

# ARCHITECTURAL STRUCTURES III: STRUCTURAL ANALYSIS AND SYSTEMS

ARCH 631

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frames.  
*tutorial*

*using*  
**Multiframe**



**CONCEPT**  
Sketch, import, generate,  
transform & visualise

**ANALYSIS**  
2D, 3D, static, modal,  
time history & non-linear

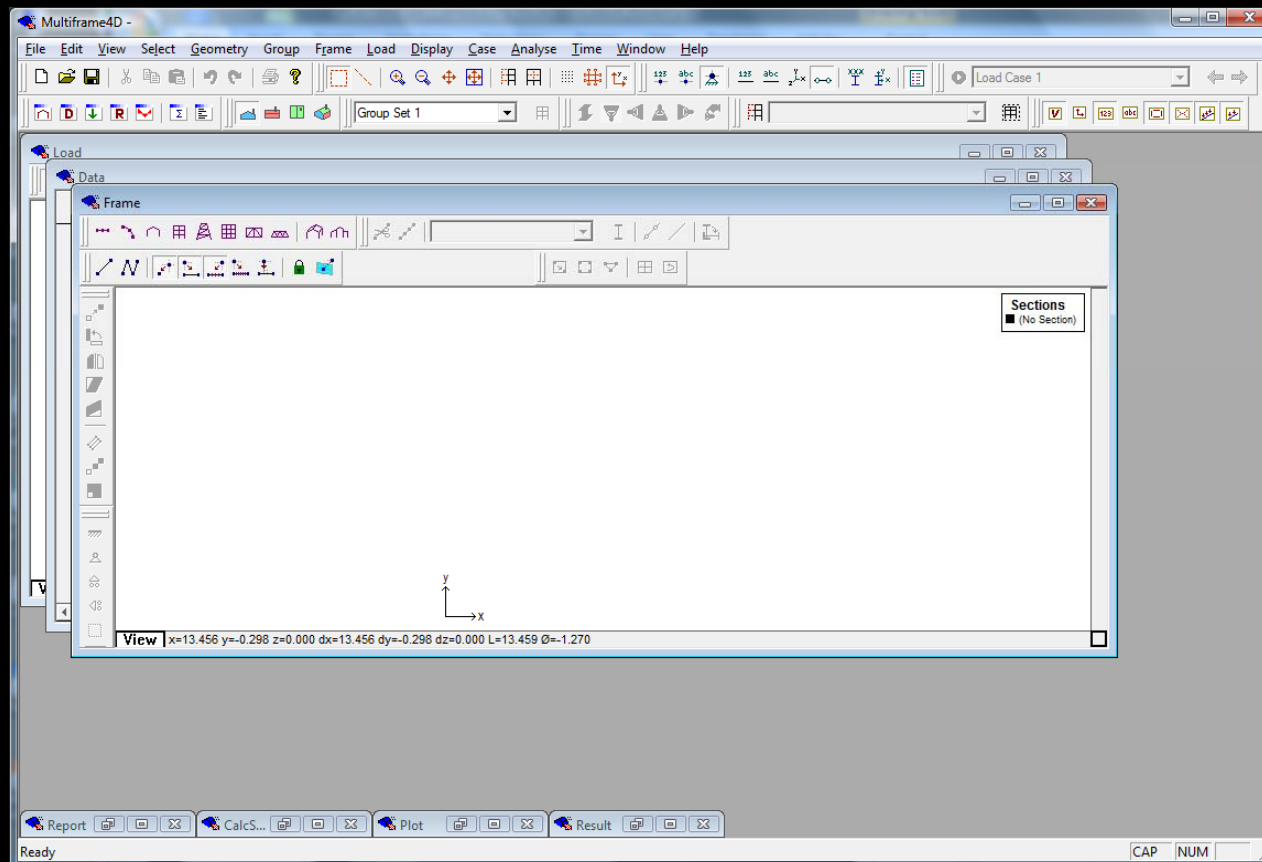
**DESIGN**  
Specify, check, design,  
optimise, report & audit

Structural engineering software  
that works the way you do.

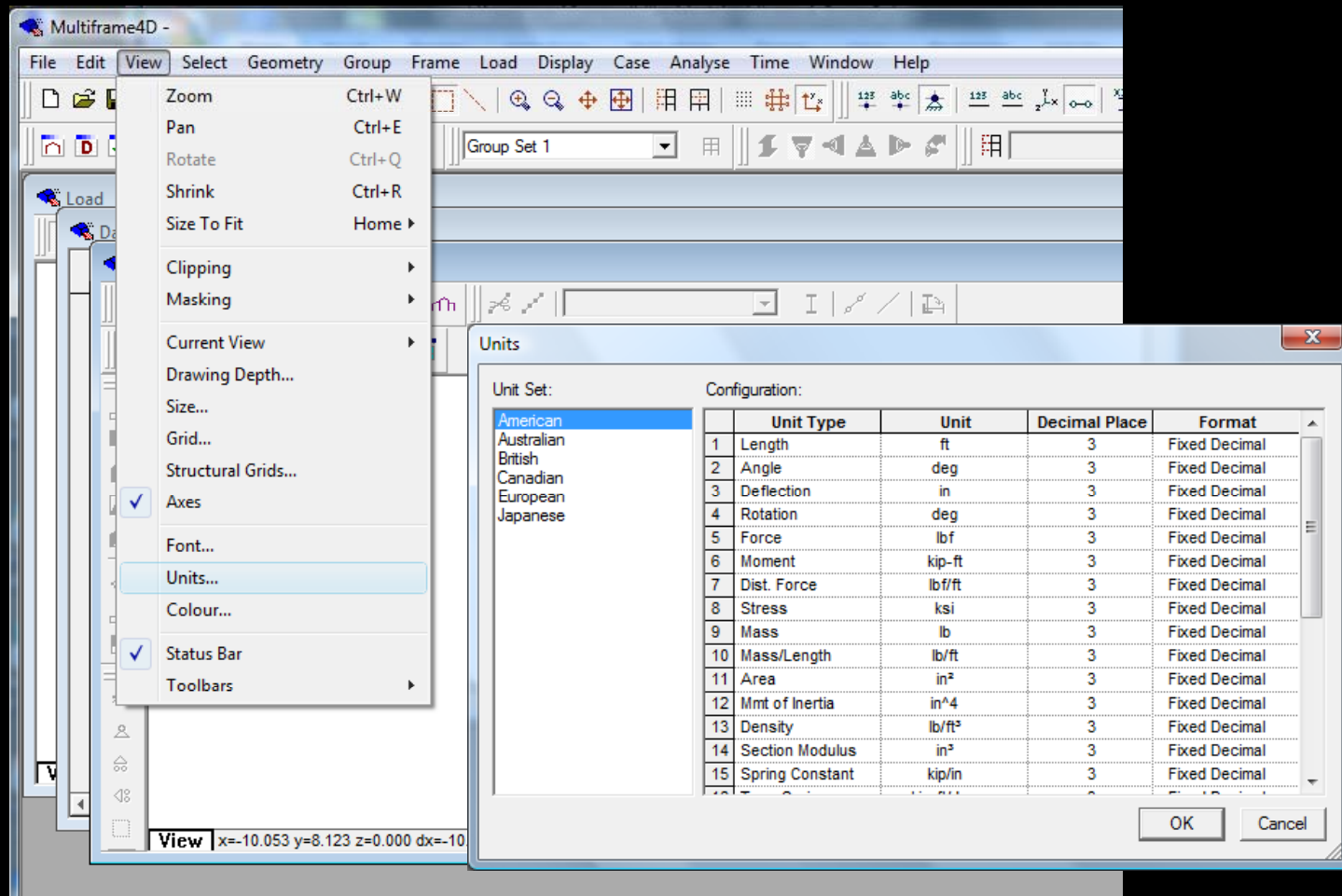
© Formation Design Systems Pty Ltd 1988-2007

# Multiframe

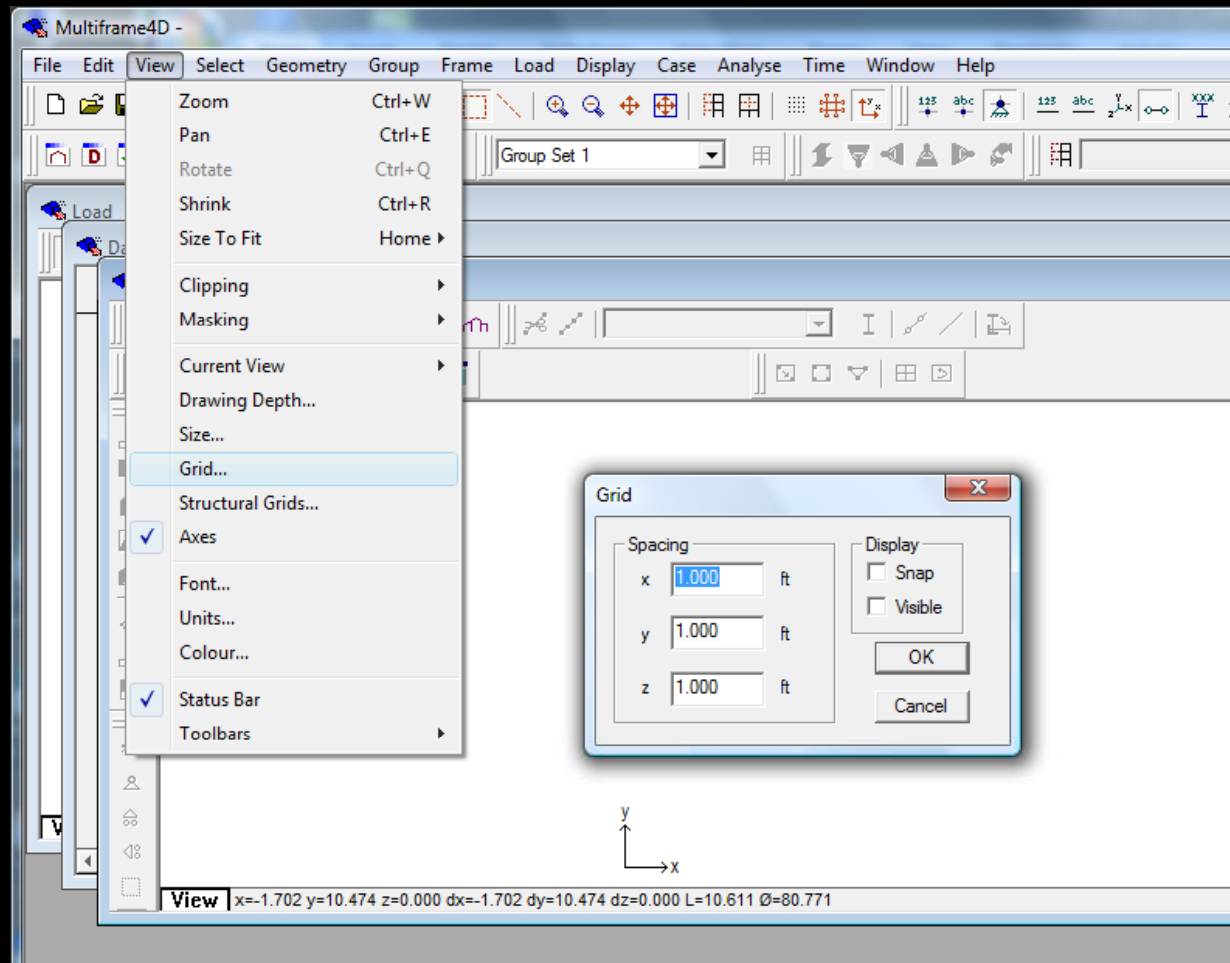
- on college computers (+ 3D academic shareware)
- start / programs menu



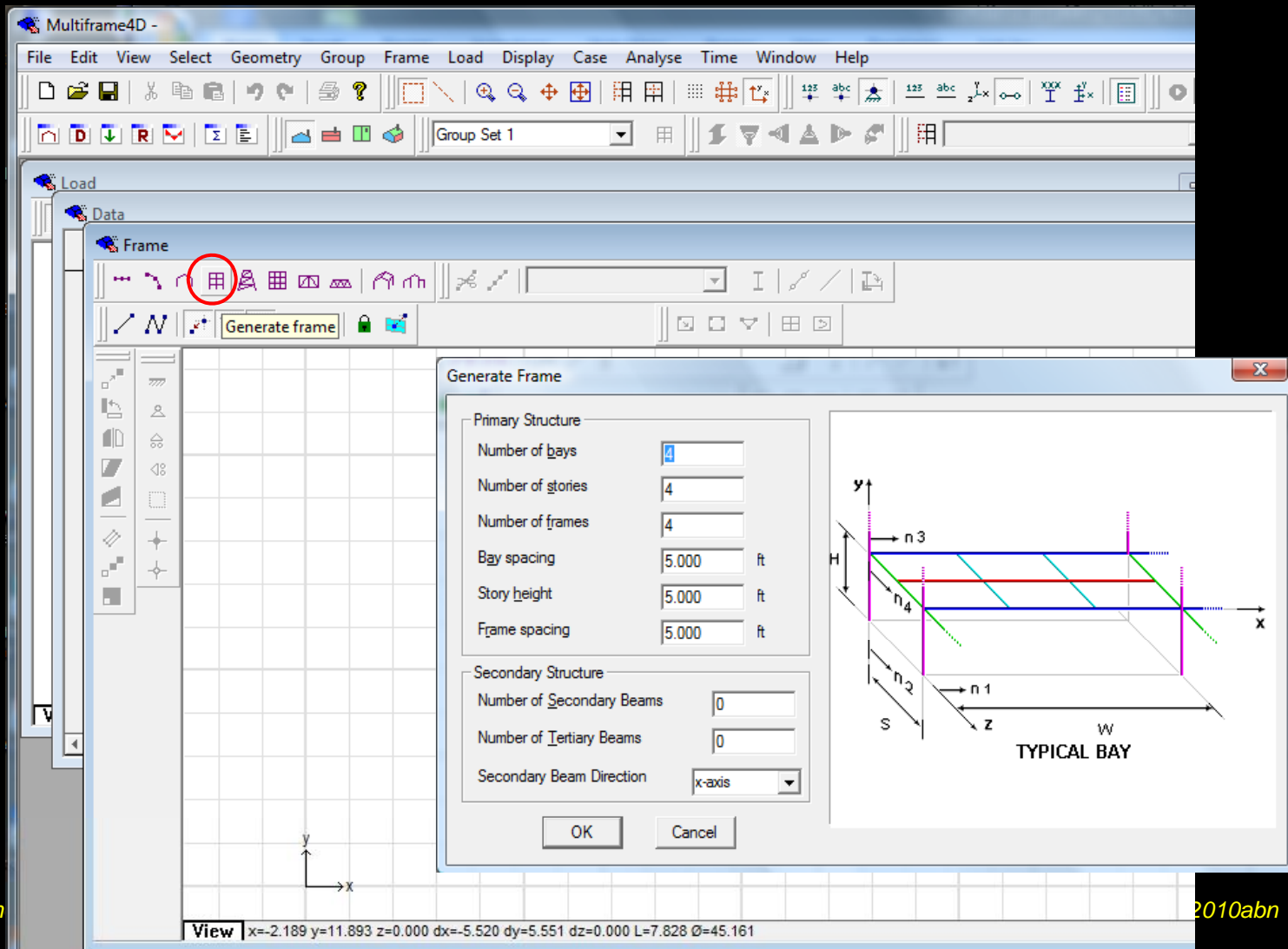
# Units (view menu)



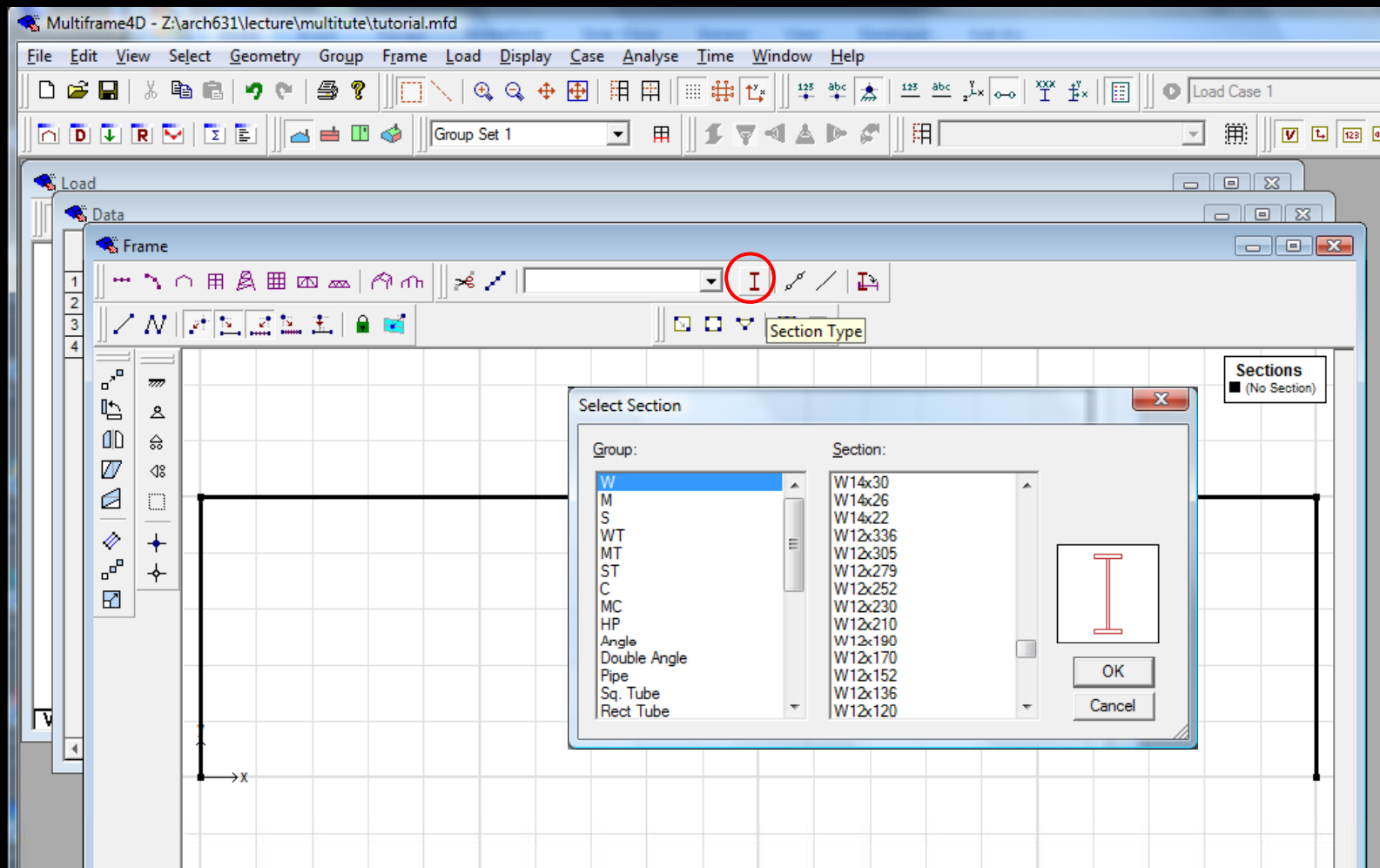
# Grid (view menu)



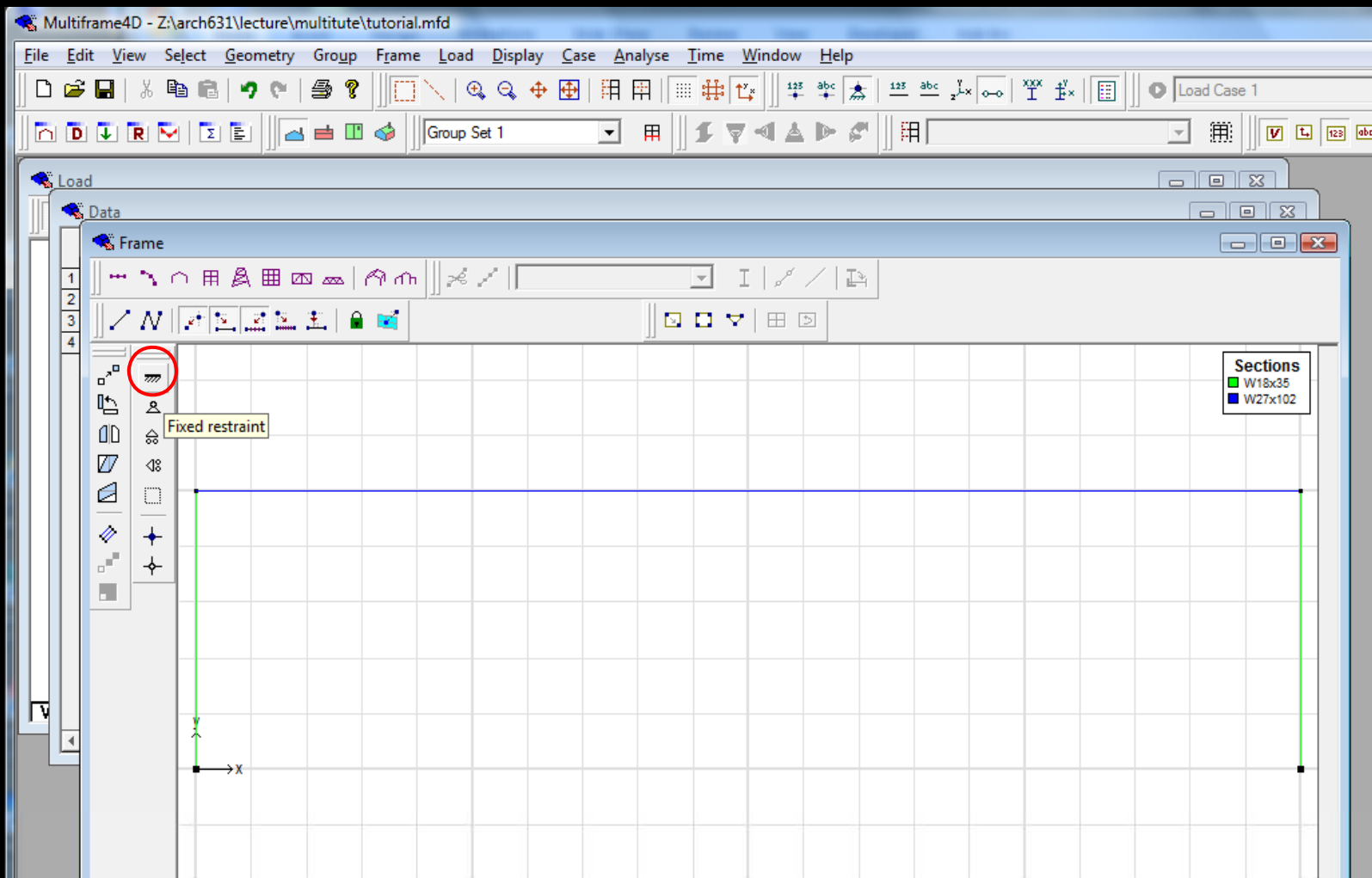
# Generate Frame (button)



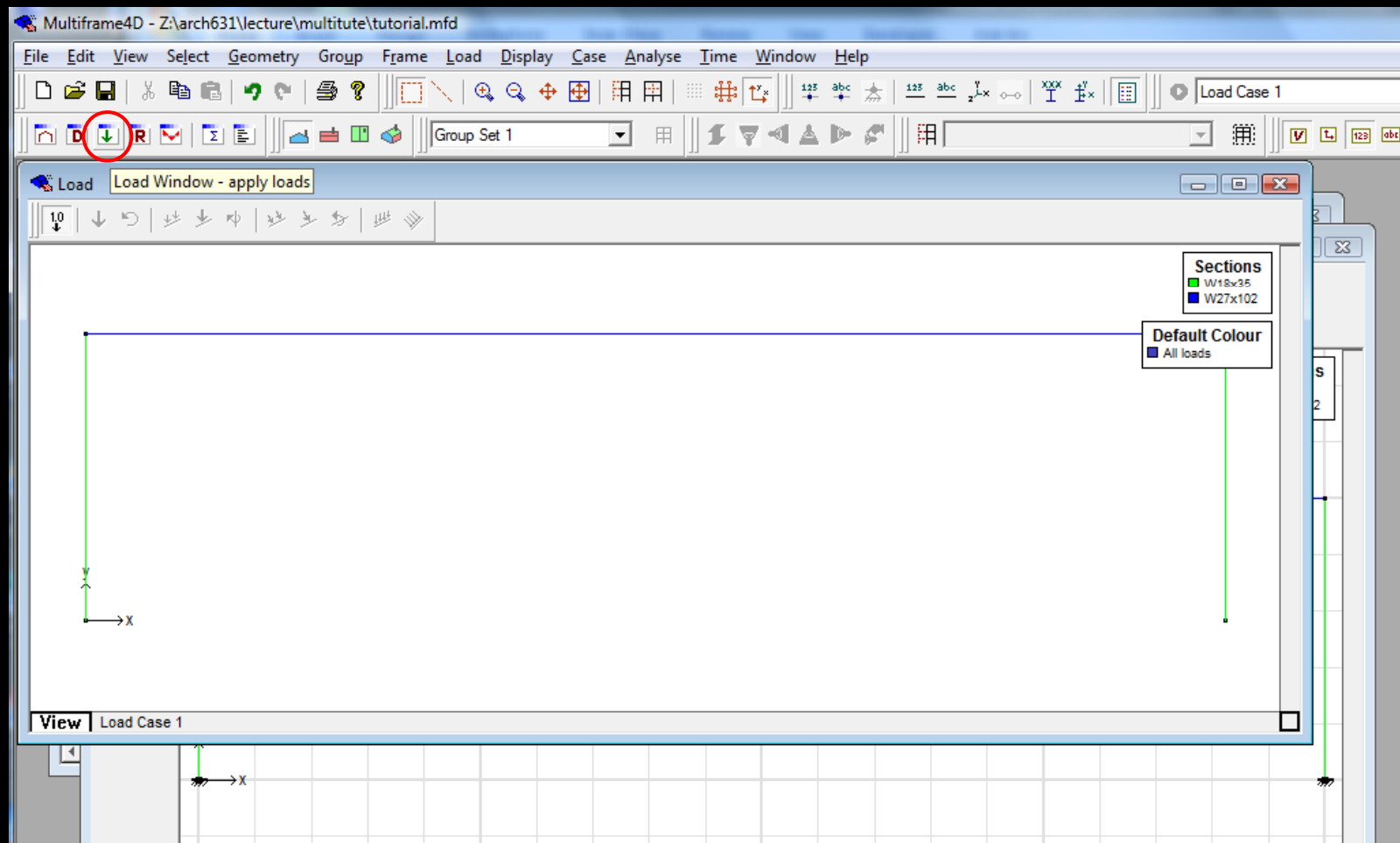
# Select Members & Assign Section



# Select Points & Assign Support Type

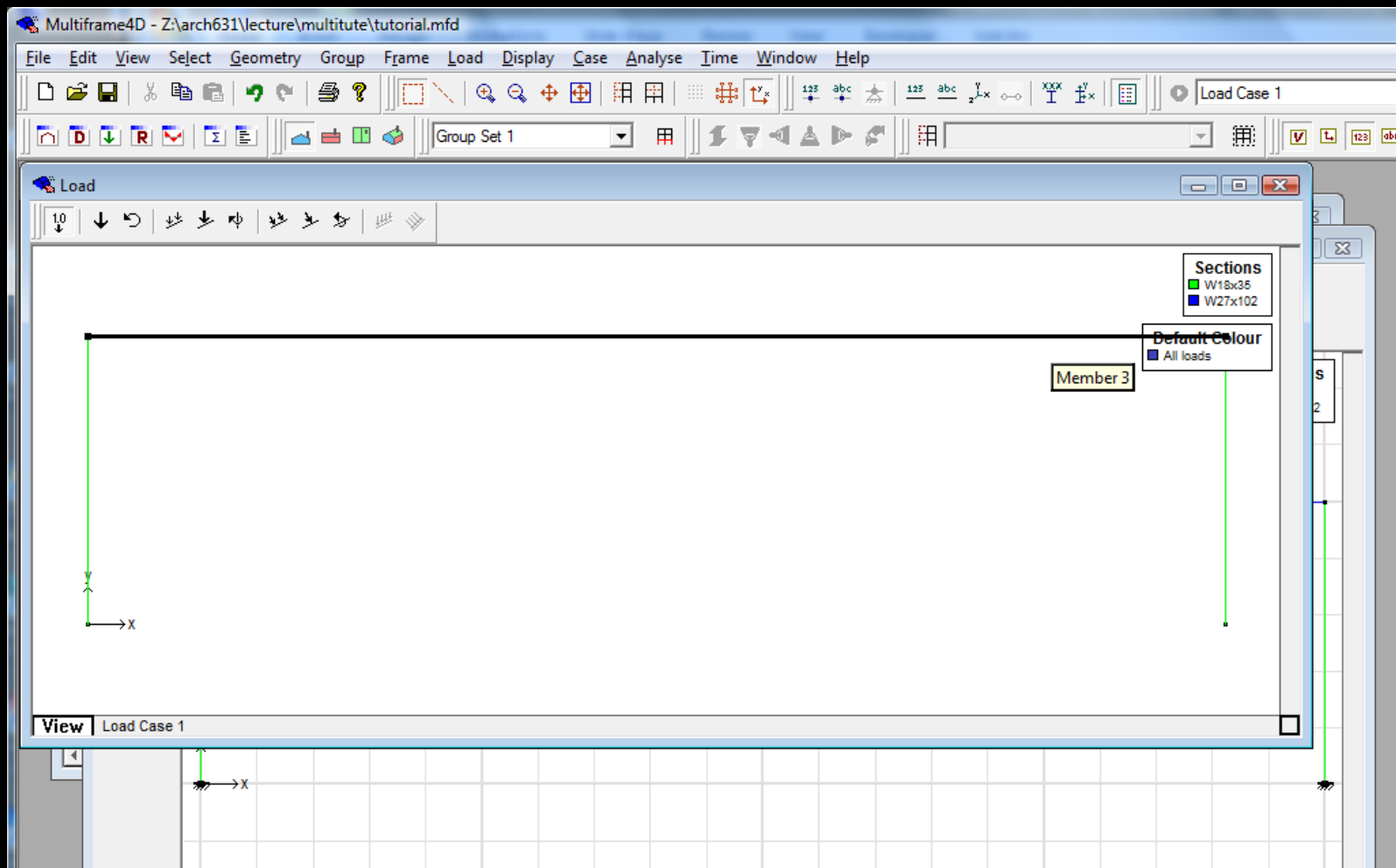


# Choose Load Window

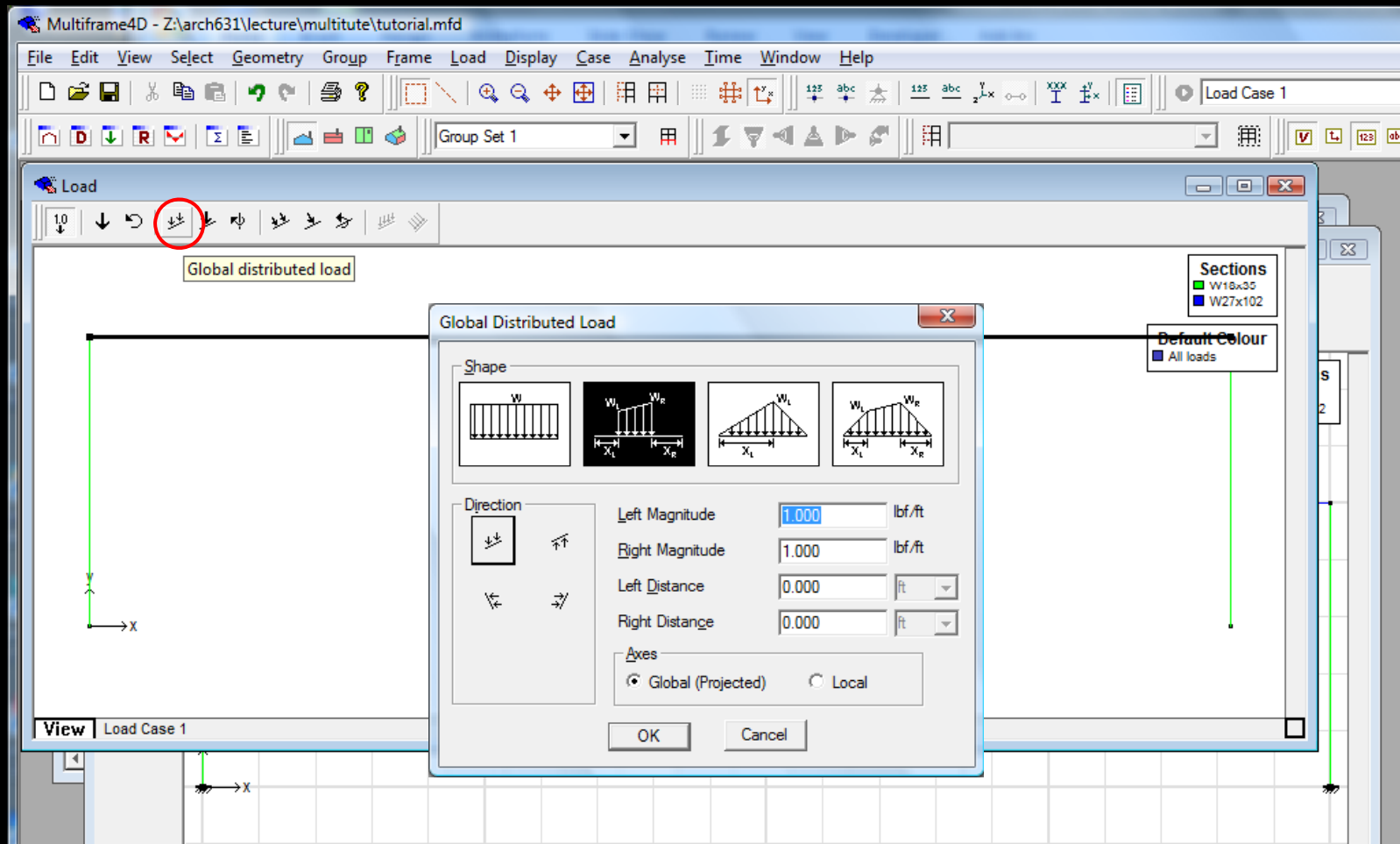




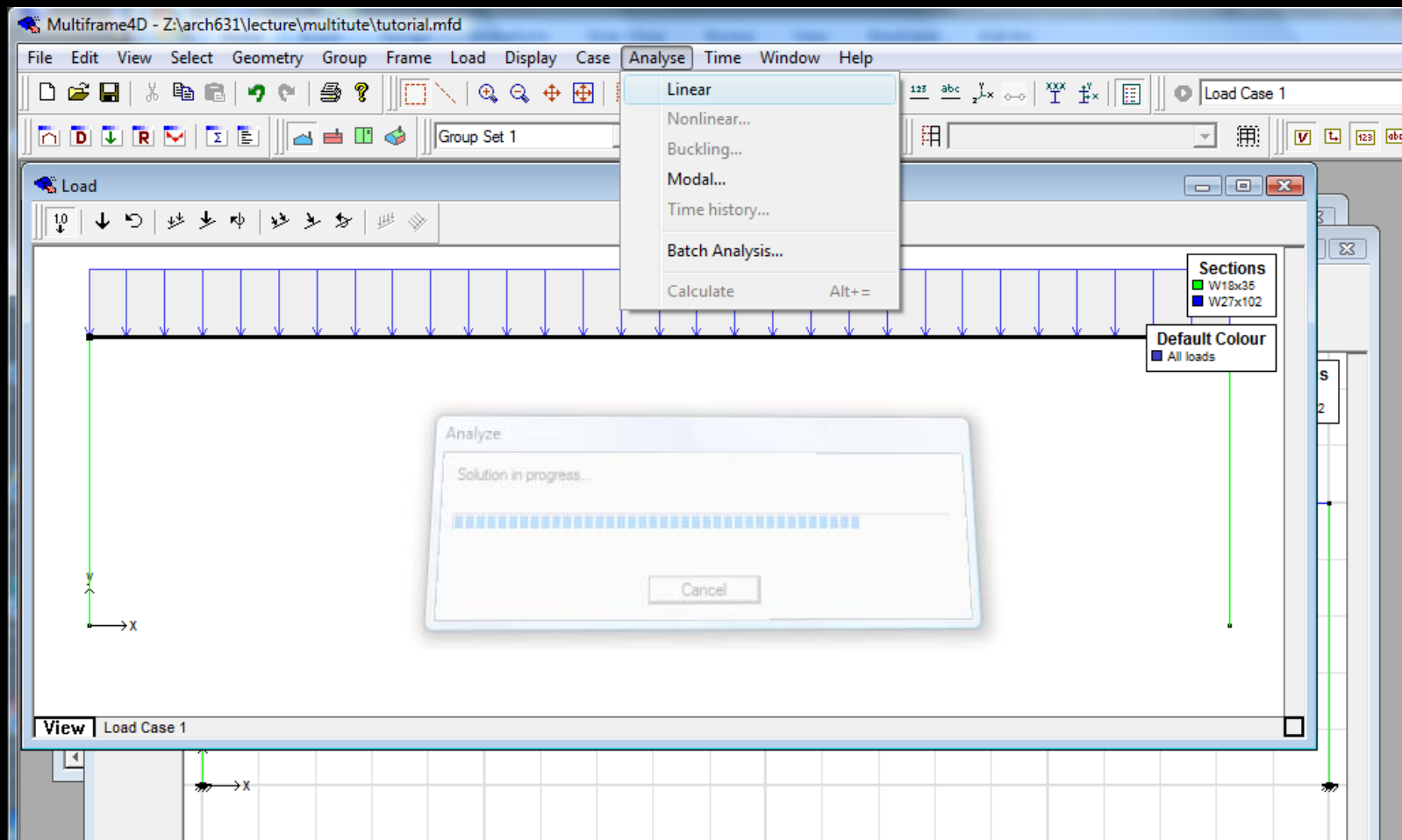
# Select Member or Joint to Load



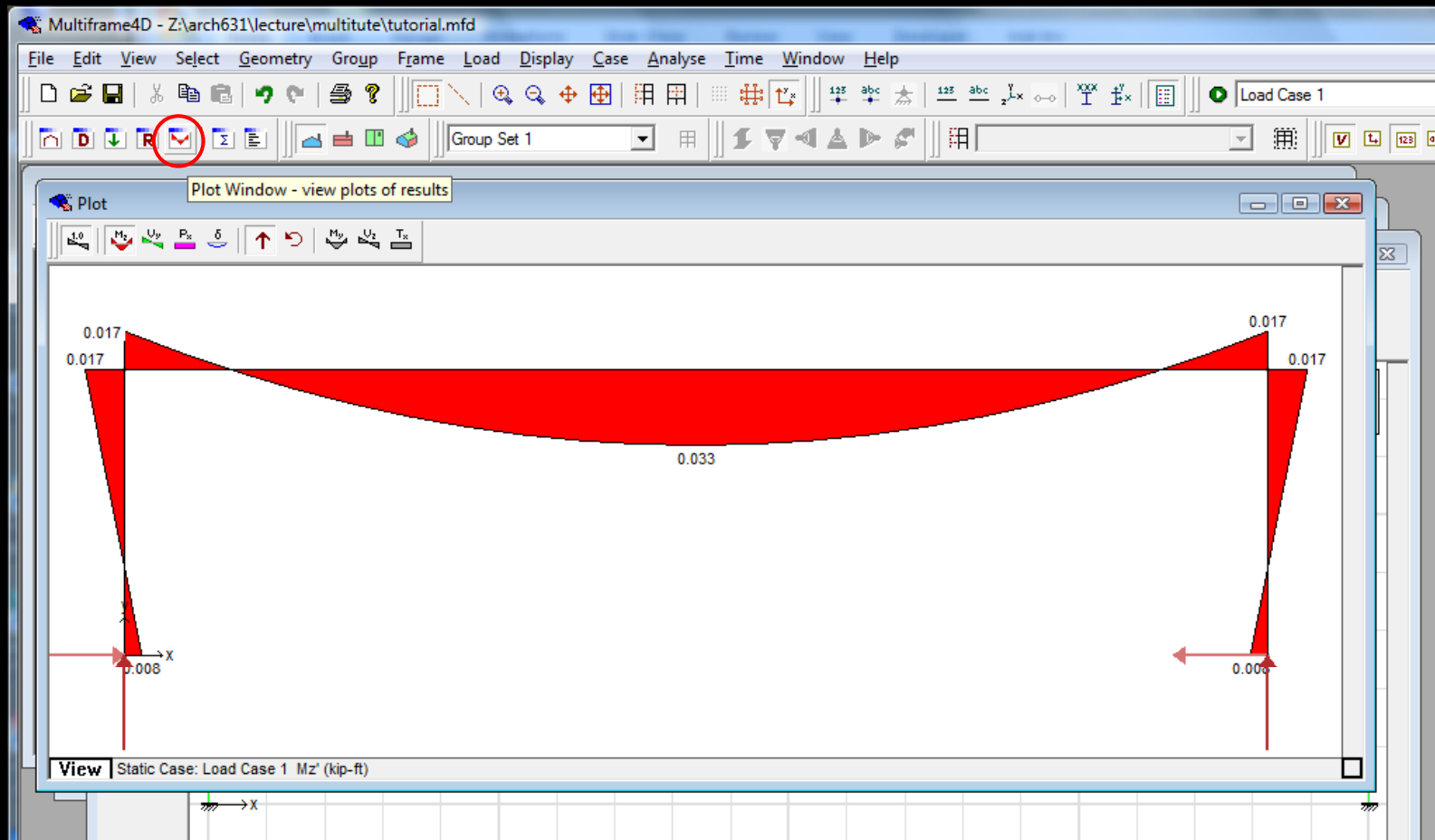
# Select Load Type (follow arrows)



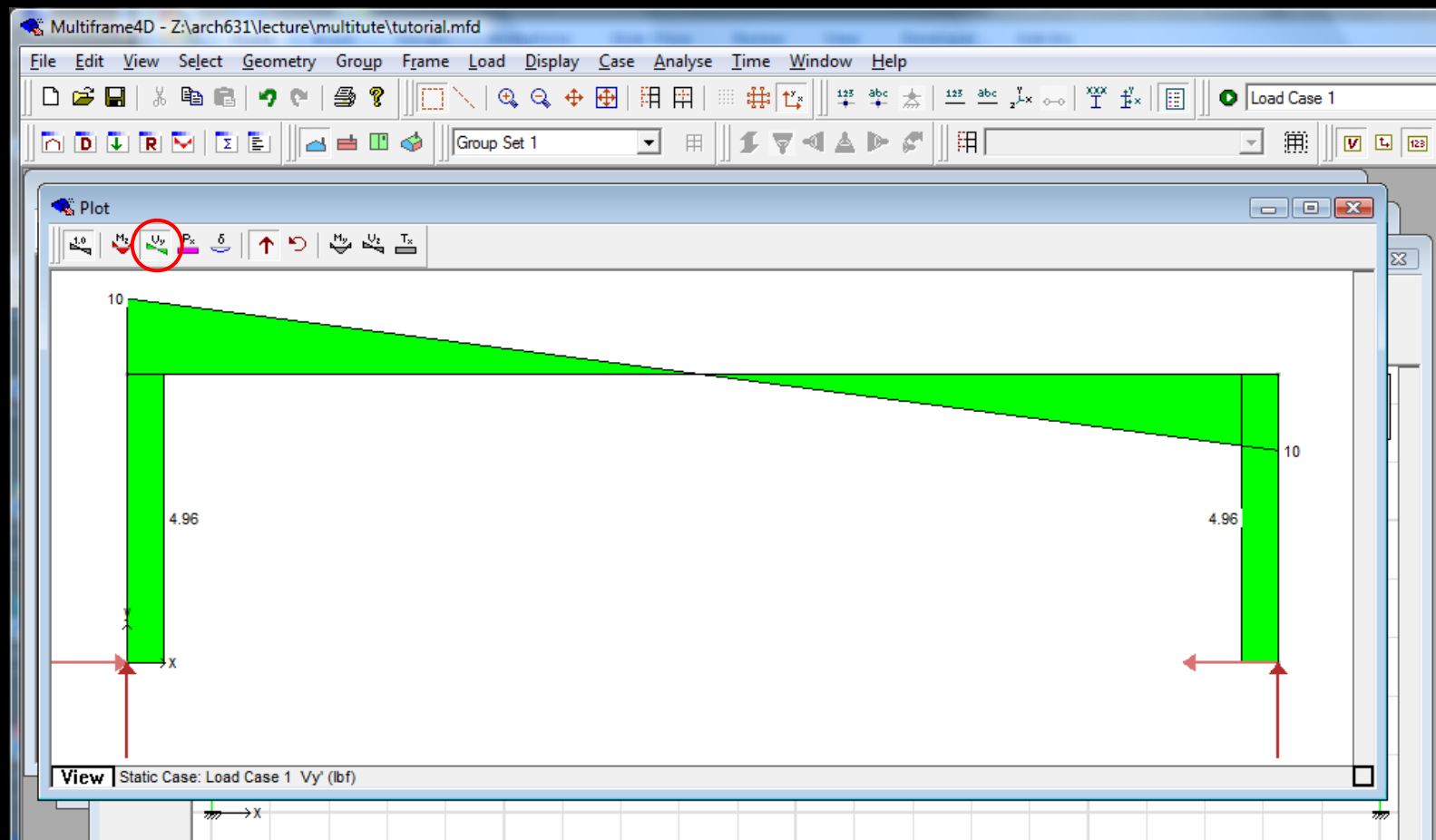
# Analyze Linear



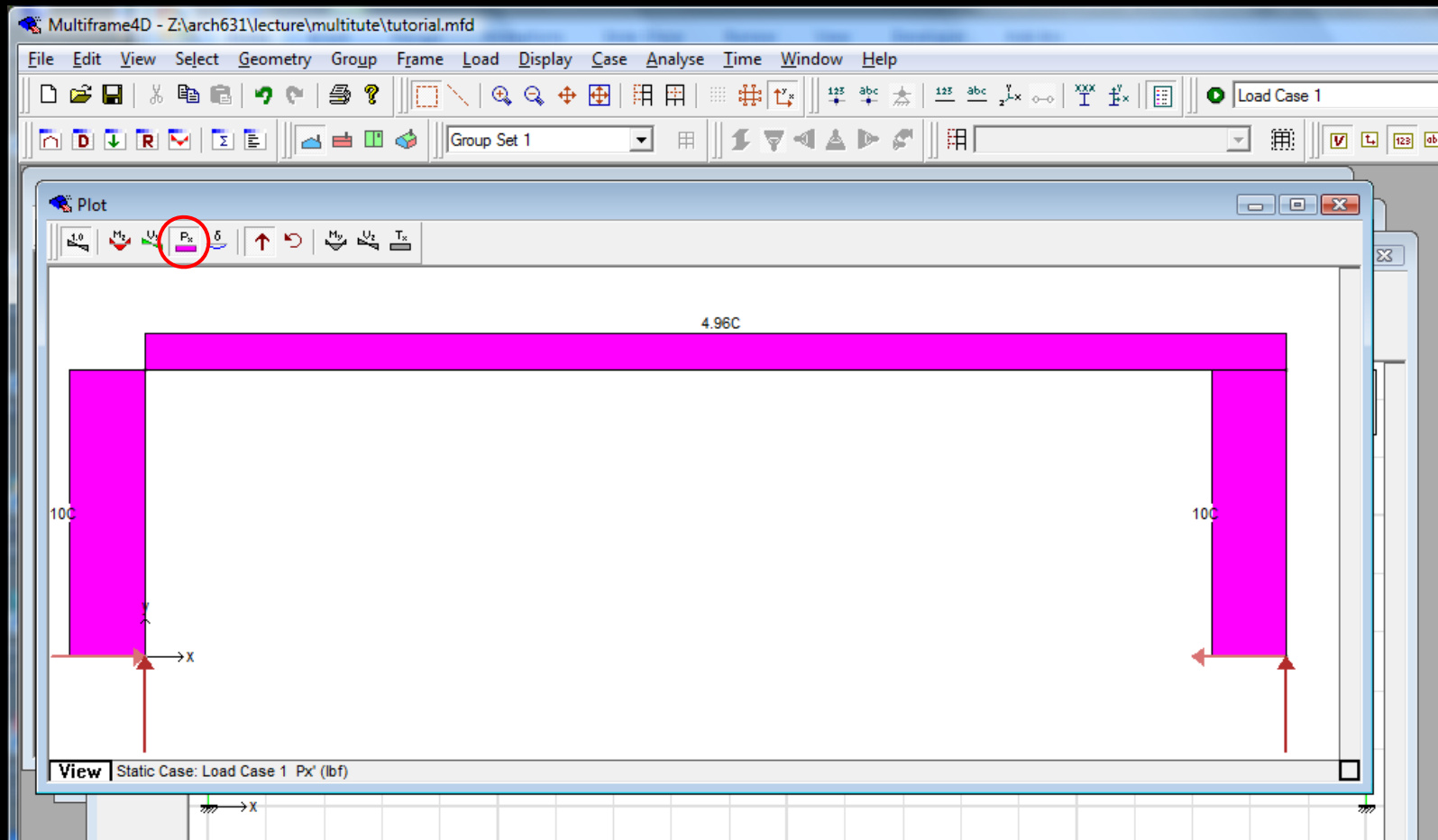
# Plot Window (moment)



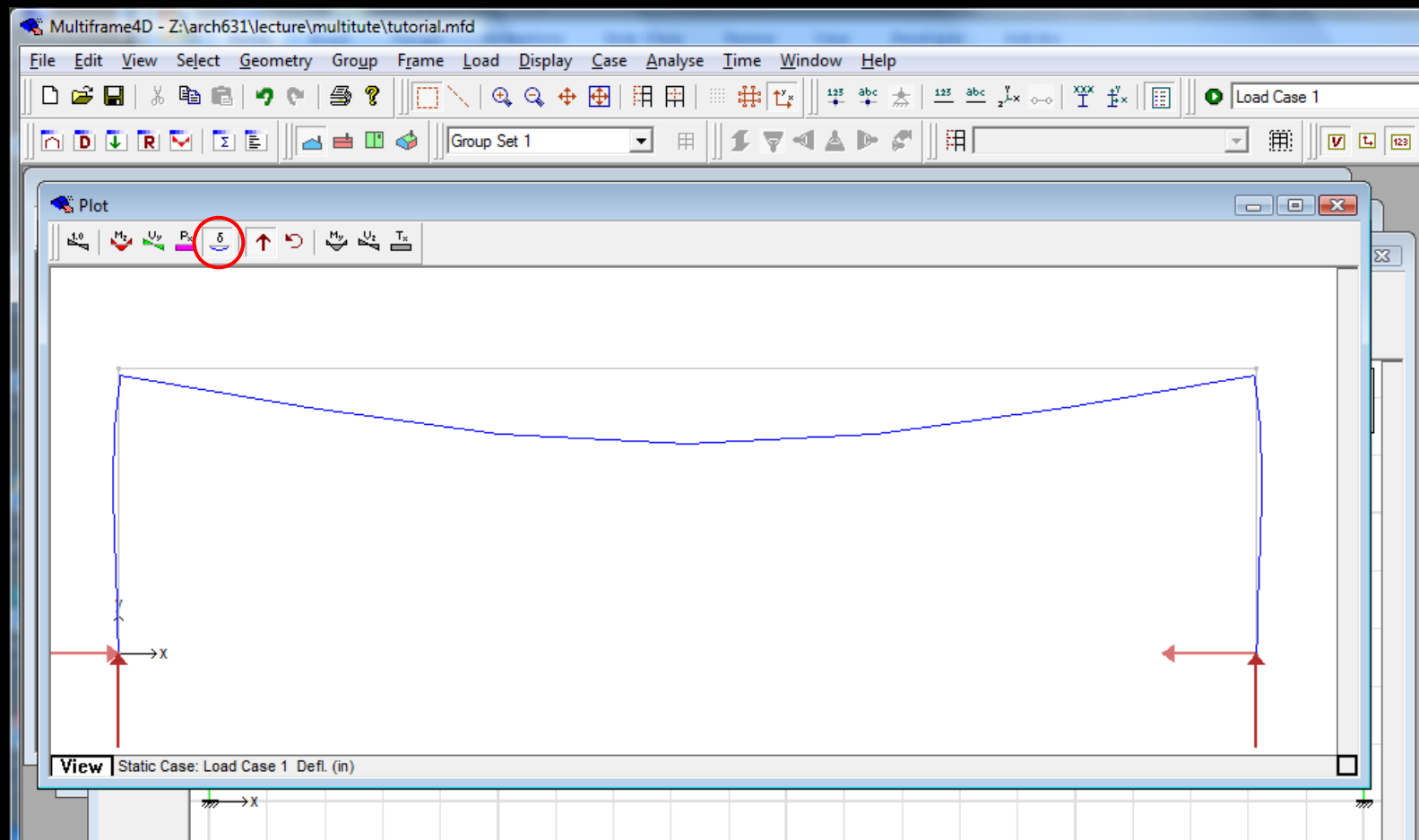
# Plot Window (shear)



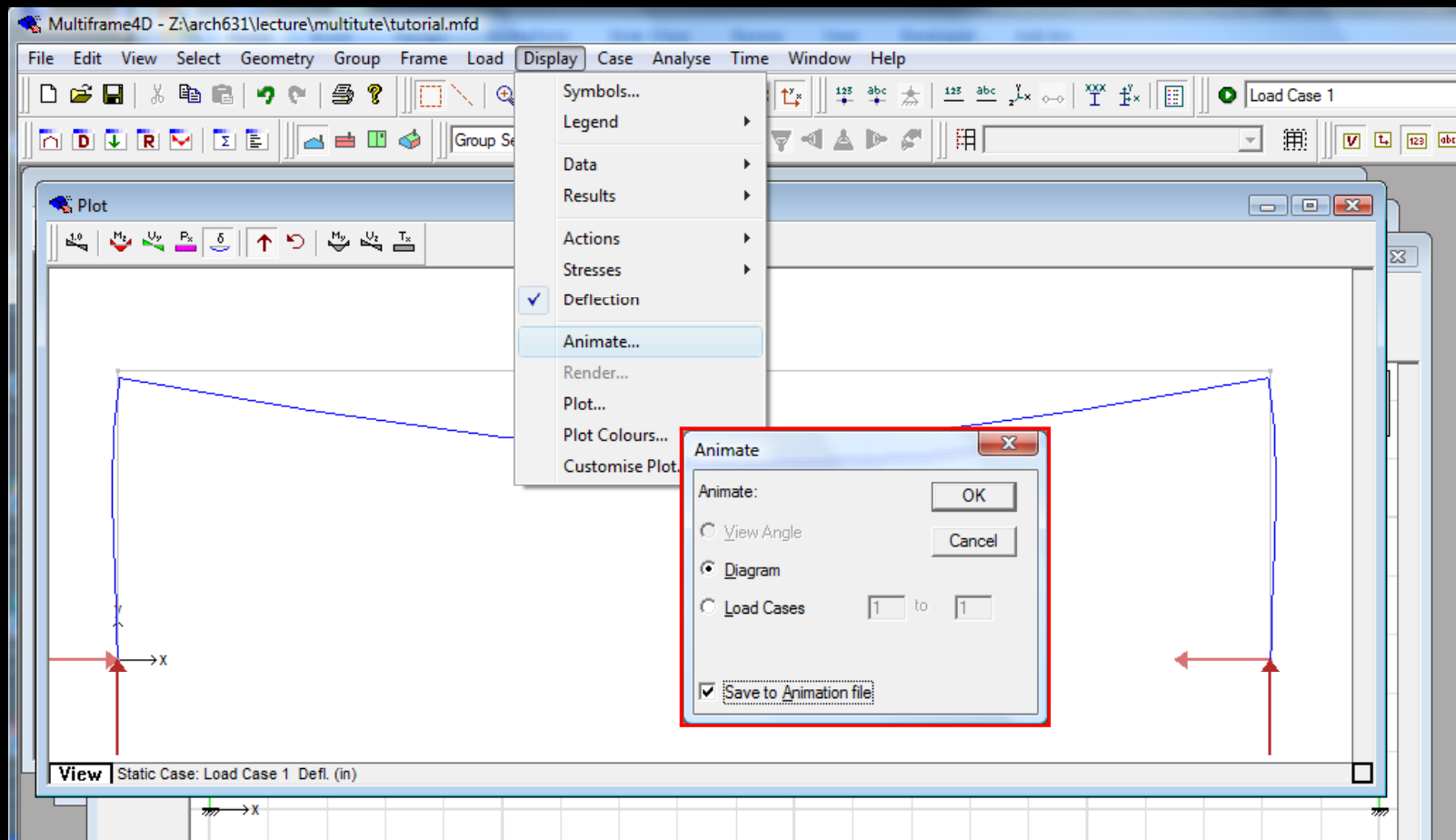
# Plot Window (axial)



# Plot Window (deflection)



# Plot Window (animation and AVI file)





# Results Window

Multiframe4D - Z:\arch631\lecture\multitute\tutorial.mfd

File Edit View Select Geometry Group Frame Load Display Case Analyse Time Window Help

Group Set 1

Result

Static Case: Load Case 1

	Memb	Label	Section	Joint	Px' lbf	Vy' lbf	Vz' lbf	Tx' kip-ft	My' kip-ft	Mz' kip-ft
1	1	Colum	W18x35	1	1000.000	-496.001	0.000	0.000	0.000	-0.780
2	1	Colum	W18x35	3	-1000.000	496.001	0.000	0.000	0.000	-1.700
3	2	Colum	W18x35	2	1000.000	496.001	0.000	0.000	0.000	0.780
4	2	Colum	W18x35	4	-1000.000	-496.001	0.000	0.000	0.000	1.700
5	3		W27x102	3	496.001	1000.000	0.000	0.000	0.000	1.700
6	3		W27x102	4	-496.001	1000.000	0.000	0.000	0.000	-1.700

Displacements Reactions Member Actions Max

View Static Case: Load Case 1 Defl. (in)

The graph shows a blue line representing the deflection of the structure. A red arrow points to the right, and a red arrow points upwards, indicating the direction of the applied load or reaction.

# Evaluating Stresses

Static Case: Load Case 1						
	Memb	Label	Joint	Px' kip	Vy' kip	Mz' kip-ft
1	1	Column	1	20.000	-17.452	-28.273
2	1	Column	3	-20.000	17.452	-58.989
3	2	Column	2	20.000	17.452	28.273
4	2	Column	4	-20.000	-17.452	58.989
5	3	X Primary Bea	3	17.452	20.000	58.989
6	3	X Primary Bea	4	-17.452	20.000	-58.989

$$f_{\max} = \frac{P}{A} + \frac{Mc}{I}$$

column:  $A = 8 \text{ in}^2$ ,  $I_{\text{weak}} = 11 \text{ in}^4$ ,  $c = 2 \text{ in}$

$$\left( S = \frac{I}{c} = \frac{11 \text{ in}^4}{2 \text{ in}} = 5.5 \text{ in}^3 \right)$$

$$f_{\max} = \frac{20^{\text{k}}}{8 \text{ in}^2} + \frac{59^{\text{k-ft}} \cdot 2 \text{ in} \cdot \left( \frac{12 \text{ in}}{1 \text{ ft}} \right)}{11 \text{ in}^4} = 2.5 + 128.7 = 131.2 \text{ ksi}$$

# Stress Results

Result

Static Case: Load Case 1

	Memb	Label	Joint	Sbz' top ksi	Sbz' bot ksi	Sy' ksi	Sx' ksi	Sx'+Sbz' top ksi	Sx'+Sbz' bot ksi
1	1	Column	1	64.154	-64.154	-1.#IO	2.500	66.654	-61.654
2	1	Column	3	-129.195	129.195	-1.#IO	2.500	-126.695	131.695
3	2	Column	2	-64.154	64.154	1.#IO	2.500	-61.654	66.654
4	2	Column	4	129.195	-129.195	1.#IO	2.500	131.695	-126.695
5	3	X Prima	3	-129.195	129.195	1.#IO	2.215	-126.979	131.410
6	3	X Prima	4	-129.195	129.195	-1.#IO	2.215	-126.979	131.410

Member Actions Max Actions Member Stress

$$f_{\max} = 2.5 + 128.7 = 131.2 \text{ ksi}$$

