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Analysis of a continuous beam by using different structural analysis methods

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Abstract – *In the analysis of continuous beam, there are many complexities and monotonous calculations involved in traditional methods. Bending moment is one of the important parameter from the structure design point of view. In this present investigations to calculate bending moment four different methods i.e. Slope deflection, Moment distribution , Kani's method and Stiffness matrix method have been applied for the analyses of the continuous beam. The study reveals that the Bending moment obtained from these methods have nearly same value. The results obtained from moment distribution method are quite accurate because the number of iteration performed In MDM method is comparatively more.*

Key Words: **Monotonous, Slope deflection, Kani's, stiffness, moment distribution, MDM**

1. INTRODUCTION

Structural Analysis is the part of the structural Engineering by which the analytical behavior of structure can be acknowledged. So after analyzing the structure goes in the designing process. To design the structure it needs various parameters which obtained in the analytical part. These parameter are the Shear force, Bending moment, axial force, deflection, displacement and torsion. So for the determination of these parameters various methods are being used. Bending moment is one of the parameter which is used mostly in the design purpose. All the calculation of material and geometry of the structure are depend on the Bending Moment.

Various methods are being used to calculate bending moment of the indeterminate structure. Sometimes it becomes tedious which method is preferable for the analysis of indeterminate structure.

So in the present study the bending moment parameter has been taken which will be calculated by different structural analysis method. These methods are Slope deflection method, Moment distribution method, Kani's Method and Stiffness matrix method.

2. PROBLEM STATEMENT

An overhanging continuous indeterminate beam has been taken as a problem for the study; the beam is of 13.5 meter span with different flexural rigidity. The loading pattern is shown in the figure 1**.**

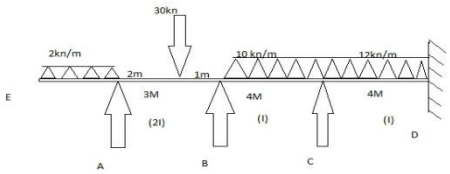


Figure: 1 Problem of beam structure

3. OBJECTIVES

Following are the main objectives of the study:

- Calculation of the bending moment by different structural analysis methods
- To determine the accuracy of the methods

4. METHODLOGY

Following four types of methods used for the investigation:

- Slope deflection method
- Moment Distribution method
- Kani's Method
- Stiffness matrix method

So to analyze the above problem first we determine the fixed end moment of the structure.

Following is the table of the fixed end moment which is same for all the methods.

Table: 1 Fixed End moment

S.No.	Member	Fixed End Moment (kn-m)
1.	AB	-8
2.	BA	16
3.	BC	-13.33
4.	CB	13.33
5.	CD	-16
6.	DC	16
7.	AE	2.25

4.1 SLOPE DEFLECTION METHOD

It is a method used for the analysis of the beam and frame structure. This method used by forming slope deflection equation and applying joint and shear equilibrium equation, the slope or rotational angle calculate by this approach. The slope values are used to obtain the moment by slope deflection equation.

Following are the moments which are obtained to analyze the problem by slope deflection method:

Table: 2 End moments

S.No.	Member	Moment (kN-m)
1.	AB	-2.25
2.	BA	14.56
3.	BC	-14.56
4.	CB	14.13
5.	CD	-14.13
6.	DC	16.94
7.	AE	2.25

4.2 MOMENT DISTRIBUTION METHOD

This method also used for the analysis of the beam and frame. In this method every joint is considered as a fixed joint to calculate fixed end moment. By this method the relative stiffness and distribution factor are calculated. This distribution factor is widely used to calculate moment of each member.

Table: 3 Distribution factor

Joint	Member	Relative Stiffness	Total relative stiffness	Distribution factor
B	BA	I/2	3I/4	2/3
	BC	I/4		1/3
C	CB	I/4	I/2	1/2
	CD	I/4		½

Table: 4 End moments by Moment distribution method

S.No.	Member	Moment (kN-m)
1.	AB	-2.25
2.	BA	14.55
3.	BC	-14.55
4.	CB	14.12
5.	CD	-14.12
6.	DC	16.92
7.	AE	2.25

4.3 KANI'S METHODS

This method offers an iterative scheme for applying the Slope Deflection method. In this method along with the distribution factor the rotational factor are also calculated and with the help of those rotational factors the final end moment are calculated. The final end moment can be expressed as

$M_{AB} = M_{FAB} + 2M'_{AB} + M'_{BA}$

S.No.	Member	Moment (kN-m)
1.	AB	-2.25
2.	BA	14.52
3.	BC	-14.52
4.	CB	14.10
5.	CD	-14.10
6.	DC	16.98
7.	AE	2.25

4.4 Stiffness method

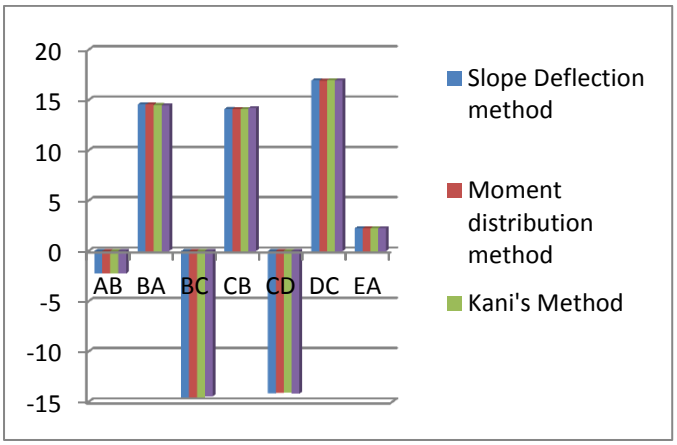
Stiffness method is the advanced method used to analysis the beam, frame and truss structure.

Table:6 End moment by stiffness method

S.No.	Member	Moment (kN-m)
1.	AB	-2.25
2.	BA	14.45
3.	BC	-14.45
4.	CB	14.19
5.	CD	-14.19
6.	DC	16.93
7.	AE	2.25

5. Result Comparison

Graph: 1



Above graph showing that the result obtained from all the methods are nearly same.

5. CONCLUSIONS

Following are the conclusion

- The end moments which are obtained from various methods are nearly same. (refer graph 1)
- The result obtained from the Moment Distribution method are most accurate because of the number of the iterations are more comparatively.
- To analyze the problem by MDM method is quite preferable because Slope deflection method involve solving a number of simultaneous equation so it is quite tedious to solve the problem by these methods.

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BIOGRAPHIES

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