EXPERIMENT NO. 4

Aim : - To study the behavior of a portal frame under different end conditions.

Apparatus: - Portal Frame Apparatus, Weight's, Hanger, Dial Gauge, Scale, Verniar caliper.

Formula : - $P h/2 - R_{cy} b = 0$, $R_{cy} = ph/2b$

Diagram:-



Theory : - Structures are categorized as statically determinate or as statically indeterminate. Determinate structures can be analysed additional conditions to solve. The portal frame is an indeterminate structure to several degree of indeterminacy depending on the end conditions.

To know the behavior of any frame it is advisable to know its different deflected shapes under different loading condition, which can be obtained by vertical work energy method analytically.

Portal structures similar to the end portals of bridge have as their primary purpose, the transfer of horizontal loads applied at their top to their foundations. Clearance requirements usually lead to the use of statically indeterminate structure layout for portals, and approximate solutions are often used in their analysis.

Consider the portal shown in all the member of which are capable of carrying bending and shear as well as axial force. The legs are hinged at their base and rigidly connected to the cross girder at the top. This structure is statically indeterminate to the first degree; hence, one assumption must be made. Solution of this type of structure based on elastic considerations, show that the total horizontal shear on the portal will be divide calmost equally between the two legs; it will therefore be assumed in the bottom areactions for the two legs are equal to each other and the bucket of 2². The remainder of the analysis can now be carried out of that it. The vertical reaction on the right leg can be obtained by taking burnent about the hings at are base of the left leg. The vertical reaction of the left leg can then the burne of $\Sigma f_y = 0$ to the entire structure. Once the reactions are known, the diagrams of bending moment and shear are easily computed, leading to values for bending moment as given in fig (b). It is well to visualize the deformed shape of the portal under the action of the applied load.

Consider now portal similar in some ways to of fig. (a) but with the bases of the legs fixed as shown in fig(c) This structure is statically indeterminate to the third degree, so that three assumptions must be made. As when the legs were hinged at their base, it will again be assumed that the horizontal reaction for the two legs are equal and hence equal to P/2. It will be noted that near the center of each leg there is point of reversal of curvature. These are points of inflection, where the bending moment is changing sign and hence has zero value.

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Step 4: Draw Frame Elements - To define each frame element, select the Draw Frame Element

button on the lower tool bar. To define an element, click on a joint at the beginning of the element and than on the joint at the end of the element. To end a series of element definitions, simply double-click on the final joint. For this truss problem, the frame elements are shown below:

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🔀 SAP2000 - handout example	
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Direction Contraction Contract	► D Immi 3-d xu xz yz 6ơ Rà 🛛 🛧 🔸
Joint Loads (LOAD1)	
NLLink	Local Axes End Official
J <u>o</u> int Sta	tic Loads Dutput Segments
Fiame S Shell Sta	tatic Loads Prestress tic Loads
N <u>L</u> Link I	loads P-Delta <u>Force</u>
Joint Pat	terns
Group N	ame
Clear Dis	splay of Assigns
8 Joints, 13 Frames selected	Kip-ft
Pro Pas	
In this example, the structure is a truss, which by definition has no moment capacity	Frame Releases
at each joint. To release the moment	Frame Beleases
capacity, click on the check boxes that are	Start End
33 , and Torsion . Torsion can only be	Axial Load
released at one end of the element,	Shear Force 2 (Major)
whereas, the other moment must be	Torsion
element.	Moment 22 (Minor)
	Moment 33 (Major)
	No Releases
After the moments are released the truss	
structure should appear in the SAP2000	UK
interface window as follows:	

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An	alysis Options				
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To restrict SAP2000 to va	ariables in he	piane, sele	ct the mane	Frane button a	and click OK . The truss
structure is now read	anaivsis. To a	analyzethe	odel press th	e Run Analysi	s button

If the analysis is successful, the **Analysis complete** window will appear and report the the analysis is complete. Click **OK** and the SAP2000 interface window will display an exaggerated deflected shape of the modeled structure.

LEMENT JOINT-FORCE	Ουτρυ	JT		10:59:50
NUMBER OF FRAME ELEMENTS SAVED		13		
FRAME ELEMENT OUTPU	Т			10:59:50
NUMBER OF FRAME ELEMENTS SAVED		13		
ANALYSIS COMPLETE		j	2001/09/18	10:59:50

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