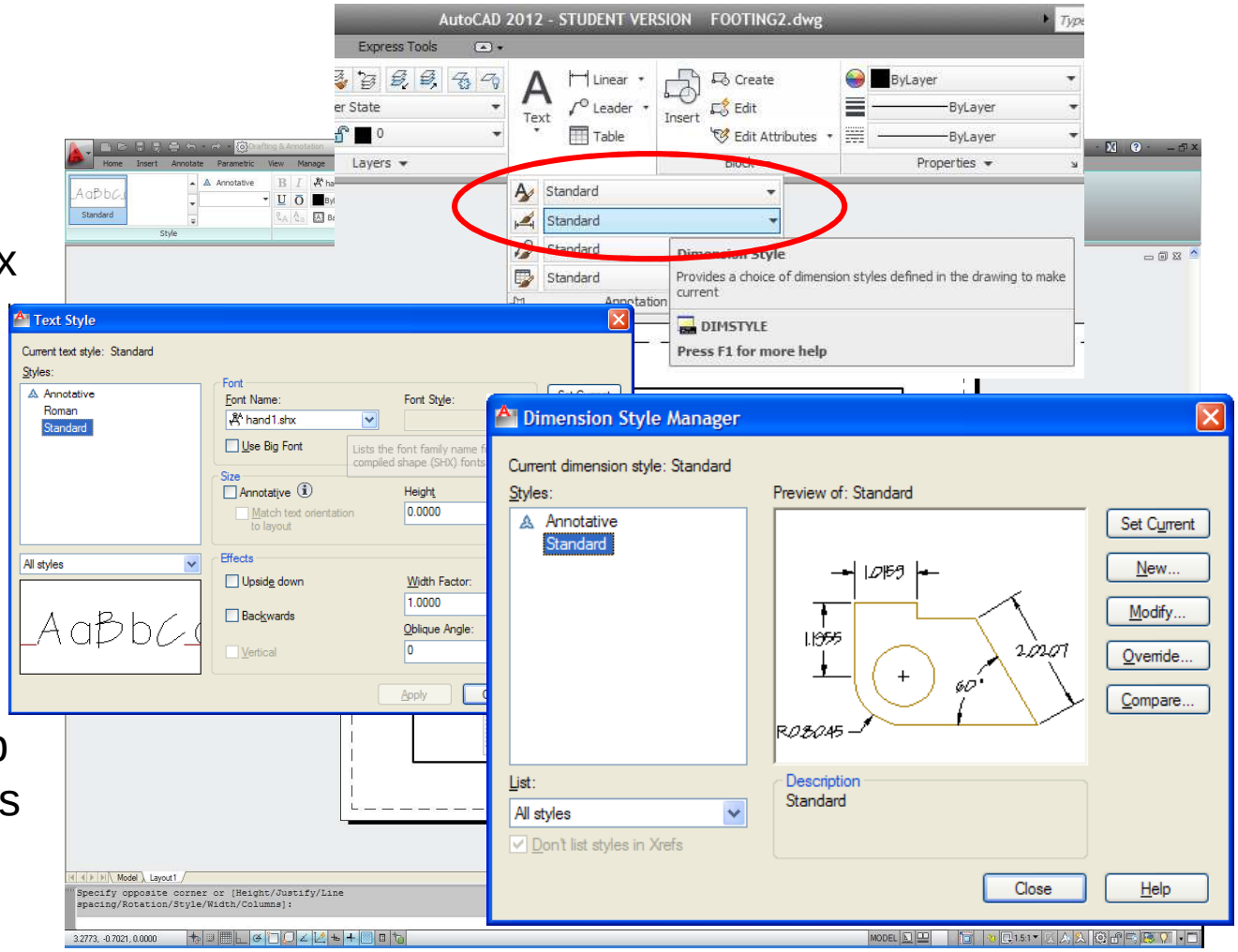
- We need to pick a scale for this drawing > This equates model units to drawing units
- Once the scale is selected “lock” the viewport



AutoCAD

Dimensioning and Annotating

- Dimension and Note appearance are set via Style dialog boxes
- Open the Text Style box and change the font to “hand1.shx”
- Open the Dimension Style Manager and modify dimensions to “Architectural”
    - Click Modify… button to bring up dimension options



AutoCAD

Dimensioning and Annotating

- Add length and width dimension to footing
- Put a note with leader calling out anchor bolts
- Add general notes without leader